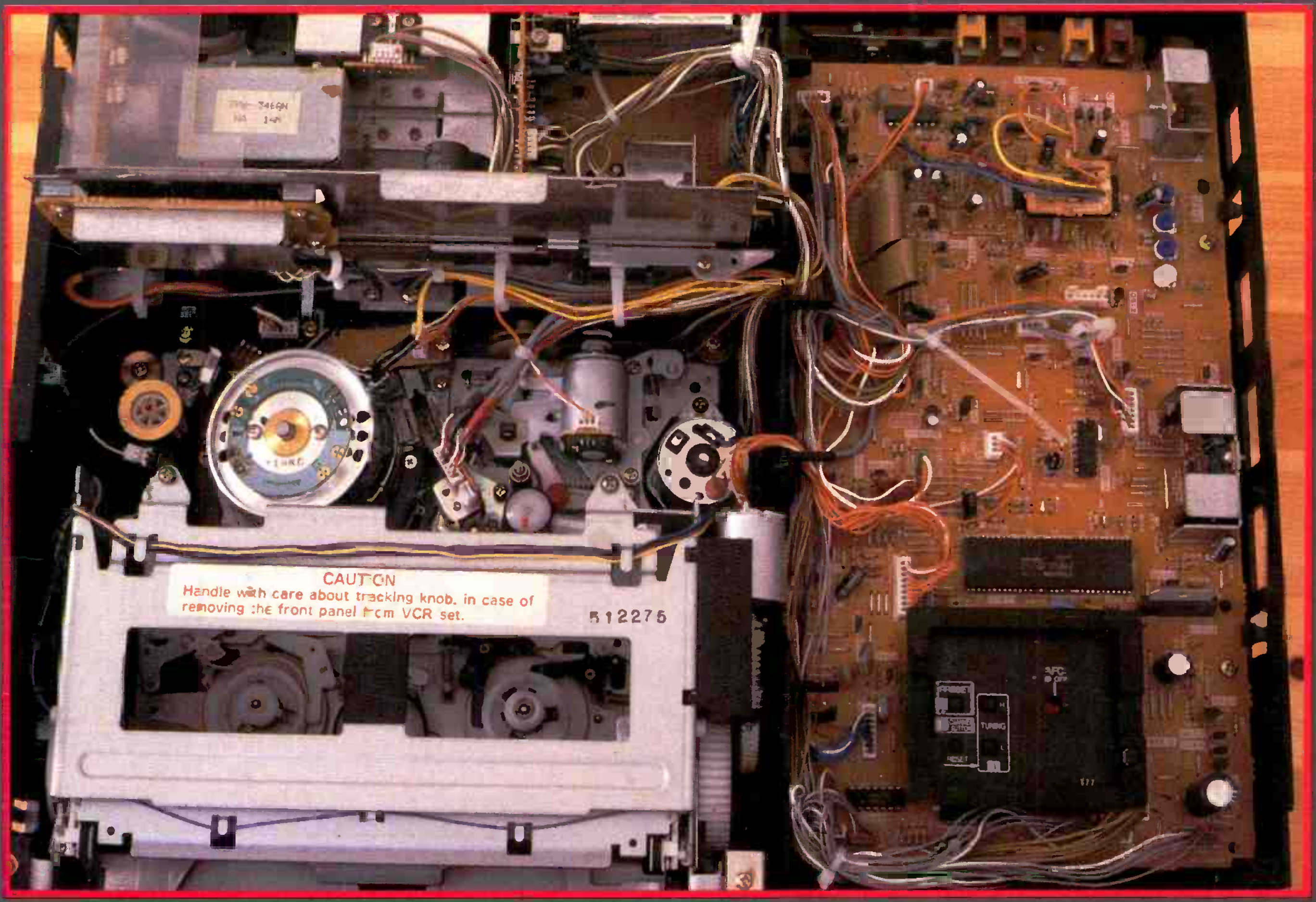
FEBRUARY 1991 £1·80

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS



Fault Notes on Toshiba VHS VCRs
The DAT Format Specification
Test Report: Tandy's Talking DMM
Hitachi G8Q Chassis Service Notes
CD Software Problems•DX-TV
VCR Clinic•TV Fault Finding

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TELEVISION

February 1991

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Issue 484

On sale January 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.

INDEXES AND BINDERS
Indexes to Vols. 36, 37 and 38 are available at £1 each from the Editorial Office (address above).

Binders that hold twelve issues of *Television* are available for £4·50 from Television Binders, 78 Whalley Road, Wilpshire, Blackburn BB1 9LF. Make cheques out to "Television Binders".

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An annual subscription costs £21·60 in the UK, £25·50 overseas (by surface mail – ask for airmail quote if required). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

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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.

this month

OUR NEXT ISSUE DATED MARCH WILL BE PUBLISHED ON FEBRUARY 20

AA119	9p
AAY32	9p
AC107	40p
AC125	25p
AC126	25p
AC127	21p
AC128	21p
AC128K	26p
AC141K	30p
AC142K	30p
AC176	22p
AC176K	28p
AC187	21p
AC187K	28p
AC188	21p
AC188K	28p
ACY18	48p
ACY19	48p
AD142	100p
AD149	60p
AD161	35p
AD162	35p
AF124	50p
AF125	50p
AF126	50p
AF127	50p
AF139	30p
AF239	30p
AF379	45p
ASZ15	100p
ASZ17	100p
BA145	10p
BA148	10p
BA154	6p
BA157	12p
BA526	188p
BB105B	18p
BB205B	24p
BC107	8p
BC108	8p
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BC109C	10p
BC115	10p
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2N.2646	40p
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3N.143	65p
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BY100	40p
BY103	32p
BY126	6p
BY127	8p
BY133	8p
BY164	40p
BY179	35p
BY184	32p
BY196	20p
BY206	11p
BY207	11p
BY208	18p
BY210	22p
BY225	120p
BY226	18p
BY227	19p
BY228	32p
BY296	20p
BY298	26p
BY299	28p
BYX10	15p
BYX55/350	30p
BYX55/600	30p
BYX70/500	32p
BYX70/800	36p
OA47	6p
OA90	6p
OA91	8p
OA200	7p
OA202	7p
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IN.4001	4p
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IN.5407	13p
IN.5408	13p
SKE4F2/06	50p
SKE4F2/08	70p
SKE4F2/10	90p
I.C. SOCKETS	
8pin	6p
14pin	8p
16pin	9p
18pin	12p
20pin	14p
22pin	16p
24pin	18p
28pin	20p
40pin	25p
ZENER	
400MV	
BYZ88 RANGE	
2V7 to 39V	6p
1.3W	
BZX61 RANGE	
2V7 to 39V	12p
CRYSTALS	
Freq in MHZ	
1.00	260p
2.00	200p
2.45670	180p
2.5	200p
3.276	115p
3.5795	95p
4.0	110p
4.194	130p
4.43	95p
4.9152	150p
5.0	130p
6.0	115p
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12.0	120p
14.0	125p
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24.0	250p
48.0	160p
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7806	35p
7808	35p
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7818	35p
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78L08	28p
78L12	28p
78L15	28p
78L18	28p
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79L12	40p
79L15	40p
7818KC	100p
7824KC	100p
LM309K	100p
LM317K	220p
LM317T	180p
LM323K	420p
LM723	40p
78HGKC	570p
78HO5KC	800p
78H12KC	700p

78GU1C	190p
79GU1C	215p
79HGKC	800p
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DAF96	60p
DF96	50p
DL92	60p
DY86	50p
DY87	60p
DY802	75p
EABC80	60p
EB91	44p
EBF80	45p
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PL95	180p
PL500	110p
PL504	120p
PL508	200p
PL519	450p
PY81	100p
PY88	100p
PY500A	190p
L.E.D.'S	
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LED 3MM YEL	10p
LED 3MM GRN	10p
LED 5MM RED	5p
LED 5MM YEL	10p
LED 5MM GRN	10p
RECTANG. L.E.D.'s	
RED	10p
GREEN	15p
YELLOW	15p
LINEAR IC'S	
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AN-210	165p
AN-214Q	170p
AN-228	280p
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AN-6362	480p
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AN-7178	270p
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AY3-8912	400p
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BA-313	60p
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BA-401	60p
BA-402	60p
BA-511	160p
BA-514	160p
BA-516	150p
BA-521	160p
BA-524	240p
BA-526	188p
BA-527	95p
BA-532	140p
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TDA-5700	200p
TDA-5800	600p
TDA-5820	480p
TDA-7000	200p
TDA-7040	250p
TDA-7050	200p
TDA-7211	150p
TDA-7220	150p
TDA-7240	300p
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TDA-7255	600p
TDA-7270	150p
TDA-7274	100p
TDA-8115	300p
TDA-8140	300p
TDA-8170	300p
TDA-8190	280p
TDA-8440	380p
TDA-9403	250p
TDA-9503	200p
TDA-9513	350p

LINEAR IC'S — Cont.

TEA-1002	660p
TLO-61	40p
TLO-64	80p
TLO-71	38p
TLO-72	55p
TLO-74	92p
TLO-81	40p
TLO-82	46p
TLO-83	67p
TLO-84	80p
ULN-2002	70p
ULN-2003	69p
ULN-2004	69p
ULN-2068	270p
ULN-2803	130p
ULN-2804	170p
UPC-16C	160p
UPC-20C	220p
UPC-554	130p
UPC-555	60p
UPC-556H	80p
UPC-566	60p
UPC-571	220p
UPC-574	60p
UPC-575C2	90p
UPC-576	200p
UPC-577	64p
UPC-580	300p
UPC-592	95p
UPC-595	190p
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UPC-1025	230p
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UPC-1197	140p
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UPC-1373	85p
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UPC-1420CA	500p
UPC-1458	100p
UPC-1470	200p
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UPC-1505C	400p
UPC-1517CA	400p
UPC-1525C	400p
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UPC-1571C	300p
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ZN-448	510p
ZN-459	190p
ZN-1034	170p
ZN-1040	640p
ZNA-134H	2150p
ZNA-234E	920p

JAPANESE TRANSISTORS

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2SA-608	15p
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2SD-970	170p
2SD-973	60p
2SD-973A	70p
2SD-985	120p
2SD-986	120p
2SD-1012	120p
2SD-1021	120p
2SD-1022	400p
2SD-1024	130p
2SD-1031	130p
2SD-1046	200p
2SD-1051	130p
2SD-1060	130p
2SD-1064	250p
2SD-1071	450p
2SD-1073	350p
2SD-1094	520p
2SD-1111	60p
2SD-1128	200p
2SD-1135	150p
2SD-1138	80p
2SD-1159	90p
2SD-1160	150p
2SD-1163A	220p
2SD-1164	120p
2SD-1168	425p
2SD-1169	280p
2SD-1185	400p
2SD-1186	400p
2SD-1189	125p
2SD-1190	150p
2SD-1196	150p
2SD-1207	50p
2SD-1210	280p
2SD-1211	120p
2SD-1225	120p
2SD-1229	250p
2SD-1237	300p
2SD-1248	270p
2SD-1251	180p
2SD-1266	180p
2SD-1272	200p
2SD-1273	100p
2SD-1275	160p
2SD-1276	200p
2SD-1277	190p
2SD-1279	600p
2SD-1289	300p
2SD-1291	400p
2SD-1292	60p
2SD-1297	425p
2SD-1308	140p
2SD-1309	140p
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2SD-1383	100p
2SD-1390	350p
2SD-1391	450p
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2SD-1398	130p
2SD-1399	300p
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2SD-1409	190p
2SD-1415	190p
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2SD-1427	380p
2SD-1428	360p
2SD-1429	410p
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2SD-1457	220p
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2SD-1468	60p
2SD-1496	450p
2SD-1497	450p
2SD-1505	120p
2SD-1554	500p
2SD-1555	450p
2SD-1576	450p
2SD-1577	480p
2SD-1579	120p
2SD-1591	310p
2SD-1595	160p
2SD-1604	200p
2SD-1608	210p
2SD-1609	100p
2SD-1632	500p
2SD-1649	260p
2SD-1651	270p
2SD-1663	450p
2SD-1666	120p
2SD-1667	120p
2SD-1668	120p
2SD-1677	300p
2SD-1739	450p
2SD-1783	100p
2SD-1815	100p
2SD-1825	120p
2SD-1843	100p
2SD-1846	350p
2SD-1884	300p
2SD-1910	280p
2SD-1941	500p
2SD-1984	150p
2SJ-49	425p
2SJ-50	425p
2SJ-77	350p
2SK-19	45p
2SK-49	50p
2SK-55	100p
2SK-68	100p
2SK-134	415p
2SK-135	415p
2SK-147	160p
2SK-192	45p
2SK-195	150p
2SK-197	140p
2SK-312	750p
2SK-323	130p
3SK-88	70p

BRIDGE RECTIFIERS

W005	1A/50V	16p
WO1	1A/100V	18p
WO2	1A/200V	19p
WO4	1A/400V	21p
WO6	1A/600V	23p
WO8	1A/800V	28p
BR81D	2A/100V	33p
BR82D	2A/200V	33p
BR84D	2A/400V	37p
BR86D	2A/600V	43p
BR88D	2A/800V	43p
BR32	3A/200V	43p
BR34	3A/400V	43p
BR36	3A/600V	44p
BR62	6A/200V	80p
BR64	6A/400V	72p
BR251	25A/100V	150p
BR252	25A/200V	165p
BR254	25A/400V	185p
BR256	25A/600V	200p
BR258	25A/800V	240p
BR351	35A/100V	185p
BR352	35A/200V	200p
BR354	35A/400V	225p
BR356	35A/600V	230p
BR358	35A/800V	260p
BY164	1.5A/100V	40p
BY179	1.5A/800V	40p

TRIACS

TIC206D	—	4A/400V	60p
TIC225D	—	6A/400V	69p
TIC226D	—	8A/400V	68p
TIC236D	—	12A/400V	85p
TIC246D	—	16A/400V	105p
TIC253D	—	20A/400V	190p
TIC263D	—	25A/400V	205p
T2800D	—	8A/400V	52p

THYRISTORS (SCR's)

2N.5061	—	0.8A/60V	20p
2N.5062	—	0.8A/100V	28p
2N.5064	—	0.8A/200V	29p
C106D		4A/400V	28p
TIC116C		8A/300V	59p
TIC116D		8A/400V	70p
TIC116M		8A/600V	79p
TIC126D		12A/400V	75p
TIC126M		12A/600V	90p
2N.4444			76p
BR103			37p
BR303			85p
BT106			180p
BT116			80p
BT119			100p
OT121			120p
TIC44			22p
TIC45			27p
TIC47			32p
17088			200p
17089			200p
17127			200p
15/80H			230p
15/85R			230p
SG613			1000p

UHF TUNERS

U322LO	600p
U341	500p
U342	500p

VIDEO LAMPS

UNIVERSAL VIDEO LAMPS
12V 60mA (300mm WIRES)
RED OR BLUE 30p

VIDEO LAMP FOR PANASONIC 50p

CASSETTE DC MOTORS

6V	200p
9V	200p
12V CW	200p
12V CCW	200p
13.2V CW	290p
13.2V CCW	290p

CASSETTE TAPE HEADS

MONO HEAD	90p
STEREO HEAD	150p
MINI HEAD	230p
AUTO REVERSE HEAD	260p

UNIVERSAL TRIPLERS	450p
SONY ON/OFF SWITCHES	200p
PHILIPS SWITCHES K30, K35, K40, KT3, KT4	150p

VIDEO HEADS

AKAI

VS-109/201/202/301/303	£15.00

AMSTRAD

VCR 4500/5200/9000	£12.00
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VCR 6000/6100	£16.00
TVR2/TVR3/VCR4600/VCR4600 MKII/VCR4700	£11.50

FUNAI

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FVHP510/520/530/615/622/710/715/720/721/722/910	£13.00
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VBS7000/VBS9000	£22.00
FVHP975	£32.00

GOLDSTAR

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HINARI

VXL2/VXL3/VXL4/VXL20/VXL25	£13.00
VXL5/V20H	£13.00
VXL6	£18.00
VXL8/VXL9/VXL10/VXL11	£20.00
VTV100/VTV200	£20.00

HITACHI

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VT7/VT17/VT19	£25.00
VT35/VT38/VT39	£33.00
VT120/VT220/VT225	£22.00
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VT5000/VT5500	£15.00
VT6500/VT7000/VT8000/VT8300/VT8500/VT8700/VT9300/VT9500/VT9700	£13.50
VT8/VT56	£34.00
VT65	£40.00
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ITT

VR3605/VR3905	£6.50
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JVC & FERGUSON

JVC/AKAI/FERGUSON 3HSS (FOR ALL MODELS)	£6.50

JVC 3HSS

HR3300/HR3320/HR3330/HR3350/HR3360/HR3750/HR3860/HR4100/HR7200/HR7300/HR7350/HRD220	£6.50

FERGUSON 3HSS

3290/8903/8940/3V00/3V06/3V22/3V29/3V30	£6.50

JVC 3HSSL PIN

HR2200/HR3660/HR7600/HR7610/HR7650/HR7700/HRD110/HRD111/HRD120/HRD121/HRD225	£6.50

FERGUSON 3HSSL PIN

8904/8924/8941/8943/8944/3V16/3V23/3V24/3V31/3V35/3V36/3V38/3V29/3V49	£6.50

JVC 3HSSVA

HRD140/HRD141/HRD143/HRD150/HRD157/HRD158/HRD160/HRD455/HRS10/HRS100	£16.00

FERGUSON

8945/8947/8948/3V42/3V44/3V45/3V46/3V47/3V52/3V54/3V55/3V56/3V57	£16.00
8950/8951/3V64/FV10/FV11	£17.00
3V48	£24.50
3V43/3V53	£33.00

JVC

HRD170	£17.00
HRD565	£24.50
HRD725/HRD755	£33.00

JVC & FERGUSON

3V32/8942/HR7655	£23.00
HRD180/3V59	£30.50
HRD370/3V58	£31.00
HRD250	£27.00

LOGIK

VR960	£17.00

MATSUI

VX500E/VX600A/VX800A/VX810A/VX880A/VX770B/VX773B	£13.50
VCRL3/VX730	£15.00
VX735/VX755	£16.00
VX735/VX755A/VX765/VX850	£17.50

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VIDEO HEADS — Cont.

MITSUBISHI

HS304/HS320/HS700	£21.00
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HS303	£21.00
HS301/HS310	£25.00

NATIONAL PANASONIC 4HSS-3HSSN

NV3000/NV300/NV7200/NV333/NV7500/NV7800/NV7850/NV322/NV332/NV340/NV390/NV2000/NV2010/NV7000/NV8170/NV8200/NV8400/NV8600/NV8610/NV8620	£6.50

NATIONAL

NV777/NV330	£17.00
NV430/NV460	£18.00
NV730/NV770	£19.00
NV366	£19.00
NV180	£26.00
NV370/NV380	£8.50
NV788	£43.50
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NV850	£50.00
NV870	£48.00
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NVG10/NVG11/NVG12/NVG14/NVG16/NVG120EM	£16.50
NVG18	£30.00
NVG20/NVG21/NVG22/NVG25/NVG28	£25.00
NVG50	£30.00
NVG730B	£41.00
BVH70	£50.00
NVH65/NVD80	£50.00
NVG7/NVG9	£19.00
CAM CORDER VEH 0366	£60.00
CAM CORDER VEH 0292	£52.00

N.E.C

N9011/N9012/N9013E/N9014E/N9014G/N9015/N9016/N901A	£20.00
N911A/N915A/N916A/917	£27.00

ORION

VH3/VH555/VH600/VH700/VH844/VH900/VH1000	£13.00

PHILIPS

VR6460/VR6520/VR6920/64VR60	£8.50
VR6711 4 HEAD	£41.00
6920	£58.00

SAISHO

VR100/VR605/VF705/VR805/VR905/VR1000/VR1200/VR1600	£13.50
VR3300X/VR3600X/VR3650/VR3800	£15.00
VR3200	£16.00
VR3300/VR3600	£16.00

SAMSUNG

SVX301/VB900/VB910/VVT510/VT320/VT5600/VX510/VX511/VX520/VX616/VX626/VX627/VX717	£19.00
6900/370097	£27.00

SANYO

VTC5000/VTC5400/VTC600/VTC6500/VTCM10/VTCM11/VTCM20/VTCM21/VTCM25	£18.50
VTC5100/VTC5150/VTC5300	£18.50
VTC5350/VTC5370/VTCNX10/VTCNX15/VTCNX20/VTCNX30/VTC5500	£18.50
VTC9100/VTC9300/VTC9455/VTC9500	£19.00
VTC9350/VTC9355	£28.80
VTC5500	£19.00
VHR1110/VHR1150/VHR1300/VHR1700/VHR2300	£16.00
VHR3200/VHR3270/VHR3100/VHR3150/VHR3400 (FVH-P 5)	£18.00
VHR1200	£18.00
VHR1500/VHR2500	£28.00

SHARP

VC300/VC381/VC383/VC386/VC387/VC388/VC482/VC483/VC486/VC3300/VC8381/VC9100/VC9300/VC9500/VC9700	£14.00
VC582/VC583/VC651/VC682/VC750/VC780/VC781	£14.00
VC600/VC6300/VC7300/VC7700/VC7750/VC8300	£31.00

SONY

DSR-35R (FOR C20/C30/C40/SLF1UB/SLF1E) 2 PIN	£15.00
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TOSHIBA

V21/V31/V33/V50/V51/V53/V9600	£14.50
V55/V57	£7.00
V71/V73/V74/V75/V81/V82/V83/V84/V85/V86/V87	£14.00
V93	£20.00
V5470/V5480	£18.00

TRIUMPH

VR9501/VR9511/VR9592	£13.00

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VCR PINCHROLLERS

AKAI

VS9300, VS9500, VS9700, VS9800	250p
VS1, VS2, VS3, VS4, VS5, VS6, VS9, VS10	320p
VS105, VS112, VS115, VS116, VS126, VS244, VS245, VS247, VS248, VS515, VS516	250p
VS201, VS301, VS303, VS304, VS603, VS606, VS607, VP58-P82	250p
VS125, VS155, VS165, VS220, VS240, VS250, VS512, VSX9	250p

AMSTRAD

VCR4500, VCR4600, VCR4600 MKII, VCR4700	250p
VCR5200	320p
VCR7000	320p

FERGUSON

3V00, 3V16, 3V22, 3V23	250p
3V29, 3V30, 3V31, 3V32	250p
3V35, 3V36, 3V38, 3V39, 3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 3V58, 3V59, 3V64, 3V65, FV10, FV11, FV12, FV14	250p

FISHER

FVHP420, FVHP520, FVHP530	320p
FVHP615, FVHP710, FVHP715, FVHP716, FVHP722, FVHP725, FVHP830	320p
FVHP905, FVHP970, FVHP980, FVHP990	320p

HITACHI

VT11, VT33	250p
VT61, VT62, VT63, VT64, VT65, VT86, VT88, VT110, VT122, VT120, VT128, VT130, VT135, VT138, VT150, VT168, VT220	250p
VT5000, VT8000, VT9300, VT9500	250p

ITT

VR3605, VR3905, VR3935, VR3985, VR3986, VR3993, VR3994	320p
VR3913, VR3914, VR3943, VR3954, VR3963, VR3984	320p

JVC

HR300, HR3330, HR3360, HR3660, HR4100, HR7700	250p
HR7200, HR7300, HR7600, HR7610, HR7650, HR7655	250p
HRD110, HRD111, HRD120, HRD121, HRD140, HRD150, HRD160, HRD225, HRD455, HRD565, HRD725	250p

MITSUBISHI

HS200, HS300, HS301, HS302, HS303, HS304, HS310, HS320, HS700	250p
HS306, HS307, HS400, HS710	250p

NATIONAL

NV100, NV180, NV300, NV333, NV340, NV366, NV600, NV688, NV777, NV788	250p
NV230, NV370, NV430, NV460, NV730, NV810, NV830, NV850, NV870, NV890, NV2000, NV2010, NV3000, NV7000, NV7200, NV7800, NV8600, NV8610, NV8620, NVG14	250p
NVG7, NVG19, NVG12, NVG18	320p
NVG21, NVG25, NVH65	320p

PHILIPS

VR6460	250p
VR2020, VR2021, VR2022, VR2023, VR2024	320p

SANYO

VHR1100, VHR1300, VHR1500, VHR2300	320p
VTC5000, VTC5150, VTC5500, VTC9300, VTCM10, VTCM20	250p

SHARP

VC381, VC386, VC2300, VC3300, VC7300, VC7700, VC8300, VC9100, VC9300, VC9500, VC9700	320p
VC387, VC481, VC482, VC483, VC486, VC496, VC581, VC582, VC583, VC585	320p
VC651, VC681, VC685, VC750, VC780, VC781, VC785, VC787, VC793, VCT72	320p

SONY

SLC5, SLC6, SLC7	320p
SLC9, SLC20, SLC24, SLC30, SLC33, SLC44, SLHF100, SLF1, SLF11, SLF25, SLF30, SLF60, SLF100	320p

VCR BELT KITS

AKAI

VP-7100	160p
VS-1	150p
VS-2EG	100p
VS-4	120p
VS-5EG	100p
VS-9300	160p
VS-9500	155p
VS-9700	160p
VS-9800	155p

AMSTRAD

TVR-1-2-3	210p
VCR-4600 & MK2	210p
VCR-4700	210p
VCR-5200	210p
VCR-7000	80p

FERGUSON

3292, 3V00, 3V01, 3V16, 3V22	150p
3V23	65p
3V29/30	120p
3V31/32	85p
3V35/36	80p
3V38-39	80p
3V42/43	65p
3V44/45	65p
3V34/54	65p
3V55	65p
3V58-59, 3V64-65, 8950-8951, FV10-11, FV12-13, FV14	140p

FISHER

VBS 7000	245p
VBS-9000	120p
FVHP520, FVHP530	80p
FVHP710, FVHP716, 722	120p
FVHP905, FVHP906, 907, 910	130p
FVHP615, 715, 725, 830	120p

GEC

4005	150p

HITACHI

VT-11, VT-33	100p
VT-5000	120p
VT-5500	130p
VT-8000	60p
VT-8500	60p
VT-9300	50p
VT-9500	50p
VT-9700	60p
VT-14-17-19-VT35, 38-88	120p
VT52-62, VT64-65-86	150p

ITT

VR3605, 3905, 3935, 3985	100p
VR3913, VR3914	100p

JVC

HR-3300, HR-3330, HR-3360, HR-3660	150p
HR-4100	180p
HR-7200	70p
HR-7600	80p
HR-7610	95p
HR-7650	75p
HR-7655	90p
HR-7700	77p
HRD-110, HRD-111, HRD-120, HRD-225	100p
HRD-250, HRD-455, HRD-565, HRD-566, HRD-725, HRD-755	100p
HRD-170, HRD-180, HRD-230, HRD-370, HRD-430, HRD-530	130p

MITSUBISHI

HS-200	200p

NATIONAL

NV-300	160p
NV-333	135p
NV-777	100p
NV-2000	150p
NV-3000	160p
NV-7000	95p
NV-7200	90p
NV-8600	160p
NV-7500, NV-7800	110p
NV-340, NV-366	140p
NV-600, NV-788	120p
NV-230, 250, 280, 370, 380, 430, 450, 460, 465, 600, 630, 730, 810, 830, 850, 870, 890	135p

PHILIPS

VR-6460	170p

SANYO

VTC-5000	75p
VTC-5300	100p
VTC-5500	95p
VTC-9300	220p
VHR-1100, 1300, 1500	100p

SHARP

VC-381/383/386	125p
VC-6300	150p
VC-7300/7700/7500	150p
VC-8300	150p
VC-8381, VC-9100	125p
VC-9300, VC-9500	135p

SONY

SL-C5, SL-C6	140p
SC-C7	140p
SC-C9	165p
SL-8000, SL-8080	200p

TOSHIBA

V-55/57	85p
V-5250/5280	230p
V-5480	210p
V-5475	160p
V-7540	160p
V-8600	150p
V-9600	85p

MOD KIT TAPE CREASING AMSTRAD

VCR450, 4600, 4700	620p

CASSETTE HOUSING

FERGUSON

3V38-39	£24.00p
3V42-43, 3V44-45	£24.00p

JVC

HRD 110, HRD 120-121, HRD 225	£24.00p
HRD 140-141, HRD 455-725	£24.00p

VIDEO MOTORS

AMSTRAD

VCR-7000 REEL MOTOR	1700p

FERGUSON & JVC

CAPSTAN MOTOR PU-45979	2100p
CAPSTAN MOTOR PU-55371V	1950p
DRUM MOTOR PU-46414	1950p
REEL MOTOR PU-51381V	2650p

NATIONAL

REEL MOTOR MYN-135V5L FOR NV333, NV366	1350p

SANYO

REEL MOTOR 4-529V-10800	630p

SHARP

REEL MOTOR RMTOV 1008 GEZZ	1350p

SONY

CAPSTAN MOTOR A-6751131A FOR SLC6	700p
CAPSTAN MOTOR BHF 1100D FOR SLC7	2500p

VIDEO LAMPS

VIDEO LAMPS UNIVERSAL 12V60mA (300mm WIRES)	30p
PANASONIC VIDEO LAMPS	50p

IDLERS & PULLEYS REPLACEMENTS

HITACHI

FF REW IDLER 6886971	150p
PLAY IDLER V-6861482	320p

JVC

IDLER ASSEMBLY PU-47752	450p
TAKE UP IDLER PU-51402A	145p
TAKE CLUTCH PU-55373	225p
IDLER ARM PU-55373-3-8	285p
FAST FORWARD IDLER PU-45896C	210p

NATIONAL

IDLER	170p

SANYO

REEL PULLEY 143-0-662T-01201	520p

SHARP

IDLER NIDL0005 GEEZ	150p
IDLER NIDL0006 GEEZ	150p

SONY

REW. PULLEY A-6706-348-B	400p
REW. PULLEY A-6706-391-A/B	300p

SERVICE AIDS

SERVISOL PRODUCTS

V. HEAD CLEANER	125p
SWITCH CLEANER	130p
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K30, K35, K40, KT3, KT4

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FEBRUARY SPECIAL OFFERS

MOTORISED VHS'C' TO VHS ADAPTOR **£18.50**
- **SONY IDLER KIT** SLC6 **£2.90**
HITACHI CLUTCH VT120/VT220 **£5.75**
AMSTRAD VCR4500/VCR4600/VCR4700/VCR4800 PINCH ROLLER MOD KIT – TAPE CREASING **£5.10**
JVC ORIGINAL VIDEO HEAD HRD565/HRD566/FERGUSON 3V48 **£32.20**
REPLACEMENT CAMCORDER BATTERIES FOR MOST MAKES AND MODELS AVAILABLE.

WE CAN SUPPLY SONY, PANASONIC AND JVC TV & VIDEOS AT WONDERFUL PRICES CASH & CARRY

WE CARRY THOUSANDS OF POPULAR VIDEO & TV SPARES AT VERY COMPETITIVE PRICES TOO MANY TO LIST HERE. FOR FULL LIST PHONE FOR FREE CATALOGUE. HERE ARE SOME EXAMPLES

VIDEO HEADS

AKAI	FROM 8.95
AMSTRAD	FROM 15.97
BLAUPUNKT	FROM 8.95
DUAL	FROM 8.95
FISHER	FROM 17.70
FERGUSON	FROM 8.95
FUNAI	FROM 16.20
GOLDSTAR	FROM 19.20
HINARI	FROM 16.20
HITACHI	FROM 16.65
ITT	FROM 8.95
JVC	FROM 8.95
MATSUI	FROM 16.95
MITSUBISHI	FROM 8.95
NEC	FROM 8.95

VIDEO HEADS (Continued)

NORMANDE	FROM 8.95
ORION	FROM 8.95
PANASONIC	FROM 8.95
PHILIPS	FROM 11.60
SABA	FROM 8.95
SAISHO	FROM 16.95
SAMSUNG	FROM 8.95
SANYO	FROM 19.80
SHARP	FROM 19.80
SONY	FROM 14.90
TELEFUNKEN	FROM 8.95
TOSHIBA	FROM 14.90

SERVICE MANUALS

ALL SONY AND PANASONIC TV & VIDEO MANUALS IN STOCK
ALL SONY, PANASONIC AND JVC MANUALS AVAILABLE ON REQUEST.

REMOTE HANDSETS

HUNDREDS OF ORIGINAL AND REPLACEMENT REMOTES IN STOCK FOR FERGUSON, GRUNDIG, ITT, LOEWE, LUXOR, NORDMENDE, PANASONIC, PHILIPS, PYE, SABA, SALORA, SELECO, SONY, TELEFUNKEN FROM 9.95

PINCH ROLLERS

VIDEO PINCH ROLLERS FOR AKAI, AMSTRAD, FERGUSON, FISHER, HITACHI, ITT, JVC, MITSUBISHI, PANASONIC, SANYO, SHARP, SONY, TOSHIBA FROM 3.90

BELT KITS

VIDEO BELT KITS FOR AKAI, AMSTRAD, FERGUSON, FISHER, HITACHI, ITT, JVC, PANASONIC, SANYO, SHARP, SONY, TOSHIBA FROM 1.45

IDLERS

VIDEO IDLERS FOR AKAI, FERGUSON, FISHER, HITACHI, ITT, JVC, PANASONIC, PHILIPS, SANYO, SHARP, SONY, TOSHIBA. MOSTLY ORIGINAL MANUFACTURERS. FROM 1.76

MISCELLANEOUS

HUNDREDS OF WEIRD AND WONDERFUL PARTS IN STOCK E.G. FAULT FINDING GUIDES JVC, SONY, PANASONIC FROM 7.30

VHS TEST TAPE COLOUR BARS	28.20
VHS TEST TAPE STAIRS	28.20
PANASONIC TEST CO	30.62
VIDEO MOTORS	FROM 9.42
SENSOR LAMPS	FROM 0.53
SONY NICAM ADAPTOR (ONLY IF TV IS ADAPTABLE)	107.50
SCREW KIT APPROX. 2500 WALKMAN SCREWS 72 SIZES, UNIT COST APPROX 4p	99.17
FERGUSON/JVC CASSETTE CARRIAGE	24.95
CARRIAGE ROLLER 3V23/31/32/hr7600	4.57
ECCENTRICITY GAUGE BETA/UMATIC	72.99
SONY 5 SERIES UMATIC SERVICE KIT	76.40
REMOTE CONTROL RUBBER PADS	FROM 4.80
OE-SOLDER BRAID	FROM 0.80
AUDIO CASSETTE MOTORS 6/9/12V	4.50
SONY CO BATTERY PACKS	FROM 11.76
SONY CAMCORDER BATTERIES	FROM 32.05
SONY CAMCORDER CHARGERS & RF UNITS. CABINET ITEMS E.G. FLAPS ETC. FOR SONY AND PANASONIC TV AND VIDEO	FROM 2.50

SWITCHES

SONY TV POWER SWITCHES	FROM 4.18
SONY TV MICRO SWITCHES	FROM 1.03
SONY SLC7 TIMER SWITCHES	1.08

PANASONIC VCR MODE SWITCHES FROM £2.26

ACCOUNTS WELCOME

PLEASE SUPPLY THE FOLLOWING INFORMATION FOR AN INSTANT CREDIT ACCOUNT.

1. COMPANY NAME
2. COMPANY TYPE (EG. LTD, PARTNERSHIP, SOLE TRADER)
3. FULL ADDRESS INC. POSTCODE
4. TELEPHONE INC. STD CODE
5. DATE COMPANY STARTED TRADING
6. YOUR FULL NAME AND POSITION
7. FULL NAMES OF ANY OTHER DIRECTORS OR PARTNERS
8. NAME AND ADDRESS OF COMPANY'S BANKERS, BRANCH SORT CODE & ACCOUNT NUMBER
9. TWO TRADE REFERENCES
10. SPECIMEN OF LETTERHEAD OR ORDER FORM.

MINIMUM TRADE £40.00 PER MONTH

ORDERS BEFORE 4.00 PM — SAME DAY DESPATCH
ALL LIST PRICES ARE EX-VAT

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VIDEO HEADS

JVC FERGUSON 3HSSV	£10.00p
JVC FERGUSON 3HSSVA	£22.00p
AKAI VS201/301	£24.99p
PANASONIC 3HSSN	£10.00p
PANASONIC NV370	£15.00p
PANASONIC NV366	£30.00p
PANASONIC NV730	£30.00p
PANASONIC NV777	£24.00p
HITACHI VT8000/9000	£17.99p
HITACHI VT11/33	£17.99p
HITACHI VT17/35/39	£37.99p
HITACHI VT120/220	£34.99p
FISHER FVHP510/910	£22.99p
AMSTRAD PSF1	£19.99p
AMSTRAD PSF2	£20.95p
SAISHO, HINARI	£20.95p
SHARP	£19.99p

VIDEO BELT KITS

HITACHI	
VT-5000	£1.25p
VT-8000	85p
VT-9300	85p
VT-11/33	£1.30p
VT-52/63/65	£1.75p
SHARP	
VC-381	85p
VC-496	£1.00p
VC-585	£1.00p
VC-651/800	£1.00p
VC-7300	£1.50p
VC-8300	£1.50p
VC-9300	£1.50p
FERGUSON	
3V22	£1.80p
3V23	85p
3V29	85p
3V35	£1.00p
3V42/43	85p
PANASONIC	
NV-333	£1.35p
NV-370	£1.50p
NV-730	£1.50p
NV-777	£1.50p
NV-2000	£1.25p
NV-7000	£1.00p
NV-G10	£1.10p
FISHER	
FVH-905/910	£1.10p
FVH-710/725	£1.10p
AKAI	
VS 2EG/5EG	£1.00p
VS-10	£1.00p
AMSTRAD	
VCR-4600	£1.75p
VCR-7000	£1.00p
SAISHO	£1.00p
TRIUMPH	£1.00p
SONY	
C5/C7	£1.40p
SANYO	
VTC-5000	65p
PHILIPS	
VR-6460	£1.50p

VIDEO IDLERS

3V29 TAKE UP IDLER	£1.45p
VT 9300 PLAY IDLER	£2.95p
VT 11/14/17	£1.95p
VC 0005GEZZ	£1.95p
VC 0006GEZZ	£1.95p
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NV 370 IDLER	£2.95p
FISHER 615/625 IDLER	£3.50p
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UNIVERSAL CASSETTE LAMP	30p
SHARP CASSETTE LAMP	50p
SHARP REEL MOTOR	£14.99p
HITACHI MODULE HM6251	£5.00p
3V29 TENSION BAND	£1.99p
UNIVERSAL TRIPLERS	£5.00p
CIRCUIT PROTECTORS ICP	80p
TX 10 FOCUS UNIT	£7.99p
PHILIPS BACKUP BATTERY	£2.50p
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ALL GOODS DESPATCHED SAME DAY
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HINARI CT4/5 LOPT	£19.99p
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VT11 CASSETTE HOUSING	£25.00p

AN5111	350p
AN5010	475p
AN5265	320p
AN5410	350p
AN5431	250p
AN5435	250p
AN5510	275p
AN5620	330p
AN5900	150p
AN6341	350p
AN6344	440p
AN6350	610p
AN7145	195p
AN7156	240p
AN7161	325p
AN7168	260p
AN7171	425p
AN7172	425p
AN7178	270p
BA532	140p
BA536	180p
BA5402	250p
BA5406	280p
BA5408	220p
BA6109	180p
BA6208	250p
BA6209	250p
BA6219	300p
BA6238	200p
BA6239	250p
BA6304	190p
HA1366	160p
HA1367	300p
HA1368	160p
HA1377	200p
HA1384	400p
HA1389	210p
HA1392	230p
HA1394	280p
HA1396	395p
HA1397	255p
HA1398	240p
HA11717	600p
HA11225	170p
HA11226	410p
HA11227	225p
HA11235	170p
HA11423	210p
HA11724	800p
HA12413	275p
HA13001	195p
LA4261	300p
LA4270	300p
LA4430	130p
LA4440	230p
LA4445	260p
LA4460	170p
LA4461	170p
LA4465	425p
LA4466	425p
LA4500	230p
LA4505	260p
LA4507	360p
LA4508	260p
LA4520	230p
LA4700	425p
LA5512	130p

M293B1	600p
M51102L	325p
M51104L	400p
M545485	400p
MB3705	180p
MB3722	310p
MB3730	200p
MB3731	300p
MB3732	300p
NE555	25p
NE646	150p
STK433	490p
STK435	510p
STK439	550p
STK460	720p
STK461	720p
STK463	780p
STK465	800p
STK0029	500p
STK0040	560p
STK2029	500p
STK2125	650p
STK2129	900p
STK2250	920p
STK3041	600p
STK3042	600p
STK4121	800p
STK4131	650p
STK4141	650p
STK4142	800p
STK4151	680p
STK4152	900p
STK4161	800p
STK4162	1000p
STK4171	1000p
STK4172	1100p
STK4191	1100p
STK5315	650p
STK5325	650p
STK5338	700p
STK5421	625p
STK5481	799p
STK5482	520p
STK7308	580p
STK7348	600p
STR451	480p
STR4090	650p
STR40090	600p
STR50103	500p
STR50020	700p
STR58041	650p
STR6020	490p
TA7205	100p
TA7193	400p
TA7203	180p
TA7222	120p
TA7229	300p
TA7230	170p
TA7240	260p
TA7241	260p
TA7245	400p
TA7269	550p

TA7270	250p
TA7271	275p
TA7272	260p
TA7273	350p
TA7274	260p
TA7279	400p
TA7280	330p
TA7281	270p
TA7282	260p
TA7299	400p
TA7680	480p
TBA800	40p
TBA820M	50p
TBA950	120p
TDA1515	250p
TDA1670	300p
TDA1908A	100p
TDA2003	100p
TDA2005	130p
TDA2575	200p
TDA2577	250p
TDA2581	200p
TDA2593	150p
TDA2653A	350p
TDA3560	320p
TDA3561	300p
TDA3562	260p
TDA3565	300p
TDA3651	250p
TDA3652	700p
TDA4500	360p
TDA4503	400p
TDA4505	300p
TDA4600	200p
TDA7240	300p
TDA8180	500p
TDA9503	240p
UPC1031	180p
UPC1181	110p
UPC1182	110p
UPC1185	230p
UPC1188	275p
UPC1225P	200p
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UPC1263	230p
UPC1277	240p
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UPC1363	190p
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2SA-673	20p
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2SA-684	40p
2SA-697	45p
2SA-715	35p
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2SA-726	25p
2SA-733	20p
2SA-748	90p
2SA-765	300p
2SA-769	130p
2SA-771	130p
2SA-777	50p
2SA-794	60p
2SA-798	55p
2SA-817	25p
2SA-841	40p
2SA-844	15p
2SA-861	50p
2SA-872	20p
2SA-893	15p
2SA-896	35p
2SA-899	60p
2SA-900	35p
2SA-905	20p
2SA-915	30p
2SA-916	30p
2SA-917	35p
2SA-921	10p
2SA-940	50p
2SA-950	25p
2SA-958	70p
2SA-962	60p
2SA-964	65p
2SA-965	25p
2SA-966	25p
2SA-968	70p
2SA-970	15p
2SA-984	30p
2SA-985	65p
2SA-992	30p
2SA-999	20p
2SA-1015	20p
2SA-1016	20p
2SA-1020	30p
2SA-1048	20p
2SA-1060	90p
2SA-1062	125p
2SA-1094	190p
2SA-1095	275p
2SA-1102	180p
2SA-1104	200p
2SA-1106	200p
2SA-1110	60p
2SA-1123	40p
2SA-1141	200p
2SA-1142	65p
2SA-1145	60p
2SA-1146	190p
2SA-1147	190p
2SA-1156	60p
2SA-1180	200p
2SA-1220	50p
2SA-1232	175p
2SA-1262	65p
2SA-1265	150p
2SA-1282	35p
2SA-1386	275p
2SB-507	100p
2SB-509	100p
2SB-511	100p
2SB-511	100p
2SB-512	100p
2SB-514	100p
2SB-527	40p
2SB-528	40p
2SB-531	200p
2SB-534	200p
2SB-536	60p
2SB-537	60p
2SB-544	60p
2SB-545	150p
2SB-546	70p

2SB-548	40p
2SB-554	170p
2SB-557	150p
2SB-558	150p
2SB-560	35p
2SB-561	20p
2SB-562	35p
2SB-564	70p
2SB-566	110p
2SB-568	40p
2SB-595	80p
2SB-596	75p
2SB-618	325p
2SB-631	40p
2SB-632	40p
2SB-633	50p
2SB-641	20p
2SB-643	20p
2SB-644	15p
2SB-647	30p
2SB-648	55p
2SB-649	40p
2SB-673	80p
2SB-681	250p
2SB-686	120p
2SB-688	130p
2SB-695	325p
2SB-705	200p
2SB-716	30p
2SB-717	70p
2SB-718	70p
2SB-738	25p
2SB-744	25p
2SB-755	310p
2SB-757	350p
2SB-764	25p
2SB-772	45p
2SB-792	45p
2SB-793	35p
2SB-817	200p
2SB-837	60p
2SB-856	60p
2SB-857	60p
2SB-861	60p
2SB-886	65p
2SC-789	50p
2SC-790	80p
2SC-815	15p
2SC-828	25p
2SC-829	20p
2SC-839	25p
2SC-929	20p
2SC-941	25p
2SC-945	20p
2SC-959	65p
2SC-984	40p
2SC-998	300p
2SC-1162	35p
2SC-1172	150p
2SC-1173	45p
2SC-1195	200p
2SC-1212	60p
2SC-1213	60p
2SC-1214	40p
2SC-1222	20p
2SC-1226	75p
2SC-1306	75p
2SC-1317	25p
2SC-1318	25p
2SC-1327	20p
2SC-1328	25p
2SC-1344	30p

2SC-1345	30p
2SC-1359	20p
2SC-1368	40p
2SC-1382	40p
2SC-1383	35p
2SC-1384	35p
2SC-1393	30p
2SC-1398	70p
2SC-1399	60p
2SC-1403	250p
2SC-1413A	240p
2SC-1417	20p
2SC-1445	250p
2SC-1446	60p
2SC-1447	75p
2SC-1454	320p
2SC-1473	30p
2SC-1474	45p
2SC-1475	45p
2SC-1507	50p
2SC-1509	45p
2SC-1514	40p
2SC-1520	85p
2SC-1550	60p
2SC-1567	60p
2SC-1568	60p
2SC-1573	40p
2SC-1577	800p
2SC-1584	600p
2SC-1627	30p
2SC-1667	150p
2SC-1669	85p
2SC-1670	85p
2SC-1675	20p
2SC-1677	80p
2SC-1708	20p
2SC-1722	60p
2SC-1756	40p
2SC-1758	30p
2SC-1760	85p
2SC-1775	20p
2SC-1815	15p
2SC-1819	50p
2SC-1845	20p
2SC-1846	45p
2SC-1848	45p
2SC-1875	260p
2SC-1890	20p
2SC-1906	30p
2SC-1909	250p
2SC-1913	100p
2SC-1914	30p
2SC-1922	275p
2SC-1923	20p
2SC-1941	40p
2SC-1942	190p
2SC-1945	250p
2SC-1969	160p
2SC-1980	25p
2SC-1986	60p
2SC-2003	25p
2SC-2009	60p
2SC-2022	60p
2SC-2026	45p
2SC-2057	25p
2SC-2068	50p
2SC-2073	50p
2SC-2120	15p
2SC-2153	40p
2SC-2229	25p
2SC-2230	30p
2SC-2236	30p

2SC-2238	60p
2SC-2240	25p
2SC-2274	30p
2SC-2275	50p
2SC-2278	75p
2SC-2320	25p
2SC-2335	120p
2SC-2371	45p
2SC-2427	80p
2SC-2440	70p
2SC-2458	30p
2SC-2482	40p
2SC-2500	30p
2SC-2501	85p
2SC-2502	90p
2SC-2537	450p
2SC-2546	20p
2SC-2550	70p
2SC-2555	150p
2SC-2564	230p
2SC-2565	260p
2SC-2570	50p
2SC-2575	25p
2SC-2577	125p
2SC-2579	130p
2SC-2580	175p
2SC-2581	200p
2SC-2582	40p
2SC-2603	20p
2SC-2611	40p
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2SC-2660	85p
2SC-2688	50p
2SC-2753	50p
2SC-2781	50p
2SC-2785	50p
2SC-2791	325p
2SC-2792	275p
2SC 2944	175p
2SC-3078	40p
2SC-3156	325p
2SC-3179	200p
2SC-3182	250p
2SC-3284	175p
2SC-3298	120p
2SC-3506	250p
2SC-3519	150p
2SD-198	180p
2SD-200	210p
2SD-234	40p
2SD-235	40p
2SD-288	80p
2SD-299	160p
2SD-313	40p
2SD-315	75p
2SD-325	45p
2SD-331	80p
2SD-400	20p
2SD-401	50p
2SD-414	40p
2SD-421	60p
2SD-424	250p
2SD-426	150p
2SD-427	150p
2SD-428	150p
2SD-438	45p
2SD-461	100p
2SD-468	25p
2SD-471	30p
2SD-476	60p
2SD-478	100p

2SD-523	150p
2SD-525	70p
2SD-526	70p
2SD-560	50p
2SD-570	40p
2SD-571	30p
2SD-592	20p
2SD-600	80p
2SD-612	40p
2SD-613	70p
2SD-621L	450p
2SD-636	25p
2SD-637	20p
2SD-639	25p
2SD-641	310p
2SD-666	25p
2SD-667	25p
2SD-669	40p
2SD-687	60p
2SD-716	120p
2SD-718	130p
2SD-721	150p
2SD-725	350p
2SD-745	250p
2SD-748	150p
2SD-761	50p
2SD-773	30p
2SD-781	30p
2SD-788	30p
2SD-789	25p
2SD-792	340p
2SD-794	60p
2SD-822	400p
2SD-836	85p
2SD-837	80p
2SD-838K	475p
2SD-845	250p
2SD-850	260p
2SD-859	100p
2SD-863	70p
2SD-869	320p
2SD-870	320p
2SD-871	320p
2SD 880	40p
2SD-882	70p
2SD-898B	260p
2SD-917	180p
2SD 951	175p
2SD-982	80p
2SD-985	80p
2SD-1128	80p
2SD-1134	80p
2SD-1135	90p
2SD-1138	60p
2SD-1153	50p
2SD-1207	50p
2SD-1265	100p
2SD-1267	140p
2SD-1273	100p
2SD-1275	125p
2SD-1276	125p
2SD-1397	200p
2SD-1398	170p
2SD 1426	275p
2SD 1427	275p
2SD-1432	300p
2SD-1439	200p
2SD-1441	200p
2SD-1453	170p
2SD-1497-02	520p
2SD-1497-06	520p
2SJ-50	425p

EAST CORNWALL COMPONENTS

Access

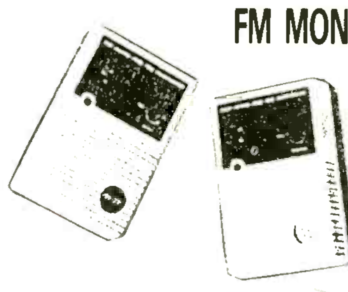
BARCLAYCARD VISA

EAST CORNWALL COMPONENTS
119 HIGH STREET DEPT.TV2
WEM
SHROPSHIRE SY4 5TT TEL: 0939 32689
TELEX: 35565
FAX: 0939 33800

FEBRUARY SPECIAL OFFER

VALVES					
OAF	0.70	EF95	0.90	PCL84	1.30
DF96	0.80	EF183	1.35	PCL86	1.50
DK96	3.10	EF184	0.90	PCL88	2.95
DY86/87	0.90	EH90	0.45	PCL805	1.55
DY802	0.98	EL34	4.15	PD500	4.35
E88CC	4.65	EL36	1.60	PFL200	1.95
EABC80	0.85	EL81	8.05	PL33	1.45
EAF42	1.78	EL84	1.50	PL84	1.20
EB91	0.80	EL86	1.45	PL504	1.98
EBC41	2.45	EL509	8.50	PL508	1.80
EBC81	1.65	EL519	8.50	PL519/509	8.85
EBF80	1.38	EM80	1.50	PL802	11.25
EBF83	1.35	EM84	0.92	PY81/800	2.00
EBF89	1.15	EM87	6.30	PY88	0.95
EC92	2.10	EY51	2.40	PY500A	3.30
ECC81	1.58	EY86/87	0.85	PY801	1.35
ECC82	1.05	EY88	1.15	UABC80	1.05
ECC83	1.30	EY500A	2.55	UAF42	1.30
ECC84	0.65	EZ41	3.45	UBC41	4.15
ECC85	1.30	GY501	1.65	UBC81	2.05
ECC86	3.25	GZ32	2.85	UCH42	2.85
ECC88	1.50	GZ34	6.25	UF41	3.45
ECC189	1.50	KT88	POA	UL84	1.50
ECF80	1.55	PC86	0.75	UY41	6.65
ECF82	1.60	PCC84	0.50	UY85	2.05
ECF83	2.25	PCC85	0.95	2D21	3.05
ECH35	4.35	PCC88	1.30	6AU6	1.50
ECH42	1.68	PCC89	0.85	6BA6	1.45
ECH81	1.30	PCC189	0.85	6BE6	2.18
ECL80	0.80	PCF80	1.35	6C4	2.40
ECL82	1.85	PCF82	0.75	6K7G	3.05
ECL83	3.80	PCF86	1.35	6X4	1.80
ECL84	1.25	PCF87	1.35	12AU6	3.20
ECL85	1.15	PCF200	3.10	12AV6	2.85
ECL86	1.45	PCF800	1.05	30FL2	2.65
EF37A	5.45	PCF801	1.50	30PL1	1.95
EF80	0.80	PCF802	1.25		
EF85	0.55	PCF805	1.65	FULL RANGE IN CATALOGUE	
EF86	2.65	PCL82	1.55		
		PCL83	2.95		

FM MONITOR INTERCOM



☆ FM wireless monitoring intercom. Transmitter and receiver are connected by domestic mains supply (no additional wiring). Ideal for monitoring nursery, telephone, door, etc. Transmitter has voice activated microphone, sensitivity control and on/off switch. Receiver has good quality loudspeaker, volume control and on/off switch.
Power: 240Vac 50Hz
Dims: 115 x 77 x 48mm
P161 (GEE468)

ONLY £13.99
A PAIR AVAILABLE WHILE STOCKS LAST
NORMALLY
£25 A PAIR

☆ All prices include 15% VAT and our p&p is now £1.75 ☆

HOME ALARM PACKAGE

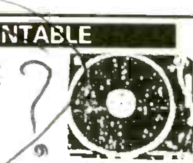
Includes
- ★ Optima Alarm Control Panel
- ★ External Feed Bell Box
- ★ 2 × 1 Internal Passive I/R
- ★ 2 × Door Contacts
- ★ Siren for Bell Box
- ★ 100 mtrs cable and clips
- ★ Full fitting instructions

ONLY £127.50
★ BACK UP LEAD ACID BATTERY 12v 1.9 £14.00

PERSONAL CASSETTES

★ SPECIAL OFFER ★
AIWA – HS-P12
Features: Auto-Stop, Metal Selector. Our Price £8.99
AIWA – HS-G35 Mk II
Features: Auto-Reverse, 3-Band Graphic Equaliser, CrO, Metal Selector. Our Price £16.99 or 2 for £30.00

BRS TURNTABLE



These need no introduction, brand new, complete with cartridge and stylus. Also, complete with turntable belt. 12V 0.06A motor fitted. Simply construct your own plinth. Absolute bargain.
ORDER CODE/SO/BSR
ONLY £9.99

★★ LATEST 1991 CATALOGUE ★★

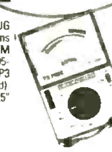
1991 Catalogue — over 128 pages incl. Special Offer sheets, Prepaid Envelope & Order Form £1.50, or free on application with orders of £15 and over. Prices in Catalogue may vary as material for advert is prepared 6/8 weeks before issue.

ALSO VELEMAN KIT CATALOGUE

FM TRANSMITTER

Very High Quality MINIBUG – Ideal for baby alarms etc!! reception on any FM radio. Frequency: 105-109MHz FM Power: PP3 9V battery (not included) Dimensions: 4.25" × 2.25" × 0.76". Code SO.004

£9.99



VIDEO HEAD TESTER

A VHS video head tester for determining whether a video head is in good condition by detecting the wear state and displaying it on a meter. Complete with carrying case and leads.

SPECIAL PRICE £39.50
★ ★ NEW LINE! ★ ★

BACK UP LEAD ACID BATTERY CHARGER £19.99

FULL RANGE OF BABINI BOOKS IN STOCK. SEE OUR LATEST CATALOGUE

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VP88 £13.65
VP-7100 £13.65
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VS 2 £13.65
VS 3 £13.65
VS 5 £13.65
VS 9 £13.65
VS 10 £13.65
VS 77 £13.65
VS 9300 £13.65
VS 9500 £13.65
VS 9700 £13.65
VS 9800 £13.65

FERGUSON
3V00 £13.65
3V01 £13.65
3V16 £13.65
3V22 £13.65
3V23 £13.65
3V24 £13.65
3V29 £13.65
3V30 £13.65
3V31 £13.65
3V35 £13.65
3V36 £13.65
3V38 £13.65
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8903 £13.65

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GRUNDIG
Full range now available
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VT8500 £25.00
VT9000 £25.00
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HRD120 £13.65
HRD121 £13.65
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HR3660 £13.65
HR4100 £13.65
HR7200 £13.65
HR7600 £13.65
HR7610 £13.65
HR7650 £13.65
HR7700 £13.65

NEC
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N831 £13.65
N832 £13.65
N833 £13.65
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NV322 £13.65
NV330 £42.50
NV333 £13.65
NV340 £13.65
NV366 £13.65
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NV380 £18.10
NV430 £27.99
NV450 £42.50
NV470 £42.50
NV480 £42.50
NV730 £42.85
NV2000 £13.65
NV3000 £13.65
NV7000 £13.65
NV7200 £13.65
NV7500 £13.65
NV7800 £13.65

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NV7850 £13.65
NV8170 £13.65
NV8200 £13.65
NV8200 £13.65
NV8400 £13.65
NV8600 £13.65
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ORION
VH 1 £13.65
VH 2 £13.65

PHILIPS
VR 6460 £18.10
VR 6520 £18.10

SANYO
VTC 3000 £25.00
VTC 5000 £45.00
VTC 5500 £45.00

SHARP
VC200/300/482/3300/9100/9300/9400/9500/9600/9700 £30.99
VC381/384/385/386/387/388/481 £28.50

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SL C5 £25.00
SL C6 £25.00
SL C7 £25.00
SL C9 £48.60
SL C20 £24.85
SL C24 £24.85
SL C30 £24.85
SL C33 £24.85
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SL F1 £24.85
SL F30 £24.85
SL 3000 £24.85
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TELEFUNKEN POA

THOMSON POA

TOSHIBA
V31 £31.70
V33 £31.70
V55 £13.45
V57 £13.45
V5470 £13.45
V9600 £31.70

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AMSTRAD
CTV1409 £17.50
CTV2200 £17.50
CTV2210 £17.50
TV/VID-TVR1 £17.50
VCR5200 £20.00
VCR7000 £12.00
VCR9000 £12.00

DECCA
80/10-NON TEXT (RC1) £24.50
101 NON TEXT £27.50

FERGUSON
TX9/10 NON TEXT £15.95
TX9/10 TEXT £15.95
TX9/10 TEXT/STEREO £15.95

FIDELITY
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FD09141 CTV14S £15.95

GRUNDIG
TP400 TELETEXT £15.95
TP400 NON TEXT £15.95

ITT
RG305 £15.95
RG306 £15.95

JVC
3V23 £15.95
3V31 £15.95
3V35 £15.95

PHILIPS
G11 TEXT £15.95
KT3/K30 TEXT £15.95
KT3/K30 NON TEXT £15.95
RC5 STD £15.95

CASSETTE LAMP

UNIVERSAL
High quality 12 Volt Universal Video Cassette Recorder Lamp and Head. Lead length: Approx. 30cm
ORDER CODE: VID/LAMP
F19Price — 60p

SERVICE MANUALS

SONY SL C5/6/7
FERGUSON VHSTJ1/3V00/HR3330EK
FERGUSON VHSTJ1/3V22/HR3320EK
ALL £8.00 EACH

PINCH ROLLERS

AKAI	1EG/2EG/4EG/5EG/6EG/9EG/SC15EG	£3.99
	VS9700	£4.35
FERGUSON	3V00/3V24	£3.99
	3V29/3V32	£5.25
HITACHI ALL		£3.99
JVC	HR2000/3000/3300/3660/4100/7700	£3.99
NEC	N830/N833	£3.99
ORION	VH 1/2	£3.99
PANASONIC	NV100/180/332/333/366/600E/777/778	£4.95
	2000/230/3000/370/430/460/465/7000/7200/730/780/810/8200/830/8400/850/8600/8610/870/890	£3.99
PHILIPS	VR 6460	£3.99
	VR 6560	£3.99
SANYO	VTC3000	£4.20
	VTC5000/5150/5300/5350/5400/5500/6000/6500/9100/9300/m10/11/20/21/30/31/M50	£4.25
SHARP	200/382/384/385/386/388/390/3300/7300/6000/6200/6300/7300/7700/7750/8000/8300/9300/9500/9700	£3.99
SONY	SL C5/6/7	£4.20
TOSHIBA	V5	£3.99

VIDEO BELT KITS

AKAI	VS 9300/9500	2.10
FISHER	MOST	2.50
HITACHI	VT5000E/5500/3000	2.75
	VT/7000/8000/8500/9300	
	VT/9500/9700	1.50
	VT11/VD88	3.75
JVC/FERG	3V00/3V22	2.10
	3V29/3V30	1.50
JVC/THORN	3V35/3V39	1.50
JVC	3300/3300/3360	2.10
	7200	2.00
	7600/7610/7650/7655	2.25
NAT. PAN.	NV7000/7200/777/7800	1.75
	NV2000/3000	2.75
	NV332/333/366	1.99
	NV8600/8610	3.75
SANYO	VTC5150/6000/5000	1.20
	VTC9100/9300	2.80
SHARP	2300/381/384/385/386/390/9300/9500	1.50
	VC7300/7700/7750	1.75
	VC6300	2.25
SONY	SLC5	2.05
	SL C6	2.30
	SL-C8000	2.30
TOSHIBA	V32 & 33	6.30
	V55 & 57	1.50
	V66/67/9600	1.20

FULL RANGE OF CASSETTE PLAYER DRIVE BELTS: 19mm to 57mm 25p; 60/94mm 29p; 100/110MM 35p each
TURNTABLE DRIVE BELTS: 121/210mm £1.99 each
CASSETTE DRIVE BELTS: 68/78mm 45p each; 81/95mm 50p each
CASSETTE DRIVE BELTS: (WALKMAN TYPE) 30p each

IDLERS

FISHER	143-0-4204-00400	3.05
FISHER	GEAR IDLER 143-0-4904 00900	6.00
FERG/JVC	TAKE UP IDLER PU51402A	1.90
HITACHI	6886971	1.99
PANASONIC	VXP 0344	1.00
PANASONIC	VXP 0251	2.30
SANYO	REEL DRIVE PULLEY VTC 5150 143-0-6621-01201	6.50
SHARP	NIDL 0005 GE22	1.90
SHARP	NIDL 0006 GE22	2.10
THORN/JVC	PU48967B	2.99

MAINS SWITCHES

PB3008 Decca/GEC	0.99
SONY (Universal)	4.05
PB5030 Rank Remote	1.50
PB3003 Philips G8 Plastic	0.95
PHILIPS KT3 (Remote)	1.99
5031 PHILIPS G11 Remote	1.40
285/1 ITT CVC5/CV20	1.40
PB3005 PHILIPS G11	0.95
THORN TX90 00E2 158-001	0.95

MOTORS

Reel Motor SANYO VTC 5150 4-529V-10800	9.20
Reel Motor SHARP VC93000/98000RMOTV 1008 GE22	18.95
Capstan Motor FERG/JVC 3V35 PU55371V/M	27.50
Audio Motor Recorder 12V CW 34mm	4.10
Audio Motor 9V CW 34mm	4.20

20mm FUSES

QUICK BLOW - 80mA, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1A, 1.25, 1.5, 1.6, 2, 2.25, 3.15, 4.5, 6.3 — 50p/10
TIME DELAY - 50mA, 60, 80, 100, 125, 160, 200, 250 315, 400, 500, 630, 800, 1A, 1.25, 1.6, 2, 2.25, 3.15, 4, 5, 6.3 10 — 1.50/10

14 QUICK BLOW FUSES

500Ma, 1A, 1.25A, 2A, 12A — 50p/10

SOLDER 18 & 22 SWG -500gm REEL

	1+	10+
18swg	£4.95	£4.70
22	£34.99	£4.75

Remember: Our prices INC. VAT!

HEATSHRINK PACK
Approx 10 lengths of assorted sizes from 1.6mm to 12.7mm. Lengths 12". Price: **£1.00** ea.

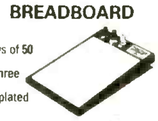
ANTEX IRONS

C-15W IRON	£8.37
CS-17W IRON	£8.48
XS-25W IRON	£8.59
XS KIT 25W	£11.98
CS KIT 17W	£11.87
C KIT 15W	£11.75

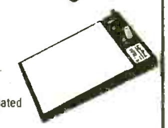
ALL BITS FOR IRONS — £1.75
ELEMENTS £4.10
STANDS £3.25
ORYX PORTABLE GAS SOLDERING IRON
£18.95 Tips £5.50

BREADBOARD

Y035E Price £13.95
Solderless breadboard with a total of 1680 contacts arranged in four blocks of 64 vertical rows of 5 interonnected sockets and eight rows of 50 interconnected sockets on a standard 0.1" pitch. Supplied mounted in a baseboard with three 4mm sockets.
No of contacts: 1680; Contact material: Silver plated nickel silver; Dims: 24 x 150 x 20mm

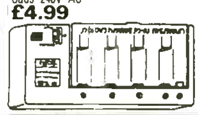


Y035G Price £19.99
Solderless breadboard with a total of 2420 contacts arranged in six blocks of 64 rows of 5 interconnected sockets and ten rows of 50 interconnected sockets on a standard 0.1" pitch. Supplied mounted on a baseboard with four 4mm sockets.
No of contacts: 2420; Contact material: Silver plated nickel silver; Dims: 243 x 195 x 20mm



NI-CAD CHARGER

Charges AAA, AA, C, D & PP3 Ni-Cads 240V AC
£4.99



NI-CAD RECHARGEABLE BATTERIES

	PRICE 1+	EACH 10+
AAA	£1.50	£1.30
AA	£0.95	£0.85
C	£1.95	£1.80
D	£2.00	£1.85
PP3	£3.90	£3.75

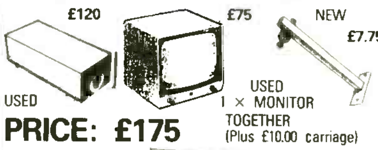
8 WAY SPLIITER

8 way splitter amplifier to supply 8 TV's from one antenna. White plastic box with aluminium panel. On/off switch with neon.

Band width	40MHz-860MHz
Gain	3dB per channel Total 21dB
Impedance	75Ω
Max. output	80mV (38dBnV) (signal/cross modulation = 6dB
Noise	6dB
Isolation between outputs	40dB min.
Power	240Vac 50Hz
Dims	250 × 100 × 60mm

£29.99

"CLOSED CIRCUIT TELEVISION SYSTEM



1 × CAMERA £120 USED
1 × MONITOR £75 USED
1 × CAMERA BRACKET NEW £7.75
PRICE: £175 TOGETHER (Plus £10.00 carriage)

12V Twin Fluorescent Lamp 12" Double Tubes

£5.99 **£4.99/10**
Attractive white fitting, ribbed perspex diffuser. On/off switch. 3ft cable. Transistorised circuitry. Keyhole fixing. 12V D.C. 8W Tubes. Dimensions: 368 × 67 × 43 mm.

VIDEO REPAIR KITS

AMSTRAD, JVC, FERGUSON, PANASONIC, HINARI, SHARP, HITACHI — Price on Application

EXTERIOR FLOODLIGHT

Super weatherproof exterior floodlight which could be used with the External PIR on the previous page.
Black in colour, supplied complete with 500W halogen bulb.
Adjustable mounting bracket and hinged glass front for changing bulbs.
C/EFL PRICE: £19.99

SPARE HALOGEN BULBS

Standard length bulbs in 3 Wattages.

200W SEC/200W	PRICE: £3.50
300W SEC/300W	PRICE: £3.75
500W SEC/500W	PRICE: £4.00

TUNGSTEN HALOGEN LAMP

VIDEO CAMCORDER BATTERIES

Now available from stock. Simply telephone with your camcorder model number for price. i.e.:
SONY £27.95 JVC £35.00

PHILIPS VIDEO/TV CO-AX LEAD

10 metres long, Co-Ax plug to right angle co-ax plug. Colour: Grey.
PRICE: 1+ £1.75 5+ £1.50 EACH

VHS-C ADAPTOR (Motorised)

Converts your VHS-C film to standard VHS. Simple to use.
SPECIAL OFFER PRICE: £25.00

COMMODORE SPARES

Simply telephone for latest prices, quoting model number etc.

VELLEMAN KITS

Send large S.A.E. now for our 1991 Full Colour Kit catalogue.

LOGIC ANALYZER

Hewlett Packard HP 1631D complete with Disc Drive (HP9122D), Printer (HP2225A), Various probes etc. Approx 4 years old. List price over £14,000!
Our Price: £1500.00

RESISTOR KITS each value individually packed

1/4W pack 10 each value E12 — 10R to 1M 610 pieces	5.10
1/4W pack 5 each value E12 — 10R to 1M 305 pieces	3.75
1/4W pack Popular — 10R to 10M 1000 pieces	6.99
1/2W pack 10 each value E12 — 2R2 to 2M2 730 pieces	8.75
1/2W pack 5 each value E12 — 2R2 to 2M2 365 pieces	5.40
1/2W pack Popular — 2R2 to 10M 1000 pieces	10.75
1W pack 5 each value E12 — 2R2 to 1M 365 pieces	15.25
2W pack 5 each value E12 — 10R to 2M2 317 pieces	25.00

ADDITIONAL KITS

DISC CERAMIC 50V	125 pieces	£3.99
ZENER DIODES 5ea	55 pieces	£3.99
ELECTROLYTICS CAPS. RADIAL	100 pieces	£8.50
FUSES Q/BLOW 20mm	80 pieces	£4.75
FUSES T/DELAY 20mm	80 pieces	£8.50
PRE-SET POTS. Hor.	120 pieces	£7.75
PRE-SET POTS. Vert.	120 pieces	£7.75
POLYESTER 100V	110 pieces	£5.00
NUT & BOLT	800 pieces	£5.99
SELF-TAPPING SCREWS 3 Sizes		P.O.A.

QUARTZ HALOGEN SPOTLIGHT

Price only £5.75

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☆ **EPROM SPECIAL**
27C256-25 (Brand New)
£3 ea.
10+ £2.50 ea
☆ ☆ ☆

p&p NOW £1.75

ORDERING: All components are brand new and to full specification. Please add £1.75 postage/packing (unless otherwise specified) to all orders. Minimum order £5.00. Either send cheque/postal order or send telephone your Access or Visa number. Official orders from schools, universities, colleges etc most welcome. (Do not forget to send for our catalogue - only £1.50 pere copy). Delivery by return on ex-stock items. All prices subject to change without notice. RETAIL shop open Mon-Sat 9.00-12.
REMEMBER ALL PRICES NOW INCLUDE VAT.

TELEVISION

Lean Production

It has long been the conventional view in the West that marketing is as important as production, maybe more so. After all, if you can't sell what's produced there's no point in making it. One odd feature of the trade imbalance between the West and Japan in consumer goods is that while Western countries are rather good at marketing this doesn't seem to be a strong point with the Japanese. In effect, Western salesmanship is being put at the service of Japanese manufacturers. What the Japanese are good at, as we all know by now, is production. The workfloor, as we have been told again and again by Japanese manufacturers – remember all those banners exhorting higher production and efficiency – is where wealth is created.

Why Japanese marketing should be relatively indifferent is an interesting question. It probably has much to do with the cultural factors. The language and general approach to communication don't lend themselves to hype. And Japanese society remains highly male dominant. It would seem that a society where men and women have considerable social and preferably economic equality as well provides optimum marketing opportunities. Oh, and maybe when the kids get an appreciable say too – advertisers call it pestering power! Not only is Japanese marketing indifferent, but the distribution system is notoriously inefficient. All this doesn't imply that the Japanese domestic market is in any way less than competitively healthy. It seems that the Japanese need no great encouragement to go out and buy consumer electronic goods despite a far greater tendency than in English-speaking countries to save (another helpful feature of the Japanese economic equation). It's a strange fact too that the Japanese don't go in for test marketing and that sort of thing. Products of all sorts are simply put on the market to see whether or not they sell. It seems that a large number don't – like maybe that tape rewinder in the shape of an automobile whose headlights come on when the rewind is complete! This apparently chaotic approach to product innovation goes hand-in-hand with a lot of research into the house of the future and so on to try to identify products that will contribute to an evolving pattern of living. Just another of those strange contrasts that make Japan watching such an intriguing business.

If the Japanese are somewhat wanting in marketing expertise, that cannot be said of their production know-how. But we've long lived in the age of mass-produced goods. You might reasonably suppose that assembly lines tend to be much of a muchness wherever they are. Just what's so different about Japanese production methods? Extra efficiency with innovative technology appears to be a large part of the answer. In particular something that's come to be known as "lean production", which seems to have developed first in the Japanese automobile industry. If you want to look into it a recently published book, *The Machine that Changed the World*, by James P. Womack, Daniel T. Jones and Daniel Roos (Maxwell Macmillan, £19·95) tells the story. Why "lean"? Because "it uses less of everything compared to conventional mass production – half the human effort in the factory, half the manufacturing space, half the investment in tools and half the engineering hours to develop a new product in half the time". How did it all start? It seems that during the Forties Taiichi Ohno, Toyota's production chief (though there couldn't have been much production at that time) visited and studied American plants and methods closely. He came to the conclusion that there was enormous waste of effort, material and time. In particular he felt that the traditional division between the assembly line workers and the specialists who designed the products and decided how they were to be produced meant that neither were able to maximise their contribution to the quality of the product coming out of the plant. This brings us to the famous quality control circles and what they are really all about. Taiichi Ohno decided that it would be better to group the production line workers in teams each with a team leader and give them responsibility for deciding on the best way of organising the various sections of the assembly process, their responsibilities to include quality control of the product and minor equipment maintenance.

A good and possibly obvious idea. To gauge its significance however one has to appreciate how bad mass production can be. Whole plants can come to a halt because of a minor fault or the delivery of out-of-tolerance components. A badly organised line with indifferent control can lead to the need for a massive amount of expensive reworking – those PCBs with odd items added on the print side. Plants can fill up with TV sets or automobiles awaiting remedial attention (too much manufacturing space, as Mr. Taiichi observed).

As important as organising the work to get maximum use of the available human resources is the use of more flexible manufacturing equipment. With traditional mass production, machines are designed to undertake large quantity production of specific items. This is not much good when you want to make subtle product changes. It's certainly no help when a plant is producing for many export markets with different requirements – say manufacturing a TV chassis that can be easily adapted for NTSC or PAL colour or for 110V or 240V mains operation. Lean production basically involves getting everyone very much involved in the production process and ensuring that it's adaptable. This aids model changes and the quick introduction of new technology. Often wondered how the Japanese can introduce three generations of VCRs in a year? Now we know some of the answers.

The authors of *The Machine that Changed the World* point out that there is nothing specifically Japanese about the concept of lean production. Anyone could do it given the necessary resources. A trained workforce is a major factor here. If the UK fails to follow this path, lack of skilled people and poor technical education will be a major reason.

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John A. Reddihough

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HELD OVER

Our February issue is produced under the difficult conditions of the Christmas/New Year holidays. Due to time constraints one or two items that we had planned to include have had to be held over.

COVER PHOTO

This month's cover photograph shows an interior view of the Toshiba V71B VHS VCR. See article on pages 260-1.

Fifty Years in Radio and TV

Part 2: The War Years and After

Harold Peters

My opening piece last month brought us to the start of the 1939-45 war. The next logical time segment is the war years themselves. Younger readers might be forgiven for wondering what they had to do with television, since everyone knows that the BBC's service stopped abruptly at ten past twelve on the day before the war started and that transmissions didn't recommence until well after the end of hostilities. Several things relevant to television happened during this interim period however, some good and some not so good. There was radar for example, which provided the commanding advantage that you could spot enemy planes before they spotted you. Production of radar equipment as required was possible because the TV production lines could be swung over to radar at the drop of a hat. There are indeed some who maintain that pre-war television was simply an offshoot of radar and was encouraged as a smokescreen to conceal what was really going on.

The EMI Team

Certainly Isaac Shoenberg's brilliant team at EMI, who gave us the 405-line system, were involved with radar. It's interesting that members of the team are reputed to have worked out the parameters of the interlaced-field system of scanning, which all present TV systems continue to use, over a weekend. One member of the team in particular comes to mind, Alan Blumlein. Well before the war he'd brought out patents for such things as tuned line output transformers, and I cherish a photocopy of Patent number 394, 325 in which he described methods of broadcasting and recording stereophonic sound, just like we have today. This patent was applied for on December 15th, 1931!

During the war Blumlein was concerned with the development of a type of airborne radar that's in common use today – it displays a plan of the ground below on a c.r.t. screen. They called it H2S because "them upstairs", when presented with the idea, said "it stinks". If you don't get the connection, ask a chemist. Blumlein set out from Orford Ness to test the prototype over enemy territory. His aircraft never returned. We shall never know how different television might have been today had he survived. In the event the USA, which entered the war rather later, robbed us of our lead in TV engineering – the 525-line system featured negative-going vision modulation and f.m. sound.

War-time Experiences

The war gave lots of us the chance to add professionalism to our technical skill and enthusiasm. They didn't let you touch service equipment without the appropriate training. At call-up we were broken into service life by a rigorous six-week period of primary training. It was mostly drill, weapons handling and sheer physical endurance. One day, direct from a morning spent shooting the topsails of passing Thames barges at the Purfleet rifle range, we were given an aptitude test. This began with a written paper consisting of puzzles etc. and culminated with the reassembly of a bayonet lampholder that had been stripped right down to the springs. This was a piece of cake for a "Saturday boy". Well within the allocated time I'd done mine and those of both my mates. But someone must have been watching. While I was posted to REME (the Royal Electrical and Mechanical Engineers) my mates weren't.

The army training was so thorough that the theoretical knowledge I acquired lasted me right up to the microprocessor era, when we began to forget about coils, capacitors and resistors etc. and concentrated on little black lozenges instead. There was plenty of opportunity to continue my interest in entertainment equipment. Anyone who could operate a cine projector or set up a public address system that didn't howl had no difficulty in filling his spare time. Production of civilian radio sets had ceased – it wasn't until later that the famous "wartime utility receiver" came along. This meant that if you could get hold of electrolytic capacitors and could wield a soldering iron (a big lump of copper on a stick, heated over the gas) your pocket money was assured. For those of you who don't remember valves, they got really hot and so did the chassis. The electrolyte used in smoothing capacitors was a borax paste that dried out with time and use. So constant replacement was necessary. When you did so hum, low gain and instability disappeared at a stroke, the improvement being so spectacular that your charge was paid without a murmur.

Developments

Wartime necessity was the mother of invention. Mullard produced the famous EF50 valve, a pinchless r.f. pentode with nine pins that came straight out of the glass. Meanwhile the Americans came up with a range of miniature, all-glass battery valves and with them the well-known, hand-held "Walkie Talkie" transceivers. Equipment portability changed the role of the infantryman, but not many wireless sets survived their accompanying paratroopers when dropped. Maybe this was due to the technique of throwing the equipment out first on a long cord then jumping after it. The idea of this was to speed the descent time till the gear touched down, giving the jumper a gentler landing.

The Polish group of one airborne division tried desperately to reduce the failure rate. I became involved in this by having to test and fix the equipment after each test drop. Thankfully the drops were carried out by a tireless Polish corporal who would take the refurbished item up in a Lysander, throw it out on its umbilical then follow it down. On landing he would try to set the equipment up then cheerfully bring it back saying "no blooming transmit" or whatever. In the end judicious packaging fixed the problem.

The Ten Set

As D day approached, radar technology was applied to army use in the shape of the Ten Set, which was the father of all modern pulse technology. The magnetron used in radar transmitters had expanded the usable spectrum into the u.h.f. bands and beyond. But a magnetron is either on or off, so it can't be amplitude or frequency modulated. Thus the Ten Set transmitted a train of squarewaves, one

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of which was a sync pulse while the others were individually modulated in width, providing up to eight separate voice communication channels.

Home Front

At home the BBC kept up morale with lively shows like *Stand Easy* and *Much Binding in the Marsh*. These were a far cry from the straight Reithian variety entertainment of the pre-war era. Incidentally Reith left the BBC just before the war to manage Imperial Airways, a bad move as far as he was concerned. Recordings and repeats became the rule out of necessity. The material had to be censored, studios got bombed, and if so much as five seconds of unmodulated carrier was left between programmes Lord HawHaw would be in there with some German propaganda.

The recordings were mainly made on Marconi Stille magnetic recorders – this was a development of the Blattnerphone, which recorded on steel band at three *feet* per second. Thus half an hour's programme was stored on a two-mile long razor blade coiled into a lethal spring. This gear couldn't be taken into the field, so action reporters used modified wax disc equipment that managed to get nine minutes of sound on to a twelve inch disc. It wasn't until the war ended and the lads brought back captured German Magnetophone gear that magnetic recording as we know it today began.

Early Post-war Years

When the European war ended the celebrations were spectacular. London went mad; street lighting, church bells and road signposts were soon restored; and the radio resumed weather forecasting and mention of place names. We were demobilised into civvy street a few at a time. Even so there were more of us looking for radio repair work than there were sets to mend. So for a little while I became a telephone engineer. Not my cherished ambition, but it was great to sleep in a real bed and to get meat and sweet dishes on separate plates.

When BBC TV resumed in 1946, in time to televise the Victory Parade, Leslie Mitchell began his opening introduction with the words "As I was saying when I was interrupted . . ." Jasmine Bligh said "Remember me?" but my pre-war pin-up Elizabeth Cowell was missing. Sylvia Peters (no relation) had taken her place.

Rightly or wrongly, the decision was taken to keep faith with the few thousand pre-war set owners and resume with the same 405-line system as before. One advantage was that the old Ally Pally gear, which was still intact, could be refurbished to provide the fastest way of getting back on air. But not for long. A fuel crisis in early 1947 closed the service down for another month.

Despite all the wartime advances TV, resuming where it had left off, stayed very much the same for the next three years or so. The only way to describe it is "intimate", with small screens and the old Emitron cameras that required a gentle ten-second crossfade to mix from one to the other, giving the "rack operators" time to adjust the tilt and bend. Despite getting back into its stride TV was still the poor relation of radio – the war years had put into radio production a slickness that took some beating. This slickness was necessary to prevent the enemy jamming quiet passages with propaganda. On top of this programmes like *ITMA* and *The Goons* relied on listeners' imagination and wouldn't translate to TV.

Alexandra Palace was on its own and started to produce its own favourites and stars. Terry-Thomas had his *How do you view* variety series, Norman Wisdom became a favourite and announcer MacDonald Hobley presented a magazine programme *Kaleidoscope* that was based on radio's *Monday Night at Eight*.

Led by the Pye B16T, post-war TV sets began to appear. The B16T was a 9in. table model full of bright red EF50s. It was a t.r.f. (tuned radio frequency) design, which means that the input signal was simply amplified and then detected. With such an arrangement there's a limit to the gain that can be achieved before instability occurs. This wasn't the B16T's main problem however. It had a bank of preset sliders in a panel below the speaker: they were all wirewound, frequently chafed and thus became open-circuit.

All this was out of reach to me in my new home in Yorkshire. It was not until just before Christmas 1949 that the coaxial link between London and Birmingham brought pictures to the Midlands via Sutton Coldfield. We were still well outside the theoretical range of TV reception, but with huge masts and mammoth three-element Yagis we had a go – and succeeded. Our workshop premises were a few doors away from the celebrated Harry Ramsden fish-and-chip restaurant, and our first customer was old Harry himself.

Post-war Sets

By the time that TV came to the Midlands receiver production, with two years' of London experience, was well under way. Mains transformers had given way to the transformerless set, capable of a.c./d.c. mains operation. Instead of wasting the line flyback energy in a huge wirewound line linearity control the energy was used to derive the e.h.t. instead, using the technique proposed by Alan Blumlein in the early thirties. Fig. 1 compares early and later line output stage arrangements. Many models continued to use t.r.f. front-ends, where we painstakingly removed turns from the coils to tune from London Ch. 1 to Birmingham Ch. 4. With the change to superhet designs most r.f. sections could be tuned right through Band I using their four iron-dust cores.

Radio manufacturers who wanted to keep abreast of developments without committing themselves to TV set production used a chassis designed and manufactured by Plessey. This was something of a relief to us: its general-purpose nature made servicing easier. With the exception of Murphy, who kept up the tradition rather longer than the rest, the days of the truly quirky, almost hand-crafted early designs were fast giving way to more straightforward arrangements, increasingly using valves specifically designed for various TV applications.

Of all the post-war innovations, the transformerless TV set was the hardest to get used to. Up till then all chassis had been at earth potential, the h.t. was around 350V and, even though it was only 5-12kV, the mains-derived e.h.t. was lethal. The transformerless TV set brought with it the live chassis and the neon-testing screwdriver, to be part of every serviceman's dress for decades to come. Thirteen amp fused plugs had yet to be invented, so most power sockets were of a simple reversible two-pin type. To add to our discomfort plenty of areas still had 200V d.c. mains supplies. These were polarised in order to keep the size of the supply conductor down. Half the street was 200V positive to earth while the other half was 200V negative to earth. This was the half we dreaded. Getting a shock from an a.c. mains supply usually throws you off the equipment. D.C. tends to make you hold on, until somebody pulls you

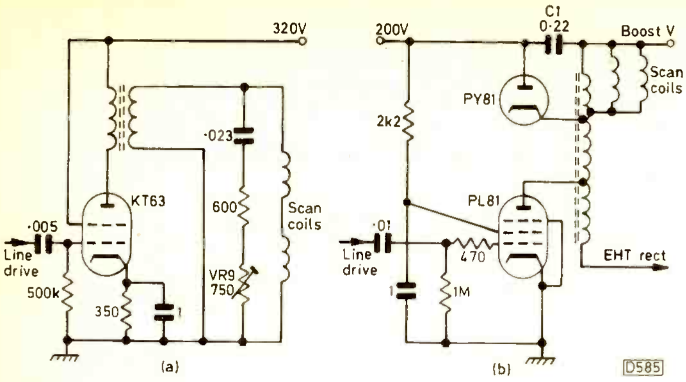

Fig. 1: Contrasts in line output stage design. (a) Early design by EMI, using a KT63 as a linear sawtooth amplifier transformer-coupled to the scan coils. The flyback energy was dissipated in the linearity control (VR9) network. (b) Classic early fifties design using a PL81 as a switch that produces a linear sawtooth scan current through the line output transformer's primary winding when it's switched on half-way through the scan (spot deflection from the centre to the right-hand side of the screen). An overwinding on the transformer feeds flyback pulses to the e.h.t. rectifier. After the flyback the PY81 efficiency diode switches on to damp the circuit, its conduction producing the first half of the forward scan (left-hand side of screen to centre) as the energy stored in the transformer decays. During this time the boost capacitor C1 is charged to produce a voltage of 1kV or so for the c.r.t.'s first anode. The transformer is tuned by its self-capacitance to produce a precisely controlled flyback pulse. The basic idea was proposed by A.D. Blumlein in the early thirties. In practice third harmonic tuning was added to optimise efficiency and reduce ringing, and linearity and width coils were generally connected in series with the scan coils.

off by the coat-tails. Some apprentices were teased that if you dismantled a test screwdriver and turned the neon round it would light up on a dead chassis instead of a live one . . .

Fortunately line-flyback derived e.h.t. was not lethal like the old mains derived type. This led to a simple, portable e.h.t. tester known as the Kilovolter. It was a simple probe with two polished metal balls inside, the earthed one being on a calibrated thread. By cranking up the thread until a spark jumped between the two balls you could read off the e.h.t. voltage on a scale.

Test Transmissions

Test transmissions from the new Sutton Coldfield station consisted of a black cross on a white background (the "Art Bars") with a 400Hz tone. We did get the odd demonstration film down the link when it wasn't being used for rehearsals. Opening ceremonies have a habit of coming unstuck. The Director General "dried" when the service opened in London. Sutton Coldfield kept up the tradition when an output stage blew during the opening ceremony. The staff blamed it on the long hours of test transmissions to help the trade prepare. Two years later, when Charles Buckle was given charge of Holm Moss, he wisely tested on reduced power right up to opening night. On the opening night he let the station rip with full power. This ruined the evening for most viewers since, without a.g.c., we'd turned up the sensitivity controls to suit the low-power transmissions. Full power produced pictures that were uncontrollably negative on most of our sets!

The DIY Era

As TV spread across the country a receiver shortage arose and magazines were crammed with advertisements offering old radar gear suitable for conversion to TV use. Most of these radar units contained a 5in. green-screen, electrostatically-scanned c.r.t., the VCR97. I bought mine for thirty shillings (£1·50) and got it going just in time to see the Boat Race in which Oxford sank. The hand-Roneoed instructions included with the gear made getting the picture easy enough, but the accompanying sound was something else. Until I got organised with a second unit we could follow only programmes that were carried on sound radio as well.

Those of you who recall the 405-line system know that amplitude modulation was used for both the vision and sound signals, making intercarrier sound i.f. strips out of the question. A constant bugbear was sound-on-vision – bars across the picture in unison with the sound. It's something that's almost unheard of today. Everything used valves – there were no transistors – in both transmitters and receivers. Valves have wire grids that can vibrate, so sound-on-vision could as equally well be produced by someone singing close to the camera as by banging on the TV set. It added up to a special "house point" if your i.f. strip was free from sound-on-vision.

With the spread of TV and the growing surplus market *Practical Wireless* began to bulge at the seams. So in 1950 *Practical Television* (this magazine's original title) was reintroduced – it had had a brief fifteen-month spell of life back in 1934-5. The 1950 version had a two-colour cover, was printed on what looked like newsprint, and cost around 5p.

Tube Troubles

Those VCR97s kept on going, which is more than could be said for the proper TV tubes of the period. They soon developed a reputation for short life, and as they were guaranteed for only six months we had to be very quick to spot the first signs of failure. There were two main types of fault: low emission, which produced the familiar dim picture with glistening foreheads, and ion burn, which showed up as a dark patch about the size of an orange in the centre of the screen. It was caused by impurities left within the tube. Ion burn was eventually cured by using an ion-trap magnet. This small magnet, clamped around the tube's neck, was generally used in conjunction with an offset gun. It deflected the offset electron beam back towards the screen while the heavier ions continued straight on, hitting the tube's neck. The ion trap quickly gave rise to a major stock fault. Use of the set created heat which loosened the magnet: as it swung from its preset position it produced exactly the same effect as a dud tube – i.e. much panic coupled with bad public relations.

Broadcasting Progress

Progress was being made on the broadcasting side in the early fifties with improved cameras. The Super Emitron had replaced the basic Emitron and was in turn replaced by the image orthicon. The improved tubes had better sensitivity. Studio lighting levels could thus be reduced, and it was now possible to cut directly from one camera to another. This gave rise to complaints that producers were indulging in "restless editing". The image orthicon was initially used for outside broadcasts: it was so sensitive that it became possible for reporters to continue even in foggy conditions. By now TV had built up a set of favourites: *What's my Line?* with Gilbert Harding in particular and spine-chilling serials like the *Quatermass Experiment*.

Scotland and Wales by now had their own high-power stations, the opening of the latter marred by the torrential rain that washed away the Devon villages of Lynton and Lynmouth on the other side of the Bristol Channel. As a country we'd lost a King and gained a Queen. To quote Wallace Greenslade, the long-suffering Goon Show announcer, "This, dear listeners, is where our story *really* begins".

Test Report: Tandy's Talking DMM

David Botto

"A talking multimeter could be made in much the same way as a standard digital meter but with the signals that activate the display applied, via an interfacing i.c. to produce the required binary signals, to a speech synthesiser chip with a suitable set of speech ROMs." That comment was made in my article on electronic speech for TVs and VCRs in the March 1985 issue of *Television*. Now it's one thing to theorise about how a talking multimeter might be built, a different matter entirely to actually produce a working model for sale commercially at a reasonable price. But this is what Tandy has just done with the Model 22-164 Micronta Voice Meter digital multimeter.

Description

The Voice Meter DMM is a hand-held, autoranging instrument with a 3,000 count (3 ⅔) LCD readout. If you normally use a DMM with a 3½ digit readout (1,999 counts) you'll find the 3,000 count readout a big help, particularly when low voltages must be accurately measured. The meter is housed in a grey plastic case measuring approximately 7 × 3 × 1⅝in., and is powered by four AA type 1·5V batteries. A six-position rotary switch selects the various functions, which include a diode check. The three-position power switch has on/off and continuity test positions.

At first sight the Voice Meter appears to be an ordinary hand-held DMM. The measured values are displayed on an easy-to-read, high-contrast 10mm LC display. The difference is that at the touch of a button that's built into the meter's positive test probe the meter speaks both the measured reading and the parameter. For example, when a 15Ω, 5 per cent tolerance resistor was measured the voice said "fifteen point one three ohms". A d.c. voltage measurement produced the spoken message "two point six seven three volts d.c." The voice is clear with good volume. A message on the LC display alerts the user when the batteries are low. If you then try to use the voice function you are told "replace batteries".

The Voice Feature

The voice feature is not a gimmick. It's an extremely useful thing to have in many circumstances. For example when you've a TV set, VCR or camera to repair on the bench it's often difficult to keep the test probes in firm contact with test points that are hard to get at while at the same time looking at the meter's readout. This is where the Voice Meter scores: there's no need to look at the readout since the electronic voice tells you the measured value in clear, authoritative tones. The same thing applies whenever you need to make measurements amongst the hard to approach places that seem to be more and more common in modern pieces of electronic equipment. In such cases you'll find that the Voice Meter enables you to make several measurements easily in the time that it would normally take you to make just one. A DMM with a display freeze will of course hold measured values, but you still have to keep turning your head to see the readings. This means extra effort plus neck and shoulder strain that you can well do without.

The Micronta Voice Meter DMM is ideal for the field TV/Video engineer. When crawling around on the floor, as you all too often have to, it's not too easy to see a DMM readout. Here the voice is a real boon.

What happens if three of four TV/Video engineers in the same workshop all use a Voice Meter DMM? Could this cause confusion as to which DMM is speaking? Probably not because the meter can be used as an ordinary one without the speech facility. Should the voice be needed you simply push the probe button in the positive test lead.

Ranges

The meter's voltage measurement coverage is excellent – up to 3kV a.c. or d.c. rather than the usual 1kV. For d.c. voltage measurement there are five fast auto-selected ranges: 300mV, 3V, 30V, 300V and 3kV. The lowest d.c. resolution is 0·1mV, with a d.c. accuracy of 0·8 per cent. The a.c. voltage ranges are 3V, 30V, 300V and 3kV. Lowest a.c. resolution is 0·001V.

Six resistance ranges cover measurements from 300Ω to 30MΩ. Lowest resolution is 0·1Ω. For current measurement there's a 300mA range for a.c. and d.c. Lowest current resolution is 0·1mA.

Summary

Personally I would have preferred to have had the voice on/off switch on the meter's body rather than within the positive test prod. Having it within the probe means that if this is damaged or an internal break occurs you would have to obtain an exact replacement from Tandy. But the probe switch does make for easier voice on/off switching.

I'm enthusiastic about the Micronta Voice Meter DMM and believe that it's a big step forward in multimeter development. There will no doubt be some initial resistance to the idea of a talking multimeter. By and large it seems that TV/Video engineers prefer the familiar to the new – some still refuse to part with their faithful old analogue multimeters. But the time may soon come when a voice function is a standard feature of DMMs.

The Micronta Voice Meter DMM is due for release early this year. The intended price of £79·95 including VAT will make it excellent value for money. It's a piece of technology that only few years ago would have cost thousands of pounds to produce and would probably have been housed in a large box on wheels! The Voice Meter is going to make life easier for the long-suffering TV/Video engineer. And should you find yourself talking back to it you'll know that it's definitely time to take that holiday you keep promising yourself!

My thanks to Ahmed Patel of InterTan UK LTD. for supplying a prototype to try out.

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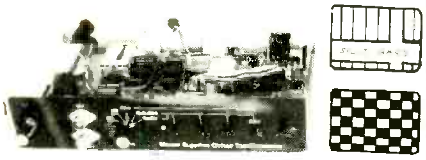

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Fault Notes on Toshiba's VHS VCRs

John Coombes

The following notes summarise our experience with the V55B/V57B, the V65B/V66B and the V71B/V73B/V81B/V83B series.

MODELS V55B/V57B

We'll start with common faults experienced with the V55B/V57B.

No play/record: The most likely culprit is the loading belt. The loading motor is another possibility.

No rewind/fast forward: Check the reel idler assembly by replacement.

Snowy vision with own recordings: Suspect a faulty video head. Check by replacing the drum.

Original sound left on tape: Probably due to a faulty plug/socket on the full erase head. For a complete cure remove the plug/socket and make soldered connections directly to the head.

Ejects tape: Probably a cassette housing fault. Check the switches for incorrect operation and if necessary check for broken cogs. The cassette loading motor could be defective.

Miscellaneous Faults

The following notes detail less common faults.

Unit inoperative/no clock or function lights: Check that the 9V supply from the regulator panel is present. If missing at pin 2 of plug/socket CN2 check transistors Q5 (2SD1128) and Q6 (2SD637). If the 9V supply is present at pin 2 of CN2 check whether protector CP2 or coil L201 is open-circuit.

Intermittent loss of sound with own recordings: There are three likely causes of this fault. The first is faulty connections to the audio/control head. It's best to remove the plug and socket and make soldered connections to the head and PCB directly. The second possibility is failure of the oscillator to start. If this is the case and you get colour patterns on the screen increase the value of C27 to 0·0082μF. The third thing to check is for an open-circuit in the leads to the full erase head.

Snowy playback: The obvious possibility is faulty heads. If the heads are o.k., ensure that the head amplifier chip is receiving about 2·5V on playback. For incorrect voltage here check Q504 (2SB641S) which can become leaky.

Intermittent stopping in the record and/or playback modes: Check the take-up reel sensor optocoupler by replacement.

Intermittent stopping and going into the rewind mode: The first suspect is the M50790SA expander chip IC202. Check it by replacement or check the d.c. conditions at its pins. The other strong possibility is that C1 (0·001μF) across the end sensor is short-circuit.

Intermittent stopping in the review mode: The main possibilities are again IC202 and C1, see previous fault.

Distorted verticals: This symptom is often associated with poor picture sync, the symptoms varying with picture content. Suspect that C7 (0·047μF) in the i.f. a.g.c. circuit is open-circuit.

Playback speed slow: Check the voltage at pin 6 of the BA6302A chip IC401. If the voltage is low D206 (1SS133) could well be leaky.

MODELS V65B/V66B

The following notes apply to the V65B/V66B.

No results, channels lit: There are two things to check for this one. First check for 5V at pin 6 of plug/socket CN3. Its absence will probably mean that CP4 (ICP-N10) is open-circuit. The other likelihood is that the 5V and 12V outputs from the power supply are low because zener diode D3 (RD3·9EB) is faulty. Check it by replacement. If the diode is simply leaky the VCR will work but the counter will continue to be operational in the stop mode.

No clock display: Check whether the −30V supply is present at pin 3 of plug/socket CN2. If this voltage is absent fusible resistor R2 (560Ω) could be open-circuit or regulator transistor Q1 (2SB644) faulty. The cause could be in the timer section however. In this case check the clock display FDP (PU57345-2), IC301 (MN1250BJA) and IC401 (HD614042SB27) as necessary.

No video/luminance: Check whether the switched 5V supply is present at pin 1 of CN3. If not CP2 (ICP-F10) is probably open-circuit.

Machine plays for a short time then goes to stop: If the counter doesn't work, suspect a faulty take-up reel sensor.

No manual record, o.k. with timed recordings and remote control: Check the d.c. conditions around IC101 (HA11839NT) on the main PCB. If you find incorrect voltages check IC101 by replacement.

Ejects tape and shuts down: A faulty loading mode sensor is the usual cause of this.

Machine half loads then unloads: Watch the drum. If it runs backwards, or simply moves back and forwards slightly, zener diode D408 (RD5·1) is probably leaky. Check it by replacement.

Intermittent drum rotation: Dry-joints on Q1 (2SB1052) are the usual cause. Resoldering will usually put matters right. If the transistor's leads are discoloured however it's best to fit a replacement to prevent further trouble.

Incorrect loading/no play: The first thing to check is the loading belt, which may be badly stretched. Check by comparison with a new one or by replacement. If the loading belt is o.k. it may be necessary to check the loading gear and cam gear assembly. Dismantle the assembly then clean off the old grease, which causes friction when it becomes hard. When reassembled the assembly must be in the correct position as indicated in the service manual.

Previous sound recording left on tape: As with the V55B/V57B the usual cause is the plug/socket connections to the erase head. Solder the leads to the head directly. Be sure not to apply excessive heat to the head, i.e. don't apply the iron for too long.

V71B/V73B/V81B/V83B SERIES

There are some common fault patterns with the V71B/ V73B/V81B/V83B. You very often get intermittent faults like going into the search mode with fast sound, or stops in pause when review is pressed in the play mode, or stops loading when only half loaded. These problems can all be caused by a faulty cam switch. When this is replaced it's important to ensure that there's an earthing screw to the reel motor bracket. This screw also prevents static discharge from the reel assembly. Such discharges can ruin the servo/logic chips.

Faulty Chips

If the TD6360N servo chip IC501 has been damaged by static discharge you may find that the problem in the record mode is no servo lock. The unlocked head switching produces picture disturbance, jitter or roll. On playback the problem is usually loss of servo control, i.e. varying speed and poor tracking.

If the static has ruined the TMP4746N5759 logic chip IC601 the usual problem is no reel rotation due to wrong voltage levels at pins 19 and 20. If there's no motor drive, or the power disappears after ten seconds due to the TA7288P chip IC602 drawing excessive current, this i.c. will have to be replaced.

If there's no reel rotation in any mode, suspect the TA6267P chip IC603. It may have been getting hot because the 2SB101SY drive transistor Q625 is defective. If necessary check it by replacement.

If the tape counter is inoperative and the machine goes into the stop mode when play is selected, replace the TA75393P reel sensor chip IC604.

Incorrect Speed

A faulty cam switch often results in the machine running fast in the play mode, with fast sound, the pinch roller not being engaged. If the machine is used to record with this fault it may run fast, giving slow replay.

Blown Fuse

Fuse F803 (1·25AT) will blow if there's a short of course, but you may find that D801/3 are open-circuit or that there's a dry-joint at the connection of D801/2.

MODEL V93B

A problem we've had on several occasions with the V93B is no clock display due to circuit protector 2L62 (ICP-N10) on the Timer-2 board being open-circuit.

Teletopics

SATELLITE TV

The IBA/ITC has decided on the terms under which BSkyB will be allowed to continue to use the UK DBS frequencies. The BSB programme contract with the IBA will be terminated on December 30th 1992, with the proviso that the ITC as successor to the IBA may, with three months' notice, withdraw all or any or part of any of the five DBS channels at any time after June 30th 1991 in favour of any licencee appointed by the ITC under the terms of the Broadcasting Act 1990. The aim of the IBA/ITC decision is to ensure that viewers with BSB receiving equipment will continue to have five channels of programme service available for at least the next two years.

To ensure that BSkyB honours its obligations during the remainder of its programme contract it has been agreed that two independent directors, both subject to ITC approval, will be appointed to the BSkyB board not later than March 31st 1991. These directors will form a majority of a special Compliance Committee of the board, each having the right to veto actions that would involve a major breach of the programme contract or any non-domestic satellite licence or other ITC licence requirements.

In seeking other uses for the DBS frequencies, the ITC will invite expressions of interest from those who might wish to apply for licences, which the ITC intends to advertise in 1991. Some suggestions have already been received. BSkyB, which owns the Marco Polo satellites, has agreed to make satellite capacity available to new licencees. BSkyB has also given an undertaking to support research and development of the D-MAC technology through a contract with NTL.

To meet the needs of present BSB viewers, BSkyB has offered all those with BSB installations at December 20th 1990 free Astra reception equipment plus free installation at or before the time when broadcasting of the BSkyB services from the Marco Polo satellite ceases. According to BSkyB those with BSB equipment will be able to retain or return it as they wish.

In the light of this agreement having been reached the ITC has granted a non-domestic satellite licence to Sky, a subsidiary of BSkyB, legalising its Astra services under the terms of the Broadcasting Act 1990.

It's understood that the number of satellite TV receiving dishes that have been installed in the UK reached some 1·2m by the end of November. Over the year the number of installations had trebled. Now that the satellite TV situation has been simplified with the BSB/Sky merger it's expected that there will be a surge of satellite TV business.

Eutelsat has been given the go-ahead to proceed with the next stage of Europsat, the European DBS system, following the signing of a memorandum of understanding by nine countries (Austria, France, Germany, Italy, Holland, Portugal, Sweden, Switzerland and Yugoslavia). Between them the nine countries have requested a minimum of 39 transponders. The DBS services will be provided by three satellites plus one in-orbit spare co-located at 19°W. The satellites will have TWT amplifiers with an output power of 125W and will be equipped with aerials providing a number of steerable circular and elliptical spot beams. Launch of the first satellite is expected in 1996, though the possibility of launching a preliminary DBS satellite with the same specification in the second half of 1993 is being considered. Eutelsat II F2, the second in the series of medium-power Eutelsat craft, is due for launch via an Ariane-4 rocket this January into orbit at 10°E.

TRANSMISSION NEWS

Concomitantly with the replacement of the IBA with the ITC on January 1st, IBA Engineering's responsibilities have been taken over by National Transcommunications Ltd. (NTL) which is to be privatised during 1991. NTL intends to maintain the high engineering standards set by the IBA and will also be building up new business in other areas of broadcasting and telecommunications, e.g. services to telecoms operators, satellite engineering, network linking, maintenance, consultancy and R and D work.

Nicam services have now started from the NTL Bilsdale transmitter and its dependent relay stations, completing the first phase of the ITV Nicam programme. The second phase will increase Nicam services via NTL transmitters from 79 per cent to 90 per cent of the population. The programme for the main transmitters is as follows: 1991 Hannington and Oxford; 1992 Waltham, Stockland Hill, Tacolneston, Craigkelly, Heathfield and Sudbury; 1993 Redruth and Selkirk.

A change in Japanese radio law has made broadcast fax transmission legal, enabling printed matter to be made available instantly to the public. Prototype equipment for a pay fax broadcast service has been developed, including receivers by Matsushita, NEC, Sanyo and Sharp. The intention is to incorporate a fax signal on a TV channel subcarrier at a frequency just above that of the sound signal. The signal would be scrambled and would use 4DPSK modulation. Display could be via a conventional fax printer, using an adaptor, or on-screen.

In our October 1990 issue Geoff Lewis reported on the US HD-TV scene. Since then American Telephone and Telegraph and Zenith Electronics have announced a new all-digital system that as a result of a series of technological breakthroughs enables it to provide significantly better performance than their earlier partially digital system. The new system eliminates transmission noise, making it possible to broadcast signals as clear as those available from cable, satellite or fibre-optic sources.

LATEST BREMA FIGURES

The latest BREMA figures relate to the third quarter of 1990. Overall TV deliveries to the trade declined by 71,000 to 820,000 compared with the equivalent quarter in 1989. Deliveries of large-screen sets declined by seven per cent while deliveries of small-screen sets declined by nine per cent (consumer sales were down twelve per cent). VCR deliveries were down just one per cent at 575,000. Camcorder deliveries increased very slightly to 89,000. Of all TV sets delivered, 22 per cent incorporated Nicam sound decoders: with VCRs the figure was twelve per cent. CD player product deliveries increased by 15 per cent to 481,000 while deliveries of music centres fell by 35 per cent to 303,000. The previous quarter had seen better increases in camcorder and CD product deliveries.

MAGNETISER/DEMAGNETISER

Here's a helpful device if ever there was one. A magnetised screwdriver can be a boon or a menace. The Magic Square from Wera Tools (UK) Ltd., Bar Lane

Industrial Park, Bar Lane, Basford, Notts NG6 0JA (0602 790 090) is a palm-sized device that's claimed to be able to magnetise or demagnetise a screwdriver instantly when the blade is pushed in and out of the appropriate hole. Its one-off trade price is £7·50 plus VAT. No batteries are required.

LOEWE OPTA

Due it seems to increased demand in the eastern part of Germany and the weak UK market Loewe Opta has decided to withdraw for the present from UK distribution of its products. Supply of spares and service back-up has been taken over by Colin Andrew Ltd. from addresses in London and Manchester. The London address is 358 Uxbridge Road, Southall, Middx UB8 3EJ (081 843 0010/0019), the Manchester address being Units 2 and 10, Piccadilly Trading Estate, Great Ancoats Street, Manchester M12 XNP (061 274 3460 or 061 273 8007).

AKAI'S HQ ENHANCEMENTS

Akai's recently introduced VS865 VCR at £450 features "Super Digital HQ". The system is designed to reduce picture noise caused by poor broadcast reception or poor quality video tapes. Several processes are used to improve picture quality. One uses digital noise reduction with field instead of line correlation. Field correlation works by adding successive fields to boost the video signal above the noise level. A split-screen display enables the user to compare the picture with and without this noise reduction, which is also claimed to offer minimal loss of vertical resolution.

The Akai VSA650 at £600 features "Intelligent HQ". This optimises the recording circuitry for the type of tape. Akai says that when standard VHS decks leave the factory they are designed to give optimum results with standard-grade tape. You thus get a poorer picture when using a high-grade tape. Intelligent HQ decks analyse the tape and then optimise the recording current and noise-cancelling circuitry to match the grade. A subsequent article will provide more details of these systems.

SHOWS

The Video Show 1991 is to be held at the Business Design Centre, Upper Street, Islington, London N1 on February 28th to March 3rd – the first day is reserved for trade/press visitors. This home video exhibition is hosted by *What Video, What Satellite* and *Camcorder User* magazines.

The CD-ROM Europe 91 Exhibition and Conference is being held at the Novotel, Hammersmith, London W6 on May 21-23rd. For further information phone 0733 60535.

The next Cable and Satellite Exhibition is to be held at Olympia, London on April 8-10th. This is a trade only event. For further information phone 081 948 9831.

GUARANTEE UNDERWRITING

The rates paid by manufacturers for in-guarantee repairs have always been a sore point in the trade. With a view to overcoming this problem Domestic and General, the UK's leading provider of breakdown insurance for domestic appliances, has announced an agreement with Pioneer. In-warranty breakdown of Pioneer's CTV, VCR and laserdisc products is being underwritten by Domestic and General: dealers participating in the scheme will receive a full commercial rate for both labour and parts when carrying out in-warranty repairs (two years for TV sets and one year for VCRs and laserdisc players).

TV Fault Finding

Reports from Philip Blundell, AMIEIE, Ed Rowland, J.R. Trimmer, Nick Beer, Stephen Leatherbarrow and Hugh MacMullen

Philips NC3 Chassis

If the chopper transistor Q401 fails, check for dry-joints at the connections to the chopper transformer T402 before fitting another BUT11AF.

You often find that the rotary channel switch gets dirty. If you are careful it can be dismantled for cleaning. **P.B.**

Philips 22CS5240 (K40 Chassis)

This set was dead. There was no line drive as R3192 was open-circuit. A picture was obtained when this had been replaced but there were striations on the left-hand side. These disappeared when the scope was connected to the collector of transistor 7190. R3191 was open-circuit. **P.B.**

Philips 14CN2201 (NC3-CR Chassis)

Here's a trap for the unwary! Late production versions of the remote control NC3-CR chassis use a Preh on/off switch that looks similar to ones used in other makes (the bracket is different, but the old one can be re-used). Check the low-voltage contacts however! Most switches have a momentary contact that makes only when the button is pressed right in and breaks when you release your finger. This is not the case with this switch. The NC3-CR type switch's low-voltage contacts remain connected as long as the mains contacts do. If you fit the wrong type of switch the power supply will not come out of standby – even though the standby LED is off. **P.B.**

Philips G90 Chassis

The problem with this set was no blue. Our first step was to check the voltages around the blue output transistor. As expected the collector voltage was high, but I was surprised to find that the emitter voltage was higher than the base voltage. Diode D6416 (BAS32) was leaky. **P.B.**

Philips K30 Chassis

If you find that there's a black band at the bottom of the picture, check for ripple on the 32V LT2 supply. You'll probably find that C1588 (680μF) is open-circuit. **P.B.**

ITT CT2612/2

This set suffered from intermittent loss of signals when it was first switched on. After about ten minutes it would settle down and be fine for the rest of the evening. The obvious suspect was the combined tuner/i.f. module. We unplugged it from the mother board and as no obvious dry-joints could be seen gave it a "blanket solder" job. There was no further trouble after we'd done this. **E.R.**

Amstrad TVR2

The customer complained that it took up to an hour from switch on before sound and vision appeared. We didn't bother to check this but went straight for C1507 (0·47μF). After fitting a 1μF capacitor in this position the equipment fired up straight away.

Removing the TV chassis is fairly easy provided you first remove the VCR unit in order to gain access to the small screw located beneath the front of the main PCB. Before returning one of these sets to the customer a point worth checking is that the 'repeat' switch at the rear of the receiver is in the 'off' position. Otherwise a call-back is a certainty – with the switch in the 'on' position the machine will carry out only the play function. Another thing to catch out the unwary is the separate mains on/off switch at the back. **E.R.**

Sony KV2705

This set had an uncontrollably bright raster with flyback lines. The problem was caused by R718 (330kΩ) which had increased in value to over 2MΩ. **E.R.**

Philips 21GR2752/RC5903 etc

A common problem I've had with this and similar models is failure of the remote control handset due to dry-joints on the infra-red diode. It's simply a matter of resoldering the diode – until you try to open the handset! In their wisdom Philips glued the two halves together. Any attempt to part them will mark the case. Here's a solution to the problem, with no visible damage.

With your thumb nail only, peel back one corner of the name-plate strip. Then, with a flat blade, peel it back just past the second row of buttons. Care is required: don't bend the strip back too far or you'll crease it. Now to the clever bit. Drill a 6mm hole in the centre of the handset, 1cm in from the top edge of the recess for the strip. The LED can now be resoldered through the hole, and the strip will restick to form an invisible repair. **J.R.T.**

Nikkai Baby 10/Samsung CI210R

These little sets have sold well. The main problem we've had with them has been failure of the potted regulator. This particular one was a bit different however. Our field engineer found that the 5A h.t. fuse was open-circuit. As he couldn't measure any shorts and the fuse had simply died (not blown) he replaced it and switched on. At this a piece of print from the bridge rectifier to the h.t. line burnt up pretty spectacularly. So the set was brought into the workshop. We found that there was a short-circuit across the h.t. line. The reverse polarity protection diode was hot favourite but blameless, as was the main reservoir capacitor. The cause of the problem was a short-circuit in the d.c. jack, which had melted. Spares for these sets are available from Willow Vale. **N.B.**

Salora J Chassis

Repeated blowing of the chopper transistors is becoming a problem with these sets. A number of things help to prevent this. First, ensure that good-quality replacements of the correct type (BUW41B) are used. Next ensure that heatsink compound is used on both. Replace the 4·7μF drive coupling capacitors CB712/726. I've had those of a certain manufacture go short-circuit when used as replacements: the most reliable ones seem to be the purple type from RS Components. Replace the 3·3Ω series resistors in each transistor's base circuit (RB703/705) – RB705 in particular tends to go high in value. If DB712 (1N4148) goes short-circuit, as it can, this resistor will go open-circuit. It's wise to check the print and soldering around the bottom of the chassis in the vicinity of the chopper transistors, particularly at the start and snubber resistors (RB715 and RB706 respectively). Check for print cracks on the heatsink connections. As with any power transistors, check the drive waveforms before completing the repair and investigate any irregularities.

We sometimes find that the Ipsalo transformer MB500 has a short-circuit or low-impedance primary winding. Physical checks here may show signs of burning or corrosion. The d.c. resistance should be about 2·8-5Ω depending on the transformer – the two most likely to fail are the FM0500 (diode split) and FM0245.

The LF0041 Ipsalo control chip can also cause this problem. All you can do in this case by way of fault finding is to eliminate other possibilities. The chip seldom fails however. **N.B.**

Amstrad CTV1400

The line sync would disappear during a channel change. After an unsuccessful prod around with blunt instruments (freezer and hairdryer) we checked with the circuit diagram and noted a couple of likely culprits, the two zener diodes D715 and D704. Replacing them cured the fault.

Intermittent lowering of the sound level and/or buzzing is caused by the adjustable capacitor on the sound i.f. subpanel. **S.L.**

Triumph CTV8211

The customer's description of the problem with this set was very dark, poor pictures. On checking we found that the c.r.t.'s first anode supply was absent. The voltage is obtained in the usual manner for a set of this age – by diode rectification of a pulse voltage. Series resistor R937 (3·3kΩ, 1W) was open-circuit. This was in turn due to print breakdown where the cathode of the rectifier (D914) passes close – too close in my opinion – to some earthed print. Careful scraping to improve the clearance cured the problem. **S.L.**

Philips K40 Chassis

After fitting a new focus unit to this set, something that's often necessary, we found that there were EW problems. R3177 was open-circuit. The manual gives the value as 4·7Ω but a 12Ω resistor was fitted. **S.L.**

Hitachi CPT1476R

The problem with this set was field roll when warm. The hold control circuit is very simple, consisting of three components connected to pin 1 of the TDA4503 chip IC201. A puff of freezer on each in turn proved that C609 (0·22μF) was responsible. **S.L.**

Fidelity CTV14R (ZX2000 Chassis)

This set had an intermittent fault – loss of signals and randomly unhappy about Ch. 3 selection. The ML923 tuning chip was faulty. After replacing it however the signals would still sometimes fail to appear, though Ch. 3 selection was o.k. As the supplies were correct a new tuner unit was fitted. This finally put matters right. **S.L.**

Ferguson TX100 (110°) Chassis

This 110° set suffered from insufficient width. We found that certain components which should have been deleted, being intended for the 90° version, were in fact fitted – width coil L19, line linearity coil L18 and parallel damping resistor R136. Our problems were over when the circuit had been put right. While the "fault" was present all the controls worked normally but the width/EW correction circuit was unable to cope with the magnitude of the error. The h.t. was correct at 119V throughout. **S.L.**

Alba CTV12

No sound or picture with normal h.t. was the fault here. We found that the 12V regulator transistor Q208 was open-circuit base-to-emitter. A TIP41 proved to be a suitable equivalent. These sets are the same as the Lloytron portables. **S.L.**

ITT Pico S Chassis

This set was dead. A relay switches the mains supply but there were no l.t. voltages on the remote-control board as the l.t. transformer was open-circuit. Its failure is quite common. **S.L.**

Hitachi NP83CQ Mk 2 Chassis

The sound was o.k. but there was no raster. We found that there was no luminance output from the colour decoder chip IC501 which appeared to be switched off. Its pin voltages were correct but the sandcastle pulse waveform at pin 8 was of rather low amplitude – insufficient to get IC501 working properly. I decided to increase the tube's first anode voltage in order to see something on the screen – a TV set with a display will talk to you! I then shorted out R558 (2·2kΩ) to increase the amplitude of the line section of the sandcastle pulse and was pleasantly surprised to see a colour picture with little or no line sync and incorrect colour over half the screen. Feedback pulses from the line output transformer are fed back to the line generator circuit in IC701 via two 3·9kΩ resistors, R720 and R721. One of them had risen in value to over 1MΩ, though it was perfect in appearance. Replacing it put everything right. **H.MacM.**

Bush 2321T

The problem with this set was no colour. After much soul searching the cause turned out to be an open-circuit connection at plug 10. Just to annoy me the sound became uncontrollable when I'd put the first fault right. The culprit this time was the SAA1293 chip. **H.MacM.**

National Panasonic TC361

This set would start to trip a few times a week, but only when cold. It worked all right when we got it on the bench but at last gave up the ghost. These sets use a thyristor line output stage and one of the diodes, D552, was found to be open-circuit. It's in parallel with the scan thyristor. **H.MacM.**

Philips K30 Chassis Edition II

After five hours with the back on the colour would go. Take the back off and the colour returned. It took me a considerable time to realise that the fault had nothing to do with temperature. When the colour was absent there was no pulse input at pin 8 of the TDA3560 colour decoder chip. The reason for this was a bad connection at tag 4 of the sync module. **H.MacM.**

DAT System Technical Details

George Cole

Digital audio systems are playing an increasing role in consumer electronics. The Video-8, Hi-8 and Laserdisc (formerly CDV – compact disc video) systems have pulse-code modulated (PCM) digital sound, while earlier last year JVC announced a digital audio specification for the Super-VHS format. Nicam sound is now available in most ITV regions and will be broadcast from most BBC transmitters by the end of the year.

The digital audio tape (DAT) system is based on the rotary-head technology developed for VCRs. Although it's primarily an audio format it does have video applications. Here are some examples: DAT has been designed to store high-quality still-video images with sound; Fuji and Toshiba have developed a digital still-video format that uses DAT tape to store over 1,000 images; Aiwa plans to market an analogue-to-digital converter to enable its HD-S1 DAT recorder to store still images from VCRs, camcorders, still-video cameras and TV broadcasts. Samsung developed a DAT video system that recorded around eighty minutes of moving analogue video on DAT tape, though the system was never launched commercially. Future DAT systems may be able to store digitally-compressed moving video material.

Recording Principles

The principles of analogue audio recording are straightforward and well known. Sound waves consist of air pressure variations. These are converted into an analogue electrical signal by a microphone. The electrical signal's amplitude in volts represents the sound wave's amplitude while the frequency of the electrical and sound signals remains the same. When recorded on tape the signal's amplitude is represented by the number of lines of magnetic flux while its frequency is related to the wavelength of the recorded signal.

With digital recording the analogue signal has to be sampled then converted to digital form before application to the recording circuit – see Fig. 1. The principle of sampling is illustrated in Fig. 2. It's simply a matter of checking the signal's amplitude at regular intervals. These samples are then converted to binary form. The accuracy of this system depends on the sampling frequency and the number of levels used (quantisation) to measure the signal samples. In our simple example three-bit quantisation (000-111) has been used, giving eight possible signal levels. This would be totally inadequate of course. The DAT system uses a sampling frequency of 48kHz with 16-bit quantisation. This means that the amplitude of the analogue signal is measured 48,000 times a second using a measuring scale that has 65,536 levels. The samples are encoded as a stream of ones and zeros. During playback this process is reversed.

Advantages of Digital Recording

Digital recording seems to be a roundabout way of going about it. Why not stick to the simpler analogue method? In practice analogue recording is a rather more complex business than it might at first seem to be if acceptable results are to be obtained. The first problem is that using an analogue signal to alter the tape's magnetic characteristics is an inherently non-linear process. This affects the frequency response. To improve the linearity a high-frequency (around 90kHz) bias signal is added to the audio signal during the record process. The snag with this is that h.f. sound signals can produce their own bias, which distorts the sound. For this reason some cassette recorders use circuitry that varies the amount of bias applied during the record process.

Another problem is noise, which shows up mainly as hiss. Most analogue tape recorders incorporate a noise-reduction system that gives a signal-to-noise ratio of around 68dB.

With analogue recording it's also important to set the correct recording level for the type of tape. Otherwise the tape may saturate, producing distortion.

If you add to all this the need to keep the deck well maintained with clean heads, to have correct bias and equalisation settings for the type of tape used and a stable transport system to minimise tape speed fluctuations that cause wow and flutter, you begin to see the problems of analogue recording. What's more, these problems are made worse whenever an analogue recording is copied.

Digital recording involves storing numbers. There's no need to worry about bias, tape hiss or wow and flutter. And there's no loss of quality when a digital tape is copied – this is why some people call digital copying "cloning". There are problems with digital recording, for example the huge amount of data that has to be processed each second and the need for powerful error correction systems. But as we shall see they have been overcome with the DAT system.

Background

Professional audio studios have for some time used digital PCM sound processors connected to domestic VCRs. DAT is in effect a fusion of the two technologies. It

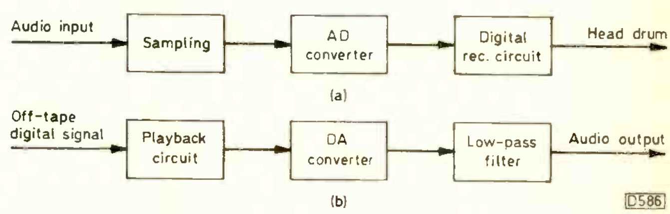


Fig. 1: Block diagram showing the basic processes involved in (a) digital audio recording and (b) playback.

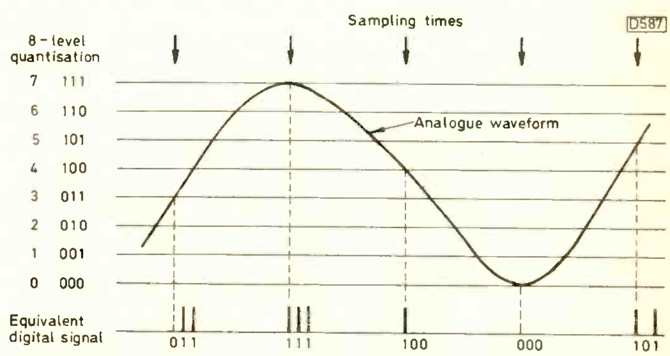


Fig. 2: Simple example of sampling and quantisation (with eight levels) of an analogue signal.

was regarded as a logical development from the compact disc (which was originally called the digital audio disc), and a number of companies produced prototype domestic digital audio tape systems. JVC for example tried recording digital sound on a conventional audio cassette. Eventually the consumer electronics companies decided to develop a standard format, and in June 1983 an inaugural meeting was held, attended by 54 companies. During the following four years the group grew to 87 and over 800 meetings were held.

The initial conference decided that the new tape system should offer a number of advantages over the standard compact cassette. These included (1) high-quality digital sound; (2) a longer record/playback time; (3) new or improved convenience features such as faster search systems, track programming, etc; and (4) the ability to be used for other purposes such as video and data storage. The DAT committee formed two working groups to consider two possible DAT formats, S-DAT (with a stationary head) and R-DAT (with rotating heads).

As its name suggests in the S-DAT system the tape ran past a static recording head. The data rate was increased by recording 22 parallel tracks across the tape. These consisted of 20 data plus subcode tracks and two auxiliary tracks. The transfer rate was 2·4Mbits/sec. An S-DAT cassette measured 86 × 53·5 × 9·5mm. Tape speed was 4·75cm/sec, the same as with a compact cassette, giving a recording time of 90 minutes. There was also an optional half-speed mode.

Unfortunately the production of S-DAT recorders proved to be too complex, involving the use of thin-film technology for the multi-track heads. S-DAT was abandoned in favour of R-DAT, the technology used by all DAT machines.

R-DAT

R-DAT is firmly based on VCR technology and it's interesting that at one stage the DAT committee considered making it compatible with the Video-8 format. The rotary-head system was chosen because it used well-established technology and was suitable for recording large amounts of data in a limited tape area. The combination of a fast writing speed and a slow linear tape speed made it possible to achieve a long recording time with a small cassette.

The data rate is equal to the sampling frequency multiplied by the quantisation number multiplied by the number of channels. With the DAT system this works out at 48,000 × 16 × 2 = 1·536Mbits/sec. When subcode and error correction bits are added this rises to 2·77Mbits/sec. In practice the processing speed during record and playback is around 7·5Mbits/sec, because the data is time-compressed. DAT's recording density is around 114Mbits per square inch, which means that a two-hour tape can store 1·3Gbytes of data – equivalent to over 1,000 floppy discs. Table 1 compares the DAT, Video-8, compact cassette and CD systems.

The DAT Format

The standard DAT drum has a diameter of 30mm. Its two heads are 180° apart, the heads having azimuth angles of +20° and −20°. The tape wrap is 90°. There are no fixed heads, the data being overwritten by the rotary heads. A series of pilot tones recorded on the tracks is used by the tracking system.

The drum is inclined at an angle of 6° 22′ 59·5″. It spins at 2,000 r.p.m., giving a writing speed of 3·13m/sec. This is around 66 times faster than the compact cassette – a C90 tape running at this speed would give just 43 seconds' recording time. DAT's linear tape speed is 8·15mm/sec. Several companies have developed miniature DAT tape mechanisms that have a 15mm drum and a 180° wrap to record tracks that are compatible with standard DAT mechanisms.

Tracks

Fig. 3 shows the DAT track format in simplified form. The helical tracks are 23·501mm long and 13·59μm wide, each pair being called a frame. There are also two 0·5mm

Table 1: Comparison of DAT, Video-8, Compact Cassette and CD systems.

Item	*DAT (Standard mode)*	*Video-8 (PCM mode)*	*Compact cassette*	*CD*
Sampling	48kHz	31·25kHz	Not used	44·1kHz
Maximum audio frequency	22kHz	15kHz	18kHz (with metal tape)	20kHz
Quantisation	16-bit linear	8-bit non-linear	Not used	16-bit linear
Dynamic range	96dB	88dB	50-60dB	96dB
Transmission speed	2·46Mbits/sec	Approx. 5·79Mbits/sec	–	2·03Mbits/sec
Subcode capacity	273·1kbits/sec	Not used	Not used	58·8kbits/sec
Modulation	8-10	Bi-phase	Not used	EFM
Error correction	Dual Reed-Solomon	CRCC	Not used	CIRC
Cassette/ disc	73 × 54 × 10·5mm	95 × 62·5 × 15mm	102 × 64 × 12mm	120mm diameter × 1·2mm thick
Recording time	120 min	90 min (normal)	120 min (max.)	74 min 42 sec
Tape width	3·81mm	8mm	3·81mm	–
Tape speed	0·815cm/sec	2·01cm/sec	4·75cm/sec	–
Relative speed	3·133m/sec	3·12m/sec	0·0476m/sec	–
Track width	13·591μm	34·4μm	–	0·5μm
Track pitch	13·591μm	34·4μm	–	1·6μm
Frequency response	4Hz-22kHz	20Hz-15kHz	40Hz-18kHz (metal tape)	4Hz-20kHz
Distortion	0·0016%	0·5%	0·3% at −20dB	0·0016%
Search time per 3 min. track	0·9sec	6sec	9sec	Less than 0·9sec

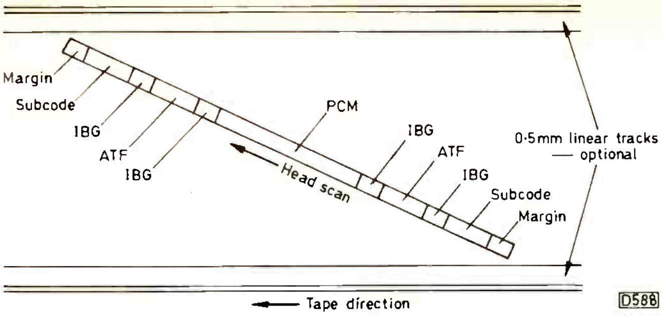


Fig. 3: Basic layout of the helical DAT track.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	D589

Fig. 4: Sections of the helical track – see Table 2.

Sync 8 bits	ID code 8 bits	Block address 8 bits	Data with parity bits 256 bits	D590

Fig. 5: Details of a PCM block. There are 128 of these blocks in the PCM area of the helical track.

wide analogue tracks at the top and bottom of the tape – these have been designated optional. DAT's slow linear tape speed would limit their use and the main reason for having them appears to be to provide protection against tape damage.

Table 2 gives a breakdown of a DAT track recorded with a 30mm drum, 90° wrap and a drum speed of 2,000 r.p.m. Each track consists of 196 "blocks", with each block containing 288 bits. The channel frequency is 9·408MHz. Fig. 4 shows the track sections. We'll take each in turn.

(1) The margin blocks (11) contain no data. They act as a spacer between the digital track and the optional analogue track.

(2) The PLL/sub blocks provide a phase lock for the subcode section.

(3) Subcode-1 is the first subcode section.

(4) The post-amble blocks contain synchronising information.

(5) The IBG (inter-block gap) acts as a spacer between the various data areas – there are four altogether. They make it possible to rerecord sections of track independently.

(6) The ATF (automatic track following) blocks contain the pilot tones for the tracking system.

(7) Another IBG, as (5).

(8) PLL/PCM, the phase lock section for the PCM area.

(9) The PCM area, consisting of 128 blocks. The composition of each of these blocks is shown in Fig. 5.

(10-16) These sections comprise a second ATF part, more subcode blocks, IBGs, post-amble etc.

Table 2: DAT track composition.

	Section	*Angle*	*Blocks*	*Time*
1	Margin	5·051°	11	420·9μsec
2	PLL/sub	0·918°	2	76·5μsec
3	SUB-1	3·673°	8	306·1μsec
4	Post-amble	0·459°	1	38·3μsec
5	IBG	1·378°	3	114·8μsec
6	ATF	2·296°	5	191·3μsec
7	IBG	1·378°	3	114·8μsec
8	PLL/PCM	0·918°	2	76·5μsec
9	PCM	58·776°	128	4,898μsec
10	IBG	1·378°	3	114·8μsec
11	ATF	2·296°	5	191·3μsec
12	IBG	1·378°	3	114·8μsec
13	PLL/sub	0·918°	2	76·5μsec
14	SUB-2	3·673°	8	306·1μsec
15	Post-amble	0·459°	1	38·3μsec
16	Margin	5·051°	11	420·9μsec
	Total	90°	196	7,500μsec

Subcodes

The DAT subcode system is more elaborate than that used with compact discs. It can store the subcodes used for the CD-Graphics format, which puts still graphics on an audio CD (see *Television* April 1990, pages 450-5). Future applications include using DAT as a storage medium for high-resolution graphics. Each track has two subcode areas.

There are two types of DAT subcodes. First those used to provide recording information, such as the sampling rate, quantisation number, etc. Secondly those used to provide user information or playback functions such as time elapsed, track number, track search, etc. The first type, called PCM-ID, is recorded in the PCM area. The second type, subcode ID, is recorded in the subcode areas. Fig. 6 provides a breakdown of the two subcode groups.

Each PCM-ID code has two bits. ID-1 is the format classification, which defines the function of the DAT recorder. For audio recording the code is 00 – it changes if the recorder is used for other purposes, e.g. data storage. ID-2 tells the recorder whether pre-emphasis has been applied to the signal: 00 = no pre-emphasis; 01 = pre-emphasis-1 applied. ID-3 provides information on the sampling frequency (as we'll see later, the DAT format offers a number of different modes with different sampling frequencies). 00 = 48kHz; 01 = 44·1kHz; 10 = 32kHz. ID-4 tells the machine whether the recording has two or four channels: 00 = two; 01 = four. ID-5 gives the quantisation number: 00 = 16 bits linear; 01 = 12 bits non-linear. ID-6 indicates the track pitch – some prerecorded tapes have wide tracks. 00 = 13·6μm; 01 = 20·4μm. ID-7 is a copy prohibit code, which tells the machine whether it's permissible to make a digital copy of the input signal. 00 = digital copy permitted; 01 = digital copy inhibition. This forms the basis of the serial copy management system (SCMS) that stops users making multi-generation digital recordings – we'll return to this later. ID-8 is an extended section that's referred to as a "pack". It consists of 32 two-bit codes. The pack is at present unused, being reserved for future applications. You'll notice that quite a number of the PCM-ID two-bit code possibilities are at present unused.

There are two optional PCM-ID codes, SC (search code) and AC (auxillary code). SC contains the track selection number and time (in hours, minutes and seconds) from the start of the tape. It can also be used to find the start and end of the tape. The AC code is used primarily for prerecorded tapes. It provides a variety of information such as time from start of the tape, programme time, programme/index number, date recorded, programme table of contents, cassette catalogue number, etc. Most of the AC data, such as time from start of tape, programme and index number, can also be held in the subcode-ID area. It may seem wasteful to have two areas devoted to storing the same information. The reason for doing so is that PCM-ID codes cannot be rerecorded without also erasing the PCM signal while the subcode-IDs can be rewritten independently.

As we have seen each PCM area consists of 128 blocks and each block contains eight PCM-ID bits. There are thus 1,024 PCM-ID bits per track. ID-1-8 at two bits each take 16 bits. SC1-4 and AC1-4 consist of four bits each, i.e. 32 in all. There are in addition 16 frame address bits. This gives

PCM area subcodes	
ID-1	Format type
ID-2	Emphasis
ID-3	Sampling frequency
ID-4	Number of channels
ID-5	Quantisation
ID-6	Track width
ID-7	Copy prohibit
ID-8	Pack
SC	Optional
AC	Optional

Subcode area information
Subcode ID
Control ID
Data ID
Pack ID
PNO ID
plus
Subcode data

D591

Fig. 6: Subcode groups.

Sync 8 bits	Subcode ID 12 bits	Parity 8 bits	Subcode data with parity bits 256 bits

Block address, 4 bits

D592

Fig. 7: Details of a subcode area block.

	8 bits		8 bits	
Sync	Control ID	Data ID	Format ID	Block address
Sync	PNO – ID2	PNO – ID3	PNO – ID1	Block address

D593

Fig. 8: Arrangement of the subcode ID sections of two adjacent subcode area blocks.

a total of 64 PCM-ID bits. Thus each bit is recorded on the track 16 times (1,024 – 64 = 16).

We'll deal next with the two separate subcode sections of the track. The DAT subcode signal capacity is 273kbits/sec, which is approximately 4·6 times greater than with the CD format. Most of the subcodes can be recorded automatically or manually or added to existing tape selections.

Fig. 7 shows the general composition of a subcode block, which is similar to a PCM block. The subcode ID section (12 bits) stores control-ID, data-ID etc. information as shown in Fig. 8. Control-ID consists of four bits which provide four items of information: TOC-ID indicates whether or not a TOC is recorded (only prerecorded tapes have TOCs); a Start-ID marks the beginning of a recorded section; a Shortening-ID (sometimes called Skip-ID) can be used for fast forward to the next Start-ID; and a Priority-ID which indicates whether the programme is rerecorded or not. The PNO-ID codes are used to mark programme numbers and are useful for tape editing or renumbering tape selections since they take priority over the PNO codes recorded elsewhere, for example the PCM-ID auxillary code.

The Start-ID code is an important part of the DAT fast-search system. With compact cassette recorders the fast-forward and rewind speeds are twenty-thirty times faster than the normal playing speed. DAT's high-speed search system is two hundred times faster than the normal speed however. Thus while it takes a conventional cassette recorder around four and a half minutes to run through an entire C90 tape a DAT recorder takes just forty seconds to search through a two-hour tape. Put another way, during fast search a DAT recorder takes one second to go through a three-minute recording.

To carry out a fast-search operation a DAT recorder requires the programme number, time and Start-ID code. The Start-ID code is recorded during the first nine seconds of a recording to help the recorders locate it when at full speed. One problem with the fast-search mode is that the relative head-to-tape speed is altered, giving rise to tracking errors. These would make it difficult if not impossible to read the ID codes. This difficulty is overcome by speeding up or slowing down the head drum in the search mode. In addition, the data is read only periodically.

If the Format-ID code is set to a value other than 00 (audio record) the subcode areas can be used to store 64-bit data packs for time from start, running time, programme time etc. as well as graphics and text.

DAT Modes

There are six DAT modes. Mode I is the standard DAT recording and playback mode, with 48kHz sampling and 16-bit linear quantisation. This mode is mandatory for all DAT machines.

Mode II, which is optional, is designed to be compatible with satellite digital stereo broadcasting. It has a 32kHz sampling frequency. Other details are the same as Mode I.

Mode III is an optional half-speed mode which doubles the recording and playback times. The tape speed is 4·075mm/sec and the transmission speed 1·23Mbits/sec (subcode capacity 136·5kbits/sec). Sampling is at 32kHz, with 12-bit non-linear quantisation. As with LP VCRs the user selects the recording tape speed and the machine automatically selects the correct playback speed. With metal particle tape the playing time is four hours: when thinner, metal evaporated DAT tape becomes available the time will be increased by about thirty per cent. JVC has developed a version called "double scanning" in which the tape speed remains the same but the drum speed is reduced to 1,000 r.p.m. when recording: for playback the drum speed is normal but the tape runs at half speed.

Mode IV gives four-channel recording. Quantisation and sampling frequency are as in Mode III.

Mode V is used for playing prerecorded tapes. The sampling frequency of 44·1kHz, with quantisation as in Modes I and II, is the same as with the CD format. This makes it easier for music companies to transfer CD master tapes to DAT. Normal-track prerecorded DAT tapes are made in the same way as prerecorded video tapes, i.e. a master recorder is connected to a series of slave recorders. This mode is mandatory. In the original DAT specification the 44·1kHz sampling rate could be used only for playback, so that DAT recorders couldn't be used to make digital copies of compact discs. However an agreement between the hardware and music companies has resulted in an extension of the DAT format to include a 44·1kHz sampling rate in the record mode. We'll return to this later.

Mode VI is an alternative prerecorded tape format which uses a wide track (20·41μm) to give improved sound quality. The tape speed is increased to 12·25mm/sec, resulting in a maximum playback time of eighty minutes. Barium ferrite instead of metal tape is used. At 700 Oersteds the coercivity of BaFe tape is lower than that of metal tape (1,500 Oersteds). For wide-track duplication a contact process is used: a master metal tape which contains a mirror-image of the signal is brought into close contact with the BaFe slave tape. Heat from a laser reduces the coercivity of the BaFe tape to below the Currie point so that the master tape's signal is transferred to the slave tape. To restore its coercivity the slave tape is then wrapped around a drum that contains a coolant. This mode is also mandatory.

Tape

The shortest recordable wavelength with the DAT system is about 0·67μm. This calls for the use of high-density, high-coercivity tape. Standard DAT tape is made from metal powder, is 3·81mm wide (the same as compact cassette tape) and 13μm thick. It's more or less the same as Video-8 tape and it wouldn't be surprising if some tape

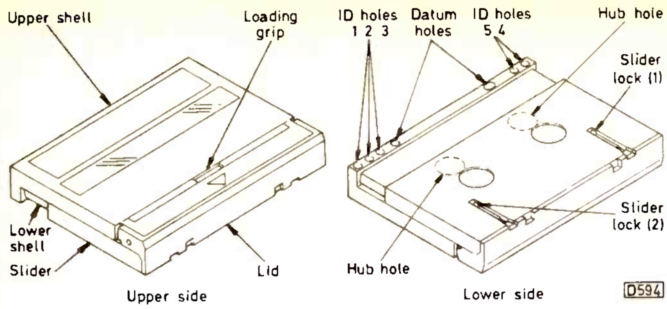


Fig. 9: Appearance of the DAT cassette.

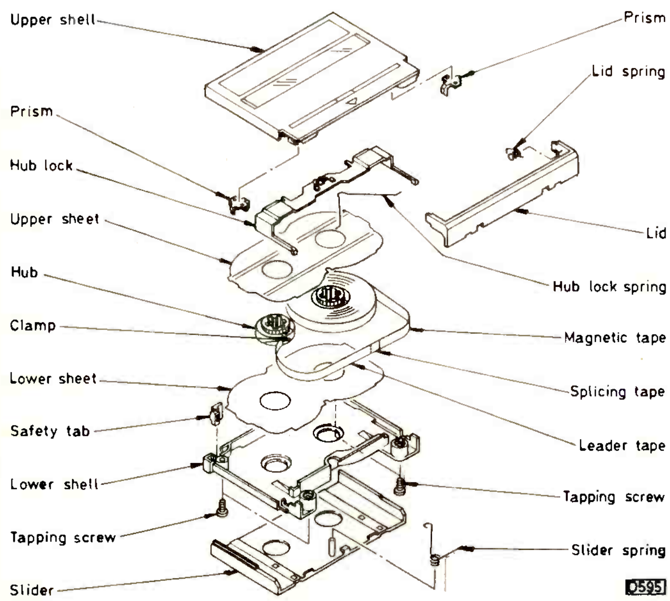


Fig. 10: Structure of a DAT cassette.

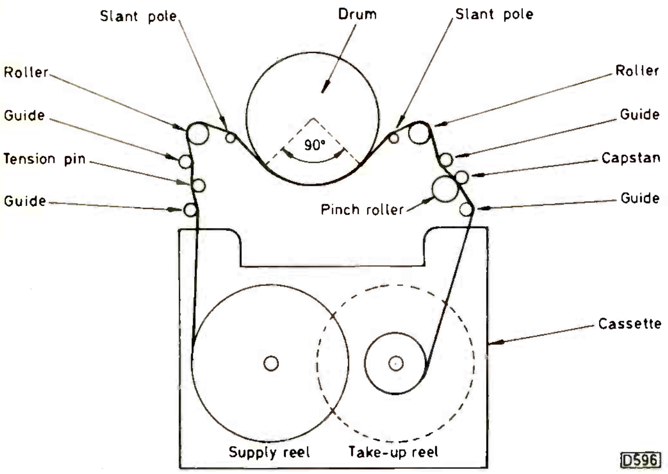


Fig. 11: The DAT tape path.

companies made their DAT tape simply by cutting 8mm tape down to size. The magnetic layer is 3μm thick, the base film is 9·5μm thick and there's an 0·5μm thick back coat. As previously mentioned, the coercivity is 1,500 Oersteds – for comparison, the coercivity of VHS tape is around 700 Oersteds. The DAT tape remanence is 2,500 Gauss. Future plans include the use of metal evaporated (ME) tape some 10·8μm thick.

The Cassette

The design of the 73 × 54 × 10·5mm DAT cassette is based on that of the video cassette. A two-hour cassette holds 60 metres of tape. As with video tape, only one side is used for recording. Fig. 9 shows the exterior appearance of the cassette. Again as with a video cassette there's a protective lid to prevent dust, dirt and fingerprints contaminating the tape. There's also a slider which covers the tape hub holes. The hubs are flangeless and are fitted with brakes. There are no guides or rollers within the cassette. When a cassette is inserted into a DAT recorder the lid opens and the slider moves back to expose the hub holes into which mechanical reel shafts go.

Fig. 10 shows an exploded view of the cassette. The format uses an optical end-of-tape sensor. Light from two LEDs shines on to prisms at each end of the cassette. These prisms reflect the light on to the tape, which is opaque apart from the leaders. Thus at the beginning and end the light shines on to a phototransistor which activates the brake. Because of the high search system speed the leaders are approximately 60mm long. This provides a wide enough braking margin.

The cassette has five identification holes. The first three are used to identify the type of tape. If one is taken as open and zero as closed, the code is 000 = metal tape or equivalent 13μm thick, 010 = thin metal or equivalent tape, 001 = 13μm wide-track (BaFe) tape, 011 = thin BaFe tape. For hole four 1 = prerecorded music tape, 0 = regular tape for recording. For hole five 1 = recording not possible, 0 = recording possible. There's also an erasure prevention slider similar to that on Video-8 cassettes – the difference is that with a DAT cassette an open hole (slider pushed back) prohibits recording while a closed hole permits it.

Hardware

The DAT tape path is shown in Fig. 11. The important point is the 90° tape wrap, which reduces head and tape wear. As the heads are not in contact with the tape for fifty per cent of the time the DAT system has to use time compression for the signal during recording and playback.

Fig. 12 shows in simplified block diagram form the arrangements used in a DAT recorder while Fig. 13 shows in a little more detail the recording system. The record channels start with pre-emphasis of the analogue left and right audio signals which are then passed through low-pass filters to remove frequencies that are higher than half the sampling frequency. This is done to prevent aliasing during the sampling process. Sample-and-hold circuits do the sampling, after which an analogue switch selects left and right samples alternately. These are then converted to digital form, and error correction bits are added. Signal interleaving is then carried out in conjunction with a 128Kbit RAM.

Cross-interleaving is the next process, to give added error protection. The block is labelled CIRC, which stands for cross-interleaved Reed-Solomon code – much the same techniques are used in the CD system, and were outlined in the August 1989 issue of *Television*, pages 756-9.

The signal then undergoes 8-10 modulation to prevent long strings of zeros or ones which would give rise to d.c. components. The 8-10 modulation system works by splitting the 16-bit words into two 8-bit words then converting each to ten bits. The data is now ready for storing on tape. DAT recorders don't use erase heads, overwriting previous data instead. The problem with this system is that when a short wavelength signal overwrites a long wavelength signal the unerased portion produces noise. For this reason the ratio between the shortest and the longest wavelength must be no greater than 1:4. Interblock gaps (IBGs) are added between the various

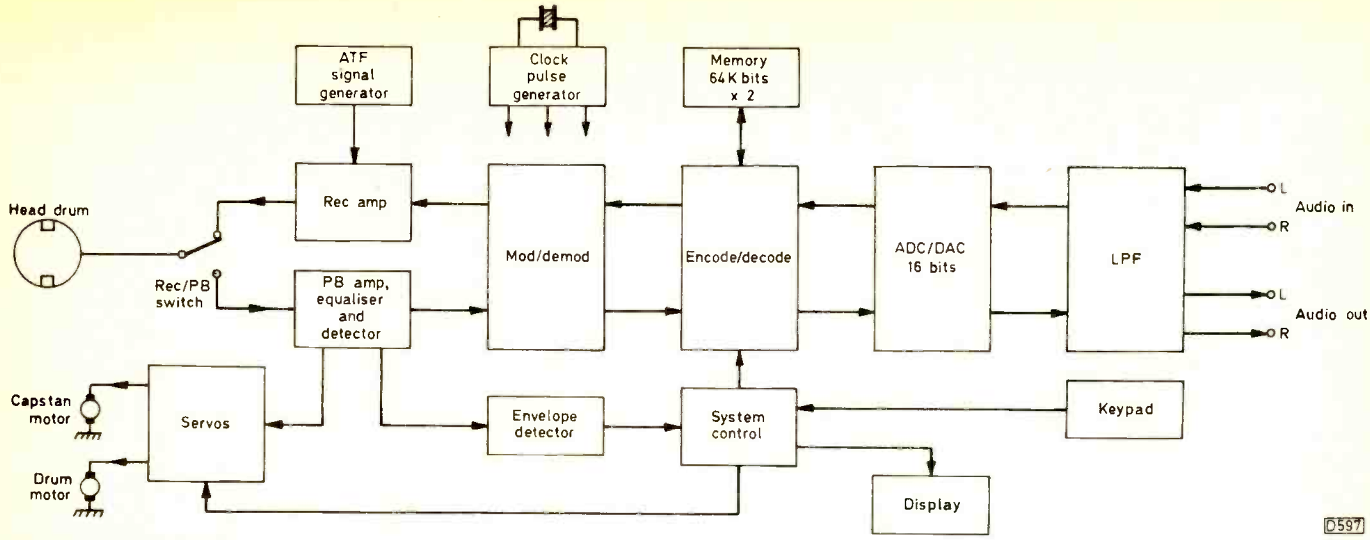


Fig. 12: Simplified block diagram showing the arrangements used in a DAT recorder.

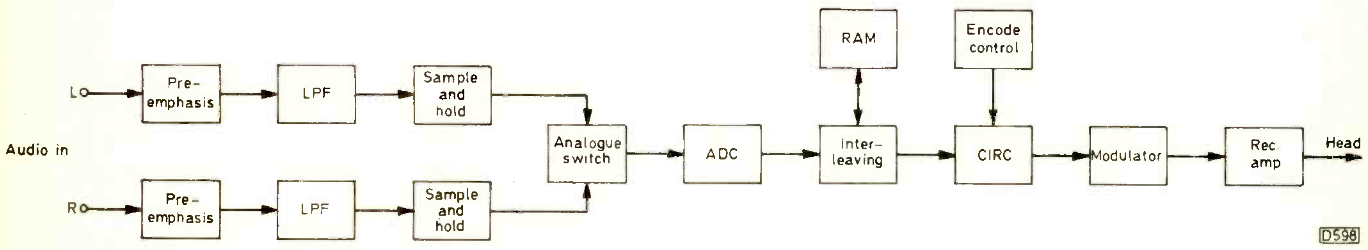


Fig. 13: Block diagram of the DAT recording system.

track blocks. These have 1·568MHz erase signals, allowing separate parts of the track to be erased and also preventing adjacent blocks from being overwritten.

Encoding

We'll now take a closer look at the DAT error correction system, which as previously mentioned has features in common with those used in the CD system, described in the August 1989 issue.

There are basically two types of errors, random and burst ones. The former involve small amounts of data while the latter can result in relatively large amounts of data becoming damaged or corrupted. Causes of burst errors include tape dropouts, incorrect tracking and fingerprints or dirt on the tape.

The DAT system uses a powerful double-encoded cross-interleaved Reed-Solomon error correction code. The error correction codes are designated C1 and C2. The C1 code can detect and correct random errors up to two symbols (one symbol = 8 bits) long or burst errors up to four symbols (32 bits) long. The C2 code can correct random errors up to three symbols (24 bits) long, six symbols (48 bits) of erasure error (where data is inadvertently overwritten) or 792 symbols of burst error.

Fig. 14 shows the interleaving principle – in practice the DAT system interleaving is far more complex than this. The data is read into a memory in sequence then read out in a different sequence. After this the data passes to the CIRC encoder. If a burst error occurs, the missing data may be corrected or filled in by interpolation. The DAT error correction system can correct linear track damage up to 2·64mm in length – equivalent to 6,336 bits – or 0·3mm wide. Larger damage requires interpolation.

Interleaving is also done across two tracks. One track contains the odd samples from the left channel and the even samples from the right channel, while the second track has the even left samples and the odd right samples (see Fig. 15). This enables the machine to carry out interpolation should one head become clogged. An engineer told me the DAT error correction system is so powerful that a recorder continued to work normally after he'd removed one of its heads!

Time Compression

Because the heads are in contact with the tape for only one half of the drum's period of rotation time compression is used. It's carried out by reading the data out of the

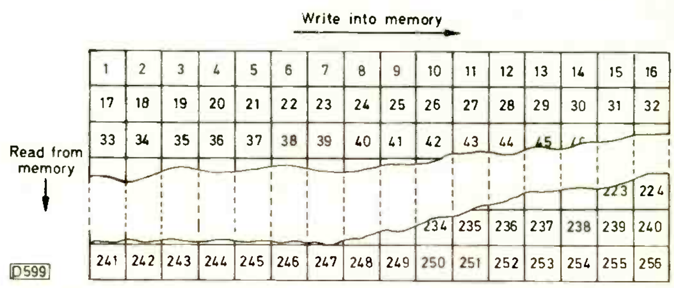


Fig. 14: Principle of interleaving by writing into/reading from a memory in different sequences.

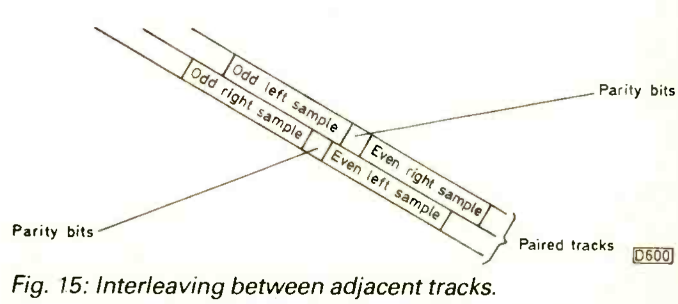


Fig. 15: Interleaving between adjacent tracks.

memory at a faster rate than it was written in. The read-out rate depends on the sampling frequency. Because interleaving is carried out over two tracks (one frame) the RAM used must be able to store a complete frame. A DAT frame contains 64Kbits, but two 64Kbit memories are required because one frame is being sent to the recording heads while the next frame is being written into the RAM for interleaving. During playback, as one frame is being sent to the DA converter the next frame is being written into the second RAM for de-interleaving.

The ATF System

The DAT system's automatic track following (ATF) arrangement follows the principles used in the Video-8 system. In a DAT recorder however the recording head is 1·5 times wider than the track pitch, so that it straddles three tracks (see Fig. 16). Fig. 17 shows the ATF track pattern in more detail. Frequency f1 is a 130·67kHz pilot tone, f2 is a 522·67kHz sync signal, f3 is a 784kHz sync signal and f4 is a 1·568MHz erase signal.

Consider a head following the track identified as A–even frame address (second from left at the bottom). The head's path is from bottom right to top left. As it travels along the track it encounters an f1 pilot tone, which is the track reference tone. Next it meets an f4 signal which it ignores. It next encounters an f2 sync signal which tells the machine to start sampling cross-talk information. As a result it reads the f1 tones in the two adjacent tracks. The amplitude of the two samples is compared, any difference indicating that a tracking error is present. The electronics then send a signal to the capstan servo to alter the tape speed.

LSI Chips

It's fair to say that without modern LSI chip technology the CD and DAT systems would not have been a practical proposition. Fig. 18 shows a block diagram of the Sony DTC-1000ES professional DAT recorder, identifying the various LSI chips used. The CXA1045Q is a 48-pin bipolar chip that's responsible for recording/playback amplification and equalisation. The CXA1046M is a 28-pin bipolar chip that carries out ATF processing. The CXD1009Q is an 80-pin CMOS device whose functions include 8-10 modulation/demodulation, subcode processing, RAM control, the system clock and the servo reference. The CXD1008Q is a 64-pin CMOS chip that's responsible for error correction and interfacing with the AD and DA converters. It has a multiple clock for the three DAT sampling frequencies. The CXD1052Q is a 48-pin CMOS device that carries out the drum servo action. This chip set has been developed specifically for DAT use. There are additional LSI chips, e.g. the AD/DA converters and the microcomputer chip.

The DSS Format

The computer company Hewlett-Packard and Sony have developed the Digital Data Storage (DDS) system which stores 1·3Gbytes of computer data on a two-hour DAT cassette. The data is arranged in groups of 22 frames (around 128Kbytes). While the DAT error correction system, which enables large burst errors to be concealed by applying interpolation, is suitable for audio use it's not acceptable for computer data.

During the system's development Hewlett-Packard carried out research into the factors that can cause errors in the DAT system. There are five categories. (1) Inherent

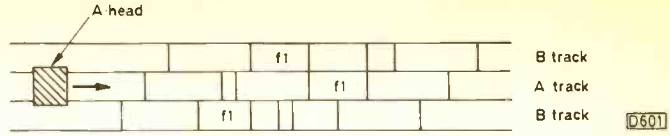


Fig. 16: A DAT head straddles three adjacent tracks.

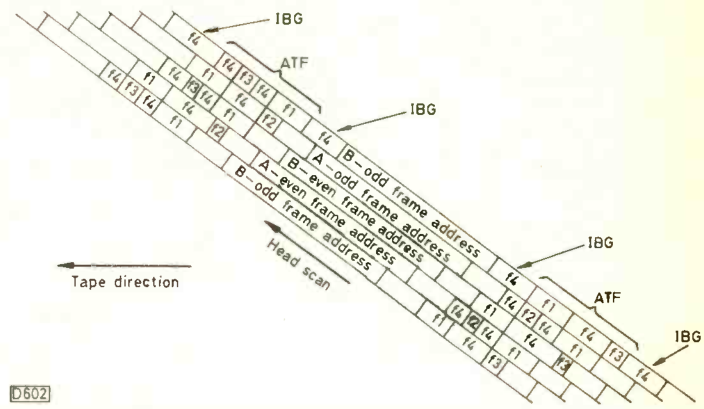
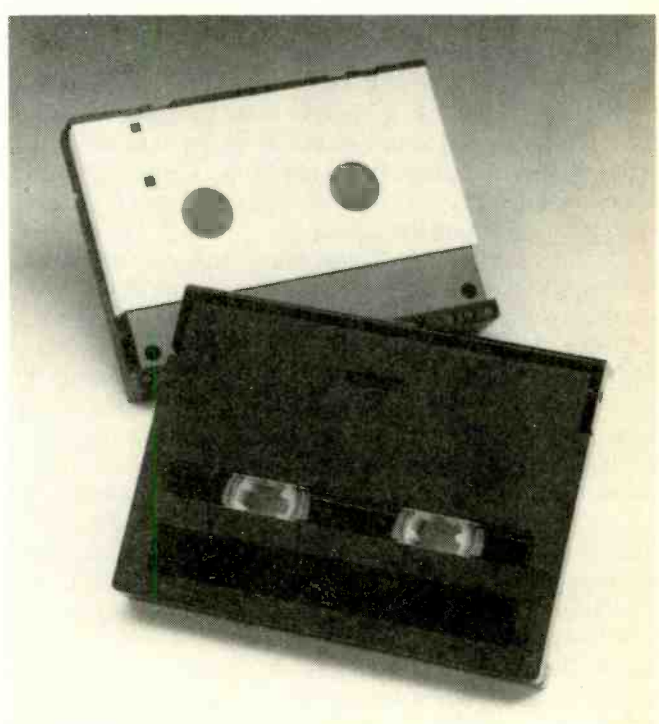


Fig. 17: Positions of the ATF signals on adjacent tracks.

media defects, including tape dropouts, particles and scratches on the tape and tape width fluctuations. (2) Tape damage after the data is written. Helical damage can be caused by debris on the tape guides; transverse damage can be caused by tape surface irregularities or faulty tape operation. Since damaged tape tends to flake off and contaminate the heads and tape guides even more errors can be introduced. (3) Head clogging, which results in misreading or non-reading of the data. (4) Head/tape design and production errors, which can cause tracking errors, r.f. level fluctuations, noise and jitter. Another factor, called inter-symbol interference, is caused by distortion between the read and write signals, resulting in misread data. (5) Tape degeneration. At present there's no official DAT tape durability figure. Hewlett-Packard, Sony and other companies are currently carrying out research



The DAT cassette. Note the slider cover over the hub holes. When the cassette is inserted in the machine the lid opens and the slider moves back to expose the hub holes.

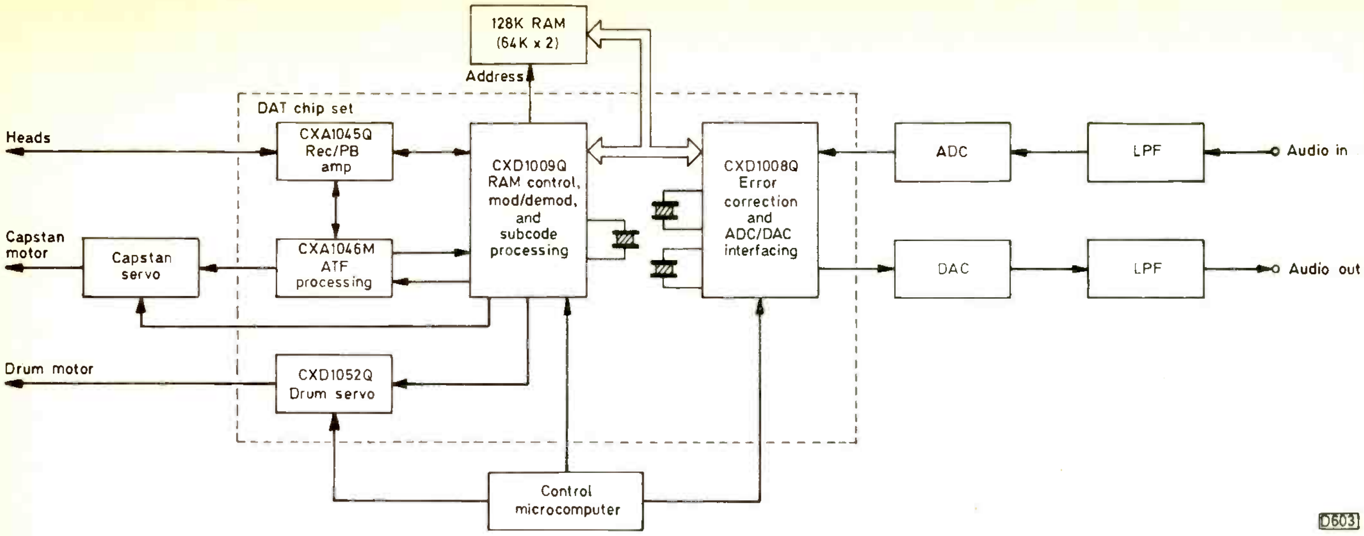


Fig. 18: Block diagram showing the DAT-specific chip set used in the Sony DTC-1000ES professional recorder.

into this. The companies believe that the archival life of DAT tape is equal or greater than that of tape used in other media.

For improved reliability the DDS format uses a four-head drum with two read and two write heads. These provide a "read-after-write" operation in which the written data is immediately read and checked for errors. If errors are found the relevant frame is rewritten. DDS also has an additional C3 error correction code that can correct errors within any two tracks within a group. The DDS error rate is 1 in 10^{15}, or one incorrect bit for every 1,000,000,000,000,000 bits read.

Professional DAT

DAT has been used in broadcasting and music studios for several years as a music source and as a low-cost digital tape mastering system. In 1989 however the German Institut fur Rundfunktechnik (IRT) research laboratory conducted a series of tests which suggested that DAT was unsuitable as a digital tape mastering medium. Amongst the claims made were that DAT recordings deteriorate before ten generations and that there are compatibility problems between tapes recorded by different machines. Further research is being carried out: meanwhile many studios continue to use DAT.

Copy Control

The Aiwa HD-S1 DAT recorder, the first consumer DAT machine to go on sale in the UK, became available last October. The first DAT machines to go on sale in Japan were launched in March 1987. DAT's late arrival in Europe and the USA was due to music companies' objections that DAT would be used to make digital copies of compact discs. Even though the first DAT recorders were unable to copy CDs digitally because they didn't have the ability to sample at 44·1kHz the music industry continued to oppose DAT.

CBS records proposed an anti-copy system called Copycode. This doctored a CD sound signal with a series of notches. If the user tried to copy the CD's signal on to a DAT machine the recorder would detect the notches and refuse to record. But Copycode was found to be unworkable.

For over three years the music industry and the electronics hardware companies attempted to resolve the problem. Agreement was eventually reached at a meeting in Athens in June 1989. The agreement states that a DAT recorder can incorporate 44·1kHz sampling when making recordings provided it incorporates Serial Copy Management System (SCMS) circuitry. SCMS was developed from a Philips system called Solocopy. The SCM system allows a single digital copy to be made on tape. When this is done an 01 digital copy inhibition subcode is laid down in the ID-7 PCM subcode area of the tape. As a result, if the user tries to make a second-generation digital copy the machine reads the code and refuses to record. It's possible to make multiple analogue copies however. Although the sound quality with analogue copies is acceptable to most people the process results in loss of the subcodes. Thus fast search etc. cannot be used. If the user makes a digital copy of the analogue recording this carries a 10 copy prohibit code, which means that only one digital copy can be made from an analogue recording.

The SCM system has enabled consumer DAT machines to be marketed in the West, though there are signs that the music industry is still not entirely happy with the system.

The Future

It's ironical that just as DAT has appeared in Europe several new developments have put a question mark over its future as a consumer system. The first is the development by Philips of its DCC (digital compact cassette) system. Brief details of this system were given in Teletopics, December (page 106). Secondly, Dolby Labs have developed Dolby S, a noise-reduction system that's claimed to dramatically improve the sound quality with analogue recordings. In addition several companies are developing recordable compact discs, while Sony has developed a digital memo recorder that records two hours of sound on a cassette measuring just 30 × 21·5 × 5mm.

At present most of these technologies require further development work or are too expensive for the domestic market. But it all points to an interesting period ahead.

Acknowledgement

I would like to thank the following for their help in the preparation of this article: David Bush, Senior Product Engineer at Sony Broadcast; Peter Wall of Peter Wall ElectroAcoustics; Celia Watts of Hewlett-Packard; and Martyn Williams, Technical Manager of TDK (UK).

Servicing Notes on the Hitachi G8Q Chassis

John Coombes

The Hitachi G8Q chassis is used in a series of models that include the CPT2196, CPT2198, CPT2578, CPT2578X, CPT2596, CPT2598, C14 P216, C21 P226, C21 P228, C21 P818, C25 P226, C25 P228, C25 P236, C28 P226 and C28 P228. Our main experience has been with the CPT2196.

Power Supply Circuit

A feature of these sets in the somewhat unusual power supply in which there are two chopper transistors, a bipolar and a MOSFET type, connected in series, see Fig. 1. Q902 is the bipolar transistor, which receives a fixed base bias. The on/off drive waveform is applied to the gate of the MOSFET device Q901 which drives the emitter of Q902. It's worth including a few notes on the operation of this power supply arrangement.

At switch on the positive temperature-coefficient thermistor TH902 has a low resistance. Thus C908 charges rapidly, the voltage developed across it being limited to 27V by zener diode ZD901. This enables the control chip IC901 to start up. When the circuit gets going the chip's supply is provided by rectifier diode D902, which maintains the charge across C908.

When Q901 and Q902 switch on, current flows via R910 and the primary winding of the chopper transformer T901. R907/VR901/R914 produce a voltage that's proportional to this current. Should the chopper current be excessive, the voltage at pin 3 of IC901 will exceed the voltage supplied to the other input of comparator-2 and the circuit will shut down.

Q942 senses the h.t. voltage, driving Q941 which in turn drives the LED in the optocoupler OC941. If the h.t. voltage rises above the level set by VR941 the voltage at pin 5 of the optocoupler will fall, reducing the voltage at pin 1 of the chip. The action of comparator-2 will then switch Q901 off at an earlier point in its operating cycle.

Excessive h.t., due for example to failure of the regulator circuit just described, will result in D908 developing a higher than normal voltage across C917. This voltage is applied to pin 2 of IC901 via R917. It's compared to an internal 2·5V reference voltage by comparator-1. When the voltage at pin 2 rises above 2·5V the output from comparator-1 falls and the chip's output will shut down.

A short-circuit across one of the outputs obtained from T901 will result in the voltage at pin 7 of the chip falling below the under-voltage reference level. The i.c. will then cease to operate. C908 will recharge and the power supply will try to start up. This action will continue until the short-circuit is cleared.

The voltage across C908 could be insufficient for Q902 to be driven to saturation. Protection against this is provided by Q903 and its associated components. Q903

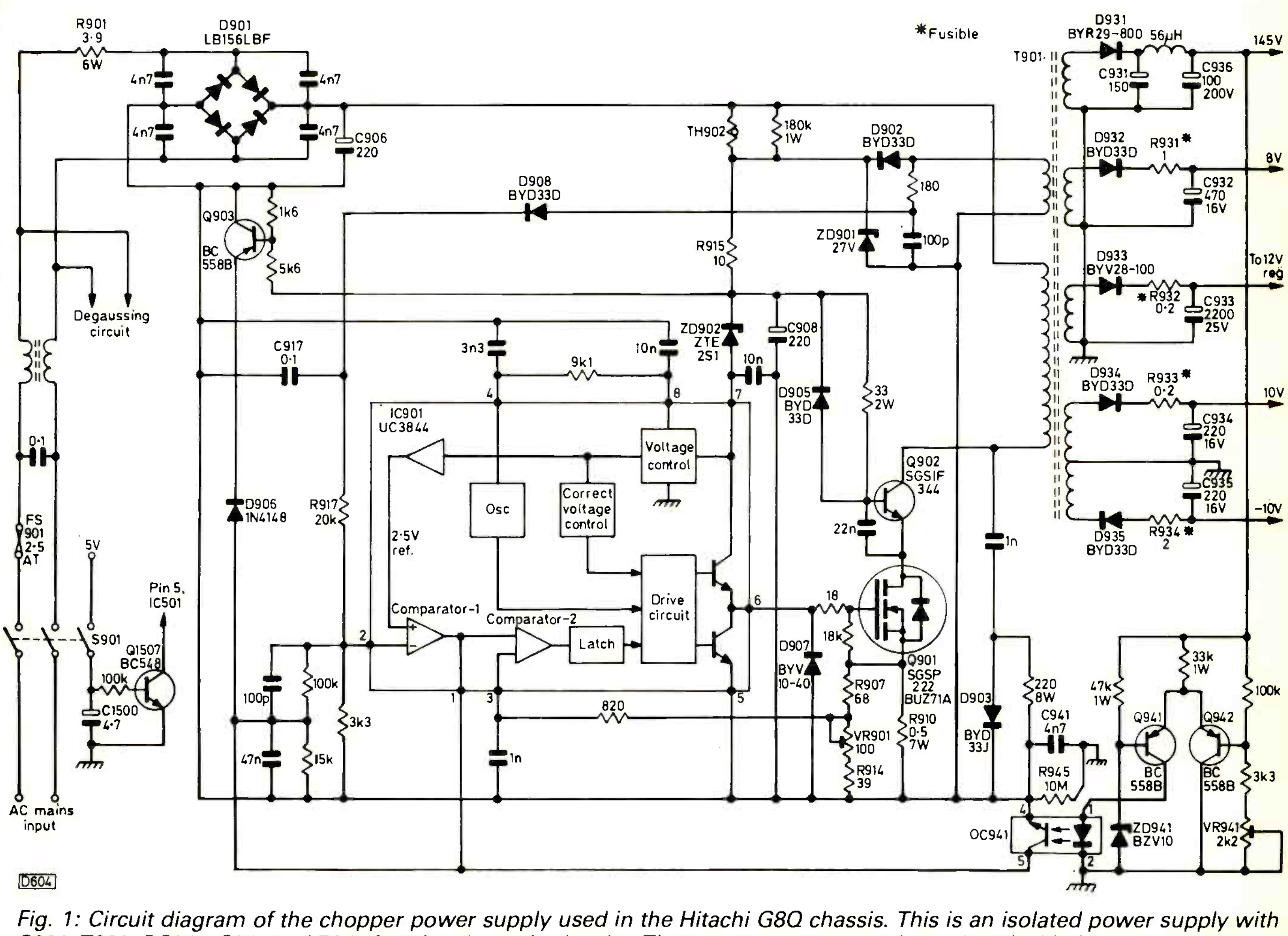


Fig. 1: Circuit diagram of the chopper power supply used in the Hitachi G8Q chassis. This is an isolated power supply with S901, T901, OC941, C941 and R945 forming the mains barrier. These components must be replaced with the correct types.

provides a voltage that's proportional to Q902's base current. This voltage is applied to pin 1 of IC901, reducing the level so that Q902's collector current cannot exceed the available base current.

Note that the mains switch S901 has a third, momentary-make contact. When it makes at switch on C1500 is charged from the 5V supply, switching Q1507 on. The low voltage applied to pin 5 of the SAA1293H control chip IC1501 brings it out of the standby state and resets the nominal control values.

Fault Finding

If the complaint is no results check fuse FS901 which may be o.k. or open-circuit. Check for broken print at pins 3 and 9 of T901. If necessary check Q902, ZD901, OC941, ZD941, Q941/2, ZD902 and D905.

Slow starting can be a tricky fault as the set starts before one has time to make a diagnosis. The usual cause of the trouble is TH902. It should normally read 4kΩ when cold. If unsure, check by replacement.

The power supply shutting down has on several occasions been traced to Q941 being at fault.

No results or intermittent no results has been traced to dry-joints on the chopper transformer T901, rectifier D933 or line output transformer T702

We've had several cases of tuning drift. The usual cause is IC1503 (ZTK33B).

TEST CASE

338

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.

We find that shop staff are getting more and more sloppy when writing out service job cards. This one just said "whirrs". We drew our service manager's attention to it. "I'll have a word with them" he said, "the situation is getting whirrs and whirrs . . ." So much for serious and responsible management.

The whirring device was in fact a JVC VCR, Model HRD170, which went to Real Technician's bench for repair. It whirred at switch on. Removal of the top cover showed that the noise came from the reel-drive mechanism, which turned the take-up spool smartly clockwise even without a cassette. RT whipped off the bottom cover and tightened the earthing screws on the under deck PCBs, then confirmed that their printed lands were earthed. They probably were to start with, because the take-up reel still whirred at switch on.

The machine was switched off and a cassette was inserted. At switch on the cassette loaded without any problems, and from that point on all the functions RT tried worked perfectly – play, record, pause, fast forward and rewind. At the end of the rewind the machine stopped as it should and waited for further instructions, which it then carried out correctly. Only when eject was tried did a problem show up. The cassette motor continued to run when the cassette had been ejected, slipping its belt for several seconds before the machine switched to standby, extinguishing the red "on" LED at the operate button.

What was RT to make of all this? He decided to concentrate on the most obvious defect, the cassette motor's overrun at eject. In place of the usual eject detection limit switch this machine uses an optocoupler which looks through a slot in the cogwheel that drives the cassette cradle. The photosensor's output is applied to pin 37 of the syscon microcomputer chip IC601, so this point was monitored. When the cassette was fully ejected, and indeed when it was fully loaded into the deck, the voltage at this point dropped to virtually zero. As this was the correct condition RT condemned the expensive M50731-610SP microcomputer chip. He reasoned that since it was getting the cassette-out message but failed to turn off the front-load drive motor it had to be responsible. No doubt when it was replaced the whirring business would also be cured. A telephone call to JVC got the wonder chip on its way, and our man turned his attention to a Sharp machine with a reel-idler problem.

When the new microcomputer chip arrived RT fitted it carefully, taking the correct precautions against static damage. At switch on the machine whirred. RT felt that his diagnostic powers were getting whirrs and whirrs as he put the maligned chip into the stores with a little label on it saying "believed o.k. – RT". Replacement of the syscon microcomputer chip had left the fault pattern exactly as before.

RT studied the circuit diagram, which showed that the cassette motor is driven by a TA8400P switching chip. This chip also drives the mode motor. Instructions for both come via a three-wire bus from pins 57/8/9 of the microcomputer chip. Could this motor-control chip be responsible for the problem? RT decided that it could, so he ordered one and turned to an ITT TV set with field collapse.

When the postman brought a little parcel with the new TA8400P chip RT fitted it and switched on. There was again no change in the symptoms. RT put the machine to one side while he attended to more pressing problems. Later that day he put the whirring JVC VCR back on his bench. After spending some time on it he arrived at a correct diagnosis and cure. What had he overlooked during his initial hasty investigations? Should he have taken greater notice of the original "whirring" complaint? See next month for the answer.

ANSWER TO TEST CASE 337
— page 191 last month —

Poor TechnoCrat! Shivering and grumbling, he had done all the right things in his attempts at diagnosing the cause of the trouble with the old Decca TV set with which he was doing battle. The problem was heavy overloading in the line output stage, and he'd found two very good reasons for this – a leaky line output transistor and a very sick line output transformer with short-circuited turns. Did the set want three diagnoses and three repairs for heaven's sake? It did. The third diagnosis was carried out by once again removing the tripler's input pulse feed from the transformer, whereupon the line output stage at last came to life. A new tripler was required to complete the repair, restoring pictures to the (slightly tired, as it turned out!) picture tube.

It was now fairly obvious what had happened. The syndrome is one that the old ITT CVC20 chassis commonly produced from its repertoire of tricks. Initially the tripler had failed. This had lead to overheating in and damage to the line output transformer. While the user had stared at the blank screen the BU500 line output transistor had succumbed. Only then had the fusible resistor R430 sprung into action to cut off the power. All four items had to be replaced to get things going again.

Poor TechnoCrat. When he'd fitted the new tripler, dressed all the wires, set up the receiver and boosted its tube he heard that ace salesman Alec had rented the customer a nice new Tatung . . .

Problems with Compact Discs

Nick Beer

With video and audio systems one has to consider software as well as hardware faults. For example video tapes can shed oxide, cassette tapes can become tight, and records can have badly pressed lead-out areas. The compact disc system has its own selection of potential software problems. It's easy to overlook them or accuse the player of being the cause of difficulties. You can also get into disputes with customers who think that a player which is under guarantee is responsible when the problem is clearly caused by a disc. The aim of this article is to serve as an introduction to disc defect troubles.

Symptoms

The symptom most often caused by a faulty disc is the symptom that occupies most of a CD engineer's time anyway – poor playability, i.e. skipping, sticking and jumping. This presents a problem: the poor playability could well be, and in fact is more likely to be, caused by a machine fault.

Procedure

The classic case is when a machine is brought in with the complaint of skipping and suchlike but performs faultlessly on test. The engineer will follow the advice given by Joe Cieszynski in his series of articles in this magazine and use an error disc to assess the machine's performance when confronted with such problems as loss of data/data interruptions, fingerprints, and dirt on the surface of a disc. Before carrying out any adjustments/cleaning it's important to check the player's performance when first received so that any improvements following service work can be noted. One or two possibilities should be borne in mind once you've confirmed that the machine plays a good disc and assessed its ability to handle disc errors.

If a player's performance is to specification or better when playing an error disc there could be an intermittent fault. Try giving the player a prolonged test. The other possibility is that very poor quality discs are being used. If the player's performance with an error disc is slightly below par but good discs are played well repair/alignment will be needed but discs that are in poor condition could still be contributing to the user's problems. If a player fails the error-disc tests it will obviously require attention. Nevertheless bear in mind the possibility that poor discs are being used, especially when the symptoms seem to be less severe than those reported by the customer.

Experience

As with so many problems of this type there's no substitute for experience. It's as important as technical ability in deciding what's the cause of the difficulties. There can for example be a great disparity in the performance of the different models in a manufacturer's range, and also of course across the complete market. Apparently identical machines can perform differently. A classic problem is where two friends or neighbours have the same model. One may buy a poor quality disc or scratch a disc and find that while it doesn't play satisfactorily in his own machine "it's perfect in my mate's".

It's important to know the capabilities of each model. This knowledge can be obtained only through experience, but this experience will be hard to gain if you handle very few of a particular model.

Most workshops are equipped with error discs. Ideally these should be professionally made and to the appropriate manufacturer's specification. Technics for example has produced discs that simulate data interruption, with variable diameter black dots, variable width wedges and simulated fingerprints on the surface, "wobbly discs" that represent a warped disc, and so on. Acceptable limits are laid down for the performance of the various players when playing these discs. Most players do better when working well, as you would expect with a quality product.

Failing this you can use a damaged disc – say one that's fallen foul of a faulty mechanism. Testing the disc, checking where the errors are by using the player's time-count, then establishing how each model reacts to the errors when working to specification is a good way of gaining experience. It's surprising how quickly you can gain experience in this way. Professional error discs do provide a better guide however.

Disc Defects

The most common disc problem, giving rise to the symptoms mentioned above, is dirt or scratches. Misuse is the cause – leaving the discs out of their cases, using them as coffee cup coasters, etc. Many customers have been misled by the massive publicity when the CD system was launched claiming that the discs are virtually indestructible. The manufacturers knew at the time that this wan't true. We certainly know now that it isn't the case. So why were there all those demonstrations with jam being spread over the discs, discs being trampled into the ground, etc? It's a similar problem to the impression given by some tape manufacturers that their cassettes last for ever.

Another problem, one that's often overlooked, is damage to the label side of the disc. This can result in transparent holes. If these are large enough they'll cause all sorts of symptoms, depending on the player concerned. For example loss of focus can result in the disc being ejected!

Customer education is the key. A little note attached to each repaired machine helps. With problem owners you may have to discuss the situation in detail and provide a demonstration with a good disc.

There are some discs on the market with a very long playing time. Some older players find it difficult to play these to the end or at all if unable to read the TOC. Many players take a surprisingly long time to read discs with a large number of tracks.

Failure to focus, especially intermittently, is a less common disc problem. If there's no obvious damage it can be caused by a faulty or poor-quality pressing or decay of the aluminium layer. The latter can be seen as a watermark type discoloration when the disc is viewed with a suitable amount of light. It tends to occur around the centre.

Discs sometimes get stuck in players because of a rough or too small centre hole as a result of which the disc sticks to the clamper/turntable. This defect can also result in a disc being damaged as it's loaded, especially in cartridge multiplayers.

When the centre hole becomes enlarged the disc will run eccentrically. This can cause playability problems. Visual inspection is the way to tell.

Clues

It's best to get the customer to include with the machine a disc that shows the symptoms complained about when played. This applies whenever disc problems could be the cause. It should speed up diagnosis and give you an idea of how well the discs are looked after. Another guide is the condition of the machine, both inside and out. Dirt in and around the disc tray is a bad sign. A dirty lens – dust or nicotine – would suggest that the average disc is in a similar condition.

Disc Repairs

It's often possible to remove small marks etc. on a disc by using a cloth and an abrasive liquid such as Brasso. This should be attempted only where there's nothing to lose, as it's a bit hit and miss. Discs should normally be cleaned in the recommended way, using a soft, dry cloth in linear motions from the centre of the disc outwards in one direction only. Disc care kits are available from accessory suppliers. Care instructions are usually printed on disc inlay sheets.

In Conclusion

That discs can cause problems should be obvious. But, as with video tapes, there seem to be many people who don't recognise this. When playability problems are experienced, particularly with a machine that's still under guarantee, there's a tendency to replace the optical unit as a first step. This is done whether the playability problem is checked or not. It's often a waste of time and money, and can lead to a dissatisfied customer. It upsets the manufacturers too, many of whom have told me that considerable numbers of the optical units returned under guarantee are perfectly all right. It's always worth asking the customer whether the symptom occurs with all, some or just one disc.

Further Information

Philips test discs, type numbers SBC421 and SBC426, are available from HRS Electronics (trade only). The SBC426 is a two-disc set that includes simulated defects. Further information on CD etc. servicing will be found in my book *Servicing Audio and HiFi Equipment*, which is due to be published by Heinemann Professional Publishing later this year.

ECONOMIC DEVICES PO BOX 15, WOLVERHAMPTON, WV2 4AZ

15/80H	3.72
15/85R	3.72
17052	4.58
17053	5.61
17074	9.30
17089	3.45
17127	2.50
17376	1.58
1N4001	0.04
1N4002	0.06
1N4003	0.06
1N4004	0.05
1N4005	0.05
1N4006	0.08
1N4007	0.07
1N4148	0.03
1N4448	0.05
1N5401	0.11
1N5402	0.13
1N5403	0.18
1N5404	0.10
1N5408	0.16
1N914	0.04
1S555	0.18
1S44	0.10
1S921	0.10
2N2219A	0.29
2N3053	0.35
2N3054	0.99
2N3055	0.66
2N3442	1.16
2N3702	0.14
2N3703	0.18
2N3705	0.15
2N3706	0.14
2N3707	0.16
2N3711	0.11
2N3771	1.56
2N3772	1.55
2N3773	1.61
2N3819	0.40
2N3823	1.17
2N3904	0.50
2N3908	0.62
2N4101	1.33
2N4240	2.68
2N4444	1.66
2N5293	0.50
2N5294	0.50
2N5296	0.50
2N5297	0.50
2N5298	0.61
2N6109	1.58
2N6130	0.85
2N6133	1.25
2N6180	0.73
2N6292	1.60
2SA1006	1.50
2SA1011	0.99
2SA1015	0.20
2SA1012	0.80
2SA1020Y	0.36
2SA1027R	0.45
2SA473	0.75
2SA766S	4.95
2SC1173Y	1.25
2SC1474	1.25
2SC1509	1.35
2SA1095	3.00
2SA1103	6.00
2SA329	0.40
2SA489	1.17
2SA490	1.32
2SA493	2.25
2SA562	0.57
2SA564	0.62
2SA614	0.97
2SA628	0.37
2SA639S	1.75
2SA659	0.49
2SA673	1.50
2SA684	1.20
2SA697	0.80
2SA699	1.25
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2SA748	1.95
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2SA835	2.50
2SA836	0.89
2SA844	0.65
2SA872	0.99
2SA884	2.15
2SA937R	0.97
2SA940	2.23
2SA940-2	2.14
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2SA951	1.75
2SA966-Y	0.85
2SA999	0.75
2SB774	0.85
2SB185	1.13
2SB375	3.87
2SB400	0.40
2SB405	1.03
2SB511	0.99
2SB54	1.39
2SB546	0.56
2SB56	2.80
2SB618A	5.82
2SB631	2.00
2SB643	0.58
2SB669	3.67
2SB681	3.96
2SB695	1.98
2SB774	0.65
2SB819	1.13
2SC1096	1.16
2SC1104	3.98
2SC1106	4.54
2SC1114	3.25
2SC1116	4.95
2SC1124	1.26
2SC1129	1.65
2SC1131	0.64
2SC1158	3.33
2SC1162	0.55
2SC1172	2.22
2SC1195	6.09
2SC1213	0.89
2SC1226	1.46
2SC1293	0.90
2SC1306	1.90
2SC1317	0.50
2SC1364	0.49
2SC1383	1.20
2SC1391	2.45
2SC1398	0.41
2SC1413A	2.27
2SC1446	1.25
2SC1447	2.07
2SC1475	0.60
2SC1505	1.00
2SC1514	1.76
2SC1573Q	1.10
2SC1583	0.34
2SC1617	3.89
2SC1678	1.98
2SC1741	1.25
2SC1810	1.70
2SC1815	0.20
2SC1826	0.67
2SC1829	2.25
2SC1875	4.50
2SC1893	3.02
2SC1906	0.98
2SC1921	1.37
2SC1923	0.30
2SC1929	2.25
2SC1942	2.59
2SC1959	0.20
2SC1957	0.95
2SC1953	1.93
2SC1962	1.93
2SC1969	1.79
2SC1983	1.32
2SC1985	0.60
2SC2009	0.34
2SC2029	2.33
2SC2028	2.11
2SC2063	0.99
2SC2078	3.39
2SC2073	2.73
2SC2085	1.65
2SC2091	1.30
2SC2141	2.44
2SC2166	0.87
2SC2216	0.69
2SC2233	1.20
2SC2236	1.69
2SC2278	1.14
2SC2314	0.87
2SC2335+Kit	7.00
2SC2551	1.26
2SC2565	4.65
2SC2570	0.46
2SC2577	1.34
2SC2578	6.75
2SC2671	0.91
2SC288A	1.85
2SC3153	3.20
2SC372	1.40
2SC373	1.16
2SC383	1.33
2SC388	0.29
2SC394V	0.81
2SC403C	0.60
2SC458	0.34
2SC495	0.92
2SC515A	1.85
2SC535	0.79
2SC536	0.06
2SC537	0.54
2SC605L	1.16
2SC620	1.46
2SC643A	1.54
2SC668	0.67
2SC681	4.40
2SC682	1.88
2SC684	1.65
2SC693	0.63
2SC710	1.15
2SC711A	0.50
2SC717	1.28
2SC734	1.43
2SC783	3.98
2SC790Y	1.85
2SC828	0.28
2SC867A	4.54
2SC876	0.96
2SC930	0.54
2SC935	4.13
2SC940	4.68
2SD1128	2.90
2SD1138	0.94
2SD1273	1.48
2SD1453	1.33
2SD152K	2.64
2SD198	3.87
2SD234	0.47
2SD235	0.60
2SD24	2.29
2SD257	1.98
2SD292	4.09
2SD313	2.92
2SD325D	2.26
2SD350	2.35
2SD353	7.50
2SD389	2.41
2SD401	1.40
2SD414	1.90
2SD471	2.13
2SD560	2.95
2SD600	2.98
2SD601R	0.65
2SD613	1.03
2SD636	0.40
2SD639-R	0.72
2SD655	0.98
2SD657	2.80
2SD661A	0.80
2SD731	2.11
2SD773	0.63
2SD811	7.63
2SD823	1.98
2SD837	1.48
2SD841	1.37
2SD856	0.89
2SD857Q	1.84
2SD882	1.15
2SD894	1.75
2SD898	2.19
2SK105H	2.15
7805-T022	0.63
7808	0.45
7812-T022	0.35
7815	0.64
7905	0.80
AD140	1.06
AD143	1.93
AD145	1.60
AD161	0.84
AD162	0.84
AF114	2.47
AF115	0.90
AF118	1.20
AF127	1.00
AF139	0.40
AF178	1.45
AF179	0.55
AF180	0.55
AF181	0.53
AF186	1.32
AF239	0.53
AF279	0.88
AN115	3.90
AN155	1.89
AN206	2.58
AN208	3.55
AN210	1.56
AN211	3.25
AN214Q	2.40
AN234	5.09
AN236	3.33
AN240P	0.99
AN241	1.71
AN245	5.48
AN253	1.80
AN260	3.85
AN272	7.92
AN295	7.63
AN301	2.45
AN302	3.09
AN305	8.88
AN315	2.46
AN316	4.95
AN318	7.16
AN320	5.47
AN321	2.25
AN322	7.62
AN337	5.37
AN340P	1.53
AN355	1.65
AN362	1.50
AN370	3.95
AN5111	3.43
AN5120N	4.50
AN5132	4.42
AN5250	4.40
AN5610	7.43
AN5612	2.20
AN5613	4.20
AN5630	3.95
AN5701N	1.66
AN6250	1.75
AN6300	4.40
AN6310	4.54
AN6340	5.62
AN6341	2.22
AN6363	16.00
AN6531	1.95
AN6551	0.50
AN6552	0.68
AN6610	1.78
AN7111	1.25
AN7115	2.52
AN7145	2.17
AN7146	9.90
AN7151	2.37
AN7156	3.37
AN7158	2.67
AN7218	0.80
AN7223	4.55
AU107	7.72
AU110	5.69
AU113	14.63
AY106	2.80
BA524	8.94
BA310	0.14
BA1310	1.50
BA1320	1.30
BA1322	3.95
BA1330	2.75
BA145	0.19
BA148	0.11
BA154	0.40
BA155	0.12
BA156	0.05
BA159	0.09
BA182	0.19
BA222	1.66
BA302	1.24
BA311	0.65
BA312	1.45
BA313	0.76
BA317	0.04
BA318	0.09
BA328	2.22
BA333	1.37
BA335	6.27
BA5102A	2.19
BA511	1.95
BA514	1.00
BA521	1.20
BA524	8.94
BA526	7.98
BA527	2.98
BA532	1.20
BA536	0.99
BA6209	1.27
BA656	1.51
BA7100	11.35
BA841A	9.27
BA843	3.96
BA854	5.76
BAV18	0.06
BAV19	0.24
BAV20	0.36
BAV21	0.12
BAW62	0.11
BAX12	0.40
BAX13	0.11
BAX16	0.08
BC107B	0.11
BC108B	0.15
BC109B	0.14
BC113	0.14
BC119	0.36
BC126	0.20
BC132	0.14
BC135	0.14
BC137	0.18
BC138	0.34
BC139	0.33
BC140	0.30
BC141	0.31
BC142	0.26
BC143	0.34
BC147	0.14
BC148B	0.13
BC148C	0.11
BC149B	0.13
BC153	0.14
BC154	0.14
BC159	0.16
BC160	0.40
BC161	0.28
BC168	0.36
BC169C	0.16
BC170	0.16
BC171	0.11
BC172B	0.27
BC173	0.17
BC174B	0.27
BC177	0.35
BC178	0.26
BC179	0.26
BC182	0.09
BC182LB	0.14
BC183LB	0.09
BC184	0.70
BC184LB	0.13
BC186	0.25
BC187	0.28
BC204	0.35
BC207	0.19
BC212B	0.26
BC213L	0.10
BC214	0.10
BC225	0.40
BC237	0.10
BC238	0.10
BC238B	0.08
BC239B	0.25
BC251A	0.31
BC294	0.50
BC300	0.38
BC301	0.34
BC302	0.53
BC303	0.48
BC307A	0.13
BC308A	0.11
BC309	0.17
BC317A	0.13
BC327	0.09
BC328	0.11
BC337	0.09
BC338	0.12
BC368	0.19
BC440	0.69
BC441	0.46
BC454	0.36
BC460	0.42
BC461	0.47
BC462	0.51
BC463	0.30
BC478	0.32
BC479	0.41
BC532	0.28
BC546	0.08
BC547	0.10
BC548	0.28
BC549	0.10
BC550	0.19
BC556	0.11
BC557	0.08
BC558	0.10
BC559	0.10
BC560C	0.14
BC635	0.34
BC636	0.20
BC637	0.24
BC639	0.20
BC640	0.24
BCX34	0.55
BD115	0.36
BD116	0.70
BD124	1.31
BD131	0.42
BD132	0.42
BD133	0.53
BD135	0.36
BD136	0.36
BD137	0.41
BD138	0.28
BD139	0.24
BD140	0.35
BD144	1.43
BD150	0.75
BD157	0.67
BD160	1.60
BD163	0.71
BD166	0.69
BD175	0.26
BD179	0.30
BD181	0.99
BD182	0.99
BD183	0.99
BD184	1.21
BD187	0.80
BD189	0.65
BD190	0.55
BD201	0.41
BD202	0.60
BD203	0.46
BD204	0.45
BD207	1.73
BD208	1.23
BD222	0.52
BD225	0.46
BD228	0.63
BD229	1.05
BD232	0.49
BD234	0.42
BD237	0.36
BD238	0.28
BD239	0.45
BD240	0.57
BD241	0.39
BD242	0.37
BD243A	0.62
BD243C	0.50
BD244	0.42
BD244C	0.58
BD245	0.83
BD246	0.85
BD253	1.05
BD278A	0.70
BD317	1.20
BD318	2.72
BD375	0.42
BD380	0.66
BD410	0.33
BD433	0.44
BD434	0.37
BD435	0.49
BD436	1.14
BD437	0.45
BD438	0.52
BD441	0.58
BD442	0.50
BD509	1.64
BD510	0.75
BD519	0.78
BD529	0.75
BD530	0.73
BD533	0.57
BD534	0.52
BD535	0.38
BD536	0.50
BD537	0.50
BD538	0.67
BD544B	0.75
BD677	0.33
BD679	0.43
BD680	0.66
BD681	1.48
BD696	2.47
BD699	1.85
BD700	3.70
BD707	0.60
BD709	0.80
BD710	0.80
BD809	0.45
BD810	0.57
BD879	0.74
BD895	2.18
BD901	0.55
BD902	0.56
BDW83C	0.99
BOW34C	0.99
BDX32	1.65
BDX53A	0.45
BDX538	3.35
BDX54B	0.33
BDX63A	2.09
BDX63A	1.96
BDY20	1.21
BDY81	1.18
BF115	0.29
BF117	0.66
BF118	0.67
BF121	0.25
BF123	0.13
BF127	0.131
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	0.55
BF178	0.40
BF179	0.36
BF180	0.36
BF181	0.32
BF182	0.34
BF183	0.39
BF184	0.43
BF185	0.39
BF194	0.14
BF195	0.14
BF196	0.17
BF197	0.24
BF198	0.17
BF199	0.17
BF200	0.37
BF218	0.36
BF224	0.17
BF237	0.65
BF240	0.19
BF241	0.17
BF245	0.50
BF245B	0.49
BF246A	2.52
BF255	0.20
BF256	0.15
BF257	0.34
BF258	0.33
BF259	0.34
BF262	0.57
BF263	0.57
BF271	0.34
BF273	0.20
BF274	0.34
BF324	0.23
BF336	0.33
BF337	0.31
BF338	0.34
BF355	0.45
BF362	0.60
BF363	0.50
BF371	0.50
BF391	0.25
BF417	0.84
BF418	1.87
BF422	0.15
BF423	0.33
BF450	0.35
BF451	0.11
BF457	0.41
BF458	0.49
BF459	1.27
BF460	1.63
BF469	0.33
BF470	0.26
BF471	0.25
BF472	0.33
BF479	0.61
BF480	0.89
BF491	0.50
BF506	0.43
BF532	0.24
BF596	0.18
BF597	0.27
BF694	0.22
BF757	0.34
BF759	0.28
BF761	0.43
BF762	0.34
BF869	0.49
BF870	0.30
BF959	0.42
BF960	0.59
BF970	0.39
BFR39	0.44
BFR61	0.92
BFR62	0.50
BFR79	0.29
BFR81	0.29
BFR86	1.08
BFR89	1.63
BFR90A	0.54
BFX29	0.34
BFX84	0.37
BFX85	0.31
BFX86	0.36
BFX87	0.55
BFX88	0.34
BFX89	0.44
BFY50	0.30
BFY51	0.33
BFY52	0.27
BFY79	0.49
BFY90	1.16
BLY49	2.20
BR100	0.23
BR101	0.78
BR103	0.79
BR303	1.20
BRC84	2.08
BRX44	0.60
BRX49	0.46
BRY39	0.65
BSS38	1.18
BSTB0140G	4.93
BSTC0246	5.99
BSTC0233	6.12
BSTCC0143	3.07
BSTD1043	2.85
BSV57B	3.91
BSW68	0.80
BSX19	0.34
BSX20	1.12
BSY52	0.50
BSY79	0.51
BT108	1.45
BT119	1.76
BT120	2.17
BT121	2.48
BT123	1.98
BT151-800R	0.85
BTT6018	1.36
BU108	2.48
BU108	1.50
BU109	2.25
BU110	5.69
BU125	2.48
BU126	1.10
BU137	6.53
BU205	1.15
BU206	1.27
BU207	1.65
BU208	1.12
BU208	2.35
BU208A	1.12
BU208D	1.43
BU209	1.75
BU226	2.55
BU326A	0.99
BU406	1.24
BU406D	1.24
BU407	0.54
BU412	5.29
BU426A	1.67
BU500	1.53
BU508A	1.50
BU536	1.55
BU608	1.95
BU705	2.67
BU806	0.98
BU807	1.40
BU826A	1.95
BUW84	0.66
BUX84	0.50
BUX85	0.69
BY126	0.13
BY127	0.13
BY133	0.15
BY164	0.64
BY176	0.93
BY179	1.42
BY182	1.05
BY187	0.77
BY189	1.76
BY198	1.62
BY207	0.17
BY208	1.86
BY210-400	0.18
BY210-600	0.31
BY210-800	0.19
BY223	1.25
BY224-600	2.63
BY226	0.15
BY227	0.20
BY228	0.60
BY229-1000	1.12
BY229-600	1.20
BY255	0.13
BY295-600	1.23
BY298	0.20
BY299	0.60
BY407	0.90
BY409	1.49
BY448	1.40
BY713	1.12
BYW56	0.29
BYX55-600	0.23
BYX71-600	0.85
BYX71-350	0.88
BYY56	1.48
BZY93C30	1.86
C106D	0.37
C106M	0.76
CA3046	1.55
CA3089	0.83
CA3090AQ	3.25
CA3094	1.72
CA3131EM	2.95
CD4001	0.24
CD4002	0.27
CD4008	1.35
CD4011	0.20
CD4012	0.24
CD4013	0.33
CD4016	0.25
CD4017	0.30
CD4020	0.75
CD4021	0.39
CD4023	0.28
CD4025	0.64
CD4028	0.84
CD4040B	0.45
CD4047	1.06
CD4049	0.24
CD4052	0.33
CD4066	0.23
CD4069	0.29
CD4070	0.24
CD4081	0.14
CD4093	0.40
CD4511	0.44
CD4528	0.52
CD4556	1.47
CRO2AM-8	1.70
CV12E	4.19
CX095D	3.14
CX104	8.77
CX108	5.52
CX109	7.20
CX130	8.76
CX134	4.50
CX136	11.49
CX139	11.83
CX157	5.52
CX158	10.45
CX177	8.80
CX187	5.26
CX755	12.95
CX885A	6.85
E1222	0.40
E5024	0.28
E5386	0.25
GD243	1.95
GF758	1.07
HA11215	1.75
HA11211	2.53
HA11225	4.29
HA11229	3.46
HA11235	1.95
HA11124	5.25
HA1125	4.29
HA1137W	1.38
HA1138	3.75
HA11414	2.25
HA1156	1.16
HA1160	5.79
HA1166X	6.73
HA1167	6.60
HA11706	3.61
HA11705	8.00
HA11703	3.45
HA11701	3.57
HA11710	3.45
HA11713	2.90
HA11711	9.40
HA11715	9.99
HA11714	7.76
HA11716	13.10
HA11725	18.26
HA11725MP	16.00
HA117555P	6.23
HA11781	21.15
HA1180	5.15
HA1196	7.43
HA13001	1.73
HA1306	2.26
HA13402	7.06
HA13342	2.65
HA13365	4.02
HA1366WR	2.88
HA1367	2.75
HA1368R	1.95
HA1368	2.65
HA1370	3.71
HA1374	1.80
AA117	0.09
HA1377	1.95
HA1389R	2.05
HA1389	2.39
HA1392	2.22
HA1394	3.19
HA1397	2.75
HA1398	3.06
HA1406	2.07
HA1452	0.85
HD1433	2.07
HD38702-A2	7.95
HD38750A53	5.77
HD38750A-7	7.25
HD38800A50	14.09
HD44801A05	14.07
HISH1010	14.60
HISH1004	6.00
HISH1002	9.50
HM6231	12.24
HM6232	7.20
HM6251	5.69
HM7103	4.85
HM9032	4.00
HM9012	3.22
HM9015	3.24
HT4207	13.25
HT4208	20.65
KA2101	1.00
KC581C	7.75
KC582C	4.85
L200CV	1.69
LA1201	0.75
LA1210	1.56
LA1230	1.18
LA1320	2.87
LA1357N	3.06
LA1363	1.05
LA1364	3.02
LA1365J	1.45
LA1385	1.53
LA1387	3.18
LA3350	1.43
LA3361	1.60
LA3390	5.52
LA4032P	2.35
LA4100	1.25
LA4101	1.30
LA4102	0.75
LA4112	1.35
LA4125	2.25
LA4138	4.98
LA4140	0.70
LA4192	1.23
LA4220	1.25
LA4420	1.72
LA4422	1.00
LA4430	2.08
LA4440	1.99
LA4445	1.80
LA4460	1.50
LA4461	1.60
LA5112N	1.18
LA7020	13.86
LA7025	11.97
LA7027	10.92
LA7040	9.20
LA7042	3.90
LA7800	1.30
LA7801	3.21
LB1274	1.90
LC7800	9.20
LD3120	1.13
LD3150	2.75
LM1017N	1.81
LM1877	1.88
LM2808	5.94
LM2877	7.45
LM317CKC	1.08
LM324N	0.59
LM339N	0.43
LM340K	11.85
LM348N	2.15
LM380N	1.50
LM567CN	1.71
LM6402/011	10.23
LM6402A093	10.15
LM748	0.69
LM8360	3.87
LM8361	2.95
LR3419	9.37
LR3471	9.37
LU1141	7.27
LU52012	20.62
LU52011	14.95
LU03112	12.37
M193	6.83
M21C	1.32
M23C	1.98
M293	7.08
M51102L	2.77
M5115P	5.24
M51203L	3.15
M51231P	0.95
M5134-9341	4.13
M51353P	6.93
M51381P	5.98
M51393AP	4.50
M51394P	14.50
M5142P	6.85
M5144P	8.25
M51513L	2.55
M51515BL	2.75
M51517L	2.90
M5192	3.13
M5194AP	5.74
M5231L	1.58
M53274P	1.33
M54532P	1.45
M54544L	4.20
M58478P	6.75
M58485P	14.43
MA06	1.07
MA8001	0.82
MA8003	1.16
MB3705	1.98
MB3712	1.85
MB3713	1.69
MB3730	2.31
MC13002	2.99
MC1310P	1.95
MC1327P	1.33
MC1330P	1.98
MC1350P	1.56
MC1351P	1.25
MC1352P	1.40
MC1357P	2.15
MC1358P	1.48
MC14493P	5.50
MC14494P	2.15
MC14497	7.10
MC14510BAL	0.68
MC14511BCP	1.10
MC15428BCP	2.15
MC1712	3.88
MC5192	19.50
MC7724CP	3.49
MCR106-5/6	1.56
MCR220/7	1.25
ME0411	0.75
ME6002	0.26
ME6102	0.28
ME8001	0.34
ME0411	0.75
MJ2501	3.30
MJ3001	1.43
MJ481	1.53
MJE2955	1.03
MJE3055	1.15
MJE340	0.49
MJE520	0.49
ML231	0.99
ML232B	3.01
ML237B	1.95
ML238	5.65
ML923	3.10
ML926	3.58
MM5314N	8.99
MM5316N	3.50
MM5318N	3.11
MM5369N	2.01
MM5387AA N	6.20
MM5841N	6.93
MN1400VL	13.65
MN1405	7.92
MN1435VX	12.32
MP1192	5.07
MP2794	4.00
MP2812	5.07
MP8512	1.57
MPC596	2.13
MPF256C	0.60
MPS6570	0.48
MPSA42	0.22
MPSA56	0.08
MPSA92	0.15
MPSU05	0.86
MPSU10	2.31
MPSU56	0.65
MPSU60	2.21
MR818	0.33
MR854	0.46
MR914	1.20
MSM5816RS	17.35
MSM5840H	12.09
MVS460-02	0.34
NE542	2.75
NE555	0.35
NE556	0.65
NP1106	11.51
DA202	0.11
OA47	0.16
DA91	0.14
OA95	0.16
OC28	2.52
DC29	2.15
OC36	7.53
OC44	1.95
DC45	0.18
OC72	0.44
OC75	0.44
ON236	1.06
ON782	1.65
DT121	1.45
PT6042	3.25
PT8504	5.13
R1038	2.19
R1039	2.19
R2008B	1.33
R2009	1.98
R2010B	2.98
R2029	1.33
R2030	1.33
R2257	2.35
R2265	1.49
R2305	1.18
R2322	0.67
R2323	0.76
R2354A	0.64
R2354B	2.01
R2443	1.36
R2461	1.50
R2540	1.65
R2540X	3.30
R2615	0.67
RCA2060	2.00
RGP01-15	0.70
RGP10	0.23
RGP30M	0.36
RT402	1.58
RT905A	3.28
S1299	5.34
S2800D	1.50
S2802	2.90
S2818	4.05
S3702S	5.21
S40W	13.10
S6080B	9.98
SA8063	15.55
SAA1006	1.85
SAA1020	4.76
SAA1025	4.40
SAA1024	2.50
SAA1075	4.25
SAA1121	7.44
SAA1124	2.60
SAA1130	6.69
SAA1174	7.77
SAA1250	3.95
SAA1251	3.20
SAA1351	8.11
SAA3027P	2.71
SAA5000	3.25
SAA5010	3.54
SAA5012	5.50
SAA5020	5.78
SAA5030	6.33
SAA5050	4.90
SAB1009B	5.98
SAB3011	7.34
SAB3013	4.69
SAB3021	3.95
SAB3024	6.36
SAB3209	5.82
SAB3210	3.21
SAF1032P	5.13
SAF1039	1.95
SAS5010	8.39
SAS560S	1.91
SAS560T	5.42
SAS570T	5.42
SAS570S	1.95
SAS580	2.85
SAS6600	1.33
SAS660	1.33
SAS6700	1.33
SAS670	1.33
SAS6710	2.21
SBA750	1.61
SC84203	19.35
SC9504P	1.95
SDA2006	17.10
SDA21122	11.77
SG264A	5.26
SG613	10.70
SG629	8.27
SG6533	9.00
SI1125H	7.50
SI163HD	20.62
SKE2F1 04	1.25
SKE2G3 04	0.73
SKE4F1/06	0.30
SKE4F2/08	1.07
SKE4F2/06	0.80
SKE4F2/10	1.36
SKE4G2/02	0.96
SKE5F3/10	1.36
SKS1/10	2.15
SL1310	3.14
SL1430T	2.31
SL414	3.69
SL432A	2.32
SL439	2.48
SL471	4.45
SL480	7.24
SL490	2.37
SL901B	8.32
SL918A	9.07
SN16861AND	0.82
SN16862AN	2.98
SN16966N	10.25
SN29717N	7.19
SN29716N	3.66
SN29715N	6.04
SN29722	11.95
SN29723AN	8.77
SN29764AN	2.60
SN29767	3.90
SN29770BN	4.17
SN29772BN	5.75
SN29771BN	5.59
SN29791	1.67
SN29798N	5.56
SN2709	0.44
SN7400N	0.61
SN7401N	0.36
SN7402N	0.65
SN7404N	0.52
SN7408N	0.27
SN7410N	0.27
SN74121	1.60
SN7143N	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	0.75
SN74LS26N	1.45
SN76001N	1.65
SN76013ND	7.45
SN76023N	2.97
SN76023ND	3.91
SN76033N	5.54
SN76110N	0.90
SN76115AN	1.61
SN76131	0.82
SN76227N	2.45
SN76226DN	2.17
SN76228N	3.27
SN76242	5.23
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SN76396	2.90
SN76533N	2.47
SN76532N	3.03
SN76545	4.87
SN7656N	3.47
SN76549	2.45
SN76570	3.08
SN76611	2.59
SN76620	2.59
SN76660N	2.48
SN76666N	1.20
SN76708	4.86
SN76709N	9.63
SN76707N	1.23
SN76705N	2.97
SN76730	5.54
SN76810N	0.60
SN76832N	1.35
SN94041	5.54
SN94042	4.32
SPS5384	1.98
ST1702L	0.99
STA401	2.49
STA441C	3.13
STA471C	8.70
STK0029	5.70
STK0050	11.96
STK016	11.23
STK022	8.95
STK031	12.95
STK040	13.34
STK054	9.35
STK058	27.50
STK077	9.28
STK1039	5.75
STK2110	7.33
STK2145	13.77
STK2240	16.65
STK2250	18.95
STK3042	6.08
STK3044	5.75
STK4019	13.87
STK433	6.18
STK4332	5.37
STK435	7.12
STK4352	1.95
STK436	7.26
STK437	6.91
STK4372	13.13
STK460	9.85
STK466	10.10
STK5833	11.97
STK501	6.32
STK502	7.25
STK5314	9.48
STK5730	3.20
STK7216	14.90
STK772	3.71
STR1096	11.20
STR4090	6.43
STR440	6.18
STR451	5.77
STR453	8.16
STR454	5.52
STR6020	6.96
T6029V	7.98
T6035V	0.73
T6036	0.67
T6037	2.11
T6044V	0.97
T6045	1.20
T6049	1.45
T6052V	0.87
T6058	4.95
T6059	4.22
T9003V	1.25
T9005V	2.38
T9011V	1.40
T9013V	4.95
T9014V	2.42
T9016	1.02
T9019W	1.98
T9034V	1.34
T9035V	1.49
T9051	8.07
T9054V	5.98
T9057V	3.44
T9062V	0.49
T9064	2.40
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
TA7074P	1.98
TA7076P	7.50
TA7089P	3.10
TA7092P	9.94
TA7093P	3.99
TA7012P	5.88
TA7108P	1.61
TA7109	3.71
TA7122B/P	0.87
TA7124P	2.34
TA7129P	1.90
TA7130P	1.27
TA7136AP	1.89
TA7137P	0.98
TA7141AP	3.87
TA7146P	5.18
TA7148P	1.67
TA7149P	3.26
TA7152P	3.16
TA7161P	16.54
TA7162P	3.61
TA7172P	1.41
TA7176P	1.75
TA7193P	4.80
TA7204P	1.95
TA7206P	12.49
TA7207P	1.68
TA7208P	2.15
TA7210P	1.45
TA7214P	3.63
TA7215P	2.58
TA7217AP	1.45
TA7222	1.95
TA7226	3.57
TA7229P	4.66
TA7230P	1.35
TA7233P	4.63
TA7240AP	2.55
TA7245P	1.95
TA7310P	2.15
TA7313AP	0.65
TA7314	3.50
TA7323P	3.15
TA7325P	1.15
TA7339P	2.50
TA7340P	5.95
TA7607AP	1.30
TA7609	2.35
TA7611AP	2.32
TA7616P	5.25
TA7622AP	8.94
TA7628P	1.73
TA7629P	7.50
TA7630P	0.95
TA7640AP	2.40
TA7672P	2.75
TA7676P	2.81
TA7726P	10.25
TAA320A	1.27
TAA350A	6.59
TAA570	1.85
TAA621AX1	4.85
TAA661B	0.95
TAA691	8.58
TAA700	2.37
TAA930	4.36
TAA970	2.83
TAG626-600	1.20
TBA120AS	1.45
TBA120SB	0.40
TBA120T	0.57
TBA120U	2.50
TBA120A	1.05
TBA1440	1.94
TBA1441	1.95
TBA395	0.66
TBA396	1.20
TBA400	2.39
TBA440C	2.34
TBA480Q	1.30
TBA510	1.37
TBA520	1.20
TBA530	1.30
TBA540	1.72
TBA560C	1.40
TBA570Q	1.60
TBA570A	1.71
TBA673	2.60
TBA700	1.85
TBA720	4.32
TBA730	3.55
TBA750Q	2.50
TBA760	1.71
TBA800	1.08
TBA810S	1.61
TBA810T	1.75
TBA820	0.66
TBA820M	0.82
TBA890	3.50
TBA920	1.65
TBA940	1.87
TBA950	1.55
TBA970	3.60
TBA990	1.98
TCA270S	2.15
TCA270SQ	1.05
TCA290A	2.39
TCA420A	2.16
TCA440	1.89
TCA530	2.24
TCA640	2.25
TCA650	3.05
TCA660B	2.60
TCA730	2.75
TCA750	2.25
TCA800D	5.95
TCA830S	2.38
TCA890	5.44
TCA900	2.04
TCA910	1.65
TCA940	0.82
TCA940E	2.93
TD3F800R	6.51
TD3F900H	6.37
TDA1001B	2.31
TDA1003A	1.47
TDA1005A	2.02
TDA1006A	7.00
TDA1010AE	4.25
TDA1011	1.14
TDA1010	1.10
TDA1011A	1.54
TDA1028	2.45
TDA1034B	2.42
TDA1035S	2.95
TDA1035T	1.70
TDA1037	1.79
TDA1037D	2.05
TDA1044	2.10
TDA1047	3.25
TDA1059B	0.80
TDA1054M	1.21
TDA1060	2.60
TDA1082	3.25
TDA1151	0.95
TDA1190	1.27
TDA1190Z	2.48
TDA1200	1.51
TDA1235	3.88
TDA1236	4.30
TDA1270	3.74
TDA1327A	6.93
TDA1412	1.08
TDA1420	1.52
TDA1440	3.45
TDA1470	2.90
TDA1470P	4.25
TDA1506	5.74
TDA1510	4.60
TDA1512	2.57
TDA1515	2.55
TDA1559	3.15
TDA1670	2.47
TDA1770	2.88
TDA1905	1.27
TDA1908	2.56
TDA1940	3.89
TDA1950	2.50
TDA2005	1.76
TDA2006	1.35
TDA2004	1.10
TDA2002	0.90
TDA2003	1.00
TDA2030	1.05
TDA2140	4.77
TDA2150	4.48
TDA2151	2.51
TDA2160	4.01
TDA2161	5.81
TDA2170	4.75
TDA2270	2.50
TDA2520	2.25
TDA2522	13.41
TDA2524	4.50
TDA2525	5.58
TDA2532	2.50
TDA2530	2.20
TDA2541	1.00
TDA2540	0.99
TDA2545Q	5.94
TDA2560	2.50
TDA2575A	0.50
TDA2578A	2.95
TDA2576A+Kit	12.35
TDA2581	1.60
TDA2582	1.35
TDA2591	2.15
TDA2594	2.45
TDA2593	1.99
TDA2595	2.46
TDA2600	7.00
TDA2611AQ	2.80
TDA2612Q	6.58
TDA2611A	1.25
TDA2610	2.79
TDA2620	0.95
TDA2630	2.50
TDA2631	2.73
TDA2640	3.80
TDA2652	9.53
TDA2653	5.16
TDA2654	4.73
TDA2670	2.48
TDA2680	3.20
TDA2740	10.14
TDA2780AQ	7.99
TDA2795	2.78
TDA2791	1.81
TDA2910	13.25
TDA3300B	7.24
TDA3330	3.16
TDA3506	4.40
TDA3501	5.50
TDA3500	7.58
TDA3510	5.95
TDA3520	9.71
TDA3540	2.25
TDA3541	2.22
TDA3560	5.83
TDA3571Q	9.06
TDA3576	7.48
TDA3590	6.79
TDA3591	6.45
TDA3650	6.91
TDA3652	5.74
TDA3651AQ	1.89
TDA3651	1.89
TDA3651A	2.50
TDA3950	4.50
TDA4050B	3.40
TDA4280	7.20
TDA4290	1.95
TDA4400	4.90
TDA4420	2.30
TDA4422	8.32
TDA4427S	9.00
TDA4431	2.27
TDA4440	1.95
TDA4442	5.14
TDA4500	4.75
TDA4600-2	1.75
TDA4610	5.99
TDA4620	7.75
TDA5500	14.20
TDA5700	2.75
TDA7270S	1.60
TDA8190	4.30
TDA9403	3.70
TDA9503	1.56
TDA9513	3.15
TDB1033	2.68
TDE1081	7.24
TEA1002	4.93
TEA1009	1.65
TEA1014	3.00
TEA1020SP	4.93
TIC106C	0.61
TIC106M	0.65
TIC44	0.72
TIC45	0.55
TIC47	0.77
TIP120	1.55
TIP110	0.35
TIP112	0.49
TIP117	0.95
TIP121	0.40
TIP126	0.38
TIP132	0.99
TIP137	0.96
TIP29	0.84
TIP2955	0.86
TIP29A	0.46
TIP29B	0.63
TIP29C	0.40
TIP29D	0.75
TIP3055	0.66
TIP30A	0.41
TIP30C	0.40
TIP31A	0.34
TIP31B	0.38
TIP31C	0.39
TIP32A	0.35
TIP32B	0.46
TIP32C	0.28
TIP33	1.30
TIP33A	1.02
TIP33C	0.95
TIP34	0.75
TIP41A	0.36
TIP41B	0.31
TIP41C	0.51
TIP42A	0.29
TIP42B	0.79
TIP42C	0.50
TIP47	0.65
TIS43	1.43
TIS90	0.21
TL011CP	1.65
TL494CN	8.77
TLD72CP	1.45
TMP4320	10.75
TMS1024NLL	6.50
TMS1025N	13.61
TMS3720ANS	5.25
TMS3748NS	10.95
TMS3755	9.66
TMS3894NL	19.25
TMS5102NLL	6.25
TUA2000	8.98
TY6010B	2.97
ULN2204	8.50
UPA53C	4.94
UPC1003	5.95
UPC1009C	6.32
UPC1025H	2.90
UPC1028H	2.00
UPC1032H	0.82
UPC1042C	8.95
UPC1156H	3.94
UPC1161C	4.98
UPC1182H	2.19
UPC1186H	1.05
UPC1181H	1.35
UPC1185H	2.10
UPC1188	2.99
UPC1212C	0.80
UPC1225H	2.82
UPC1230	1.88
UPC1238	1.52
UPC1278H	5.95
UPC1351C	1.81
UPC1350C	0.75
UPC1353	1.63
UPC1355C	2.13
UPC1363	4.20
UPC1362	1.80
UPC1365C	2.50
UPC11366	1.65
UPC1360C	2.30
UPC1378H	1.95
UPC141C	4.95
UPC1458	2.00
UPC151C	2.95
UPC2002	1.48
UPC30C	2.51
UPC324C	4.70
UPC32C	4.95
UPC339C	4.35
UPC41C	2.99
UPC4558C	1.24
UPC474	5.11
UPC554C	1.85
UPC575C2	1.55
UPC580C	2.73
UPC587C2	1.34
UPC592H	2.15
UPC595	2.95
UPC596	1.98
UPD1514C	4.76
UPD2819C	4.98
UPD553-164	19.52
UPD8049C-1	11.50
XO022CE	5.75
XO029CE	7.09
XD031CE	6.32
XD035TA	6.60
XO040TA	4.50
XO042CE	3.19
XO043CE	2.75
XD056CE	6.25
XOD57GE	6.00
XDD65CE	5.77
XD074GE	15.29
XO077GE	14.60
XO079CE	4.95
XO092CE	10.31
XOD96CE	6.20
XD109CE	11.25
XO113CE	9.48
XO195CE	9.60
XO204CE	8.74
XO261CE	8.98
2PY120	4.77

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GEC
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Machine Nos.: 4000H 4001H 4002H — **VHS I**
Head Part Nos.: 5458282 5458413 5458415 5458992
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Head Part Nos.: 5458104
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Machine Nos.: VT6500 VT7000 VT8000 VT8040 VT8100 VT8500 VT8700 VT9000 VT9300 VT9500 VT9700 VT9900 — **VHS I**
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HS700 HS303 HS304 — **VH700**

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Head Part Nos.: DDRMU 0001 HE00 0002 HE02 04 05 06
Machine No.: 2C9 VC110 VC200 VC220 VC300 VC381 VC384 VC386 VC387 VC388 VC477 VC481 VC482 VC930 VC970 VC3300 VC9100 VC9300 VC9400 VC9500 VC9600 VC9700 — **VHS C**
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Head Part Nos.: DDRMU 0001 HE10
Machine No.: VC6300 — **VHS E**
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Machine No.: VC8300 — **VHS L**
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Machine No.: SL3000, 8000, 8080, SLT 6Me, 7, 7E, 7ME — **BETA A**
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Machine No.: SL5W, 5000 5100 SLC5, C6, C7 — **BETA B**
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VHS A	£11.95
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VHS E	£75.43
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01X0 033 825	£47.05
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VID3	01X0-018-025	Rewind idler assembly T3V16/PU49282	6.20
VID4	01X0-018-729	Take up idler T3V00/PU49280	7.96
VID5	01X0-040-006	Loading belt T3V29/30/PU48941-2	0.26
VID6	01X0-033-454	Roller Assy. (cass. Housing) T3V23/PU49042	4.50
VID7	01X0-040-007	Take up idler 3V29/30/PU48967B	2.45
VID8	01X0-040-017	Reel motor assembly 3V29/30/PU51381V	27.95
VID9	01X0-065-009	Capston motor 3V35/36/38/39/PU55371V	20.92
VID10	01X0-065-016	Cass. housing Assy. 3V35/36/38/39/PU29825	22.55

GEC/HITACHI

VID11	V5577355	GEC 4100/Hitachi VT11E capston motor	26.78
VID12	V6413663	GEC 4000/Hitachi VT33 f/f rewind arm	2.10
VID13	V6861471	GEC 4001/2/Hitachi 93/9500 f/f rewind arm	2.07
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VID16	V2423461	ET541 Tuner Unit	13.50

NATIONAL PANASONIC

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VID18	VXP0344	Idler NV7000/7200	0.85
VID19	VXZ0078	Tension Band NV7000	2.85
VID20	VXP0521	Idler NV370	1.65
VID21	VXP0463	Reel Idler NV777	4.30
VID22	VXP0432	Pinch Roller NV333	3.50
VID23	VXP0401	Idler wheel NV333	0.85

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SANYO/FISHER

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VID25	1430662T01201	Reel drive pulley VTC 5000	5.49
VID26	PR2758	Pinch roller VTC5000/5150	2.95
VID27	1430490400900	Gear idler Fisher FVH-P615	4.50
VID28	1430420400300	Heart idler Fisher FVH-P615	2.95

SHARP

VID29	RMOTP1029	Capston motor 73/9300	29.95
VID30	RMOTV1008	Reel motor VC9700	16.14
VID31	NIDL0006	Idler VC387H etc	1.60
VID32	NIDL0005	Reel idler VC9300 etc	1.80
VID33	NIDL0004	Idler wheel VC2300	3.50

VIDEO LAMPS/BULBS

VID34	LA9295	Universal lamp without socket 290mm	0.35
VID35	LA9210S	Universal lamp with socket 310mm	0.50
VID36	NAT/PAN.	P.C. MTG. leadless lamp	0.20
VID37	SHARP 9300	Etc. lamp plus plastic shroud.	1.27

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VS 3	DBK134	£1.76
VS 5 EG	DBK101	£1.50
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VS 9500	DBK103	£1.42
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VS 9800	DBK103	£1.42

JVC

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HR 3300	DBK107	£5.25
HR 3330	DBK126	£1.65
HR 3360	DBK103	£1.42
HR 3600	DBK107	£5.25
HR 3660	DBK103	£1.42
HR 4100	DBK127	£2.50
HR 7200	DBK139	£1.22
HR 7600	DBK138	£0.86
HR 7650	DBK132	£0.86
HR 7700	DBK108	£0.85

FERGUSON

3292	DBK103	£1.42
3 V 01/16	DBK103	£1.42
3 V 22	DBK103	£1.42
3 V 23	DBK108	£0.85
3 V 24	DBK137	£0.68
3 V 31/32	VID7806	£1.40
3 V 35/36	DBK150	£1.25
3 V 38/39	DBK150	£1.25
3 V 42/43/44	VID7540	£1.95
3 V 45/48/54	VID7540	£1.95
3 V 55/57	VID7540	£1.95

NATIONAL PANASONIC

NV 300	DBK110	£2.20
NV 330	DBK110	£2.20
NV 332/333	VID7521	£2.10
NV 336	VID7521	£2.10
NV 450	DBK133	£1.50
NV 777	DBK131	£1.28
NV 2000	DBK109	£1.57
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VBS 7600	DBK105	£1.15
VBS 7000	DBK105	£1.15
VBS 9000	DBK10	£1.76
FVHP 420	VID7532	£1.99

SHARP

VC 381/383	DBK116	£2.15
VC 385/386	DBK116	£2.15
VC 2300	VID7545	£0.99
VC 6000/6300	DBK117	£1.40
VC 6500	DBK117	£1.40
VC 7300	DBK118	£1.50
VC 8300	DBK119	£2.10
VC 9300/9500	DBK120	£1.20
VC 9700	DBK121	£2.65

GEC

V 4000 H	DBK129	£1.10
V 4001 H	DBK129	£1.10
V 4002 H	DBK129	£1.10
V 4100 H	DBK128	£1.95

HITACHI

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VT 6500	DBK142	£0.77
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VT 8500	DBK144	£0.68
VT 9300	DBK129	£1.10
VT 9500	DBK129	£1.10

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SL 8500	DBK115	£2.00
SL 8600	DBK115	£2.00
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SLC 7	DBK100	£1.95
SLC 9	DBK130	£2.00
SLJ 7	DBK100	£1.95
SLT 7 ME	DBK100	£1.95
SLT 7 MER	DBK100	£1.95

SANYO

VTC 5000,5150	VID7807	£1.19
VTC 6000	VID7807	£1.19
VTC 5300	DBK105	£1.15
VTC 5400	DBK105	£1.15
VTC 5500	DBK106	£1.95
VTC 6500	VID7533	£1.00
VTC 9300	DBK104	£3.12
VTC 9350	DBK145	£1.70
VTC M10/11/20	VID7809	£0.61
VTC M21/30/31	VID7809	£0.61
VTC M50	VID7809	£0.61

TOSHIBA

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V 66/67	VID7540	£1.95
V 7540	DBK123	£1.79
V 8600	DBK124	£1.24
V 9600	VID7810	£1.95
V 5250	DBK148	£2.66
V 5280	DBK148	£2.66
V 5475	DBK122	£1.50

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VCR Clinic

Reports from Eugene Trundle, Steve Cannon, Ed Rowland, Hafidh Mahmood, Andy Worrall, Ray Crockit, Nick Beer and Mick Dutton

Mitsubishi HS400

The job card said "keeps pausing". Sure enough a soak test showed that the tape stopped moving for a second or so at rare intervals. It would sometimes stop long enough for the system control to shut down the deck. With the top cover of the capstan motor removed it took us some time to establish that the motor itself stopped when the fault occurred. The culprit was the STK6962 motor drive chip IC5A4. It's similar in shape and size to the motor-drive chips that gave a lot of trouble in earlier models. **E.T.**

Hitachi VT9500

This is a veteran machine. The unusual symptom was complete failure – no clock display, no indication lights and no functions. Mains current was flowing into it however, and the several rectifiers were doing their stuff. The system control/regulator panel along the back of the machine is no fun to deal with physically. We found that the trouble was due to one of the 10V dropper diodes here – D904 was open-circuit. **E.T.**

Toshiba V93

This machine's owner, or rather her two small children of two and four, were very upset. It had chewed a couple of their tapes. The reason for this was obvious when the fault developed: the take-up reel stopped but the capstan continued to run, thus making a right mess of Noddy and Big Ears. As we've had problems with it on earlier models suspicion fell on the reel motor. Sure enough if it was given a sharp knock with the handle of a screwdriver it stopped. A replacement put matters right, but unfortunately Rod, Jane and Freddie were no more. **S.C.**

Hitachi VT35

No clock display with the machine otherwise working correctly is a fault we've had on a number of occasions with this model. The cause is a defective d.c.-to-d.c. converter chip, IC711, which burns out L701. Hitachi supply a new d.c.-to-d.c. converter and a modification kit that includes L701. Its part number is 7026181. **S.C.**

Hitachi VT130

The problem with this machine was no tape transport. Suspicion fell on the A5V supply to the syscon section of the circuitry. Sure enough it was missing. We traced the circuit back to the 9V circuit protector which was open-circuit. Before fitting a new one a resistance check was made between the 9V line and the deck. The reading was only a few ohms. Further checks showed that there was a short-circuit inside the A5V regulator IC802 on the VST board. Replacing this restored normal operation. **S.C.**

Hitachi VT520

This quite new machine had an unusual fault: the playback picture was very poor and was rolling while the sound was low and very muffed. With a fault like this the audio/control head is the first thing that springs to mind, but in fact the symptoms were caused by insufficient back tension. A check on the back-tension post showed that it was about half an inch away from the tape. The reason for this was not at all obvious. Nothing was jamming it. The mechanism that controls the arm looked o.k., but it didn't move the arm far enough. Curiously, if the loading motor was given a few more turns the mechanism and back-tension post moved to their correct positions and normal operation was obtained. Of course when the machine was stopped and play was again selected the fault was back.

We made a note of the number at which the arrow on the mode switch pointed. In play or record it should normally be 6, but the arrow pointed to 5. This is the position for reverse play, in which no back tension is needed. A new mode switch from Hitachi, part no. 5610702, cured the problem. **S.C.**

Ferguson FV30

This machine went into the stop mode after a few seconds of play, record, rewind, etc. The fault was very nearly the same as the one with the GoldStar machine featured in Test Case 335. We followed the same test procedure, but rather than gunged up reflectors the fault in this machine was caused by the supply spool optosensor. **S.C.**

Hinari VXL6

There was no drum rotation though all the other functions were in order. Voltage checks in the power supply disclosed that the P-on 5V rail was low at 2·8V. The culprit turned out to be Q504, though the device read o.k. when checked on a transistor tester. As we didn't have a direct replacement we fitted a TIP42C. This restored normal operation. **E.R.**

Panasonic NV2000

This repair served as a reminder of the usefulness of the servicing articles in this magazine. The symptoms were no E-E signals with the channel LEDs out. As we hadn't had this problem before we referred to Nick Beer's article on the machine in the January 1990 issue. This enabled us to go straight to Q1006 which was open-circuit base-to-emitter. Thanks Nick. **E.R.**

Panasonic G Series

Intermittently going to stop during play and sometimes not winding the tape back into the cassette is due to dry-joints on the AN3821K DD capstan drive chip. Make a point of resoldering this i.c. whenever any VCR that uses it comes in for repair. It will save you a call-back. **H.M.**

Panasonic NV7000

The picture was intermittently smeary – as if it was out of focus. Flexing or patting the bottom PCB, one half of which carries the chrominance and luminance circuitry, would instigate the fault. Sometimes the machine would behave itself for a day or two, then we were back to square one. The problem was that there was no time to scope any signals when the fault appeared. So I went on tapping the board until I came to the luminance playback level preset which seemed to be the cause of the fault. After changing it

I gave the machine a soak test then returned it to its owner. Five days later it was back with the same fault. To cut a long story short I eventually found that filter FL3002 had a dry-joint at one end. **H.M.**

Panasonic NV7000

Sound was o.k. but there was no picture. In fact there was a blank white raster on playback. As the E-E picture and sound were o.k. we suspected either a blanking or recording fault. It turned out that the record-on switch transistor Q3013 was short-circuit, a replacement restoring the picture. **H.M.**

Panasonic NV340

Apart from the clock display nothing worked. The power supply rails were all as specified however. When the machine was plugged in the capstan motor rotated slowly and wouldn't stop until the machine was disconnected. Now when VTR is pressed pin 8 of the MN1405VKF syscon chip should go low. It didn't change state. Replacing this chip restored all functions. **H.M.**

Panasonic NV8600

Playback produced a blank white raster with normal sound. There was no E-E picture and we couldn't get the test signal. I suspected the r.f. converter but as we didn't have one to hand I decided to start fault finding. The first step was to check the supply to the r.f. converter. It was correct at 9V. Next the converter's video input was checked. The manual says there should be a 1V p-p signal here but there was a 10V d.c. reading. This 10V was traced to the buffer transistor Q313 which was short-circuit all ways. A replacement put matters right. **H.M.**

Panasonic NV7000

For snowy playback pictures, as if the heads are worn out, check the continuity of the rotary transformer's windings before changing the drum. I've had three machines with this fault and in each case one winding was found to be open-circuit. **H.M.**

Panasonic NV-G12/G21 Series

We've had several cases of a broken safety tab switch with these machines. The symptom is that the cassette is ejected when record is selected. **H.M.**

Panasonic NV250/NV450

In cases of intermittently going to stop during playback then rewinding, in fact with all sorts of confusing conditions, check for a leaky supply phototransistor. There should be 3·2V at pins 20 and 21 of the syscon chip IC6001. If not change both sensors. **H.M.**

Panasonic NV-M7

The complaint with this camcorder was that it wouldn't eject. It came from a teaching hospital and we were asked to carry out a "general service". So we replaced worn belts, the pinch roller and idler, and the main loading pulley. The latter had caused a lot of knocking while the threading operation was being carried out – like what you get with the NV730. But we never saw the eject fault! The very dry grease was replaced with some nice new Moritone and we then powered the unit (still disassembled). There were no deck functions. I've had this before but it took me a few minutes to remember the cause. If the earthing lead from the top bolt hole of the battery compartment is undone you won't get anything. This lead earths the main PCB to the deck. Another reminder to stick above the bench! **N.B.**

Toshiba V55

E-E operation was o.k. but this machine wouldn't load a cassette. My first check was on the power supply outputs, which were all o.k. A scope check was then made on the inputs to the microcomputer chip. It was receiving instructions but was it carrying them out? I scoped the outputs but these didn't make much sense. Try a different approach: maybe no power is going to the motors? Three changeover switch chips feed 13V to the motors. Check and find that there's nothing at IC204/5 because circuit protector CP1 is open-circuit. As there were no shorts I replaced CP1. At switch on 13V appeared at the switches.

A cassette could now be inserted and the drum and capstan motors rotated, but there was no lace up. Feel each switch chip and find that one is too hot. Is it faulty? Switch off and remove the chip to check it. Checks not conclusive. Decide to try feeding each switch output with 10V from an external power supply – with the VCR switched off of course. Find that all the motors except the mode one run. Remove leads from mode motor and connect to power supply. Motor still doesn't run even with the drive belt removed. Replace motor and i.c. switches and find that all is now well. **R.C.**

Hitachi VT33

The complaint was that tapes remained looped in the machine on eject. Whilst removing the covers I noticed a label on the base plate saying that another company had repaired the machine some months earlier. Considering this fact I was amazed at the amount of dust inside it. On running the machine with an old "test" tape I found that there was no fast forward or rewind action because the rubber drive wheels and the clutch assembly had all been coated with a layer of oil, which appeared to be due to over-generous application to bearings during the previous service. This meant a complete mechanical strip down, clean and rebuild, somethng that could have been avoided if the previous "service engineer" had been more careful in cleaning the machine properly and had not been so generous with the oil. **A.W.**

Sony SLC6

This machine suffered from lack of capstan servo lock, the problem being worse in play than record. The cause was C7 ($0{\cdot}22\mu F$). Sony say that this is a common problem and in addition recommend changing C8 which is also $0{\cdot}22\mu F$. **M.D.**

Sharp VC7300

The playback picture showed increasing interference as the machine warmed up – the effect was similar to that produced by an arcing tripler in a colour TV set. The E-E picture was normal and the sound was not affected. We found that the problem was caused by the HA11703 chip I403 in which the playback f.m. signal is detected. **M.D.**

Long-distance Television

Roger Bunney

Reception during November was very varied. Perhaps the only thing we missed was a good Leonids meteor shower. Band I was fairly active, with both F2 and Sporadic E reception. There was a sprinkling of tropospheric signals, with a dramatic day on the 8th.

Tropospheric reception started to improve early in the month, the 6-7th providing West German, Benelux and French signals over much of the UK. The 8th was something quite different however. Really intense signals were seen on this day and, to a lesser extent, on the 9th. It looks as though records have been broken. A list of the countries received tells all: Sweden Band III/u.h.f.; Norway Band III/u.h.f.; Finland chs. E7 and 9 (Turku YLE-2); USSR chs. R7, 12, 29; Poland chs. R8, 35; Czechoslovakia chs. R10, 24, 36; countless French and Benelux stations; Denmark; and German broadcasters ARD/ZDF, RBI, NDR, HR, West 3, SFB, SWF, SAT 1, SSVC and DFF1/2. Our congratulations in particular to Simon Hamer on his Russian Band III/u.h.f. and Finnish Band III reception – Russian Band III/u.h.f. stations had previously been seen in Norfolk but not as far west as North Wales. On the 9th reception widened to include Austria – both ORF outlets, chs. E8 and E34, were seen – plus Switzerland chs. E6, 7, 12, 31 and 34. The next tropospheric opening occurred on the 14th, when Roger Fussell in Cornwall received the following Spanish channels: E2, 3, 5, 7, 8, 31, 34, 35, 37, 39, 42, 45 and 49!

The general SpE log was as follows:

5/11/90 RAI (Italy) ch. IA; TVE (Spain) chs. E2, 3.
6/11/90 TVE E2.
7/11/90 TVE E3.
9/11/90 +PTT (Switzerland) E2.
11/11/90 RAI IA; TVE E2, 3; MTV (Hungary) R1.
12/11/90 TSS (USSR) R1; CST (Czechoslovakia) R1; RAI IA, B; RUV (Iceland) E4.
16/11/90 TVE E2, 3, 4; +PTT E2; DR (Denmark) E3.
18/11/90 TVE E2, 3; DR E3.
19/11/90 TVE E2, 3, 4.
20/11/90 +PTT E2.
23/11/90 CST R1; TVE E3.
24/11/90 +PTT E2.
27/11/90 TVE E2, 3; +PTT E3.

With the high sunspot activity F2 signals were also present at times:

4/11/90 Weak R1/E2 vision received.
5/11/90 USSR R1; unidentified E2 signal.
9/11/90 Chinese programming on ch. C1; unidentified E2 programming at 0800.
11/11/90 Unidentified E2 colour bars at 0750; Arabic E2 programming; USSR/China ch. R1/C1; Australia ch. 0, very strong but with severe fading, at 09.30; unidentified A2 transmission (525 lines) at 1400. The m.u.f. reached 55MHz, with a weak ch. E3 signal being seen by Roger Fussell.
13-15th Unidentified signals received on chs. E2/R1/C1 during the morning. ZTV (Zimbabwe) ch. E2 seen at 1200 on the 14th.
19/11/90 Ch. E2/R1/C1 signals plus ZTV E2 at 1230 GMT.

Bill Cotterill (Tipton) tells us that he's built a specialised TV-DX receiver based on a Rediffusion translator. It has switched selectivity modules with different i.f. bandwidths, enabling very weak signals to be resolved. We hope that Bill will provide an article on this receiver, which cost little to build and has far better performance than the average DX-TV installation.

My thanks to the following for sending in reception reports: Peter Schubert (Rainham), Simon Hamer (Powys), David Glenday (Arbroath), David Oliver (Birmingham), Tim Anderson (St. Leonards) and Roger Fussell (Torpoint).

News Items

Germany: Unification is bringing with it many changes in the broadcasting field. The DFF-1/2 networks are being merged into a single service called OST 3, carried on all former DFF-2 transmitters. This will operate until the end of 1991 then cease. All transmitters that formerly carried DFF-1 now carry ARD programming with regional opt-outs. ZDF is expanding eastwards with new transmitters – Lobau E56, Cottbus E57 and Dresden E59 are already in operation, with PAL colour. Five regional centres for the ARD service are being established at Rostock, Berlin, Dresden, Halle and Gera. In the west ARD/ZDF now start on weekdays at 0600 local time with a programme made by RIAS-TV, Berlin – the RIAS logo is often seen during the early mornings with its network offerings. Incidentally the postal prefixes have changed – W instead of D in the west with O replacing DDR in the east. The SAT 1 group has moved to a new broadcasting centre at Mainz and now uses a FUBK pattern with identification SAT 1 MAINZ.

Yugoslavia: The Zagreb station OTV now broadcasts on chs. E31 (West Zagreb/central Slovenia) and E45 (East Zagreb/Sisak/central Croatia). Programme hours are 1700-0100 daily. The transmitter network is to be expanded to cover the rest of Croatia.

France: Now that pirate Discret-II decoders are commonly available Canal Plus has deciced to change to the new Syster scrambling system from Eurodec. There have been delays with Operation Chadec (decoder change) due to manufacturing problems – a shortage of ITT chips. The new scrambling system was originally to have been introduced this January. It will apply initially to terrestrial transmissions.

Rumania: The new independent AI-TV station in Bucharest is now testing on a 24-hour basis.

Spain: George Gaskin (Gibraltar) reports that most large Spanish towns now have a local, independent TV service. He's noted a new transmitter at Malaga and from his home can receive Spanish Canal Plus on ch. E39, Tele-5 on ch. E42 and Ant-3 on ch. E45 from the Mijas region.

Monte Carlo: TMC, which is now forty per cent owned by the Italian chemical/agricultural firm Ferruzi, is to expand to provide three services aimed at Italy and other nearby countries.

Greece: The situation is becoming like that in Italy, with some towns having up to ten terrestrial and eight satellite TV channels available. The government has yet to decide who shold be given official licences.

USSR: Several independent stations are now in operation. Locations include Vladivostok and Chita. The Union of Organisations of Cable and on-air TV of the USSR has been set up with the aim of increasing local independent broadcasting.

Thailand: A teletext service called Armtext has been introduced in the Bangkok region. It's based on an Australian system.

Australia: Robert Copeman reports that a second estate agent in Melbourne is now using "talking house" transmissions (see page 196 last month), this time at 100MHz. It's likely that the system will spread to other cities. Incidentally the McDonalds drive-in at Burwood, Victoria transmits food orders at 35·02MHz. Now if conditions get that good . . .

Meteor Showers 1991

The main 1991 meteor shower dates are listed below. Our thanks to George Spalding, Meteor Section, the British Astronomical Association, for once again providing the details.

Lyrids April 19-25th peaking on the 22nd at 1400.
May Aquarids May 1-10th peaking on the 5th.
Delta Aquarids July 15th-August 20th peaking on July 19th.
Perseids July 15th-August 20th peaking on August 13th at 0400.
Orionids October 16-27th peaking on the 22nd.
Taurids October 20th-November 30th peaking on November 4th.
Leonids November 15-20th peaking on the 17th.
Geminids December 7-16th peaking on the 14th at 0900.
Ursids December 17-25th peaking on the 23rd.

Satellite TV News

The Japanese BS-3A DBS satellite is now fully operational, allowing three channels (two NHK plus a commercial one operated by Japan Satellite Broadcasting) to be received using 45cm dishes. A backup satellite is due to be launched later this year. There have been rumours of Japanese interest in the Marco Polo satellites.

Middle East Broadcasting is due to start programme transmissions in February via Eutelsat II F1 at 13°E, at 11·55GHz.

Israel intends to launch its Amos satellite, for TV and communications use, late next year. The satellite system has been developed by the Israelis. Launch will be via an Arianspace vehicle. If the satellite is successful it will be marketed internationally.

Germany is refusing to promote D2-MAC from TV-Sat 2 at 19°W. With this and the problem of the ailing TDF craft (faulty TWT amplifiers and no backups) it seems that D2-MAC will be hard pushed to survive. Most German services are moving to the Astra slot at 19°E, since this provides cheap and easy coverage of the area, and are opting for straight PAL.

BBC-TV Europe is to be relaunched in September with a new scrambling system, Eurocrypt D2-MAC, instead of the easy to pirate SAVE system at present used. The Bravo Channel via Intelsat 27·5°W has been carrying out SAVE tests, so maybe the system will survive.

Book Review

Bernard Babani has published a new book on amateur radio satellite reception. It covers the basic theory of satellites and orbiting, amateur radio activity in the satellite field such as the UOSAT series, plus weather satellite reception and how the domestic operator can construct and assemble an efficient receiving system, doing all this in a straightforward way with the absolute minimum of mathematics. In the case of the NOAA and METEOSAT weather craft it describes the display of received images of the Earth's surface on a domestic TV set using easily obtainable units and either a frame store or a home computer such as the BBC one. This very readable book costs just £3·95 and is thoroughly recommended. Most of the satellites covered in the book are in inclined rather than synchronous orbit, which requires different aerial arrangments. The 100-page book can be obtained from bookshops, Maplins or direct from Bernard Babani (Publishing) Ltd., The Grampians, Shepherds Bush Road, London W6 7NF – add 40p to cover postage. Its full title is *An Introduction to Amateur Communications Satellites* by A. Pickard, Babani catalogue number BP290.

The Galaxy 25 Colour Receiver

Aerial Techniques is at present marketing the NordMende Galaxy 25, a 10in. multistandard set with full v.h.f./u.h.f. coverage. Features include full-function remote control and 39 programme storage tuning. It can be operated from a 220-230V a.c. or 10-30V d.c. supply. There are headphone and external loudspeaker sockets while baseband audio/video in/out facilities are provided by a scart connector.

I've had one of these sets on test recently and found that the picture and sound are excellent, with truly impressive weak signal performance. The tuner covers Band I then upwards to 300MHz without a break and after that the u.h.f. bands. Thus coverage includes the OIRT and Italian Band II channels and all the cable channels. PAL or SECAM can be selected by push-button, with sound at 5·5, 6 or 6·5MHz, i.e. systems B/G/I/L. Though the OIRT R channels can be received the 6·5MHz facility is for French a.m. sound only, so with these channels you get the picture but no sound. The North American system (525 lines NTSC) is not catered for. All of Western Europe, most of the Middle East, Australasia and many parts of

Africa are included in the coverage. Two large LED digit displays tell the user what's happening while tuning, setting up or viewing.

There are two aerials, an integral seven-section whip that extends from 6½in. when closed to 33in., and a bowtie u.h.f. aerial with a short connecting feeder to clip to the telescopic whip etc. There's a Belling-Lee type socket for other TV aerials.

I found that the remote control and tuning were very difficult to operate at first. You need a careful read through the instructions, then perhaps a second and third read. By then the basics of setting up the beast should become apparent. Once the setting up and memorising functions have been mastered the set is relatively easy to operate. You can set up the receiver for all the Band I/II SpE channels and simply skip along them during an opening. This direct channel access is a real boon.

In conclusion it's a well-built, quality receiver that covers most of the transmission standards you are likely to need in Western Europe, the Middle East, etc. It's attractive to look at but at over 20lb would be difficult to carry over long distances. A leaflet on the set can be obtained from Aerial Techniques – for address see nearby advertisement.

Test Card Videos

Andrew Emmerson (71 Falcutt Way, Northampton NN2 8PH) is able to supply two VHS video tapes that cover various aspects of test cards/patterns. Highly recommended for those interested in the early days of 405 lines to the present day is *The Development of the TV Test Card* in which George Hersee discusses the evolution of test cards from the Alexandra Palace days to Test Card F. Lots of cards are shown. This E180 costs £5 in the UK.

TV Test Cards of Eastern Europe is a remarkable offering which will be compulsive viewing for all TV-DXers and satellite TV enthusiasts. In addition to Eastern European cards there are items from Mongolia, Libya etc. The tape runs for nearly fifty minutes and was recorded in an Eastern European TV studio using professional broadcasting equipment. At £10 (UK) this is a bargain.

These tapes can be ordered from Andrew Emmerson at the address above – no callers please.

CD Player Casebook

Reports from Mike Leach, Philip Blundell, AMIEIE and Joe Cieszynski

NordMende CP3000

This player wouldn't read the TOC – our customer complained that it made a strange noise. On removing the top cover we saw that the disc didn't spin. Basically, as the tray didn't load fully the microcomputer chip wouldn't tell the player to go.

With a fault like this the usual procedure is to replace the loading belt and clean the tray loaded/unloaded switch – you usually find it on the mechanism somewhere under the tray. Not on this one however. In fact there's no switch. The microcomputer chip simply relies on the loading motor coming to a stop when the tray is fully loaded. It then tells the laser to come on and the disc motor to spin. It's possible to initiate this procedure by hand. When we did this we found that due to a faulty loading belt the loading motor continued to spin with the tray in. When the motor was stopped with a finger the machine switched the laser on and read and TOC. After replacing the loading belt and the motor I got the necessary jolt as the tray fully loaded. The machine then worked perfectly. **M.L.**

Philips CD373

The headphone output was o.k. but when the output was fed into an audio amplifier there was distorted sound. This was due to a burn up on the audio board. The culprits were R3126 (33Ω) and its associated smoothing capacitor C2106 (100μF). **M.L.**

Pioneer PDM500

This multi-play machine suffered from the now all too common Pioneer problems. First, it wouldn't read the TOC because of a faulty turntable motor. When this item had been replaced and the machine had been reassembled I found that it was very slow at finding tracks. It would also occasionally jump across large sections of the disc.

I put the machine in the test mode to start going through the setting-up procedure. When these machines are in the test mode it's possible to move the laser assembly across the disc quickly by pressing the manual search forward and reverse buttons. The action was very slow with this machine however. This was because I hadn't cleaned and lubricated the worm gear when I'd fitted the new turntable motor. The problem has been mentioned before in these pages – Nick Beer wrote about difficulty with dirty worm gears in Technics machines. Always clean them: it could save you the price of a laser. **M.L.**

Mission PCM4000

The problem with this machine was crossover distortion in the right-hand channel sound. The output from the DAC is too small to see easily with a scope but as the manufacturer has brought the DAC outputs out to links it's a simple matter to swap them over in order to check whether the analogue section is o.k. It was. A new TDA1541 DAC chip put matters right. **P.B.**

Sanyo CP08

The complaint was of intermittent cutting out whilst playing. When I tried the player it seemed to be very sensitive to the slightest disturbance. Tapping the player would result in the servos going out of lock and the CPU would then initiate the stop mode. It seemed likely that there was a dry-joint somewhere. So I removed the main panel, using jump leads to maintain the earthing. The player now behaved impeccably. Suspecting that I'd disturbed something I resoldered any joint that looked dry.

After extensive board tapping and flexing I reassembled the player only to find that the fault was back again. This routine continued for some time until, by sheer good fortune, a jump lead fell off while I was flexing the board. The fault then showed up instantly. How could I have missed it? The main panel has a number of earth connections, one of which is made via the fixing screw at the rear, right-hand corner. Contact is made via a pad of solder which in this case had become tarnished. I should have been warned – I'd had a very similar tussle with a Toshiba colour TV set a few years ago. After remaking the solder pad I fitted a grip washer between the pad and the chassis to make sure that the fault didn't recur. **J.C.**

Letters

COST OF SPARES

The practice of badge engineering is widespread in our industry, especially with higher-technology video products. But I was surprised to find that a new range of Sony VHS VCRs uses the Panasonic G mechanism. Not only this, but the mechanism is obviously purchased from Grundig who also use it. I discovered this when a new SLV270, the basic machine, came back with the complaint of excessive noise. I tried it and thought to myself that if it was a G mechanism the noise level would be normal. On removing the lid I was somewhat taken aback to discover that it *was* a G mechanism!

The problem was the centre pulley unit of course. But as the machine was under guarantee we had to purchase the part from Sony in order to be able to claim its cost. This was unfortunate as we keep several Panasonic pulleys in stock. We ordered the part (G98726503) from Sony. It came a few days later packed in a Grundig "Genuine Spares" box. On undoing this we found the pulley and belt in a Panasonic box and bag complete with the Panasonic part numbers. The Grundig part no. 75987-265.03 and the Sony number have common elements as you can see. The same cannot be said of the prices. As Panaservice dealers we get preferential spares prices, say £5 in this case. Willow Vale will supply the Grundig part for £6. You will therefore appreciate our amazement at the price Sony charged us as one of their dealers – £18.03. We obtained the part from Sony only for guarantee reasons, and we shall be reimbursed, but this does highlight one or two worrying points. First, is Sony being charged ridiculous amounts by its suppliers? Secondly, dealers unaware of this situation could be ordering spares from Sony and in some cases doubling the cost of a repair.

Sony is not the only manufacturer cursed with high spares costs for badge engineered products. Another good example is NCS (Salora/Luxor). A capstan motor for a badge engineered Sanyo machine costs £70 to a Salora dealer. From Charles Hyde the same motor can be obtained for £38 under the Sanyo part number. NCS's explanation is that its UK arm cannot source spares from anywhere except its parent company in Finland. The Finnish company obtains the spares from Sanyo in Japan. It can be seen therefore that the massive transportation costs and successive handling mark-ups result in a very high price. The answer would appear to be to allow common sense to prevail and let UK spares departments obtain parts from UK sources.

There are ways of overcoming this problem. Bang and Olufsen, who use Philips and Hitachi products, had a number of astounding price differences. Their service manager Bob Clementson adopted a positive approach to dealers' complaints and findings. As a result of a combined effort, with dealers compiling information and B and O following it up, the anomalies no longer exist. In fact certain Philips VCR parts that previously cost almost twice the price of those supplied by Willow Vale are now marginally cheaper!

One problem is that when as a dealer you approach a manufacturer about this sort of problem you rarely get an admission that the products are badge engineered however obvious it is.

It would be interesting to know whether all Sony's Panasonic mechanism parts are as expensive, also whether the situation is not as simple as I make it out to be. I must make it clear that I'm not singling out Sony, but the example quoted above does at best seem ridiculous.

Nick Beer,
Bideford, Devon.

FUSEHOLDER FAULTS

On a number of occasions over the past few years I've found that many of the infuriating intermittent faults now so common are caused by one simple item – the set's mains fuseholder. I was prompted to write about this by a friend's sorry experience with a Philips G11 chassis. The set concerned had a history of short-circuit BU208A line output transistors. My friend had attended to the usual causes – the reservoir capacitor in the power supply, the line output transformer, dry-joints, etc. In desperation he finally brought the set to me. On inspection I found that the left-hand mains fuseholder was very loose and charred – this should have been noticed during the many mains fuse replacements. After replacing the fuseholder and fitting another B208A the set has worked happily for over a year.

I've had the same problem with the GEC C2110 series, the Decca 80 and 100 chassis and the Ferguson TX9, TX10, 9000 and 9600 chassis. Often the only fault you get is soft blowing of the fuse. Incidentally, in sets with two mains fuses it's usually the one in the neutral line that blows. Remember the great plugtop debate? Perhaps other engineers would care to comment on this.

K.W. Saxon,
St. Helens, Merseyside.

LNB FREQUENCY RESPONSE

In his article on our LNB repair service last month Steve Beeching asked whether an LNB with a 5dB dip in its frequency response would be regarded as faulty. The answer is yes, it would.

J.A. Glenton, Director,
MCES, Manchester.

OH DEAR

As an avid *Television* reader I usually start by reading all the words, then the spaces between the words and then do it all over again to see if I've missed anything. After all it comes out only once a month.

So it was with some surprise that I read the item in Teletopics under the heading "Video News", or it should have been "The Blind Leading the Blind"? Have Akai really designed a VCR with help form the Royal Institute for the Blind? And is there any truth in the rumour that they are considering designing a Nicam adaptor for it with help from the RNID?

Sorry about that. But in these hard times it helps to have a sense of humour.

John Hopkins, The TV Workshop,
Felixstow, Suffolk.

Editorial note: Our apologies to all for this mistake.

MICROWAVE OVEN SERVICING

We would like to endorse the comments made by Brian Francis in his letter (January). It's vitally important that any engineer taking on microwave oven servicing and repair is adequately trained.

The lack of money that's been put into training in the UK over the past twenty or so years is one of the main reasons for the acute shortage of competent technical people. According to the latest figures available, only 25 per cent of young people in the UK enter further or higher education. This compares with about 75 per cent in Germany (the bit previously known as West Germany) while Korea is aiming for 85 per cent by the year 2000. Lack of trained staff contributes to factory closures and the consequent high level of unemployment.

Many employers maintain that if they spend money on training, their staff leave for better paid jobs as soon as they are trained. This raised two questions. First, are wage levels too low? Secondly, if everyone received training there would be people who could be taken on to replace those leaving for higher pay.

Microwave oven servicing and repair involve health and safety, so it's vital that correct training is provided. This should not however be a problem that deters TV engineers from entering this field. We know of an excellent series of training courses that are both inexpensive and effective. If any reader thinking of taking on microwave servicing likes to contact us we would be pleased to pass on details. It's a fact that more and more TV engineers are taking on microwave ovens. They have a head start because of their experience of electronics, and will find the information in the courses easy to assimilate. In addition our Technical Department is able to offer help and information for new entrants. In these difficult times many of us will have to diversify to survive. So think positively TV engineers: you *can* do it!

Peter Vile, AMITD, Sales Manager,
Express Components Ltd., 2 Holyoake Street,
Wellington, Somerset.
Telephone 0823 667525.

EXPLANATION WANTED

To return briefly to the subject of static shocks from TV sets, a really nasty shock can occur when a set has been switched off (perhaps at a wall socket) while the handler's chest (not necessarily naked!) is held against the c.r.t. glass. The discharge that will occur if a supply pin on the mains plug is then touched could certainly result in the set being dropped. Could someone explain the theory?

Sandy Hewat,
Troom, Ayrshire.

VIDEO AMPLIFIERS

I would like to make a few comments in connection with C.W. Murray's satellite TV video amplifier/filter article last month. First, it's perfectly true that video amplifiers can be difficult to lay out, and that an integrated approach is attractive. But the NE592 circuit suggested requires amendment. The NE592's input pins are 2 and 14 and both must be biased positively with respect to the substrate (pin 5). This can be achieved by using a bias network between ground and the positive supply, but since the total resistance to ground in the suggested circuit is only a few hundred ohms this would call for a similar value resistor to the supply. As a result, appreciable current would flow. An alternative approach is to use split supplies – in fact the manufacturer of the device recommends this. A ±6V supply is suggested as the maximum rating is ±8V.

Although the NE592 or the similar μA733 is a convenient chip it has its own share of stability problems and good decoupling is essential. Since TV signals are broadband the decoupling should be suitable for low and high frequencies. In this respect tantalum electrolytics are probably the best choice. The NE592 also suffers from the problem of limited output current capability, and it cannot drive 75Ω loads. If the latter is required, an output buffer stage will be necessary. Another problem is severe distortion at high signal levels. Some time ago I attempted to use the device as a video amplifier in a broadband modem I was designing, but I had to reject it because of poor transient response at high signal levels. This shows up in line-time non-linearity testing, and also as poor differential gain with high signal levels. For these reasons most high-quality commercial equipment still uses discrete component circuitry.

For anyone interested in experimenting with new devices the products of the American company Maxim are well worth investigating. There are video switches and multiplexers which can make excellent video distribution units, also a useful range of high-signal video amplifiers. For example the MAX450 can deliver at least 2V p-p into 75Ω with a useful gain up to 10MHz.

M. Priestley,
Tranent, East Lothian.

HELP WANTED

Could anyone provide or suggest a source for a service manual or circuit diagram for the Telequipment D43 oscilloscope? As this model was discontinued over twenty years ago Tektronix cannot help.

P. Cogan, Leacht Cross,
Carrigaline, Co. Cork, Eire.

Can anyone supply alignment details for a National NVS120A cartridge recorder and help with cartridges for it? All expenses would be met.

Vincent O'Loan, 3-3, 158 Allison Street,
Glasgow G42 8RP.
Telephone 041 423 3896.

Can anyone supply or tell me where I can obtain a high-voltage transformer for a Tektronix 453 oscilloscope?

J.D. Electrical, 23 Elmdale Road,
Earl Shilton, Leicester.
Telephone 0455 845 186.

Can anyone supply a circuit diagram and/or operating handbook for an AVE Pro convar slide dissolve unit used with slide projectors for audio-visual presentations? Mk 5 unit if possible, but any information welcome. All costs paid and information returned after photocopying.

Ed Dinning, 55 Bryans Leap, Burnopfield,
Newcastle-upon-Tyne NE16 6BP.
Telephone 0207 70122.

JOBS AND EXPERIENCE

With reference to Paul Byrne's letter (December), I fully agree with everything he says. Being 45 myself I've now reached the stage where I give up when I see an application form that asks one's age on the first page. You know you have no chance.

I was made redundant last August after spending 17 years teaching radio/TV servicing. All this publicity about training and what is being done about the unemployed puzzles me. I was a trainer and I'm on the dole. Most of this so-called training is so diluted that it's of no significant

use to anyone – except for the spivs and fast-buck people who are now on the training bandwagon.
*Jim Littler, 363 Atherton Road,
Hindley Green, Wigan, Lancs WN2 3XD.*

I've had similar experiences to Paul Byrne (letters, December) at the hands of prospective employers. For some five years I was self-employed, and as far as employers are concerned I might as well have been in jail during this period. It's definitely something they don't seem to like. On application forms I can echo Paul's comments. Often, after sending a detailed, carefully compiled c.v. and covering letter in response to an advertisement, back comes a two-page application form which inevitably, after name, address, qualifications and employment history sections, has a two-line deep space headed "any other attributes which you feel may make you especially suitable for this vacancy".

Interviews can also be an eye-opener. I once attended an interview for a job with a major oil company. The interview was scheduled for 9 a.m. at a five-star hotel not far from the company's H.Q. Imagine my surprise when, expecting to be shown into a suite with perhaps three interviewers present, I was ushered into a large function suite where, along with about a hundred others, I had to sit and do "Psychometric Tests" for three hours. The value of such tests is a controversial subject that's been widely debated elsewhere, but to anyone who has completed an approved course of training and studied long and hard to get a better qualification or grade they are a real slap in the face.

Details of qualifications and grades obtained are very seldom asked for at an interview, and although you may establish a good rapport with any engineering or technical staff who are present you can bet your bottom dollar that the decision on who to appoint will rest solely in the hands of the personnel department whose representative at the interview will, in my experience, be a 22 year old bimbo who wouldn't know a good engineer from a bottle of Perrier water. As long as the personnel department is happy you'll get the job. It worries me. I bet they choose some real duffers. Perhaps Paul's letter should have been headed "too good at 38".
*Alastair J. Downes, 36 Danderhall Crescent,
Dalkeith, Lothian EH22 1LZ.*

FOR DISPOSAL

I have for disposal to anyone willing to collect the following VCRs: Philips 1500 with suspect head; Philips 1502; and two Philips 1700s. Also about thirty assorted tapes for these machines. Please contact me on 0494 33558 after 6.30 p.m. during the week, 11.00 a.m. at weekends.
*C. Carter, 4 Bushey Close,
High Wycombe, Bucks HP12 3HL.*

TUNING TROUBLE

Remember the good old days when dealing with a TV tuning fault consisted of soldering the tuning bar back on? A bit of solder to do the job could always be found. But you try to get a MAB8441PT048 microcontroller chip for a Sanyo TV set! Sanyo say they have it in stock, but non-account holders have to get it from Charles Hyde who say they are waiting for Sanyo and can't give a delivery date. Philips say they can't supply direct as the ROM program is owned by Sanyo. So we have an otherwise perfect three-year old set that's useless!

I notice from letters that there's a lot of interest in the Bush DAC90A. I have one that's free to a good home. It's not working so will require some restoration. I also have free to someone interested in restoring it a small TV set dating from about 1950. Now for my request: does anyone have a circuit diagram for the Amerex ACD800 stereo cassette deck? Please phone 0642 581570 evenings, 0325 332805 daytime.
*W.G. Hall, 67 Selwyn Drive, Bishopsgarth,
Stockton, Cleveland TS19 8XF.*

Remote Control Handset Checker

Colin Birch

A complaint that's common enough with TV sets and VCRs is "works o.k. with its own controls but no remote control operation". The problem is to know whether the set or the remote control unit is at fault. If you don't have a compatible unit you can waste time stripping down the customer's handset only to find that it's perfectly all right. Annoying, isn't it? I've had this happen to me on any number of occasions. So I decided that what was required was something cheap and simple to check whether a handset was producing an output. Into the odd bits box I delved, the outcome being the circuit shown in Fig. 1.

The infra-red sensor I used was a spare end-of-tape one from an Hitachi VT65E, though more or less any sensor could be used. The components were assembled on a piece of Veroboard. When soldering has been completed, check for any solder bridges across the tracks then connect the battery. To set up the circuit, switch the unit on and adjust VR1 until the LED goes out. Check the unit's action by aiming a good handset at it then pressing a key. The LED should light. If it doesn't, adjust VR1 slightly.

Although simple the unit has already saved me much valuable time. I only wish I'd built it years ago.

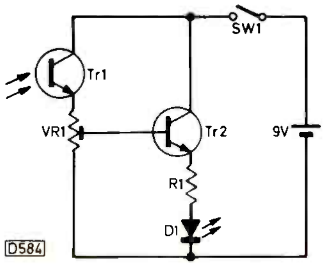

Fig. 1: Circuit diagram of the remote control handset checker. Infra-red sensor Tr1 drives emitter-follower Tr2 which in turn drives the LED indicator D1.

Component details

Tr1	Infra-red sensor
Tr2	BC108
VR1	250kΩ preset
R1	1kΩ, ¼W
D1	Red LED
SW1	Single-pole, single-throw switch

Veroboard – 7 holes × 9 strips
PP3 battery and clip
Small plastic box

What a Life

Donald Bullock

One of the good things about our old house is that it's roomy enough to have a bar. And a friendly place it becomes as the evening wears on. The other night I was getting comfortable when the phone trilled. Out rang the crisp, authoritative tones of one of my retired military customers. It was unmistakably Major Hagger.

"Hello Donald, old boy. Moving house don'tcha know. To one of those retirement homes where they wetnurse a chap whilst fleecing him! Wife's idea but there you are. Got a pair of youngsters moving in here. Teachers. Think they're intellectual and want the aerials taken down. Frightened of lightning or the programmes? Anyway, see to it will you?"

At that there was a click. So next morning I asked Mario the contractor to attend to the aerial job. He doesn't speak much English, nor does his brother. But they're as nimble as cats and make do with a minimum of ladders. Then I put the first set on the bench.

The Waltham TV600

It was a Waltham TV600 colour portable. The sound was o.k. and there was a rustle of e.h.t., but no raster. I seemed to recollect having had this problem before with a Waltham. So I flicked through my card index, where I keep a record of any noteworthy faults, and pulled out one labelled Waltham TV600. "No brightness, sound o.k." it said. Wow! With quickening pulse I read on. "Turn up A1 voltage (lower line output transformer potentiometer) to reveal field collapse." I did and it did. "Check R122, 3·3Ω, white ceramic case" it continued, "at back left near line output transformer for being open-circuit." Again spot on. In no time the set was off the bench.

An Akai VS240

The next job was an Akai VS240 VCR with remote control. Its symptoms were no results with a display that showed only the letter L. I took the covers off and checked for obvious things but got nowhere. An hour spent carrying out checks in the power supply produced no further progress. I didn't have the manual and was toying with the idea of sending off for one when Ernie called in. He's chief cook and bottle-washer at a nearby guest-house and drops in when he has a bit of spare time. Always takes an interest in what's going on.

He took a look and commented "same as ours. See you've 'locked him up'. We do that. Stops people using it without our say-so."

"I haven't locked it up" I said. "It's faulty and I have to fix it. Only I don't know how."

"Pick up that remote control" said Ernie. "Point it at the recorder and press it six or eight times."

I did as I was told and the L disappeared in favour of other cyphers. I put in a tape and the machine worked beautifully. This did wonders for Ernie's ego but little for mine. But Ernie's wife knows where to find him. The phone rang and after a brief exchange he scuttled off.

Solavox NVCR5000

The next job had me flummoxed again. It was a Solavox NCVR5000 VCR that was devoid of life apart from a few bits of incomplete gibberish in the display area. Working on the basis that I had a brain while the recorder only thought it had one I settled down to crack the fault. A long time was spent, then I retired to the house worn out and defeated.

Greeneyes was having a fair old time playing one of her Spanish language cassettes on my audio system. Wearing some strange gear too. Just then the phone rang. It was my Solavox customer wondering how I was getting on with his video.

"I'm not" I said. "We've taken an acute dislike to each other. Where did you buy it?"

"Comet" he replied.

"I'll see if they can help" I said.

So I phoned the Bristol branch and was put through to their helpful technician Peter Ambrose. He was not only familiar with the fault but came up with the solution. "Add a 4·7kΩ resistor between the positive of the 5·5V back-up 'battery' C821 and the base of transistor Q809 next to it" he said. "It'll never come back with that fault. It's a Nikkai chassis. There's an Alba model that uses it, and a Questor one as well I think."

I did the modification and sure enough the machine burst into life. Curiously, the next job on the bench turned out to be the Alba version. It was as dead as could be – not even a segment of display. But the same modification fixed it.

Those Military Men

That evening I was safely settled in the bar when the phone rang. It was Major Hagger. Hopping mad too.

"What do you mean by having my practically new aerials hacked down by some foreigners? When I asked they said you'd sent them. You'll answer for this. If you know what's best you'll get my aerials replaced forthwith – then send me an apology."

Greeneyes had heard every word and wanted to know what was going on. "Probably asked me to do it without referring to his wife" I said. "You know how it is. Then wants to pass on the blame."

"Do you really think so?" she said.

"Of course I do. It's obvious. He'll probably call to apologise in due course."

The phone went again. Greeneyes took the call – it was Captain Hodder. When she'd put the receiver down she called over "wants to know what happened to the aerial riggers. Said he called you the other night and he's still waiting. He's off to the old folks home in the morning. Why can't you take proper notes when you get these calls? Especially when you've been in this bar for a while."

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AL25	5 pin din socket to 2 x phono plugs. Both wired 3 + 5 together	0.23	0.27
AL26	5 pin din plug to 2 x phono sockets. Both wired 3 + 5 together	0.23	0.39
AL06	2 pin din speaker plug to 2 pin speaker line socket	5	0.33
AL04	2 pin din speaker plug to 2 pin speaker plug	10	0.49
AL09	Stereo line jack socket to 2 x 2 pin din speaker plugs.	0.28	0.27
AL10	Stereo headphone extension lead. 3 pole jack plug to 3 pole jack line socket.	6 (curl)	0.71

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SCART 18	Scart plug to 2 x BNC plugs and 1 x 7 pin din plug.	1.2	2.42
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VL04	BNC plug to phono plug	1.2	0.64
VL05	UHF plug to phono plug	1.2	0.48
VL11	8 pin din plug to car cigar lighter plug. Portable video lead (3A fuse neg. earth)	2	0.70
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CL03	7 pin din plug to 7 pin din plug	1.2	0.59
CL06	7 pin din plug to 2 x 3.5mm jack plugs and 1 x 2.5mm jack plug	1.2	0.61
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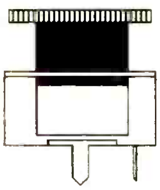

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CONVA 100R	100R
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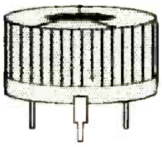
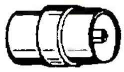


COAXIAL LINE CONNECTORS



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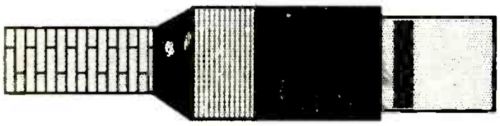

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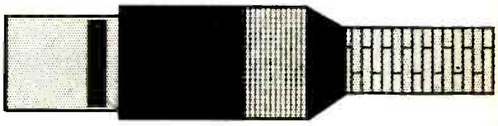

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DINLINE4P	4 pin	8p
DINLINE5P180	5 pin (180)	8p
DINLINE5P240	5 pin (240)	8p
DINLINE5P360	5 pin (360)	8p
DINLINE6P	6 pin	8p
DINLINE7P	7 pin	8p
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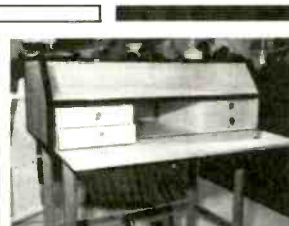

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3HSS4VB-3V32/HR7655 £25.00
3HSS4VC-3V48/HRD565 £26.00
3V48,58,59,65,FV10,11,12,13,14,20,21,26
And most other Fergusons POA

HITACHI

3HSSHA-VT8000,9000 series £17.00
3HSSHB-VT11,33 etc £17.00
10082-VT120,220 £29.00
10081-VT130,135 £30.50

PANASONIC

3HSSN-2 Head universal £9.95
3HSSU1N-NV100,370,380/Philips VR6460 £11.00
3HSSU2N-NV230,470,480,G9,10,11,15PX £21.00
3HSSU3N-NV430,460 £16.00
3HSS3N-NV777,330 £18.50
3HSS4NB-NV730 £26.00
3HSS4NA-NV366 £24.00
NVG30,33,40,45,46,130, & most other Panasonics POA

SANYO

3HSSSY-VHR1100,1110,1300 £20.00
3HSS3SY-VHR1500 £34.00

SHARP

3HSSSP-VC9300,9500,9700,381,481,482,483,486 etc £17.00
3HSSSPB-VC581,583,651,670 etc £17.00
VC7000,8000 series (Brass) £42.00

OTHER MAKES

Alba 4000, Goldstar 8000, Sentra 8000, Solavox 1000 £22.50
Fisher FVHP510,520,530,615,710 etc £18.00
Fisher VBS7000,9000 etc £25.00
Hinari VXL2,4,3,20,25 £18.00
Hinari VXL5,6,20H £15.00
Mitsubishi HS306,710 £30.00
Orion VC150,180,VH1,2,3 etc £18.00
Saisho VR100,605,705,805,905 £18.00
Samsung Universal 2 Head £24.25
Toshiba V71,73,74,75,81,82,83,84,85,87 £20.00
Toshiba V93 £21.00

ASK FOR VIDEO HEADS NOT LISTED
The above heads are new and replacements.

BELT KITS

AKAI

VS1,2,5 1.20
VS4,6,9,15 1.10
VS9300,9500,9800 1.60

AMSTRAD

7000 1.00
VCR4600,5200 1.90
VCR4500,9000 2.00

FERGUSON/JVC

3V00/16/22 Mechanical Models 1.60
3V23 1.00
3V29/30 1.20
3V29/30 Loading Belt 0.35
3V31/32 1.00
3V35/36/38/39 1.10
3V42/43/44/45/48/54/55 1.00
3V58/59/64/65/8950/51/FV10/11/12/13/14 1.60

FISHER

FVHP520/530 1.70
FVHP615/710/715/716/722/725/830 1.00
FVHP905/906/907/908/910/911/915/916 1.20

HITACHI

VT11/14/17/19/33/34/35/38/39/88 1.30
VT52/61/62/63/64/65/85/86 2.10
VT100/110/111/113/115/118/120/125/130/135/145/150/175 2.50
VT8000/8500 1.70
VT9300/9500/9700 1.50

PANASONIC

NV230/250/280/370/380/430/450/460/465/485/630/810/830/850/870/890 1.90
NV300/333/340/366 1.60
NV600/777/788 1.50
NV2000/3000 1.50
NV7000/7200/7500/7800 1.40
NV8600 2.20
NV730 0.60

PHILIPS

VR63676467/6561/6751/6760/68SB4 2.00
VR6460/6920/6520 2.40
VR6580/6581 2.50
VR6362/6367/6470/6467 2.25
VR6542/6843 2.00

SANYO

VTC5000/6500 0.65
VTC5300/5350 1.00
VHR1100/1300/1500 1.00
VHR2300/2500/2700 2.90

SHARP

VCF3/VC402/500/571/581/582/583/584/585 1.10
VC6F3/6V3/VC600/651/681/682/683/684/685/693/700/7832.10 2.10
VC200/381/384/385/386/390/9300/9500/9700 1.95
VC300/387/388/481/483/486/488/496 1.20
VC7300/7700/7750 1.95
VC8000/8300 1.95

TOSHIBA

V8600/8700/9600 1.05
V55/57 1.10
V66/67 2.80
V31/33 2.30
V73/81/83/85 2.30

Belt kits for Funai, GEC, Goldstar, Grundig, Hinari, ITT, Mitsubishi, NEC, Orion, Saisho, Samsung, Schneider, Sony and Tensai also available.

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ITT CVC20 12.50
ITT CVC25/30/32 9.50
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ITT Compact 80 Series 90 19.75
ITT CVC45 18.00
ITT 1109F 14.00
ITT CVC1204 11.50
ITT CVC800/1/3 21.50
ITT CVC1100 16.50
ITT CVC1150/1175 20.00
ITT 6325 18.50
ITT 3546 18.50
ITT 1200/1 20.00

Other ITT transformers available

Fidelity all models up to 20" ZX3000 10.50
Fidelity Panel for ZX2000 1.00
Fidelity 22" ZX3000 24.50
Hinari CT4/5 & TVA1 22.00
Philips KT3 12.95
Rank Bush T20A 11.50
Thorn 1615 8.00
Thorn TX100 Green Spot 110 17.25
Thorn TX90 Mains Trans 18.85
Ferguson TX90 LOPT 19.50
Ferguson 3V35/36 Mains Transformer 23.00
Ferguson 3V44/44/45 Mains Transformer 18.85
Sony – Please state model for price
Universal Tripler 4.75
Universal Tripler with focus unit 9.50
Decca 120/130 series tripler 8.50
Thorn TX10 Focus Unit Kit 9.00

VIDEO MOTORS

REEL MOTORS

Ferguson 3V29/30 £20.00
Ferguson 3V58,59,65,FV10,11,12,13,14,20,21,22 £17.25
Ferguson FV26D £14.50
Hitachi 8000,8300,8500 £8.50
Sanyo VTC5000,5150,5400,5300,6500 £7.50
Sharp VC9300,9500 etc, Original £15.90
Panasonic NV333,366 Original £13.20
All other Panasonics POA

DRUM MOTORS

Ferguson/JVC (Mechanical models) £23.00
Sharp 7000 series Original £24.63
All Panasonic Original POA

CAPSTAN MOTORS

Ferguson 3V35,36 Original £22.50
Ferguson/JVC (Mechanical models) £20.00
Hitachi VT11 Original £30.00
Hitachi VT33 Original £32.00
Hitachi VT64 Original £19.75
Hitachi VT8000 series Original £34.50
Hitachi VT9000 series Original £34.50
Sharp VC7000 series Original £30.50

MODE CONTROL MOTORS

Ferguson 3V42,43,44,45,48,49,52,53 £6.00
Ferguson 3V58,59,65,FV10,11,12,13,14,20,21,22,26 £4.50

IDLER ASSEMBLIES

FERGUSON

Take up Clutch (Mechanical models) £5.00
3V29/30 Take up Idler £2.00
3V29/30 Take up Clutch £2.85
3V29/30 Reel Idler £3.00
3V35 Reel Idler £3.00
3V35,36,38,39 Take up Clutch £2.85
3V58,59,64,65,FV10,11,12,13,14 Idler Arm £1.80
Clutch Assembly 3V44,45,48,49,52,53,54,55 £14.00
Clutch Assembly 3V42,43 £14.00

FISHER

FVHP615,905,910, Idler Assembly Original £5.00
FVHP615 Gear Idler Assembly £4.35
FVHP905,910 Gear Idler Assembly £5.00
FVHP520,530 Idler £3.00
FVHP520,530 Pulley £0.70

HITACHI

VT11,33 etc. Original Idler Arm £2.50
VT11,33 etc. Idler Arm Replacement £1.75
VT9300,9500 etc. Play Idler £3.65
VT9300,9500 etc. F/F Idler £2.95
VT9300,9500 etc. Idler £2.95
VT8000,8500 etc. F/F Rew Idler £2.95
VT8000,8500 etc. Play Idler Assembly £3.00
VT8000,8500 etc. FF/Rew Pulley £0.70
VT11,33 etc. Clutch Assembly £8.00

PHILIPS

VR6460,6920 Idler Arm (original) £3.00
DV464,6462,6463,650 etc. Idler Mod. Kit £4.50
VR6542,6843 Reel Idler £6.50
VR6542 Reel Drive Pulley £7.75
VR6843 Reel Drive Pulley £8.50

PANASONIC (All Original)

NV370 Idler Arm Unit VXP0521 Gen. £3.00
NV8600,8610 Play Idler VXP0243 £0.95
NV332,777,788 Idler Unit VXP0463 £3.00
NV600,688 Idler VXP0515 £3.00
NV333,366 Idler Arm 2 Unit VXL0997 £10.50
NV8400,8600,8610 etc. VXP0245 £0.95
NV333,366 etc. Idler VXP0401-NV700,7200, 7800 Idler VXP0344 £0.90
NV2000,3000 Play Idler VXP0331-NV2000,3000 Idler Unit VXP0329 £1.10
Back Tension Bands From £1.50
All Panasonic Maintenance Kits POA

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FOR PARTS NOT LISTED

SANYO

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Idler VHR2100,2300,2500,2700 £5.50
Reel Drive Pulley Unit VTC5000,5150,6500 £5.00
Idler Roller Assembly VTC5000,5150,6500 £2.25

SHARP

Idler VC9300,9500 etc £1.75
Idler VC481,581 etc £1.95
Idler (original) VC9300,481,581 etc. £3.50
Idler Assembly (original) VC651,681,685 £6.50
Idler Assmbly (original) VC780,781,785,787,793,VCT72 £6.50

AMSTRAD

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OTHER SPARES

Universal Video Copying Kit £4.25
Universal Video Copying Kit (Scart) £5.20
Video Cassette Lamp Ferguson with/without plug £0.50
Video Cassette Lamp Sharp, Panasonic, Amstrad, Hitachi £0.50
Video Cassette Lamp Sharp 9300 etc with plastic moulding £0.75
Universal Cassette Lamps 40mA/60mA £0.50
CRT Anode Caps £0.60
Video Tape Splicing Kit £6.95
Hitachi TV Frame Module HM6251 £5.50
Cassette Housing Assembly Ferguson 3V35, 36, 38, 39,42, 43,44 £25.25
Cassette Loading Roller Assembly 3V23,3V31,3V32 £3.50
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Philips 2.4V Back up Battery £5.25
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Cassette Housing Assembly Hitachi VT11 £19.50
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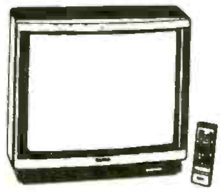

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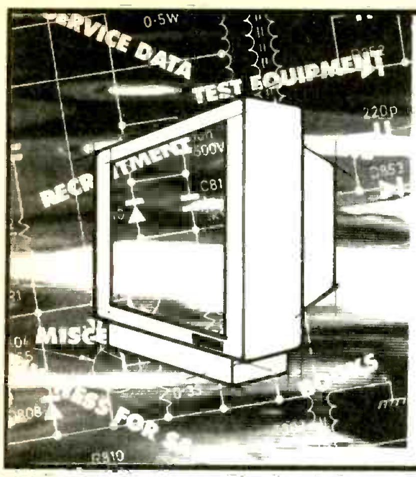

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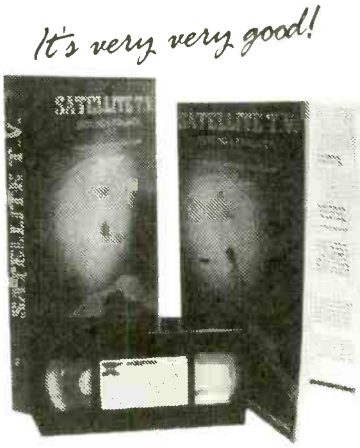

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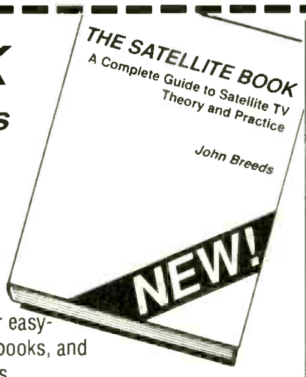

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- Rank 11TCP A823 £3.50
- TU 25 30K Rank £3.00
- 11 TEZ Rank £3.00
- G9 Philips £4.00
- GEC 2110 £4.00
- 3500 Thorn £3.00
- 8500 Thorn £4.00
- 9000 Thorn £7.00
- 9500 Thorn £4.50
- 9600 Thorn £4.00
- 2040 GEC £3.50
- GEC TVM25 Tripler £2.00
- Universal Tripler £5.00
- G8 Tripler £5.00
- CVC20-32 £5.00
- Decca 80 100 £4.50
- Grundig TVK 52 £2.50
- IITBO Pye 731 £3.00
- IITHY £4.00
- D22 for Pye 18" colour portable £4.00
- LP 1193/63 £4.00
- BG 100/41 £3.25
- ERO Tripler print type with foacs PO7
- BG2087 £5.00
- T/text ultrasonic rec'r panel £14.00
- 12-14V. 20 for £5.00 200 for £25.00
- GEC 8 touch unit assy complete with all I.C.'s + pots £4.00
- G11 E.W. Transformer 50p
- G11 E.W. coils £1.00
- G11 Transient Suppressors 245V 20p
- G11 Scan Coils £5.00
- G11 100K tuner pots 12 for £1.00
- KT3 IF panel £6.00
- KT3 line OSC transformer £1.00
- KT3/K30 infra-red receiver head £1.00
- K30 drawer unit with IC's (home) £10.00
- K30 drawer unit with IC's (export) £10.00
- KT3 AE Sockets 50p
- KT3 receiver panel £8.00
- KT3 line driver transformer 50p
- Pye, K30, GEC, etc. Pre-mains stand-by switch £1.00
- Decca 80/100 IF panel £5.00
- NPN PNP 80V 6 Amp TO66 O.P. Trans. pair 25p
- 5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 560T/570T £7.00
- Control panel 5 sliders + mains lead £1.50
- G11 8 touch button unit replaces old 6 P.B.U. £24.00
- Tube base + base unit for 820 Euro chassis £4.00
- GEC Line O/P Trans. & Rec Stick for Portable £3.00
- CVC 20/25/30/35/40 decoder panel £10.00
- CVC 20/25/30/35/40 decoder panel (untested) £5.00
- CVC 40/45 IF panel £5.00
- 40K Transducer 50p
- PHILIPS NE511N £1.20
- LM337M Reg. 30p
- 20 GEC Black Spark Gaps £1.00
- KT3 Front Panel Control Assy. £2.50
- BTW 30/50 50p

Voltage Regulators
- +5V/UA78PO5SC 30p
- −8V/79M08c 30p
- +6V/78M06c 30p
- +10V/78LA10 20p
- LM 317T 30p
- LM 337 30p
- LM 342/18 30p
- LM 340T 5.0 50p
- +12V/LM 340T12 50p
- +18V/MC78M18 20p
- +24V/78M24 30p
- MC 7724cp 40p
- MC 7824 40p

- TIS 90 10p
- TIS 92 20p
- TIS 93 20p

- U 19885 40p
- U 3832 15p
- U 3845 15p
- MR 508 10p
- MR 501 10p
- MR 502 10p
- BCW 71R 30p
- BYF 1202 10p
- BYF 1204 10p
- BYF 3126 40p
- BYF 3214 40p
- BYX 10 10p
- BYX 36/600 35p
- BYX 38/300 25p
- BYX 49/600R 75p
- BYX 55/350 10p
- BYX 55/600 (Bead) 10p
- BYX 71/350 20p
- BYX 71/600 50p
- BYX 72/300 20p
- BYX 36/600 50p
- BYV 95B 10p
- BYV 95C 12p
- BYV 96D 10p
- BYZ 106 10p
- BPW 41 15p
- BYW 56 2A/1000v G11 8p
- BYW 29/50 15p
- BYW 95C 10p
- BZU 15/24 54p
- BZY 93c75 50p
- BZW 15/18 30p
- BZW 15/30 30p
- BZW 70c6v2 10p
- BZX 79.3v 10p

- Bush Thyristor RCA 76122 £1.00
- Transformer 240v/20v-500Ma 75p
- Chassis type Transformer 240v/12 Volts 500m/a 75p
- CVC 20 tube base £2.00
- Tube Base Rank & G11 £1.20

BRIDGES
- KBL 005 30p
- KBL 02 30p
- KBP 04 30p
- W02 15p
- W004 15p
- W005 20p
- 800V Bridges 2½ Amp 30p

- G11 Drawer ASS 3 pots Mains Switch and Lead £2.00
- K30 Drawer Ass with pots cable forme £1.00
- TX10 Drawer with 8 way pots. ass. £2.50
- TX10 Ex. port with band switch (drawer) and U.H.F. only £2.50
- Hills Meter for the car man. volts. amp. ohm with dwell and r.p.m. £35.00
- Hills 9 piece tool kit in case £5.00
- Abbey Security Smoke Alarm Model 101 £4.00
- Philips Coaxial Cable Stripper SBC325 £7.50
- Self adjusting cutter stripper £5.00
- 10 mixed tube bars £4.00
- 5000 Diodes-Resistors £3.00 pack
- D/P push mains switch 20p each
- Mains lead & two pin socket for radio cassette 35p
- T/V loop aerial 75p
- Radio Telescopic Aerial £1.00
- Philips Silicon Grease £1.50 each
- Freeze Philips £1.50 each
- Foam Cleaner Philips £1.50 each
- Contact Cleaner Philips £1.50 each
- 100 Coax Plugs 14p
- De-solder pump + 2 nozzles Philips £4.00
- Flat Red LED and Green 5p
- 500gm 60/40 Solder reel £6.00
- Dual v/u meter −20 — +10db £1.00
- K30 Thermistor 232266298009 75p
- De-solder Pump £2.50
- Portasol Flameless Gas Soldering Iron £16.00
- Green & Red LED pack mixed 100 for £1.00
- Hill Meter Leads. S/Rubber and Probes £4.00

- CV 8617 10p
- Y 716 10p
- Y 729 30p
- Y 730 10p
- Y 827: 6A/1KV 20p
- Y 860 30p
- Y 933 5p
- Y 969 50p
- Y 997 30p
- Min 12 volt Relays 75p
- R 1038 40p
- R 1039 40p
- R 2009 80p
- R 20106 £1.00
- R 2029 50p
- R 2210 60p
- R 2257 60p
- R 2265 50p
- R 2305 50p
- R 2306 30p
- R 2322/2323 pair 80p
- R 2323 15p
- R 2396 50p
- R 2461 80p
- R 2030 50p
- R 2433 = BD124 30p
- R 2540 £2.00
- R 2737 40p
- R 2738 = TIP41 30p
- R 2775 = TIP41c 40p
- R 3129 = TIP47 40p
- T 6068V 50p
- R 4050 £1.00
- S 2008b 80p
- 2SD898B £1.00
- 2SC1942 £1.00

Hitachi sets etc.
- STR454 £2.00
- STR6020 Kit £6.00
- S 2000AF line o.p. £1.00
- 2SC940 £1.00
- BU 105/04 80p
- BU 108 £1.00
- BU 124 50p
- BU 126 80p
- BU 180a 65p
- BU 204 60p
- BU 205 75p
- BU 206 £1.00
- BU 207 £1.00
- BU 208 80p
- BU 208A 75p
- BU 208D 90p
- BU 222 £1.00
- BU 326 £1.00
- BU 407 60p
- BU 426A 45p
- BU 500 £1.10
- BU 500D £1.00
- BU 508A 90p
- BU 508D 80p
- BU 508V £1.00
- BU 705 £1.00
- BU 806A £1.00
- BU 807 £1.00
- BU 824 50p
- BUT 11 50p
- BUT 13 600V-28A £1.00
- BUW 11 50p
- BUW 84 60p
- BYW 20-48-9 £1.00
- BYW 95 10p
- BUX 39 25A-150V £1.00
- BUX 84 50p
- BUX 85 50p
- BUY 49 20p
- TIC 106a 30p
- TIC 116m 30p
- TIC 116n/Y 1003 30p
- TIC 126N 30p
- TIC 225S 30p
- TIC 226E 30p
- TIC 226m 30p
- TIC 236m 30p
- TAG 226/600 30p
- TICV 106D
- (T092 case 2A/400V) 10p
- TIP 29 25p
- TIP 30 25p
- TIP 30A 25p
- TIP 30B 25p
- TIP 30C 25p
- TIP 31 25p
- TIP 32 25p
- TIP 33B 50p
- TIP 33C 70p
- TIP 34A 50p
- TIP 34B 60p
- TIP 34C 70p
- TIP 35B 50p
- TIP 35C 70p
- TIP 35D 80p
- TIP 36 50p
- TIP 36C 70p
- TIP 41 15p
- TIP 41B 40p
- TIP 41D 70p
- TIP 42 10p
- TIP 42/BRC 6109 10p
- TIP 48 40p
- TIP 49 30p
- TIP 57 30p
- TIP 100 30p
- TIP 102 30p
- TIP 110 20p
- TIP 115 50p
- TIP 117 50p
- TIP 125 35p
- TIP 126 40p
- TIP 127 40p
- TIP 130 30p
- TIP 131 6p
- TIP 136 30p
- TIP 140 50p
- TIP 142 80p
- TIP 640 50p
- TIP 2955 35p
- TIP L761A-1000V/4Amp 75p
- T6032 30p
- T6036 40p
- T6040 40p
- T6047 40p
- T6049 40p
- T6051 40p

- Philips Handset IC £3.00
- SAA3010P £3.00
- MAB8461/WO63 £3.00

- MAB 8420P-C031 £3.00
- MAB 8400B-6 £3.00
- MAB 8440P-D070 £3.00
- MAB 8440P-D033 £3.00
- MAB 8440P-D056 £3.00
- MAB 8441P-T001 £3.00
- MAB 8441P-T132 £2.00

- M58484P £2.00
- Hand Sets — Fidelity £15.00 to £35.00
- ITT 8 and 6 Push Button £1.00
- Pye 725 LOPTs £6.00
- Pye 731 LOPTs £6.00
- Thorn 8500-8800 LOPTs £5.00
- CMC 301 front panel £5.00
- CMC 303 front panel £5.00
- CMC 302 Panel with TC mains switch etc £5.00
- CMD 800 Decoder £8.00
- C7 Hand Set £6.00
- 3 I.C. Power Supply G11 Full Remote Receiver Panel £3.00

- Meters Hills 520 £17.00
- Meters Hills 420 £10.00
- Hills HD5000 Digital Meter 1000V DC 750AC 10 Amp 20 MRG Rangers £28.00

- ITT100 Multimeter £6.75
- ITT300 Multimeter £7.75
- ITT500 Multimeter £9.00
- ITT700 £15.00
- HD1000 Digital £20.00
- HD1200 Low Cost Digital £13.00
- HD2500 £18.00
- HD3000 Digital £25.00
- HD5500 Digital £29.00
- HD6000 Digital £32.00
- HD8000 Digital £35.00
- HD9500 Digital with capacity Temp Trans Volts Ohms and Amps ranges £60.00

Infra Red Hanset Tester
- Works at 24 feet – Sound repeater. Works off 9 volt battery £8.00
- Fits in top pocket.

- Handset Tester with LED £4.50

Repaired Handsets
- Philips K4-K35, RC5350-RC5300, RC5370, RC5375, repaired same day £10.00
- RC4001 Full Remote KT3 K30 Teletext Handsets exchanged £15.00
- NEW Type RC4001 9 CH not 12 £6.00
- GEC Full Remote Infra-red, 1983 models £15.00

TOSHIBA HAND SETS
- CT9185 CT9176 CT9133 CT938
- CT995 CT9144 CT9185 CT9193
- CT9383 CT9384 £4.00 each

- Rediffusion MK3 £5.00

TOSHIBA HAND SETS
- 24 Button CT938 Fullremote £5.00
- 32 Button CT983 Videotext £6.00

THORN
- VCR Front Display Panel £7.00
- Large type ITT TV and V.C.R. Handset £15.00
- GEC Ultrasonic 8CH Full Remote £10.00
- G11 Full Remote Ultrasonic £10.00
- G11 Ultrasonic Teletext Handset £10.00
- 8 C.H. Ultrasonic GEC Full Remote C2014H/C2219H £15.00
- New Replacement for G11 Ultrasonic Full Remote £12.00
- Thorn 4000 insert with 7 buttons £5.00
- Decca RC 11 £14.00
- Decca RC 12 £14.00
- G11 Infra-red full teletext £20.00
- Dynatron-Full remote CTV 62, 63, 64 £19.00
- Hitachi infra red handset £18.00
- Philips full remote KT3, 16C928/20K934; 7228/7324; K12 26C 797/1ST 60K 1826 £12.00
- GEC infra red full remote 8 channel (I.C.SAA1250) £14.00
- Philips infra red full remote 9 channel for 60 CP2605 £6.00
- Philips infra red full remote 12 channel for 60 CP2605 £12.00
- K35
- KT3/K30 T/Text £12.50
- KT3/K30 Full remote £15.00
- KT3 Power supply £4.00
- GEC infra-red 2236-2026 £4.00
- GEC 8 button full remote £14.00
- GEC push pad handset button blobs 10p each
- Pye & Philips handset KT3-K30 chassis. No RC5150-RC5176-RC5171-RC5177. Special Price £13.00
- RC4001 KT3 and Teletex £14.00
- IT CVC 32 handset repaired £15.00
- CVC 32 Hand Set £15.00
- CVC 45 3 and 2 Pin
- TX10 Hand Set Text £12.50
- TX9 with Text £12.50
- TX9 & TX10 button print £2.00
- TX10 Focus Pots £5.50

ITT
- T/V & Video Processor, 1200 Type £10.00

PHILIPS
- UNIVERSAL HAND SET £12.00 RC5 KT3 – K45

We have all parts for Philips Handsets
- RC5353 £15.00
- RC5300 £12.00
- Philips RC5 £15.00

TEXT-TYPE
- Replace Hand Set for Philips KT3-K30, K4 etc £12.30

THORN HAND SETS
- 9000 – 9600 – TX9 – TX10 – TX100 Text and Non-Text £10.00

PHILIPS
- RC5171 £12.00

K35-K4 HAND SET
Repaired for £5.00