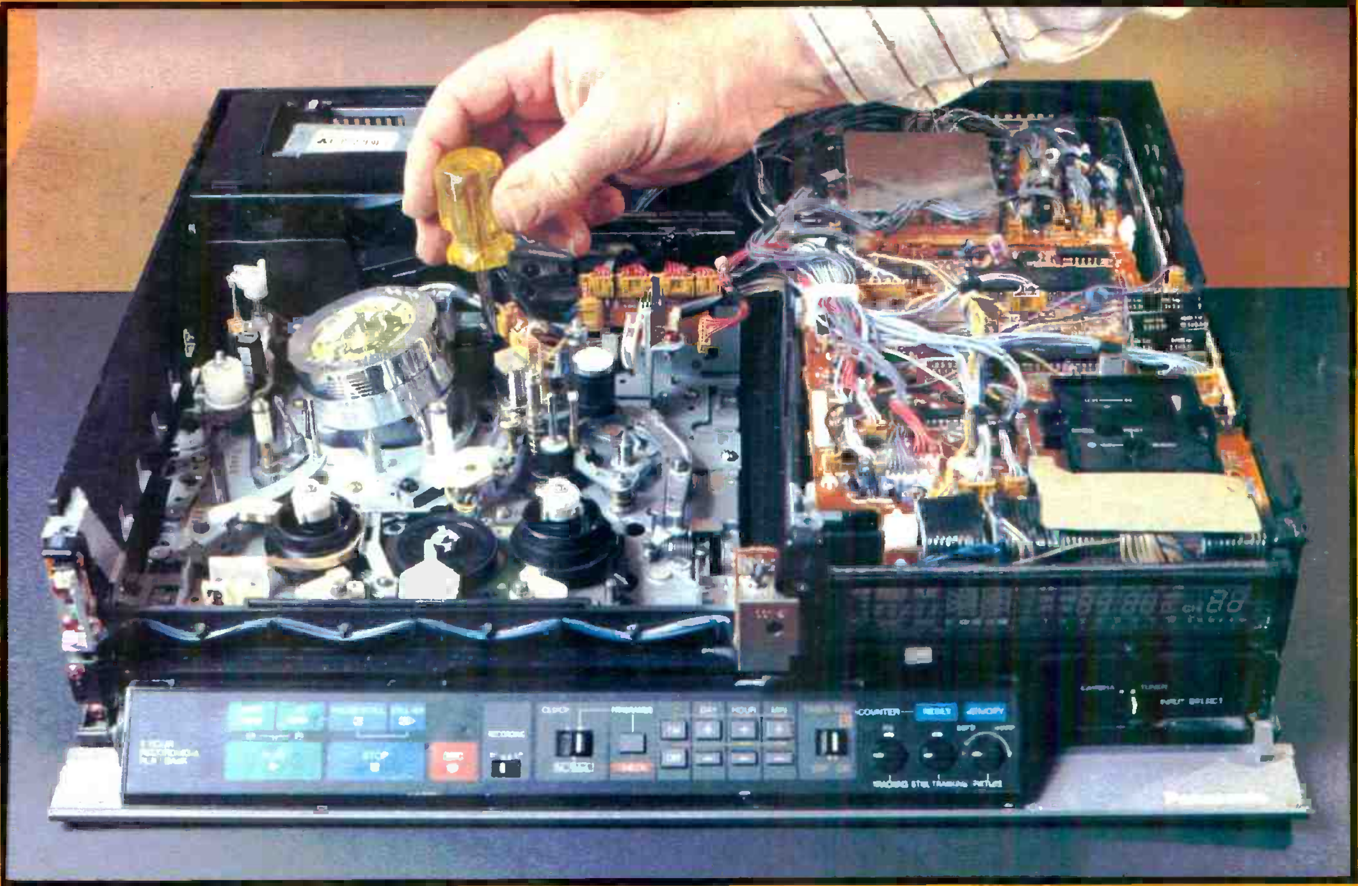
NOVEMBER 1989

Ireland

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

Extra: HRS Video Head Chart



Servicing the Panasonic NV730B
The High-band 8mm System • DX-TV
Ferguson's SRA1 Satellite Receiver
Servicing the Philips KT3 Chassis
VCR Clinic • TV Fault Finding
Dealing in Second-hand VCRs

11
9 770032 647009

TELEVISION

November 1989

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On sale October 18th

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
Indexes to Vols. 36 and 37 are available at 80p each from the Editorial Office (address above).

SUBSCRIPTIONS
An annual subscription costs £20 in the UK, £24 overseas (by surface mail). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

BACK NUMBERS
Subject to availability, copies of issues published during the last 12 months are available at £1·80 each from Television, John Denton Services, Unit 13, Thornham Grove, Stratford, London E15 1DN. Please make cheques/postal orders payable to IPC Magazines Ltd.

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

this month

OUR NEXT ISSUE DATED DECEMBER WILL BE PUBLISHED ON NOVEMBER 15

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
BB105B	18p
BB205B	24p
BC107	8p
BC108	8p
BC109	8p
BC109C	10p
BC115	10p
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BDX65	80p
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BDW94	50p
BDY20	100p
BDY92	100p
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BF154	25p
BF167	30p
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BF178	30p
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BF198	10p
BF199	8p
BF200	16p
BF225	30p
BF240	16p
BF245	25p
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BRY56	33p
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BSX29	19p
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BT119	100p
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OC36	250p
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OC200	180p
OT121	120p
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R2010B	100p

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T2800M	72p
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TIP31C	30p
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TIP32A	24p
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ZTX550	24p
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2N 706	22p
2N 708	22p
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2N.930	18p
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2N.1893	30p
2N.2102	50p
2N.2218A	24p
2N.2219	24p
2N.2221	23p
2N.2222	23p
2N.2369	15p
2N.2484	20p
2N.2646	40p
2N.2904	20p
2N.2905	20p
2N.2906	18p
2N.2907	18p
2N.2926	8p
2N.3019	28p
2N.3053	18p
2N.3054	40p
2N.3055	38p
2N.3055H	50p
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2N.4403	12p
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2N.5245	45p
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2N.5296	30p
2N.5320	90p

2N.5321	60p
2N.5366	25p
2N.5401	12p
2N.5448	12p
2N.5496	80p
2N.6107	40p
2N.6109	40p
2N.6254	110p
2N.6292	40p
2N.6384	120p
2N.6385	120p
2N.6403	160p
3N.143	65p

DIODES

Rectifier Diodes

AA119	9p
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
IN.914	2p
IN.4001	4p
IN.4002	4p
IN.4003	4p
IN.4004	4p
IN.4005	4p
IN.4006	4p
IN.4007	5p
IN.4148	2p
IN.5400	9p
IN.5401	10p
IN.5402	10p
IN.5403	11p
IN.5404	11p
IN.5405	12p
IN.5406	13p
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
8.0	125p
8.867	125p
10.0	140p
11.0	250p
12.0	120p
14.0	125p
14.756	200p
15.0	160p
16.0	130p
18.0	130p
18.432	130p
24.0	250p
48.0	160p

VOLTAGE REGULATORS

7805	35p
7806	35p
7808	35p
7812	35p
7815	35p
7818	35p
7824	35p
7905	35p
7906	40p
7908	40p
7912	40p
7915	40p
7918	40p
7924	40p
78L05	28p
78L08	28p
78L12	28p
78L15	28p
78L18	28p
78L24	28p
79L05	40p
79L08	40p
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

VALVES

DAF96	60p
DF96	50p
DL92	60p
DY86	50p
DY87	60p
DY802	75p
EABC80	60p
EB91	44p
EBF80	45p
EBF89	50p
ECC82	80p
ECC83	60p
ECC84	70p
ECC85	80p
ECH81	100p
ECH84	70p
ECL80	65p
ECL82	80p
ECL84	70p
ECL85	70p
ECL86	90p
EF80	65p
EF85	65p
EF89	85p
EF183	75p
EF184	85p
EL34	250p
EL36	90p
EL84	75p
EL95	85p
EL500	100p
EL504	130p
EY86	45p
EY87	45p
EY88	65p
EZ35	65p
EZ80	70p
EZ81	55p
GZ34	200p
PC97	100p
PCC85	60p
PCF80	80p
PCF200	135p
PCF801	110p
PCF802	80p
PCF806	115p
PCH200	100p
PCL81	62p
PCL82	80p
PCL84	50p
PCL85	80p
PCL86	80p
PCL805	80p
PFL200	110p
PL36	120p
PL82	60p
PL83	60p
PL84	80p
PL95	180p
PL500	110p
PL504	120p
PL508	200p
PL519	450p
PY81	90p
PY88	70p
PY500A	190p

L.E.D.'S

LED 3MM RED	5p
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

AN-203	210p
AN-210	165p
AN-214Q	170p
AN-228	280p
AN-236	235p
AN-240P	150p
AN-241	135p
AN-245	290p
AN-247	230p
AN-252	150p
AN-259	250p
AN-262	140p
AN-271	230p
AN-272	480p
AN-274	250p
AN-301	330p
AN-303	250p
AN-304	360p
AN-305	320p
AN-315	210p
AN-316	350p
AN-318	460p
AN-360	100p
AN-362	140p
AN-366	150p
AN-610	160p
AN-612	160p
AN-5151	600p
AN-5612	400p
AN-5620	330p
AN-5712	350p
AN-5722	140p
AN-5730	160p
AN-5732	160p
AN-5753	170p
AN-6135	150p
AN-6300	600p
AN-6320	300p
AN-6330	380p
AN-6341	350p
AN-6344	440p
AN-6350	610p
AN-6359	810p
AN-6360	400p
AN-6362	480p
AN-6371	510p
AN-6387	560p
AN-6677	550p
AN-6811	130p
AN-6876	270p
AN-6884	240p
AN-7105	210p
AN-7110	130p
AN-7114	150p
AN-7115	150p
AN-7116	130p
AN-7120	130p
AN-7130	110p
AN-7222	300p
AN-7310	90p
AN-7311	90p
AN-7410	250p
AN-7420	250p
AN-7140	450p
AN-7145	195p
AN-7146	210p
AN-7154	180p
AN-7156	240p
AN-7158	310p
AN-7168	260p

AN-7178	270p
AY3-1015	290p
AY3-1270	800p
AY3-1350	450p
AY3-8910	360p
AY3-8912	400p
BA-301	65p
BA-311	80p
BA-313	60p
BA-333	100p
BA-340	150p
BA-401	60p
BA-402	60p
BA-511	160p
BA-514	160p
BA-516	150p
BA-521	160p
BA-524	240p
BA-526	220p
BA-527	95p
BA-532	140p
BA-534	290p
BA-536	180p
BA-546	180p
BA-612	160p
BA-656	150p
BA-658	380p
BA-684	400p
BA-685	400p
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TDA-7000	200p
TDA-7040	250p
TDA-7050	200p
TDA-7211	150p
TDA-7220	150p
TDA-7240	300p
TDA-7250	600p
TDA-7255	600p
TDA-7270	150p
TDA-7274	100p
TDA-8115	300p
TDA-8140	300p
TDA-8170	320p
TDA-8190	280p
TDA-8440	380p
TDA-9403	250p
TDA-9503	240p
TDA-9513	350p

LINEAR IC'S — Cont.

TEA-1002	650p
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-1023	60p
UPC-1025	230p
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UPC-1028	90p
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UPC-1032	60p
UPC-1158H2	70p
UPC-1167CL	170p
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UPC-1185H2	230p
UPC-1186	80p
UPC-1187	150p
UPC-1188H	400p
UPC-1197	140p
UPC-1200	325p
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UPC-1365	320p
UPC-1368H	425p
UPC-1373	85p
UPC-1378	210p
UPC-1382	110p
UPC-1394	170p
UPC-1397	450p
UPC-1403CA	750p
UPC-1420CA	500p
UPC-1458	100p
UPC-1470	200p
UPC-1504C	400p
UPC-1505C	400p
UPC-1517CA	400p
UPC-1525C	400p
UPC-1536C	550p
UPC-1571C	300p
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ZN-425	320p
ZN-426	260p
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ZN-428	425p
ZN-429	215p
ZN-435	340p
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-509	120p
2SA-550	150p
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2SA-608	15p
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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
2SD-1310	140p
2SD-1326	200p
2SD-1328	60p
2SD-1347	70p
2SD-1348	85p
2SD-1350	150p
2SD-1376	125p
2SD-1379	100p
2SD-1380	100p
2SD-1383	100p
2SD-1390	350p
2SD-1391	450p
2SD-1392	150p
2SD-1395	150p
2SD-1396	240p
2SD-1397	250p
2SD-1398	210p
2SD-1399	300p
2SD-1400	280p
2SD-1402	280p
2SD-1406	120p
2SD-1407	160p
2SD-1409	190p
2SD-1415	190p
2SD-1425	430p
2SD-1426	350p
2SD-1427	380p
2SD-1428	450p
2SD-1429	410p
2SD-1430	280p
2SD-1431	400p
2SD-1432	600p
2SD-1433	750p
2SD-1438	140p
2SD-1439	320p
2SD-1441	440p
2SD-1448	140p
2SD-1450	60p
2SD-1451	260p
2SD-1453	170p
2SD-1455	320p
2SD-1457	220p
2SD-1459	120p
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-1941	500p
2SD-1609	100p	2SD-1984	150p
2SD-1632	500p	2SJ-49	425p
2SD-1649	260p	2SJ-50	425p
2SD-1651	270p	2SJ-77	350p
2SD-1663	450p	2SK-19	45p
2SD-1666	120p	2SK-49	50p
2SD-1667	120p	2SK-55	100p
2SD-1668	120p	2SK-68	100p
2SD-1677	300p	2SK-134	415p
2SD-1739	450p	2SK-135	415p
2SD-1783	100p	2SK-147	160p
2SD-1815	100p	2SK-192	45p
2SD-1825	120p	2SK-195	150p
2SD-1843	100p	2SK-197	140p
2SD-1846	350p	2SK-312	750p
2SD-1884	300p	2SK-323	130p
2SD-1910	280p	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	250p
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	79p
TIC126M	12A/600V	94p
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		850p

UHF TUNERS

U322LO	600p
U341	500p
U342	500p

VIDEO LAMPS

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

VIDEO LAMP FOR PANASONIC — 60p

CASSETTE DC MOTORS

6V	240p
9V	240p
12V CW	240p
12V CCW	240p
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

JVC/AKAI/FERGUSON 3HSS (For all Models)	£12.80
NATIONAL PANASONIC 4HSS = 3HSSN (NV322, NY332, NV340, NV2000, NV2010, NV7000, NV8170, NV8200, NV8400, NV3600, NV8610, NV8620)	£12.00

AKAI

VS-109/201/202/301/303	£24.00

AMSTRAD

VCR 4500, 5200, 9000 VCR 7000	£19.50

FERGUSON

3V32/JVC HR7655	£38.00
3V42/44/45/46/47	£21.00

FISHER

FVHP510/520/530/615/620/622/710/715/720/721/722/910	£20.75
FISHER VBS 7100/VBS 7500	£29.00
FISHER VBS 9000/VBS 9900	£29.00
FISHER VBS 7000	£30.00

HITACHI

VT11/14/33/61/63	£20.00
HITACHI VT7-17, VT35-38, VT39	£38.00
HITACHI VT19	£38.00
HITACHI VT120, VT 220	£31.50
HITACHI VT3000	£14.00
HITACHI VT5000, VT 5500	£20.00
HITACHI VT65, 7000, 8000, 8300, 8500, 8700, 9300, VT9500, 9700	£20.00

NATIONAL

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NV 730 4 HEAD	£30.50
NV 366 4 HEAD	£30.50
NV 180 PORTABLE 4 HEAD	£41.00
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SANYO

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VTCM10/11/20/21/25/30/31/35/40/50 VTC 5100, VTC 5150, VTC 5300	£28.00
VTC 5350/5370, VTCNX 10/15/20/30, VTC 5550	£28.00
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VTC 9100/9300/9455/9500	£30.50
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SHARP

VC 381, VC 383, VC 386, VC 387, VC 388, VC 482, VC 483	£19.00
VC 486, VC 3300, VC 8381, VC 9100, VC 9300, VC 9500, VC 9700, VC 582, VC 583, VC 651, VC 681, VC 750, VC 781	£19.00

SONY

DSR-35R (FOR C20, 30, 40 SLF1, SLF1UB, SLF1E)	£19.00
DSR-43R (FOR SLC7 RANGE SL 5000, SL 5100, SL 3000)	£16.50

TOSHIBA

V21/V9600	£22.00

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AKAI

VS9300, VS9500, VS9700, VS9800	280p
VS1, VS2, VS3, VS4, VS5, VS6, VS9, VS10	360p

AMSTRAD

VCR4500, VCR4600, VCR4600 Mk2, VCR4700	280p
VCR5200	360p
VCR7000	360p

FERGUSON

3V00, 3V16, 3V22, 3V23	280p
3V29-30, 3V31-32	280p
3V35-36, 3V38-39, 3V42-43, 3V44-45, 3V48,	280p
3V53, 3V54-55, 3V56-57, 3V58-59, 3V64-65, FV10-11, FV12-14	

HITACHI

VT11, VT33	280p
VT61-62, VT63-64, VT65, VT86-88,	280p
VT110-122, VT120-128, VT130-135, VT138-150, VT168,-220 VT5000, VT8000, VT9300, VT9500	280p

JVC

HR3300, HR3330, HR3360, HR3660, HR4100, HR7700	280p
HR7200, HR7330, HR7660, HR7610, HR7650, HR7655	280p
HRD110, HRD111, HRD120, HRD121, HRD140, HRD150	280p
HRD160, HRD225, HRD455, HRD565, HRD725	

MITSUBISHI

HS200, HS300, HS301, HS302, HS303, HS304, HS310,	280p
HS320, HS700	

NATIONAL

NV100, NV180, NV300, NV333, NV340, NV366, NV600,	280p
NV777, NV788	
NV230, NV370, NV430, NV460, NV730, NV810, NV830,	280p
NV850, NV870, NV890, NV2000, NV2010, NV3000, NV7000, NV7200, NV7800, NV8600, NV8610, NV8620, NVG14 NVG7, NVG10, NVG12, NVG18	360p
NVG21, NVG25, NVH65	360p

PHILIPS

VR6460	280p

SANYO

VHR1100, VHR1300, VHR1500, VHR2300	360p
VTC5000, VTC5150, VTC5500, VTC9300, VTCM10, VTCM20	280p

SHARP

VC381, VC386, VC2300, VC3300, VC7300, VC7700, VC8300	360p
VC9100, VC9300, VC9500, VC9700 VC387, VC481, VC482, VC483, VC486, VC496, VC581	360p
VC582, VC583, VC585 VC651, VC681, VC685, VC750, VC780, VC781, VC785, VC787	360p
VC793, VCT72	

SONY

SLC5, SLC6, SLC7	360p
SLC9, SLC20, SLC24, SLC30, SLC33, SLC44, SLHF100	360p
SLF1, SLF11, SLF25, SLF30, SLF60, SLF100	

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★ SOCKETS FOR TV TO VIDEO ★
★ BLACK COLOUR 2 METRES ★
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★★★★★★★★★★★★★★★

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 & Mk 2	210p
VCR-4700	210p
VCR-5200	210p
VCR-7000	80p

FERGUSON

3292, 3V00, 3V01	150p
3V16, 3V22,	
3V23	65p
3V29/30	120p
3V31/32	85p
3V35/36	80p
3V38-39	80p
3V42/43	65p
3V44/45	65p
3V45/54	65p
3V55	65p

FISHER

VBS-7000	245p
VBS-9000	120p

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

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,	100p
HRD-565, HRD-566, HRD-725, HRD-755	

MITSHUBISHI

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

PHILIPS

VR-6460	170p

SANYO

VTC-5000	75p
VTC-5300	100p
VTC-5500	95p
VTC-9300	220p

SHARP

VC-381/383/386	125p
VC-6300	150p
VC-7300/7700/7750	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-8000-8080	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

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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	700p

SHARP

REEL MOTOR RMTOV 1008 GEZZ	1500p

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	60p

IDLERS & PULLEYS REPLACEMENTS

HITACHI

FF REW IDLER 6886971	190p
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	200p

SANYO

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

SHARP

IDLER NIDL0005 GEEZ	195p
IDLER NIDL0006 GEEZ	195p

SONY

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

SERVICE AIDS

SERVISOL PRODUCTS

V. HEAD CLEANER	100p
SWITCH CLEANER	115p
SILICONE GREASE	135p
FREEZE IT	125p
FOAM CLEANER	120p
ANTI-STATIC	120p
AEROKLEANE	100p
AERO DUSTER	125p
PLASTIC SEAL	115p

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★ **UNIVERSAL TRIPLERS** ★
★ **450p** ★
★★★★★★★★★

★★★★★★★★★
★ **SONY ON/OFF SWITCHES** ★
★ **200p** ★
★★★★★★★★★

★★★★★★★★★
★ **PHILIPS SWITCHES** ★
★ **150p** ★
★K30, K35, K40, KT3, KT4★
★★★★★★★★★

4000B SERIES CMOS IC's

4000	13p
4001	13p
4002	13p
4006	34p
4007	13p
4008	38p
4009	20p
4010	21p
4011	13p
4012	13p
4013	19p
4014	32p
4016	18p
4017	29p
4018	30p
4019	28p
4020	33p
4021	36p
4022	36p
4023	13p
4024	25p
4025	13p
4026	60p
4027	18p
4028	29p
4029	34p
4030	17p
4031	90p
4032	52p
4033	60p
4034	76p
4035	42p
4036	180p
4037	75p
4038	46p
4039	180p
4040	30p
4041	36p
4042	30p
4043	36p
4044	36p
4045	72p
4046	42p
4047	45p
4048	27p
4049	18p
4050	20p
4051	38p
4052	35p
4053	35p
4054	53p
4055	52p
4056	52p
4060	40p
4063	52p
4066	20p
4067	120p
4068	13p
4069	13p
4070	13p
4071	13p
4072	13p
4073	13p
4075	13p
4076	42p
4077	13p
4078	13p
4081	13p
4082	13p
4085	36p
4086	30p
4089	75p
4093	18p
4094	44p
4095	58p
4098	50p
4099	42p
4501	27p
4502	36p
4503	30p
4504	55p
4505	180p
4506	58p
4507	30p
4508	67p
4510	32p
4511	30p
4512	38p
4513	80p
4514	65p
4515	65p
4516	36p
4517	100p
4518	36p
4519	28p
4520	36p
4521	86p
4522	43p
4526	38p
4527	41p
4528	38p
4529	65p
4532	48p
4551	75p
4553	140p
4555	29p
4556	36p
4557	140p
4583	60p
4584	30p
4585	40p
40100	120p
40101	78p
40102	150p
40103	120p
40104	80p
40105	140p
40106	35p
40107	50p
40108	260p
40109	74p
40110	170p
40114	180p
40117	180p
40147	240p
40160	55p
40161	55p
40162	55p
40163	55p
40174	48p
40175	60p
40181	170p
40182	70p
40192	48p
40193	48p
40194	58p
40208	240p
40257	120p

74 SERIES

7400	20p
7401	16p
7402	18p
7403	20p
7404	35p
7405	10p
7406	36p
7407	36p
7408	25p
7409	20p
7413	30p
7414	45p
7416	40p
7417	32p
7420	22p
7421	25p
7425	15p
7430	25p
7437	28p
7438	32p
7442	38p
7447	60p
7450	22p
7451	10p
7454	25p
7470	30p
7473	25p
7474	35p
7475	25p
7481	90p
7482	60p
7485	28p
7486	28p
7489	75p
7490	35p
7492	45p
7493	35p
7495	48p
7497	80p
74107	30p
74111	52p
74116	85p
74119	85p
74122	40p
74123	20p
74125	40p
74126	45p
74132	42p
74141	55p
74145	70p
74153	45p
74155	45p
74157	45p
74160	50p
74164	50p
74167	35p
74173	50p
74174	60p
74175	65p
74176	45p
74180	50p
74182	45p
74192	40p
74196	40p
74197	45p
74393	70p

74HC SERIES HIGH SPEED CMOS

74HC00	14p
74HC02	14p
74HC03	14p
74HC04	15p
74HC08	18p
74HC10	20p
74HC11	14p
74HC14	26p
74HC20	19p
74HC21	20p
74HC27	20p
74HC30	20p
74HC32	20p
74HC42	30p
74HC51	20p
74HC73	24p
74HC74	24p
74HC75	28p
74HC76	28p
74HC77	35p
74HC85	33p
74HC86	29p
74HC93	50p
74HC107	28p
74HC109	28p
74HC112	28p
74HC113	28p
74HC123	35p
74HC125	32p
74HC126	33p
74HC131	36p
74HC132	33p
74HC133	33p
74HC137	52p
74HC138	33p
74HC139	22p
74HC147	42p
74HC148	38p
74HC151	32p
74HC153	32p
74HC154	90p
74HC155	48p
74HC157	34p
74HC158	34p
74HC160	44p
74HC161	44p
74HC162	44p
74HC163	44p
74HC164	44p
74HC165	56p
74HC166	60p
74HC173	52p
74HC174	38p
74HC175	38p
74HC181	180p
74HC182	60p
74HC190	46p
74HC191	55p
74HC192	53p
74HC193	41p
74HC194	46p
74HC195	46p
74HC221	80p
74HC237	50p
74HC238	55p
74HC240	48p
74HC241	47p
74HC242	55p
74HC243	60p
74HC244	44p
74HC245	48p
74HC251	25p
74HC253	36p
74HC257	40p
74HC258	50p
74HC259	52p
74HC273	42p
74HC279	35p
74HC280	61p
74HC283	61p
74HC298	50p
74HC299	105p
74HC354	38p
74HC356	48p
74HC365	34p
74HC366	36p
74HC367	36p
74HC368	36p
74HC373	46p
74HC374	48p
74HC375	52p
74HC377	52p
74HC386	20p
74HC390	50p
74HC393	47p
74HC423	65p
74HC533	65p
74HC534	61p
74HC540	70p
74HC541	70p
74HC563	60p
74HC564	60p
74HC573	68p
74HC574	65p
74HC583	90p
74HC595	85p
74HC597	80p
74HC620	110p
74HC623	110p
74HC640	90p
74HC643	90p
74HC646	120p
74HC648	120p
74HC651	100p
74HC652	100p
74HC670	75p
74HC688	80p
74HC690	110p
74HC691	110p
74HC4002	25p
74HC4015	85p
74HC4016	75p
74HC4017	48p
74HC4020	50p
74HC4022	40p
74HC4024	34p
74HC4028	40p
74HC4040	34p
74HC4049	38p
74HC4050	38p
74HC4051	85p
74HC4052	85p
74HC4053	85p
74HC4059	85p
74HC4060	33p
74HC4066	33p
74HC4072	31p
74HC4075	26p
74HC4078	32p
74HC4094	50p
74HC4316	100p
74HC4351	110p
74HC4352	160p
74HC4510	120p
74HC4511	70p
74HC4514	120p
74HC4515	120p
74HC4516	125p
74HC4518	55p
74HC4520	60p
74HC4538	75p
74HC4543	75p
74HC7266	75p
74HC22106	580p
74HC40104	190p
74HC40105	250p

74LS SERIES LOW POWER SCHOTTKY T.T.L.

74LS00	12p
74LS01	12p
74LS02	12p
74LS03	12p
74LS04	12p
74LS05	12p
74LS08	12p
74LS09	14p
74LS10	12p
74LS11	12p
74LS12	12p
74LS13	20p
74LS14	24p
74LS15	14p
74LS20	14p
74LS21	14p
74LS22	14p
74LS24	35p
74LS26	14p
74LS27	14p
74LS28	14p
74LS30	14p
74LS32	15p
74LS33	15p
74LS31	15p
74LS38	15p
74LS40	15p
74LS42	25p
74LS47	52p
74LS48	48p
74LS51	13p
74LS54	13p
74LS55	15p
74LS73	24p
74LS74	18p
74LS75	24p
74LS76	24p
74LS78	24p
74LS83	37p
74LS85	37p
74LS86	25p
74LS90	26p
74LS91	55p
74LS92	32p
74LS93	26p
74LS95	41p
74LS96	52p
74LS107	28p
74LS109	28p
74LS112	28p
74LS113	28p
74LS114	28p
74LS122	35p
74LS123	35p
74LS124	85p
74LS125	30p
74LS126	30p
74LS132	30p
74LS133	30p
74LS136	30p
74LS138	28p
74LS139	28p
74LS145	65p
74LS147	90p
74LS148	75p
74LS151	27p
74LS153	31p
74LS154	78p
74LS155	36p
74LS156	36p
74LS157	22p
74LS158	27p
74LS160	38p
74LS161	38p
74LS162	38p
74LS163	36p
74LS164	36p
74LS165	50p
74LS166	55p
74LS168	60p
74LS169	55p
74LS170	68p
74LS174	30p
74LS175	32p
74LS190	47p
74LS191	43p
74LS192	41p
74LS193	41p
74LS194	41p
74LS195	44p
74LS196	45p
74LS197	42p
74LS221	45p
74LS240	45p
74LS241	42p
74LS242	43p
74LS243	50p
74LS244	40p
74LS245	40p
74LS247	40p
74LS248	40p
74LS249	70p
74LS251	24p
74LS253	36p
74LS256	52p
74LS257	32p
74LS258	35p
74LS259	50p
74LS260	30p
74LS266	22p
74LS273	44p
74LS279	33p
74LS280	88p
74LS283	51p
74LS290	26p
74LS293	26p
74LS365	26p
74LS366	31p
74LS367	28p
74LS368	30p
74LS373	45p
74LS374	45p
74LS375	46p
74LS390	42p
74LS393	37p
74LS399	68p
74LS629	95p
74LS641	88p
74LS642	105p
74LS644	105p
74LS645	105p
74LS670	62p
74LS674	310p
74LS687	250p

COMPUTER IC'S

2114	200p
2532	330p
2716	200p
2732	280p
2732A	300p
2764	240p
27C64	550p
27128	350p
26256-25	400p
41256-12	450p
256DRAM	450p
4116	75p
4164	150p
6116	180p
6264	400p
6502	300p
6502A	400p
65C02	930p
6503	570p
6520	170p
6522	330p
6530	1050p
6532	460p
6545	880p
6551	530p
6800	210p
6802	220p
6803	800p
6808	500p
6809	600p
6810	150p
6818	380p
6820	140p
6821	140p
6840	310p
6845	620p
6850	110p
8080A	400p
8085A	300p
8086	500p
8088	500p
8155	360p
8156	360p
81LS95	120p
81LS96	130p
81LS97	130p
81LS98	130p
8224	240p
8226	240p
8228	270p
8243	250p
8250	850p
8087	11000p
8251	270p
8253	230p
8255	200p
8256	1200p
8257	220p
8259	280p
8271	3400p
8272	1200p
8279	270p
8282	300p
8283	400p
8284	440p
8287	360p
8288	650p
8748	1100p
8755	1400p
AY3-1015	290p
SP0256AL2	500p
Z80ACPU	150p
Z80BCPU	400p
Z80ADMA	500p
Z80AP10	220p
Z80BP10	340p
Z80ACTC	200p
Z80BCTC	320p
Z80AS10	460p
Z80AS10-1	580p
Z80BP10-2	580p
Z80ADART	500p
74S289	180p
74S387	200p
75107	65p
75110	75p
75113	100p
75122	110p
75150	95p
75154	100p
75162	700p
75182	95p
75183	95p
75188	55p
75189	55p
75195	185p
75451	40p
75454	65p
75492	55p
8T26	95p
8T28	110p

OPTO COUPLERS

4N25	50p
4N26	50p
4N27	50p
4N28	50p
4N29	50p
4N30	90p
4N31	90p
4N32	100p
4N33	100p
4N36	58p
4N37	58p
4N38	58p

LED DISPLAYS

MAN.72	115p
MAN.74	115p
MAN.4640	180p
MAN.8910	230p
DL.747	160p

SOLDERING IRON

ANTEX XS25W 240V Soldering Iron 240Vac	540p
Spare Element for XS25W 240V	260p
ANTEX C15W 240V Soldering Iron 240Vcm	540p
Spare Element for C15W 240V	260p

DESOLDERING PUMP SOLDERING IRON

ANTEX XS25W 240V Soldering Iron 240Vac	540p
Spare Element for XS25W 240V	260p
ANTEX C15W 240V Soldering Iron 240Vcm	540p
Spare Element for C15W 240V	260p

DESOLDERING PUMP

Desolder Pump	290p
Spare Nozzle	60p

SOLDER MOP	65p

SOLDER

18 SWG	500g	500p
20 SWG	500g	650p

SOLDERING IRON STAND

Soldering Stand	200p
Spare Sponge	40p

FLOPPY DISCS

$5^{1}/_{4}$ inch DSDD (10 in box) Branded Name	£7.50
$5^{1}/_{4}$ inch DSDD (bulk pack) 25	£10.00
$3^{1}/_{2}$ inch DSDD (10 in box) Branded Name	£13.00
3 inch CF2 Branded Name	£2.40
3 inch CF2D Branded Name	£3.00

PLEASE PHONE US FOR TYPE NOT LISTED HERE AS WE ARE HOLDING 5000 ITEMS AND QUOTATIONS ARE GIVEN FOR LARGE QUANTITIES.
Please send 70p P&P and VAT at 15%. Govt, Colleges, etc. Orders accepted. Quotations given for large quantities. Please allow 7 days for delivery. All brand-new Components. All valves are new and boxed. Prices quoted are subject to stock availability and may be changed without notice.

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No. 1 LIST BAKERS DOZEN PACKS

All packs are £1 each, if you order 12 then you are entitled to another free. Please state which one you want. Note the figure on the extreme left is the pack ref number and the next figures is the quantity of items in the pack, finally a short description.

BD2	5	13A spurs provide a fused outlet to a ring main where device such as a clock must not be switched off
BD7	4	in flex switches with neon on/off lights, saves leaving things switched on
BD9	2	6v. 1A mains transformers upright mounting with fixing clamps
BD11	1	6½" speaker cabinet ideal for extensions, takes your speaker. Ref BD137 + 50p.
BD13	12	30 watt reed switches, it's surprising what you can make with these – burglar alarms, secret switches, relay etc. etc.
BD22	2	25 watt loud speaker two unit cross-overs
BD29	1	B.O.A.C. stereo unit is wonderful breakdown value
BD30	2	nicad constant current chargers adapt to charge almost any nicad battery
BD32	2	humidity switches, as the air becomes damper the membrane stretches and oeprates a microswitch
BD42	5	13A rocker switch three tag so on/off, or change over with centre off
BD45	1	24hr time switch, ex-Electricity Board, automatically adjust for lengthening and shortening day.
BD49	5	neon valves, with series resistors, these make good night lights
BD56	1	mini uniselector, one use is for an electric jigsaw puzzel, we give circuit diagram for this. One pulse into motor, moves switch through one pole
BD59	2	flat solenoids – you could make your multi-tester read AC amps with this
BD67	1	suck or blow operated pressure switch, or it can be operated by any low pressure variations such as water level in water tanks
BD103A	1	6v 750MA power supply, nicely cased with input and output leads
BD120	2	stripper boards each contains a 400v 2A bridge rectifier and 14 other diodes and rectifiers as well as dozens of condensers etc
BD128	10	very fine drills for p.c.b boards etc. Normal cost about 80p each
BD132	2	plastic boxes approx. 3" cube with square hole through top so ideal for interrupted beam switch
BD134	10	motors for model aeroplanes, spin to start so needs no switch
BD139	6	microphone inserts – magnetic 490 ohm also act as speakers
BD148	4	reed relay kits you get 16 reed switches and 4 coil sets with notes on making c/o relays and other gadgets
BD149	6	safety cover for 13A msockets – prevent those inquisitive little fingers getting nasty shocks
BD180	6	neon indicators in panel mounting holders with lens
BD193	6	5 amp 3 pin flush mounting sockets makes a low cost disco panel – need cable clips
BD196	1	in flex simmerstat – keeps your soldering iron etc always at the ready
BD199	1	mains solenoid very powerful has 1" pull or could push if modified
BD201	8	keyboard switches – made for computers but have many other applications
BD211	1	electric clock mains operated put this in a box and you need never be late
BD221	5	12v alarms make a noise about as loud as a car horn. Slightly soild but OK
BD242	2	6" × 4" speakers 4 ohm made from Radiomobile so very good quality
BD252	1	panostat, controls output of boiling ring from simmer to boil
BD259	50	leads with push on ¼" tags – a must for hook ups – mains connections etc
BD263	2	oblong push switches for bell or chimes, these can mains up to 5 amps so could be foot switch if fitted into pattress
BD268	1	mini 1 watt amp for record player. Will also change speed of record player motor
BD283	3	mild steel boxes approximately 3" × 3" × 1" deep – standard electrical
BD293	50	mixed silicon diodes
BD305	1	tubular dynamic mic with optional table rest
BD667	2	4.7uf, non-polarised block capacitors, pcb mounting
BD400	4	Books. Useful for beginners. Describes amplifiers, test equipment and kit sets
BD653	2	Miniature driver transformers Ref LT44. 20k to 1k, centre tapped
BD553a	2	3.5 volt operated relays, each with two pairs CO contacts

There are over 1,000 items in our Bakers Dozen List. If you want a complete copy please request this when ordering.

EQUIPMENT WALL MOUNT. It is a multi-adjustable metal bracket that could be used for mounting flood light, loud speaker, TV camera, even a fan and on almost any sort of wall or ceiling even between wall and ceiling. The main fixing brackets rotate such that an inward or an outward corner can be accommodated Front panel also tilts upwards or downwards to a reasonable angle and can be easily removed separately for wiring. A very useful bracket. Regular price would be around £6 each. Our price only £3 Our ref 3P72. Or 2 for £5. Our ref 5P152

EXTRA SPECIAL CROC CLIPS. Medium size, just right for most hook-ups Normally sell for around 10p to 15p each These are insulated and have a length of wire connected to them but this is very easy to snip off if you do not need it. 20 for £1 Our ref BD117A

COPPER CLAD PANEL for making PCB. Size approx 12in long × 8½in wide Double-sided on fibreglass middle which is quite thick (about 1/16in) so this would support quite heavy components and could even form a chassis to hold a mains transformer, etc. Price £1 each. Our ref BD683.

FET CAPACITOR MICROPHONE EAGLE C1.200 Output equivalent to a high class dynamic microphone while retaining the characteristics of a capacitor microphone. Price £1. Our ref BD646

SUB-MAN TOGGLESWITCH Body size 8mm × 4mm × 7mm SBDT with chrome dolly fixing nuts. 3 for £1.00 Order ref BD649.

POWERFUL IONISER

Generates approx. 10 times more IONS than the ETI and similar circuits. Will refresh your home, office, shop workroom etc. Makes you feel better and work harder – a complete mains operated kit, case included **£12.50 + £2 P&P.** Our ref 12P5/1.

REAL POWER AMPLIFIER for your car, it has 150 watts output. Frequency response 20hz to 20Khz and signal to noise ratio, better than 60 d/b. Has built in short circuit protection and adjustable input level to suit your existing car stereo, so needs no pre-amp. Works into speakers. Ref. 30P7 described below. A real bargain at only £57.50. Order ref: 57P1.

REAL POWER CAR SPEAKERS. Stereo pair output 100w each. 4-Ohm impedence and consisting of 6½" woofer, 2" mid range and 1" tweeter. Each set in a compact purpose built shelf mounting unit. Ideal to work with the amplifier described above. Pric eper pair £29.96. Order ref: 30P7.

STEREO CAR SPEAKERS. Not quite so power – 70w per channel. 3" woofer, 2" mid range and 1" diameter. Again, in a super purpose built shelf mounting unit. Price per pair: £27.95. Order ref: 28P1.

ELECTRONIC SPACESHIP. Sound and impact controlled, responds to claps and shouts and reverses when it hits anything. Kit with really detailed instructions. Ideal present for budding young electrician. A youngster should be able to assemble but you may have to help with the soldering of the components on the pcb. Complete kit £8. Our ref 8P30.

12" HIGH RESOLUTION MONITOR. Black and white screen, beautifully cased for free standing, needs only a 12v 1.5 amp supply. Technical data is on its way but we understand these are TTL input. Brand new in maker's cartons. Price: £25.00 plus £5 insured delivery. Order ref: 25P10.

14" COLOUR MONITOR made by the American Display Tek company. Uses high resolution tube made by the famous Japanese Toshiba company. Beautifully made unit intended for console mounting, but top and sides adequately covered by plated metal panels. Full technical spec. on its way to us. We have a limited number of these. All brand new still in maker's cartons. Price: £89 each plus £6 insured carriage. Order ref: 89P/1.

BUSH RADIO MIDI SPEAKERS. Stereo pair. BASS reflex system, using a full range 4in driver of 4ohms impedance. Mounted in very nicely made black fronted walnut finish cabinets. Cabinet size approx 8½in wide, 14in high and 3½in deep. Fitted with a good length of speaker flex and terminating with a normal audio plug. Price £5 the pair plus £1 post Our ref 5P141

3½in FLOPPY DRIVES. We still have two models in stock: Single sided, 80 track, by Chinon. This is n the manufacturers metal case with leads and ICD connectors. Price £40, reference 40P1 Also a double sided, 80 track, by NEC. This is uncased. Price £59.50, reference 60P2 Both are brand new. Insured delivery £3 on each or both.

ATARI 65XE COMPUTER At 64K this is most powerful and suitable for home and business. Brand new, complete with PSU, TV lead, owner's manual and six games. Can be yours for only **£45 plus £3 insured delivery.**

REMOTE CONTROL FOR YOUR 65XE COMPUTER. With this outfit you can be as much as 20 feet away as you will have a joystick that can transmit and a receiver to plug into and operate your computer and TV. This is also just right if you want to use it with a big screen TV. The joystick has two fire buttons and is of a really superior quality, with four suction cups for additional control and one handed play. Price £15 for the radio controlled pair. Our ref 15P27.

65XE COMPENDIUM. Containts: 65XE Computer, its data recorder XC12 and its joystick, with ten games, for £62.50 plus £4 insured delivery

ASTEC PSU. Mains operated switch mode, so very compact. Outputs: +12v 2.5A, +5v 6A, ±5v .5A, ±12v .5A. Size: 7¼in long × 4⅜in wide × 2¾in high. Cased ready for use. Brand new. Normal price £30+, our price only £12.95. Our ref 13P2.

VERY POWERFUL 12 VOLT MOTOR. ⅓rd Horsepower. Made to drive the Sinclair C5 electric car but adaptable to power a go-kart, a mower, a rail car, model railway, etc. Brand new. Price £20 plus £2 postage. Our ref 20P22.

PHILIPS LASER

This is helium-neon and has a power rating of 2mW. Completely safe so long as you do not look directly into the beam when eye damage could result. Brand new, full spec, £30 plus £3 insured delivery. Mains operated power supply for this tube gives 8kv striking and 1.25kv at 5mA running. Complete kit with case £15, ditto for 12v battery. Also £15. Our ref 15p22.

ORGAN MASTER. Is a three octave musical keyboard It is beautifully made, has full size (piano size) keys, has gold plated contacts and is complete with ribbon cable and edge connector. Can be used with many computers, request information sheet. Brand new, only £15 plus £3 postage. Our ref 15P15.

FULL RANGE OF COMPONENTS at very keen prices are available from our associate company SCS COMPONENTS. You may already have their catalogue, if not request one and we will send it FOC with your goods.

HIGH RESOLUTION MONITOR. 9in black and white, uses Philips tube M24/306W. Made up in a lacquered frame and has open sides. Made for use with OPD computer but suitable for most others Brand new, £16 **plus £5 post.** Our reference 16P1.

12 VOLT BRUSHLESS FAN. Japanese made. The popular square shape (4½in × 4½in × 1¾in). The electronically run fans not only consume very little current but also they do not cause interference as the brush type motors do. Ideal for cooling computers, etc, or for a caravan. **£8 each.** Our ref 8P26.

MINI MONO AMP. on p.c.b. size 4" × 2" (app.) Fitted volume control and ahole for a tone control should you require it. The amplifier has three transistors and we estimate the output to be 3W rms. More technical data will be included with the amp. Brand new, perfect condition, offered at the very low price of **£1.15 each of 13 for £12.00**

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Dept. T.V., 250 PORTLAND ROAD, HOVE, BRIGHTON, SUSSEX BN3 5QT.

MAIL ORDER TERMS: Cash, P.O. or cheque with order. Orders under £20 add £2.00 service charge. Monthly account orders accept from schools and public companies Access & B/card orders are accepted – minimum £5 Phone (0273) 734648 or 203500.

POPULAR ITEMS – MANY NEW THIS MONTH

TELESCOPIC FM AERIAL. Stands up or folds over Solidly constructed and heavily nickel plated. Supplied complete with fixing nut. Price £1 each Order ref: BD717

TELEPHONE TYPE KEY PAD. Really first class rear mounting unit. White lettering on black buttons. Has conductive rubbers contacts with soft click operation. Circuit arranged in telephone type array. Requires 70mm by 55mm cut out and is connected by 10-pin IDC socket. Price: £2.00 each. Order ref 2P251.

JOYSTICKS for BBC, Atari, Dragon, Commodore, etc All £5 each. State which required

SUB-MIN PUSH SWITCHES. Not much bigger than a plastic transistor but double pole. PCB mounting. Three for £1 Our ref BD688

CARTRIDGES for the Double Microdrive Price 4 for £5. Our ref 5P146.

NICAD CHARGER UNIT. Metal pronged, plastic case contains mains transformer and rectifiers with output lead and plug – made to charge two cells but no doubt adaptable or wonderful spares value. Only 50p each, two for £1. Our ref DB385.

EDGEWISE PANEL METER. If you are short of panel space then this may be the answer. It has a FSD of 100μA and a nice full vision scale. It fits through a hole approx 1¼in × ½in Another feature is that it has an indicator lamp behind the scale which you could light up, it would then serve as an on/off indicator. Price £1. Our ref BD700.

AA CELLS. Probably the most popular of the rechargeable NICAD types. 4 for £4. Our ref 4P44.

COMPUTER SPECIAL. The Perex 16meg Byte tape streamer. These are brand new and really an exceptional bargain A few only so hurry. Only £15. Our ref 15P29.

20WATT 400HM SPEAKER. With built-in tweeter Really well made unit which has the power and the quality for hi-fi reproduction. 6½in diameter. Price £5. Our ref 5P155 It is heavy so please add £1 to cover postage if not collecting.

MINI RADIO MODULE. Only about 2in square with ferrite aerial and solid dia tuner with its own knob It is a superhet and it operates from PP3 battery and would drive a crystal headphone direct but be better with our mini mono amp. Price £1. Our ref BD716

BULGIN MAINS PLUG AND SOCKET. The old faithful 3 pin with screw terminals The socket mounts through a 1½in hole and the mains is brought in by the insulated plug. Used to be quite expensive but you can have 2 pairs for £1 or 4 of either plug or socket for £1. You could make yourself a neat and compact bench panel with these. Our ref BD715, BD715S or BD715P

MICROPHONE. If you want a low cost microphone then just arrived we have a very small hand-held dynamic mic with on/off switch in the handle, its lead terminates with one 3.5 plug and the other a 2.5 plug for remote control. Price only £1 Our ref BD711.

EXTENSION CABLE WITH A DIFFERENCE. It is flat on one side making it easy to fix and to look tidy It is 4 core so suitable for telephone, bell, burglar alarms, etc. 50 yard coil for £5. Our ref 5P153.

MOSFETS FOR POWER AMPLIFIERS AND HIGH CURRENT DEVICES. 140v 100w pair made by the famous Hitachi Company. Reference 25K413 and its compliment 25J118 Only £4 the pair. Our ref 4P42.

BATTERY OPERATED TRAVEL MECHANISM. On a plastic panel measuring approx 9in × 3½in. Is driven by a reversible 12v battery motor, fitted with pulley and belt which rotates a threaded rod and causes a platform to travel backwards and forwards through a distance of approx 5in Price £5. Our ref 5P140.

MAINS OPERATED WATER VALVE with hose connection for inlet and outlet suitable for low pressure. Auto plant watering, etc. Only £1 each Our ref BD370.

20 VOLT 4AMP MAINS TRANSFORMER. Upright mounting with fixing feet. Price £3. Our ref 3P59.

16 OHM PM SPEAKERS. Approx 7in × 4in. 5 watts. Offered at a very low price so you can use two in parallel to give you 10 watts at 8 ohms. £1 for the two Our ref BD684

EHT TRANSFORMER. 4kv 2mA Ex-unused equipment. £5 Our ref 5P139

4 CORE TINSEL COPPER LEAD. As fitted to telephones, terminating with flat BT plug. 2 for £1. Our ref BD639.

EHT TRANSFORMER. 8kv 3mA £10. Our ref 10P56

VERY USEFUL MAGNETS. Flat, about 1in long, ½in wide and ¼in thick. Very powerful. 6 for £1. Our ref BD274(a)

ACORN COMPUTER DATA RECORDER. Ref ALF03 Made for the Electron or BBC computers but suitable for most others. Complete with mains adaptor, leads and handbook £10.00. Ref 10P44. Add £2 special packing

SOLAR CELLS. Will give a good current (depending on size) from sunlight or bright daylight. Module A gives 100mA. Price £1. Our ref BD631. Model C gives 400mA. Price £2. Our ref 2P199. Module D gives 700mA. Price £3. Our ref 3P42.

SOLAR POWERED NI-CAD CHARGER 4 NI-CAD batteries AA (HP7) charged in eight hours or two in only 4 hours. It is complete, boxed ready to use unit Price £6. Our Ref. 6P3.

METAL PROJECT BOX. Ideal size for battery charger, power supply etc; sprayed grey, size 8" × 4¼" × 4" high, ends are louvered for ventilation other sides are flat and undrilled Price £3. Order Ref. 3P75.

13A PLUGS. Sleeved and complete with fuse, parcel of 5 for £2 Order Ref. 2P186

CAPACITOR BARGAIN – axial ended – 4700uf @ 25v Jap made. Normally 50p each, but you will get 4 for £1 Ref 613

SINGLE SCREENED FLEX 7 02 copper conductors, pvc insulated then with cooper screen, finally outer insulation. In fact quite normal screened flex 10m for £1 Our ref BD668.

3 CORE FLEX BARGAIN No. 1 – Core size 5mm so ideal for long extension leads carrying up to 5 amps or short leads up to 10 amps. 15mm £2 Ref 2P189

3 CORE FLEX BARGAIN No. 2 – Core size 1 25mm so suitable for long extension leads carrying up to 13 amps – or short leads up to 25A. 10m for £2 Order Ref 2P190

ALPHA-NUMERIC KEYBOARD – this keyboard has 73 keys with contactless capacitance switches giving long trouble free life and no contact bounce The keys are arranged in two groups, the main area field is a QWERTY array and on the right is a 15 key number pad, board size is approx. 13" × 4" – brand new but offered at only a fraction of its cost namely £3, plus £1 post. Ref 3P27

1/6TH HORSEPOWER 12 VOLT MOTOR. Made by Smiths, the body length of this is approximately 3in, the diameter 3in and the spindle 3/16th of an inch diameter. It has a centre flange for fixing or can be fixed from the end by means of 2 nuts. A very powerful little motor which revs at 3,000 rpm. We have a large quantity of them so if you have any projects in mind then you could rely on supplies for at least two years Price £6. Our ref 6P1, discount for quantities of 10 or more

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Lightweight superdynamic headphones with samarium cobalt mylar transducers designed for use with Compact Disc. Swivelling earcups fit comfortably and exactly on the ears. Ratchet adjustable tough plastic headband. All black finish.

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WEIGHT	185gm	POWER	100MW
IMPEDANCE	32Ω	LEAD	2M Screened
RESPONSE	20-20000Hz	PLUG	6.35mm

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Hand held or hanging. Heat resistant poly carbonate housing; highly polished reflector. Protective lens cover, doubles as base stand. With On/Off switch and 12ft curly cable terminating in cigar lighter plug. Produces 250,000 candle power – 5 times the intensity of average car headlamps. Power: 12Vd.c 4.5A. 55W. Dims: 160 × 88 × 110mm.

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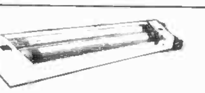
12V Twin Fluorescent Lamp



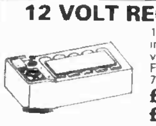
12" Double Tubes

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

Ideal for Caravans, Boats, Vans etc.

	1+	10+	50+
PRICE	£5.99	£4.99	£4.50

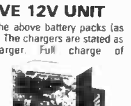
12 VOLT RECHARGEABLE UNIT



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

£9.19 each + P&P £1.85
£8.34 for 10 + P&P £4.50

CHARGING UNIT FOR THE ABOVE 12V UNIT



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

4-PIN £11.50 6-PIN £11.50 + £1.85 P&P

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TEKTRONIX D755 – 50 meg. Solid State.
Price £295.00 incl. V.A.T. Carriage £12.00

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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

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Reception can be obtained on any F.M. Radio.
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Price: **£9.99**

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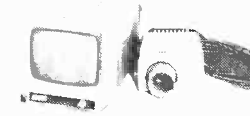

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EBC41	1.45	EL84	1.30	PL33	1.80
EBC81	1.10	EL86	1.45	PL84	1.20
EBF80	0.60	EL509	7.25	PL504	1.80
EBF83	1.35	EL519	7.25	PL508	1.35
EBF89	0.85	EM80	1.50	PL519/509	5.55
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ECC81	1.75	EM87	4.75	PY81/800	1.35
ECC82	1.08	EY51	1.10	PY88	0.85
ECC83	1.40	EY86/87	0.85	PY500A	2.35
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ECL85	1.20	PCF82	0.75	6K7G	3.05
ECL86	1.25	PCF86	1.35	6X4	1.75
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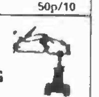

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High quality 12 Volt Universal Video Cassette Recorder Lamp and Head Lead length. Approx. 30cm.
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PRICE – 60p

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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
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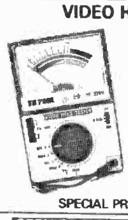
VIDEO HEAD TESTER



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 £35

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CORRECTION
Our news item on Rumbelows last month was inaccurate: see correction on page 15.

HELD OVER
Due to shortage of space in this issue we have had to hold over the next instalment in the series on servicing Salora CTVs. We'll be back next month with the J series chassis.

COVER PHOTO
This month's cover photograph shows the Panasonic NV730B with the top cover removed. See article on pages 19-21.

Strategy at Sony

The strange things that happen as firms evolve and grow never cease to amaze. We've commented on this subject before, in particular on the fashion of firms in the English-speaking world to become conglomerates during the Sixties and Seventies and then, more recently, to revert to the core-business strategy. The fascination is that some horrendous mistakes can occur when firms decide to become active in fields outside their traditional ones. Also when they stick to their own trade but venture abroad, as the sad case of the Midland's Bank's experiences in California after buying the Crocker Bank show.

This sort of question must be in many people's minds as they contemplate the recent, and initially somewhat puzzling, moves by Sony. The Sony Corporation, a comparative newcomer amongst the giants of the Japanese electronics industry, having been formed just after the war, first established a reputation as a superb innovator in the field of consumer electronics, with a long list of successful launches. It was inevitable that at some stage Sony would feel the need to venture into fresh fields. The initial moves, many years ago now, were logical and closely related to the company's original activities – it quickly established an enviable reputation in the fields of professional and broadcasting equipment. Subsequently it moved into industrial and office electronics, again a logical step into fields where similar technology is used. Last year Sony's fastest growing businesses were in computer disc drives, semiconductor devices and engineering work stations. What we have seen more recently however has been moves into quite different types of business activity – first records and now film and TV production.

This latest strategy started when Sony, in 1987, bought the world's largest music recording company CBS Records for $2 billion What would it do with CBS? The answer, for the time being, seems to let it be. There probably wasn't much else that Sony, lacking experience in the software side of the audio business, could do. It was a surprise move, but one has to recall that there is a long history of firms that combined home entertainment and the supply of the equipment required for it. One thinks in particular of EMI and Decca in the UK, RCA in the USA and Telefunken in Germany. When Decca was going through a rough period in the late Twenties it seemed logical to start supplying gramophones through the outlets that sold its records. We eventually had the famed Deccola, Deccalian and so on! And what more fitting in those days than to play HMV's superb shellac pressings on their equally excellent radiograms? But for some reason this strategy has long been abandoned in the West, where the electronics and music industries have gone their separate ways.

The tape era possibly once again made closer links between home entertainment software and hardware more logical. After all, if you can make the cassettes it's not a giant step to supplying them complete with the music. Sony's entry into the recording field has not been a high-profile one, rather a case of extracting whatever benefits there are from the business synergies. Sony's latest move, in taking over Columbia Pictures for $3·4 billion, is seen by the company as being a development along the same basic path. It subsequently took over Guber-Peters Entertainment for $200 million in a related move.

Columbia gives Sony a large library, the fourth largest in the world, of visual software – some 2,700 films and 23,000 television shows. It has paid a high price for them however. In its last reported quarter, to May 1989, Columbia managed to make a profit of just $400,000 on a turnover of over $351 million. Hardly a huge success in business terms. In fact Columbia has been making substantial losses on its film making activities, the profit coming from its television production operations. Moreover the price Sony is paying for Columbia works out at a price-earnings ratio of 350, which is not staggering by some Japanese standards but is breathtaking by Western ones. You have to be pretty sure of the potential to pay that sort of price, yet Sony has no experience of programme making and, as with CBS Records, has announced its intention to leave matters in the hands of local management

There's no great secret in Sony's belief that being a major player in the film/TV programme making field will assist one of its main longer-term aims, to get 8mm video established as a successor to the 16mm VHS system. Beta lost out in the 16mm video systems war largely because JVC/Matsushita were quicker to licence out their technology and, once substantial libraries of VHS recordings had been established, no one was particularly keen to duplicate them in Beta form. Now Sony appears to feel that with major interests in the software side of the industry it will have a better chance of calling the tune.

However this may work out, Sony has taken a considerable risk. With Columbia and CBS as subsidiaries, about a quarter of Sony's sales will be in the software field. This is a highly competitive field of which Sony has no direct experience. The entertainment industry is also extremely fickle in comparison to the relatively stable Japanese consumer electronics industry. Sony is paying for Columbia with a bridging loan, after which it will raise long-term funds. It can well afford this provided its other activities continue to make good profits – and the electronics side has been doing well following the difficult period of the overvalued yen in 1986-8. It will be interesting, to say the least, to see how Sony's strategy succeeds.

Teletopics

CHANNEL 5 COVERAGE

The Department of Trade and Industry has issued a map showing the anticipated coverage of the new Channel 5, which is expected to start broadcasting in 1993. One reason for the delay is that the Channel 5 franchise will not be awarded until after the present ITV franchises come up for renewal in 1992. Twenty five transmitters using channels 35 and 37 should enable Channel 5 to reach about seventy per cent of the population. Coverage is limited by the need to avoid interference to Irish, French and Belgian TV services. Areas that will not be covered include much of Scotland, Cumbria, Wales and the Welsh border area, a large part of Cambridgeshire/Suffolk/Essex and most of the south coast, including much of Kent, Sussex and Hampshire. Those who will be able to receive the service will require a new aerial just for Channel 5.

One problem is that many VCRs and the sets with which they are used will have to be retuned. That's quite a bit of work for the trade. The government intends that the cost of this should be borne by the holder of the franchise.

TV DEVELOPMENTS

The BBC demonstrated a system called digitally-assisted television (DATV) at the recent Berlin International Television and Radio Festival. This significant development enables a high-definition TV signal to be transmitted in an existing broadcast channel. The BBC has been working on the system, which uses a separate subcarrier to carry digital instructions that enable the receiver to regenerate high-definition pictures, for about three years. Field storage is required in the receiver, but this is now becoming a fairly common feature with up-market models. The BBC's DATV technique enables a 30MHz, 1,250-line signal to be transmitted in a standard 5·5MHz, 625-line channel.

Much work on improving the present PAL system is being undertaken in West Germany. The Institute of Broadcasting Technology has developed improved PAL (I-PAL) while Dortmund University has developed quality PAL (Q-PAL). There is also PAL-Plus which uses I-PAL or Q-PAL plus digital sound and the possibility of switching to an aspect ratio of 16:9. These systems are all compatible with current PAL transmissions. Grundig is participating in field trials of these EDTV (extended definition TV) systems currently being conducted in West Germany.

LATEST BREMA FIGURES

The latest brown goods delivery figures from BREMA, for the second quarter of 1989, show that TV sales remained depressed though demand for video equipment picked up. April-June CTV deliveries at 778,000 were 8 per cent down on the same period last year. The decline was greater in large-screen sets, down 15 per cent while the fall in small-screen set deliveries was only 0·5 per cent. Interesting that CTV exports rose in value by 40 per cent while imports declined by 14 per cent, giving a trade surplus of nearly £30 million.

VCR deliveries rose by 9 per cent to 468,000 while camcorder deliveries at 58,000 increased by 35 per cent. There was a trade deficit in VCRs, UK-made machines taking 48 per cent of the market.

According to the British Phonographic Industry, sales of compact discs overtook those of conventional vinyl LPs for the first time in the second quarter. CD shipments rose 69 per cent to 8·67m in comparison with the same period in 1988 while LPs fell 7·4 per cent to 8·04m.

BSB ON TEST

BSB's Marcopolo-1 satellite at 31°W is now on test. The company gave its first public demonstration, with D-MAC encoding, at the recent Royal Television Society convention at Cambridge. A 38in. Sony receiver with a 16:9 aspect-ratio screen was used for the demonstration. BSB's channel frequencies are 11·78502GHz, 11·86174GHz, 11·93846GHz, 12·01518GHz and 12·0919GHz. BSB is currently evaluating at locations across the country a number of Squarial-type aerial designs from several companies.

SKY ACCELERATES

Sky Television's rental package (see last month's leader) attracted over 100,000 enquiries during the first two weeks. Retail sales of Astra equipment are understood to be running at a rate of well over 30,000 a month and it's estimated that around 170,000 UK homes are now equipped to receive the transmissions. At this rate the number of installations could reach around 400,000 by the end of the year.

J2T's FIVE MILLIONTH

JVC announced that the J2T joint venture formed by JVC, Thorn EMI and Telefunken in 1982 has reached the five million unit mark in VCR production. The company has two European plants, in Berlin and Tonnerre, France. J2T is now a 50-50 venture between JVC and Thomson, who bought out Telefunken and Thorn EMI's video/TV manufacturing interests.

Berlin's current production rate is around 100,000 units a month, the plant employing about 1,000 people. Tonnerre employees total 650. According to JVC the local content of J2T's products that are locally designed is over 60 per cent.

THORN EMI RENTAL REORGANISATION

Thorn EMI is reorganising the management side of its three rental chains DER, Radio Rentals and Television and Video Centres. The finance and system support departments are being transferred to a new office site in Reading – the existing offices at Swindon, Chertsey and Bracknell will be closed. Job losses will be less than 100 and no branches are to be closed. The three chains will continue to trade independently.

VIDEO SERVICING BOOK

U-View has published *Video Servicing 1987-88*. The book contains technical information covering 130 video models and is a companion to the company's *Television Servicing* book covering 389 models. It's hoped that the new book will fill an important gap in the provision of general video maintenance and repair information. It is bound in improved hard-cover form. For a colour leaflet listing the models included and price, apply to U-View, 29 Warmsworth Road, Doncaster, Yorkshire DN4 0RP (telephone 0302 855 017).

HINARI's NEW CHAIRMAN

Brian Palmer, who established Hinari Consumer Electronics in 1985, has resigned as chairman and chief executive. He is handing over to John Robinson who is ex-managing director of Electrocomponents. Hinari grew rapidly from a turnover of £10m in 1985-86 to £65m in 1988-89. It evolved from the wholesale distributor Trical, which Brian Palmer also started. It seems that he prefers the challenge of the new to running an established firm.

RUMBELOWS – A CORRECTION

We must apologise for a most unfortunate error in our news item last month on the Rumbelows reorganisation. Our suggestion, due to a misinterpretation, that the servicing side will be contracted out to other companies is quite wrong. What we should have said was that servicing work carried out for other companies will be gradually reduced. Solutions has ceased to trade, the servicing side becoming an integral part of Rumbelows' customer offer, organised on a local, regional basis.

What Next?

Les Lawry-Johns

Still more letters and cards have arrived! My thanks to you all. Because of my muddled head I can't write like I could just a few years ago, but I can manage to repair a few TV sets that people phone up about. Unfortunately it seems to take me a lot longer to do these sets than it did just a short time back, but I still try.

The Philips G11

Take the Philips G11 that someone phoned up about recently. I've repaired more of these sets than any other type. He asked me to call at his house to have a look at it. I did and couldn't find a thing wrong. He said it suffered from field collapse every day or so. The only thing to do was to cart it off down to the shop to have a closer look. When it was on the bench I couldn't induce field collapse however much I tapped around, but every now and then the picture went red then failed completely. This was soon traced to a poorly fitting plug on the video panel. I thought I'd leave the set on for a while to see what happened. While waiting I popped into Dave's Coach and Horses next door, leaving a note to tell prospective customers where they could find me. Just half a bitter, because more than that makes my mind even more cloudy and I had to drive quite a way. The set was still all right when I got back, so I resoldered every joint around the TDA2600 field timebase chip, its supply, etc., after which I kept an eye on it for another hour or so. Then I carted it back to its owner and asked him to let me know if it misbehaved again.

Next day he phoned to say that it was doing something different. Every now and again the field varied and curved. So I drove off for a further inspection. As the height was varying I thought I'd have another go at finding a dry-joint. The upshot of this was no field scan at all. After checking that the supplies to the field timebase were present I fitted a new TDA2600. With the heatsink back on everying seemed to be o.k. I watched for several minutes, then checked the video plug and socket again. After that I left. I've not heard further, so I must conclude either that the set's now all right or that the owner is fed up and has bought a new one.

Back to the shop to meet a couple who are thinking of buying it and using it as a hairdressers. I showed them over the place but they didn't show any signs of eagerness to buy. I suppose I'll just have to wait until the Indian solicitors down the road have made up their minds, which they've been trying to do for several months without actually showing their hand . . .

Another Philips Set

As I was about to leave a chap came in with this 20in. Philips colour set – Model 20/CT4636/05T (KT4 chassis). It wasn't necessary to let down the main panel because I could see that the trouble was over on the right-hand side: the line output transformer had an obviously poor contact, which I carefully resoldered along with the connections to several of the other pins, just to be sure. This seems to be a common fault condition that affects many models nowadays. The transformer does lead a busy life of course. I wrapped the set up and tried it once more, for the young fellow's sake. He then departed in high spirits, having had to pay me only a fiver.

After this I locked up and returned to the bungalow to see how Gunga Din was coping – our new dog, a pal for Zeb and Tessa. As usual he started a scrap with Zeb as soon as I reached the gate – he seems to be possessive and wants to show Zeb that I'm his. Tessa has to come between them to stop any real damage being done. She does this with amazing ability and they don't argue with her – she's the boss! Incidentally Spock (the cat) still hasn't come in. She sleeps outside, coming up on the shed when she wants to be fed.

Later I had to return to the shop to show it to another chap, a second-hand furniture dealer who is looking for premises in the town or just outside it. He was impressed with the place (heaven knows why) and said he would contact me later if he could raise the cash.

Loss of Picture

While I was dealing with him someone else brought in a portable TV set with the complaint that the picture failed every time the aerial plug was touched. Memories of that other portable flooded back – the one with just the same symptoms, caused by the aerial cable disturbing the tuner unit. This time however nothing went wrong when I fitted my own aerial. He'd brought with him his short piece of aerial cable. I checked this and then fitted new plugs. This done there was no further disturbance no matter how much the aerial plug was waggled about. I charged him a couple of quid and he left quite pleased.

Back at the bungalow I wondered whether the shop would soon be a hairdressers, a second-hand furniture emporium or a solicitors' office . . . .

CCTV Faults

Peter Graves

We were called in to update a CCTV system that was new to us, having been installed by someone else. The main requirement was to add a VCR and a switcher (see Fig. 1) to select the outputs from the cameras alternately. When we started, the cameras and their associated monitors were all working. The new VCR, its monitor and the switcher were fitted and cables were run from the bank of monitors to the switcher.

All went well until the system was tested. We then found that the output from one of the cameras couldn't be selected by the switcher, which just skipped over it. We checked by connecting the camera's output to the VCR directly and making a recording. When this was played back, the VCR's monitor displayed a badly broken up, jumping picture. The picture displayed by the camera's own monitor was steady however, so we came to the conclusion that the new cables or the connectors were faulty, producing a weak signal input at the VCR. Cable continuity was checked, then the signal at the VCR was monitored with an oscilloscope. This displayed the composite video waveform with satisfactory levels.

The clue to the cause of the problem came when a test monitor was connected to the cable. Its picture flickered noticeably, an effect that had not been seen with the brand-new VCR monitor. Realisation came quickly: the camera was working on the 525-line, 60Hz field standard, a rare sight in this country. A closer look at the pulse timings in the scope waveform provided confirmation.

The range of adjustment of the hold controls in a 625-line monitor is usually sufficient to enable it to lock to the signal from a 525-line camera. When the camera's output was connected to only a single monitor it didn't matter what the standard was, but a UK 625-line VCR couldn't cope with the 525-line signal. In addition a sync separator within the switcher is used to detect the field sync pulses in the incoming video signals so that, during the field blanking period, the switcher automatically skips any unused input. The sync detector had been upset by the different pulse timing of the 525-line signal. Normal results were obtained when a 625-line camera was installed.

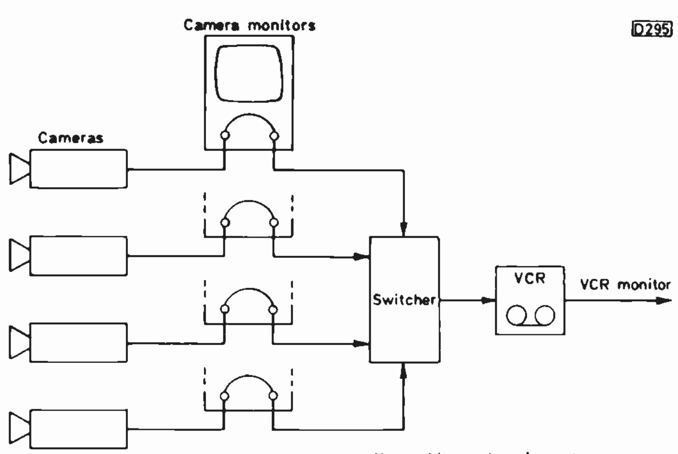


Fig. 1: Modifications that were made to update a CCTV system – addition of a switcher, VCR and VCR monitor.

Another Switcher Problem

A similar switcher and four brand-new cameras were installed at another site. Shortly after commissioning the installation the customer complained that the switcher occasionally skipped a camera. The engineer who paid the first visit to the site checked the video levels, which were all within specification, then replaced the switcher, assuming that the initial one was faulty.

The fault persisted however. During a further visit to the site we noticed that the only odd feature of the system was the use of two different makes of camera. Installations usually use just one make. We found that the cause of the fault was the different d.c. levels of the video signals from the two types of camera. The switcher's inputs are d.c. coupled, and the different levels upset the sync detection circuits which would occasionally decide that no camera was connected to a particular input. The switcher then skipped to the next one. Fitting coupling capacitors to all the inputs to remove the d.c. components of the signals solved the problem.

Connector Fault

Another fault that required several visits to produce a cure developed at the same site. Every three months or so one of the cameras, over the door of a warehouse, would apparently stop working. An engineer would call, find no video signal at the switcher input, go out to the camera and connect his test monitor, only to find that the camera was working perfectly. Reconnecting the cable to the switcher restored the picture on the main monitor and no reason could be found for the loss of picture, despite much camera tapping and connector waggling.

The cable's BNC connector was a crimp-on type and we finally found that the original installer had failed to push the inner pin fully home into the insulator. It had gone in sufficiently to make contact but, as the weather got colder, it must have contracted slightly, pulling it out just far enough for contact to be broken and the picture lost. The disturbance when a test monitor was connected restored contact again for a while. A replacement connector cured the fault.

Night Picture Fault

The complaint with an outside camera in a weatherproof housing was that while the daytime picture was fine a white disc appeared on the picture at night. A visit after dark confirmed the presence of a round white circle on the picture. There was nothing in the field of view that could have been responsible – no odd lights or reflective objects. Inspection of the housing revealed the cause of the fault. The camera has a power-on LED indicator on its front panel, by the side of the lens. During a recent service the camera had been removed from its housing and when replaced it must have been farther away from the window than originally. An image of the LED was being reflected back into the lens from the inside of the window. A short piece of insulating tape over the LED cured the problem.

Servicing the Panasonic NV730

Nick Beer

The Panasonic VCRs that followed the NV333/366 and preceded the NV-G21 series all had very similar mechanisms, no matter how they looked externally and however many features they had. The D1 deck was used in the majority of the machines of this era. Even those machines that didn't use the D1 deck had a very similar mechanism, with the result that manuals refer you to the one for the D1 deck for alignment details. A later article will cover the D1 deck and the electronic faults in the machines that use it. Other models we propose to cover will be the NV688, NV777 and NV788. This article however is devoted to the NV730, not because it's very different but because it has a very distinctive fault pattern that would be difficult to outline in a more general article covering several machines.

The NV730B was Panasonic's second dual-speed VCR. It superseded and was a considerable improvement upon the NV688. It's a front loader with an eight-event, two-week timer and an infra-red remote control system that was comprehensive for its time though without timer setting facilities. For mechanism control there's a membrane-type soft-touch pad on a fold-down flap the full width of the machine. Despite the relatively high price, £529 initially rising to £549 later, large numbers of these machines were sold. One problem is the poor video head life – more on this later.

Dismantling

The top is held down with four screws, two at each side, and simply lifts off. The bottom is held on by seven gold screws. To remove the screening can, loosen the five red screws and slip it up and off. The front comes off in two parts. The main part can be unclipped after removing three red screws across the top. This allows you to remove the four red carriage retaining screws. After disconnecting the plug at its rear right the carriage can be lifted out. Removing the carriage makes life a lot easier – when changing the idler for example. See later for further front dismantling.

Mechanical Operation

The mechanism has only two belts. One is the front loading belt (part no. VDV0151) which Panasonic refer to as a "slot-in" belt. It's a wide, flat belt at the top right-hand side of the carriage. When it fails the result is sluggish front loading. You get one with the maintenance kit (part no. VUD4091KIT) for this model. The other is the loading belt (VDV0152) which is at the rear, right-hand corner at the bottom of the mechanism. It drives the tape loading mechanism, in turn being driven by the loading motor (VEM0211) via the loading pulley (VDG0177). The latter is also part of the maintenance kit – it becomes noisy on its pinion and the teeth on its lower drive surface tend to wear. The loading method is the same as with the earlier NV333/366/370 etc., via a series of gears that drive the guide arms, main lever and cam. Mode selection is effected by the mode switch which is actuated by the main lever. In this machine the mode switch (VES0251) is unique and extremely reliable – unlike its counterparts VSS0110 and VSS0135 in D1 mechanism machines.

The capstan motor is a fixed-stator, direct-drive type that's used only for the capstan. D1 machines differ in this respect as they tend to use a belt driven by the capstan flywheel to drive the reels. In the NV730 there's a separate motor (VEM0212) for reel drive, via the reel idler (VXP0581 – not UXP0581 as in the manual). This is also part of the maintenance kit. Kick is via the main lever. The reel motor tends to become noisy both mechanically and electrically – the latter defect causes noise on the picture display.

There's a direct-drive unit (VEG0341) for the drum. This is virtually a hundred per cent reliable. The original head is type VEH0256 but the replacement supplied is type VEH0267. The two are identical as far as appearance and fitting are concerned. The discharge angle is at the bottom of the drum unit. It doesn't give a tenth of the trouble that you get with the VXA1584 fitted at the top on NV333/366s. When it does fail the symptom is a squeal.

The VEH0259 audio/control head is much better wearing than some I could mention. The only one I had to change developed a sticky surface which led to tape path/transport trouble like tape riding etc. As with all Panasonic audio/control head assemblies, the leads plug in and adjustment/fixing is by means of three screws at the base. Replacement is thus quick and straighforward.

Mechanical Service

We'll run through the replacement procedures for general service items, including those in the maintenance kit.

It's best to remove the cassette carriage before you replace the reel idler – access is very tricky with the carriage in place. Remove the reel motor from above (three gold screws) and the take-up reel. This will allow you to move the idler over to the right-hand side and out through the cut-out. Make sure that you re-engage the spring underneath the idler plate.

To remove the video head, unsolder the eight arrowed connections on its PCB and take out the two securing bolts. Ensure that all solder is removed from the pins and that they are free to move before you remove the bolts. This way no damage will occur due to removing the drum without unsoldering the pins, as is so easily done. Replace in the opposite order. There are threaded holes for use with the Panasonic head puller, but use of a hairdryer will usually enable a tight drum to be removed.

One end of the brake band is held by the adjustment screw. The other is held to the back of the tension post arm by its own sprung plastic retainer. It can thus be pulled off without having to remove the post, as in earlier machines. When you replace it, check the back tension and the post's landing position.

The front loading belt can be slid over its two pulleys on the right-hand side of the cassette carriage after unclipping the worm retainer and lifting the top end of the worm upwards. There's no need to remove the worm completely, or indeed the carriage, to replace just this belt. The loading belt is the simplest job – just slip it over the loading motor pulley and the loading gear pulley after removing the bottom plate. To replace the loading pulley simply undo the two retaining circlips.

The pinch roller (VXL1209) is held by a single circlip, but watch the washers as you remove it. This is another job that calls for removal of the carriage first.

The impedance roller (VDP0908) is held on its shaft with the standard nut. It's essential that the replacement roller is at exactly the right height, otherwise there will be severe disturbance to the picture. Do this by making a note of its rough position before removing the old one. Then fine set it by playing a standard tracking tape – don't use your best one as it may get marked as you adjust the height of the roller. If possible it's best to replace and readjust the impedance roller as a separate job. If you are doing a general service, do everything except for the roller, check that everything is o.k., then replace the roller. It will save you a lot of heartache!

Mechanical Adjustments

The various mechanical adjustment figures are as follows:

Back tension should be 25-30g measured with a tentelometer.

The rewind and fast-forward torque should be over 400g/cm.

The take-up torque should be 130-180g/cm.

If the torques are low, attention should be turned to the reel drive mechanics. To reset the back tension, adjust the slotted hole of the brake band on the supply reel. Also ensure that with the back tension set correctly you have a perfect still frame. See the faults list.

Faults List

The following summarises our fault experiences with this machine.

(1) Tapes not ejected far enough, not ejected at all, or won't accept a cassette. Check whether the cassette carrier in the carriage flops about. If so, suspect that the sprung cam (VXP0575) at the front right-hand side of the carriage has broken. The spring mounting pips break, as a result of which the spring becomes loose and there's no tension. If this is the case the front loading motor will continue to run as the cassette out switch will not make. After a few seconds the machine will depower.

(2) Intermittent failure to rewind/fast-forward wind/play a tape, or intermittent cut-out on these functions. Caused by lack of reel motor drive due to dry-joints on Q1504. This regulator is on a small subpanel at the far rear right-hand side of the machine.

(3) Machine won't switch on. Clock o.k. but on LED not alight and no functions. This fault can be permanent or intermittent. In the latter case the machine runs all right for some time and then goes off: unless unplugged for about half an hour it will not switch back on. The first thing to do is to check the reset pulse at pin 16 of the syscon chip IC6001 (MN15342VGD). This is best done with a digital storage oscilloscope. If the reset pulse is present and o.k. the likely culprit is IC6001 itself, but I've also had identical symptoms due to the crystal X6001 (VSX0082). It's obviously quicker and cheaper to replace this first, but if the fault is particularly intermittent and you don't want to spend too much time on fault finding it's worth changing both on spec. When the fault is permanent it's easy to determine which of these items is at fault. If the reset pulse is not present or is distorted, attention should be directed to QR6003, D6003, C6006 and C6008 – only rarely have any of these components been at fault however.

(4) No back-up memory. You've guessed it, the famous gold capacitors, C75401/2. They are of the same type as those used in the NV366 and the same things happen when they leak, so be careful: never apply a hot iron to the electrolyte – in this machine things can be a bit more serious if you do. Since the timer PCB has numerous plugs attached, the easiest way to replace the gold capacitors is to unclip the PCB and work at an angle from the side to solder. If you catch some electrolyte it invariably spits all over the print side of the syscon PCB which is directly below. This can cause some wonderful faults – I've had to sort out one machine following this disaster and it's not something to be desired!

(5) Intermittent tape chewing. It seems that whenever this fault appears on the job card the machine performs perfectly, never giving a hint of tape chewing despite hours on test. A check on the reel drive torques will however usually reveal a poor reel idler (VXP0581). Sometimes the torque reads o.k., but replacing the idler always seems to cure the trouble. As with any machine that suffers from this problem, ask to see the tapes – sometimes they are cheap four-hour ones bought for £2·49 from a basket at the supermarket check-out!

The Head Problem

(6) Poor picture in the SP or LP modes or both. This is invariably due to faulty video heads. Before replacing them, check the back tension. The tentelometer reading half way through an E180 cassette, measured between the full erase head and the entry guide, should be 25-30g. Pull the head off the tape while making the measurement and make two or three checks. You will find that you need to adjust the back tension for 29-30g to get the best noise suppression in the trick modes.

What you will also usually find is that the back tension is 45-50g, so there's little wonder that the video heads have a short life (12-18 months)! When you replace the heads you find that, with the back tension reduced, the SP still frame is appalling. What you have to do is to set the back tension to 29-30g then adjust the landing position of the back-tension post to restore the perfect SP still. A point can be found where, with correct back tension, a perfect still can be obtained – it will take you a while the first couple of times you try! Don't be tempted to increase the back tension again as you will soon need new heads.

As mentioned earlier, replacement heads have a different part no. Remember also the need to remove all solder from the pins before trying to pull off the head. We've found that MCES heads are excellent. We don't fit them on chargeable machines, on the principle that these should be fitted with manufacturer's replacements, but find them ideal for our rental machines.

More Faults

(7) Won't play: arm's don't lace or drum not rotating. Unlike D1 machines this is not very common. The cause

is the same however – the mode switch (VES0251).
(8) Dim display. Usually the centres of the segments remain bright and the rest go dim, giving a display not unlike a "silvering" c.r.t. Digitron D7501 (VSL0037B) has gone low emission. Replacement is not too expensive.
(9) Will not switch on and will not front load. Front loading motor driver chip IC6005 (BA6209) faulty, loading the 9V rail if the machine won't switch on. Check the 9V rail.
(10) No deck operation when a cassette is in, or cassette comes out again. As with the NV370B, cassette up and/ or down switches (VSM0050) on carriage faulty.
(11) No clock, all deck operation displays illuminated, or wrong display. Output from regulator IC1501 (STK5361L) faulty, absent or low depending on symptoms. If the chip is short-circuit internally R1505 (68Ω fusible) and F1002 (1·25AT, 20mm) will probably be open-circuit.
(12) No go. No −30V and unregulated 45V supplies. Usually due to random failure of R1002 (4·7Ω).
(13) No capstan operation. Usually due to IC2004 (AN3281) or the capstan stator (VEK2208) being faulty. Very often if one goes faulty it damages the other, so it's best to change them both.
(14) Display strobing. X7504 (VSX0138) dry-jointed or open-circuit.
(15) No drum rotation. If the drives at pins 1, 2 and 23 of IC2003 (AN6387) are missing or faulty, suspect this chip.
(16) No go, no mechanism shuffle at switch-on. As with the NV370, the reel drive chip (IC6004, BA6209) is faulty.
(17) No go, no display or timer inoperative. Replace the timer microcomputer chip IC7503 (MN1512VTJ).
(18) Will not remember channel settings. Replace IC7504 (MN1228).
(19) Will not switch from SP to LP or vice versa. Switching chip IC2501 (AN6356N) faulty.
(20) Clock o.k. but when switched from standby the machine goes right off again. Excessive loading on the 30V line due to IC7504 (MN1228) being faulty. Lift supply pin 9 as a check.
(21) No go, fuse F1003 (1·25AT, 20mm) and R1505 (68Ω fusible) open-circuit. IC1501 (STK5361L) faulty. Before replacing it make sure that there are no shorts across the output pins 2, 3 and 5.
(22) Intermittent or no drum rotation. This is usually due to C2018 (3·3μF, 25V).
(23) Slight tear on playback picture and a barely audible tick on sound. Exit guide sleeve is running roughly. Replace roller post assembly (VXP0444).
(24) Creaking noise on playback, stops in pause. Usually the pinch roller (VXL1209) or capstan bearing VXD0091.
(25) Tape riding in cue or review, causing excess noise on the picture. Generally due to excessive friction in capstan bearing VXD0091.
(26) Knocking noise in cue/review. Idler riding due to slipped retainer. Replace idler (VXP0581).

Control Membrane

Now that these machines are a few years old the plastic control membrane tends to crack. This is more likely to occur when the machine is used in cold conditions or by a heavy-handed user. A replacement (VYK0733) isn't expensive and fitting one is fairly straightforward though it does call for a fair amount of dismantling. Remove the top and bottom, then the top half of the front, as described earlier. Then unclip the lowermost part of the front from the three front bottom securing screw holes. Four red screws hold the flap assembly to the front. With this removed, take out the five screws that hold the flap together, across the bottom, and the tracking, slow tracking and sharpness control knobs. The two halves of the flap then push apart.

Remote Control Unit

The VSQ0357 handset used with these machines is a brown one and is pretty reliable unless subject to spillage. No-go failure is usually due to broken legs on the crystal or a defective MN6030B chip. A faulty chip can also cause excessive battery drain. As with all Panasonic remote control units, in the event of intermittent operation ensure that the battery is not a Duracell type – the rounded ends don't make good contact with the remote control unit's connectors.

In Conclusion

In conclusion, this is a very smart looking machine with plenty of features. It gives good results in both the SP and LP modes, unlike the earlier NV688. Except for the head problem, reliability is good. Once the head problem (incorrect back tension) has been sorted out and the machine has been given a mechanical service it can be expected to give long, trouble-free service.

Letters

QUALITY OF COMPACT DISCS

I have been reading with great interest Joe Cieszynski's series on compact disc players. Despite the sophistication of the system and the techniques used, the quality of the discs themselves is unfortunately not all that it should be.

Giant leaps in hi-fi technology took place in the Seventies. These included metal tapes, Dolby, moving-coil cartridges, quartz-locked d.c. motor turntables, tuners with synthesis tuning, MOSFET-based amplifiers, ferro-fluid tweeters and a myriad of various poly-based loudspeaker cones. In the midst of all this we suffered from an appalling standard of record pressing quality, albums in particular. The record industry got its knuckles severely rapped, and as a result there followed a considerable improvement in the quality of pressing and surface noise. The industry's aim was presumably to save its profits, faced as it was with the ever more popular tape cassette medium.

Is this fiasco being repeated in the Eighties and Nineties with the compact disc? Once again there has been a mega-leap forward in sound reproduction technology, with CD players costing from as little as £50 to £2,500 or more. The average is around £200, for which you get advanced features such as multi-oversampling, bit multiplication, digital pulse axis control plus user benefits such as remote control and programmable track play. We are promised a signal-to-noise ratio of 100dB or more and harmonic distortion of −95dB, plus zero crosstalk, wow and flutter, hum and a superb frequency response.

Why is it then that after paying for the latest in CD player technology we find that not one compact disc in the charts even nearly approaches the performance of a standard player? I've found that the typical signal-to-noise ratio on many chart compact discs is a little over 60dB (about the same as a good record). In addition some have low levels of 50Hz hum, again typically −60dB, something that should have been banished from all recordings years ago. The best compact disc I could find, Paul McCartney's *Flowers in the Dirt*, clocks in a mere 75dB signal-to-noise ratio, some 25dB short of the promised 100dB.

The present state of CD recording quality makes complete nonsense of the latest state-of-the-art technology found in CD players. Compact discs are also not particularly cheap. I believe that the public is being grossly misled by the promised improvement when the quality of the recordings is so poor. So come on record industry, put some of those huge profits back into refurbishing your recording equipment so that it reaches a standard at least matching that of today's hi-fi systems.

Les Sage, Sage Audio Electronics,
Bingley, Yorks.

SEPTEMBER LEADER

Your September issue editorial says that our educational system "has a lot to answer for" because of the lack of engineering knowledge in the boardrooms of British companies.

As a teacher of A level physics I see all too many able pupils who would make good physicists or engineers choose careers in accountancy, banking and management instead. These pupils must have enjoyed their physics education because they had twice opted for physics, at GCSE and A level. They chose these other professions because these offer better career opportunities than those in engineering. They also appreciate that it's difficult for someone with an engineering background to break into the upper echelons of management.

Engineering suffers from a lack of status in this country. One reason for this is that people from motor mechanics to full members of the professional engineering institutions are labelled "engineers" alike.

While the educational system is not perfect, it has to be realised that the problems I've mentioned can be put right only by industry itself.

R. Skoczylas,
Stafford.

Talking of the good old days is a common theme when it comes to domestic electronics and motor cars. One major complaint is that industries are now run by accountants. Every medium-sized customer has an account manager assigned to him, so has each department. The operations of those departments that are not directly revenue earning, such as stores, training, etc., are cut to the minimum. Financial controls are essential of course, but engineering driven by accountants has proved to be a counter-productive approach. It would be far better for accountancy to be a part of engineering syllabuses. Engineers would then be able to control the financial affairs of their departments and could put up ideas backed by figures.

The other problem of course is that we cannot beat the cheap labour of the Far East. But the next best thing could be provided by the DTI – a marketing and research unit accessible to industry and available free of charge. This would no doubt help in 1992.

J. Tharanee,
Bicester, Oxon.

PLAYING NTSC TAPES

Several letters have appeared recently on the subject of playing NTSC tapes in the UK. No one to date has mentioned Panasonic's new L series machines. The NV-L28 plays NTSC tapes and produces colour on a PAL TV set – it converts the subcarrier to 4·43MHz and adds phase inversion, i.e. PAL switching. The line/field standard is not changed however, so there is still the problem of reduced height or picture rolling with some sets. Also the tapes cannot be copied by PAL VCRs.

The L20 and L25 use the same servo system. They will play NTSC tapes in monochrome without modification, though no mention of this is made in either of the handbooks or the service manuals.

Gareth Foster,
Whitton, Middlesex.

PROBLEMS WITH SPARES

Yet another moan about obtaining spares, this time for Sony products. As we don't have an account with Sony, being a service department rather than a sales shop, we rely on SES Staines for our spares. The advantage is that we can use a Barclaycard for payment, thus avoiding the need to send a written order and the associated delay. The disadvantage is the difficulty in getting through on the phone.

After a long wait one morning I thought I'd try SES Dulwich. But they insisted on charging us retail prices if we wanted to pay by Barclaycard!

In the end I had to send a written order to SES Staines. Why is life made so difficult for the independent service department? And why are so many manufacturers' spares suppliers so inefficient and unhelpful?

M.J. Hobby TV Service,
Horsham, West Sussex.

HELP WANTED

We are in need of a front panel for a Sharp VC4824 VCR. This is no longer available from Sharp or the company's distributors. If anyone has a surplus or second-hand panel, we'd be willing to buy it.

J. Rivas, Service Manager, Audio Visual Centre,
Northamptonshire Education, Covington Street,
Northampton NN1 5JU. Telephone 0604 230 567.

We require a stereo decoder chip for the Philips car radio-cassette unit Model RN712 – Philips say that they cannot help and don't even know the type used. The number 729 appears on the top of the i.c., which is a 14-pin device. We'd also be prepared to purchase a complete set. The same decoder is used in Model RN512.

Leon Electronics, 11 Woodend Close,
Three Bridges, Crawley, West Sussex.
Telephone 0293 20 536.

Can anyone help me to obtain an M193C chip? We require it for the tuning/control board in a Network Model NWC1402 colour portable. In fact we've three of these sets, all good except for this i.c., so ideally we need three of them.

C.E. Toms, EPPS Services,
212 Teignmouth Road, Torquay, Devon TQ1 4RX.
Telephone 0803 35 177.

CLEANING POTENTIOMETERS

Regarding F. Gregory's potentiometer tip (letters, October), there's another remedy for curing noisy potentiometers. I've used it for many years. Instead of applying a spot of fine oil to the track, clean it thoroughly with carbon tetrachloride applied with a medical cotton-bud stick (a readily available and convenient source of carbon tetrachloride or similar solvent is the thinner for typewriter correction fluid or the Thawpit type of stain remover). When the track has been cleaned sufficiently, apply a mixture of white petroleum jelly (Vaseline) and carbon tetrachloride – formed as a greasy paste in a watch-glass or similar container – with the aid of either a clean cotton-bud or the end of a used matchstick. Then rotate the potentiometer's spindle several times, the full traverse of the track. This completes the cleaning operation, leaving a fine, conductive film of lubrication. If the track is a carbon type, a small amount of loose carbon mixed with the jelly will form the equivalent of the graphite lubricant used with heavy engineering machinery.

Ivor Nathan,
Southgate, London N14.

Test Report: Sadelta MC42 Pattern Generator

Alfred Damp

The time had come to replace our elderly pattern generator. It dates from the early days of colour TV and still works, well just about.

The features we wanted in a new pattern generator were: switchable rasters in the three primary colours; a peak white raster; colour bars; a crosshatch pattern; and, in view of the almost total absence of a test card, a test pattern with a circle. A generator that fulfills these requirements is the Sadelta MC42 TV Stereo Pattern Generator.

First a word about the "stereo" side of things. This is designed around the West German stereo sound system. Switches relating to stereo sound have been isolated in the UK version and the i.f.s have been modified to system I.

The test patterns provided are as follows:

(1) The main test pattern has a crosshatch grid with a circle, thus meeting two of the requirements listed above. The circle is digitally produced and is stored in an EPROM. Within the circle there are frequency gratings and a section of colour bars. The pattern also has two postbox rectangles with a vertical line within each: one box is white with a black line and the other black with a white line. Border castellations complete the pattern.

(2) Standard colour bars.

(3) Colour rasters in the three primary colours: secondary colours can be obtained by selecting two switches together.

(4) A peak white raster.

In addition there are a black and white switch and an inverse switch that inverts the phase of the video and chroma.

There are three outputs, r.f., i.f. and video, at the front of the unit. The r.f. output frequency can be selected from one of four tuning potentiometers, all of which cover the entire u.h.f. band. The potentiometers also include band switches for Bands I and III. The output level can be set for 10μV-10mV. The i.f. output is switchable between the sound and vision i.f.s. The third output provides a composite video signal.

There's a scart connector at the back. This provides composite video, RGB and composite sync outputs. Inputs can also be fed in via the scart connector – video and two-channel audio.

Two sound tones are available, one at 1kHz and the other at 400Hz – the two tones can be on together. A switch enables the carrier to be modulated by an external source via the scart connector.

The generator gives superb results and is a real help in the workshop when working on colour TV receivers, VCRs and computer monitors.

The Sadelta MC42 is available from HRS Electronics Ltd., 11 Garretts Green Lane, Garretts Green, Birmingham B33 0UE at £331·10 trade plus VAT.

Servicing the Philips KT3 Chassis

John Coombes

The well-known KT3 chassis was used in a series of Philips and Pye models that were released over the years 1979–1982. They have 90° tubes with 14, 16 and 20in. screen sizes. There are two versions with different colour decoder panels: in the earlier panel there are two chips, types TDA2560 and TDA2523; the later panel has a single TDA3560 chip. There are non-remote, remote and remote plus teletext models. The complete model list is as follows:

Philips: 14C925, 14CT3005, 14CT3205, 16C927, 16C928, 16CT3015, 16CT3215, 16CT3715, 20C933, 20C934, 20CT3027, 20CT3227, 20CT3723 and 20CT3726.

Pye: 37KT3052, 37KT3060, 37KT3062, 37KT7225, 42K7227, 42K7228, 42KT3150, 42KT3152, 42KT3157, 51K7324, 51K7326, 51KT3237, 51KT3260, 51KT3262, 51KT3267, 51KT3272, 51KT7323 and 51KT7326.

We will deal with the various fault symptoms that arise and the items to check in each case.

No Results

The most common fault is no raster and no sound, and the most common cause of this is that the surge limiter resistor R6191 (4·7Ω) is open-circuit. If the fuses, FS6291/2 (2AT), are open-circuit, check the following items for shorts: the bridge rectifier diodes D6292/4/5/6 (type BY227), the associated protection capacitors C6292/4/5/6 (2·2nF), and if necessary the 2·2nF mains filter capacitor C6290. These capacitors sometimes go short-circuit intermittently.

If the HT1 line (output from the bridge rectifier) is low, check whether the chopper transistor T1463 (BUW84) is leaky or the reservoir capacitor C1460a (200μF) is open-circuit.

The next thing to check is the 129V output from the chopper circuit – at pin 6 of power supply module U7470. If the voltage is excessive, 300V or more, check for shorts/leaks in T1463 (BUW84), D1461 (BY208) and C1462 (470pF).

If the HT2 (129V) voltage is correct, check for faults in the line output stage. The chief suspect is the line output transistor T1562 (BU205). It may be faulty or without drive. In the latter case check whether any of the following are open-circuit: R1561 (2·7Ω), L1563 and the relevant secondary winding on the chopper transformer L1465.

If the HT2 line is low at less than 100V, check the resistance between the collector and emitter of T1562. If you get a short-circuit reading, check T1562 and C1568 (560pF). If the reading is in excess of 6Ω, remove the power supply panel (chopper drive) and check the voltages at pins 6 (280V) and 10 (12V) of the bridge rectifier panel. Check R6294/7/8 (each 10kΩ) if the voltage at pin 6 is incorrect or missing. If the 12V supply at pin 10 is incorrect or missing check C6300 (470μF), the 12V zener diode D6300 (BYX79/12) by substitution and if necessary R6299 and R6300 (both 8·2kΩ). Replace the power supply panel and check the voltage at pin 12 (should be 12V): if the reading is 30V or more check the chopper driver transistor T7353 (BSS38), the driver transformer L7351 (by substitution) and if necessary the bias resistor R6293 (150kΩ, on the bridge rectifier panel). If still in trouble check the voltage at pin 6 of the power supply panel. This should be at 129V. If the reading is less than 30V, check T1463 (BUW84), D1464 (BY208), C1559 (0·1μF) and C1560 (0·39μF).

If the set is tripping, the usual cause is the tripler. It breaks down internally and this sometimes leads to the destruction of IC7322 (TDA2581Q) on the power supply panel. If the tripler gets very damp around the e.h.t. cap and is left in this condition the c.r.t.'s final anode can be ruined, calling for a replacement c.r.t.

For repeated random tripping, check the mains plug, socket and fuse for intermittent operation. Make sure that the h.t. is correctly set at 129V and that the earthing connections to the c.r.t.'s external coating and the P band are in good condition. If necessary check the edge connectors of the modules.

Sound but no Raster

For no raster with the sound all right the first thing to check is that the c.r.t.'s heaters are alight. If not, check c.r.t. pins 6/7 for heater continuity, likewise for continuity at pins 13/14 of the line output transformer, and the plug and socket connections in between.

If the tube's heaters are alight, check the first anode voltage at pin 10. The reading here should be 350–400V. If this voltage is missing check back through R9602 and the plug and socket to the preset R1581 (2·7MΩ) which is in series with the focus control R1572 (24MΩ).

Beam current limiting is carried out via the contrast control circuit and faults here can remove the picture. Check C1565 (150pF) and C1566 (220pF) which can go short-circuit, the value of R1565 (24kΩ in 20in. sets, 39kΩ in 16in. sets and 47kΩ in 14in. sets) and if necessary zener diode D1423 (BZX79/C12) by substitution.

If still in trouble, check the voltage at pin 9 of the colour decoder panel. This is the field blanking input and the voltage here should be about 1·5V with the earlier panel and 1·1V with the later panel. If the reading is incorrect and the panel is an earlier one, remove the signal and check the voltage at pin 12 which should vary between 0·8-3V as the brightness control is adjusted from end to end. If the conditions here are incorrect, check the TDA2560Q chip IC3192 by replacement: if the voltage at pin 12 is correct, check T1426 (BC548) and, by replacement, zener diode D1435 (BZX79/B5V6).

If the voltage at pin 9 of the colour decoder panel (either version) is incorrect, check the field blanking transistor T1535 (BC558). If the 13V supply is not present at its emitter, check whether R1585 (1Ω) is open-circuit. Then if necessary check the field output and driver stages. The voltage at the collector of the upper transistor T1530 in the output stage should be 30V. If this voltage is missing check R1590 (3·3Ω), D1590 (BY406) and C1588 (680μF). Items to check in the field timebase are T1530 (BD223), T1532 (BD234), R1531/2 (both 1·5Ω), T1523 (BC337) and C1521 (470μF).

Colour Faults

Loss of one colour is usually caused by an open-circuit resistor on the RGB output panel. Check R4250 for red, R4266 for green and R4282 for blue. These resistors are all 470Ω.

The TDA2523Q chip IC3223 on the earlier colour decoder panel can be responsible for a number of colour faults as follows: no colour, intermittent loss of colour, loss of one or two colours, loss of colour sync or a Venetian blind effect.

If the colour control has no effect, check the control itself (R1884, 4·7kΩ) and the TDA2560Q chip IC3192. Also check the edge connector, if necessary by replacement, and for cracks on the panel and the mother board.

Poor or weak colour can be caused by a purity fault. Ensure that this is not due to an external magnetic field. Then check the degaussing posistor R6292, C6293 (0·1μF), and the coils L1102/3 for open or shorted turns. Check for dry-joints in this area and that the plugs and sockets A21/2/3/4 are in order.

Tuning Drift

In the event of tuning drift, first check that the 155V (HT3) voltage is correct. The reservoir capacitor here is C1583, which was changed to 4·7μF to prevent formation of a switch-off spot. Then check the 33V regulator D1401 (ZKT33B): replace it or see whether the 33V line varies when D1401 is subjected to heat and freezer. Resistors to check if necessary are R1401 (15kΩ), R1404 (270kΩ), R1405 (2·2MΩ) and R1410 (22kΩ). If the drift is still present the U321 tuner is suspect – check by replacement: If the drift is on one channel only, check the pushbutton assembly and the tuning potentiometer, again by replacing the unit.

No Sound

For no sound first check that switch S1013 is closed and that neither the switch nor the loudspeaker L1100 (16Ω) is open-circuit. Then check whether the output coupling capacitor C5182 (220μF) is open-circuit and that the 20V supply is present at pin 1 of the TDA2611AQ audio output chip IC5181. If the supply is low, check C5179 (47μF) and IC5181, which could also be responsible for distortion. If the 20V line is missing, check whether R1413 (4·7Ω) is open-circuit or C1413 (1,000μF) short-circuit. These items are on the main panel. Then check R6303 (2·2Ω) and D6303 (BY406) on the bridge rectifier panel.

If necessary, move back to the TBA120AS intercarrier sound chip IC5164. Check that 12·5V is present at pins 11 and 12. If this voltage is low or absent, check R5169 (270Ω), C5168 (22μF) and C5169 (22nF), then if necessary IC5164 by substitution. Check whether the preset volume control R5166 (4·7kΩ) or the user volume control R1886 (4·7kΩ) is open-circuit.

Finally check whether coupling capacitor C5176 (0·1μF) is open-circuit and for poor connections, dry-joints and cracks on the PCB.

Miscellaneous Faults

Faults sometimes arise in the EW modulator circuit. Check the three transistors in the following order: T1494 (BC548), T1490 (BD234) and T1485 (BC548). Then if necessary check D1562 (BY208) and/or C1562 (15nF) for leakage and the condition of the width control R1513 (10kΩ).

For poor line sync when cold ensure that C7336 is 4·7nF and not 2·2nF.

Long-distance Television

Roger Bunney

There was a decline in Sporadic E reception during August which wasn't a very good month. As the log below shows, reception was possible for the vigilant with plenty of time available. But the month was below average, and I feel that this must have something to do with the approach of the peak of the current sunspot cycle. Any comments on this?

5/8/89 TVE (Spain) chs. E2, 3, 4; RAI (Italy) ch.1A; Ercalano E2 (Italian private station); C+ L2 (France-Canal Plus); ARD (West Germany) E2, 3; ORF (Austria) E2a; ZTV (Zimbabwe) E2 – at 1805-1834, a Pop programme called 'Sounds of Saturday' via Trans Equatorial Skip with Sporadic E enhancement.
6/8/89 TVE E2, 3, 4; TVE-2 E2; RTP (Portugal) E3; RAI IA, B; ARD E2; C+ E3, 4; JRT (Yugoslavia) E3; MTV (Hungary) R1, 2; TSS (USSR) R1.
7/8/89 TVE E3, RAI E2.
8/8/89 TSS R1; CST (Czechoslovakia) R1, 2; JRT E3, 4; RAI IA, B; TVE E2, 3, 4; RTP E3.
9/8/89 SVT (Sweden) E2, 3; NRK (Norway) E2, 3, 4; TSS R1; CST R1; MTV R1, 2; JRT E3, 4; RAI IA; TVE E2, 3, 4; RTP E3; ORF (Austria) E2a; RUV (Iceland) E4.
10/8/89 TSS R1, 2; SVT E2; CST R2; C+ L2; TVE E2; RAI IA.
11/8/89 RAI IA, B; Ercalano E2; RTP E2, 3; TVE E3; ZTV E2 at 1808.
12/8/89 TSS R1; RAI IA; MTV R1. The Perseids meteor shower this day produced a lively Band I with many signal bursts being seen.
13/8/89 JRT E3, 4; ARD E2; TVE E3; TSS R2; NRK E2, 3.
14/8/89 RAI IA, B; Ercalano E2; C+ L2, 3; TVE E2, 3, 4; TVE-2 E2; YLE (Finland) E3, 4.
15/8/89 RAI IA; TVE E2, 3, 4; ORF E2a; ARD E3; C+ L2; NRK E2.
16/8/89 TVE E2, 3, 4.
17/8/89 RAI IA; +PTT (Switzerland) E2.
18/8/89 RAI IA, B; Ercalano E2; TVA (Italian private) IA; EPT (Greece) E3; JRT E3; MTV R1, 2; ORF E2a; ARD E2; C+ L3; TVE E2, 3; TSS R1.
19/8/89 TVE E2, 3, 4.
20/8/89 TVE E2; RAI IA.
22/8/89 RAI IA, B; Ercalano E2; JRT E3, 4; TVE E2; RTP E2, 3.
23/8/89 RAI IA, B; TVA IA; EPT E3; C+ L2; TVE E2, 3, 4; TSS R1, 2; CST R1; TVP (Poland) R1; RTSH (Albania) IC; TVR (Rumania) R3.
24/8/89 JRT E3; RAI IA, B; MTV R1, 2; C+ L2; TVE E3; RTP E2, 3; TSS R1, 2.
25/8/89 TVE E3, 4; RAI IA, B.
26/8/89 TVE E3.
27/8/89 TVE E2, 3.
28/8/89 CST R1.
30/8/89 NRK E2, 4; SVT E3.

There was an improvement in tropospheric conditions during August, thanks in part to settled hot weather, but no real openings occurred. The 9th produced Band III/u.h.f. signals from the nearer West German stations (NDR/WDR/ZDF) in the southern UK. The 11th produced an interesting Band I signal, Goettelborner Hoehe ch. E2, again in the southern UK. The 19th produced further West German Band III/u.h.f. signals while on the 29th in the south west Roger Fussell (Torpoint) logged TVE chs. E4, 5, 31 and 45 during a tropospheric lift – a degree of ducting was evident.

Auroral activity was noted on the 15th, with TSS ch. R1 at 2200 plus unidentified signals. Auroral effects in Band I were noted in Scotland on the 17th, 21st and 23rd, but no signals were identified.

Simon Hamer excelled with MS reception. On the 16th he logged DR (Denmark) ch. E5 and SVT-1 ch. E8 while on the 17th he had YLE chs. E4 and 9, TSS ch. R7 and TVP ch. R8 – really excellent going for the Band III MS catches.

One piece of late news is that a new transmitter at Liege, Belgium is now on test in ch. E39 with 100-200kW.

During early August I was on holiday at Bonne Nuit bay on the north coast of Jersey, about half a mile east of the massive Fremont Point IBA transmitter site. The BBC Les Platons f.m. transmitter is about a mile east of the bay. Les Platons used to transmit TV on ch. B4 – there are still many v.h.f. receiving aerials in position across the island. The local relay at Mont Orgueil Castle, Gorey, is on the battlements itself: a double-stacked log-periodic receives the Fremont Point horizontal group B signals, with retransmission on a more obvious single group W log-periodic with vertical polarisation.

My thanks to the following for sending in reports on reception and conditions this month: Peter Schubert (Rainham), Tim Anderson (St. Leonards), Cyril Willis (King's Lynn), Simon Hamer (Powys), Bill Cotterill (Tipton), Roger Fussell (Torpoint) and Iain Menzies (Aberdeen).

News Items

Low Countries: A new ch. E50 transmitter is operational in Brussels, co-sited with the RTBF Tele-2 ch.45 transmitter. It uses the PM5544 test pattern with the identification "Bruxelles CANAL 50" but no programme name. It seems that this and the Anderlues ch. E58 transmitter are to be used for the forthcoming Belgian Canal Plus service. Because of the ch. 50 transmitter the local Brussels relay has removed WDF-3 (Monschau ch. E50) from its cable, fearing co-channel interference. The Brussels ch. E45 and E50 transmitters both operate at 500W e.r.p.

Interesting that a TV-DXer logged a test pattern with the identification "RIAS-TV NATO" for one day only at 0530 local time from the Brussels ch. E56 transmitter which normally carries TV-5 Europe. Can anyone identify or comment? The Ekofisk oil platform TV service has been received on ch. E55 vertical with the Phillips Petroleum 66 identification and the text "EKOFISK TV CH 1" and on ch. E52 vertical with a subtitled Norwegian film.

One of the AFN TV channels at Shape/Casteau has been moved from ch. E34 to ch. E33.

Italy: Further information has been received from the BDXC on private Italian transmitters operating in Band I, as follows: Quarta Rete TV1, ch. IA. Corso Brescia

62, 10152 Torino. Audiovision ch. IA. Via Ferrucio 10, 20145 Milano. Telelomellina ch. IA. Corso Pavia 34, 27029 Vigevano (PV). Telelibera chs. IB and IC. Piazza Michelotti 3/a, 06100 Perugia. TSC Telespazio Compano ch. IA. Vicolo Forno, 82019 Sant Agata Dei Goti. Telebari ch. IB. Lotto Vigna Laura, 70125 Bari.

Yugoslavia: Dalibor Frkovich reports that TV Koper-Capodistria is to become independent of JRT. The channel is being taken over by the Italian entrepreneur Silvio Berlusconi who is well known for his interests in the Italian private TV market.

Amateur Radio: The RSGB reports that a 50MHz beacon is now in operation at St. Austell, Cornwall. The 45W transmitter has been widely received and nearby TV-DXers will certainly need notch filters or phasing systems to prevent or reduce breakthrough. Australian amateurs are now allowed to operate at up to 400W in the 50·05-50·2MHz band. Luxembourg is shortly to issue radio amateur licences for operation at 50MHz. On July 8th a Worcester based amateur, G1INK, heard a Japanese station calling CQ at 50MHz, using SSB. The time was 0815.

For Scanner Operators Only!

Those TV-DXers who operate scanners in Band I may find the following list from Robert Copeman helpful for identifying those distant F2 signals we hope to receive during the coming winter.

Ch. 1 New Zealand. Offset vision carriers.
45·2396MHz Mt. Studholm, South Canterbury. 10kW vertical.
45·24MHz Waiatarua, Auckland and Waikato, Te Aroha. 100kW horizontal.
45·25MHz Mt. Hedgehope, Southland and Kaukau, Wellington. 100kW horizontal.
45·26MHz Whakapunake, east coast and Hikurangi, Northland. 10kW horizontal. Queensway, Otago 100kW vertical.
Ch. A0, Australia.
46·17MHz Toowoomba, Queensland. 300kW horizontal.
46·237MHz Cooma, NSW relay. 500W.
46·24MHz Wagga, NSW. 100kW horizontal.
46·2515MHz Gordonvale, Queensland. 500W.
46·258MHz Tamworth, NSW. 1kW horizontal.

Seven other lower power relays have not been included in this list.

Commercial Corner

Aerial Techniques is marketing a low-cost, dual-standard TV set with the following coverage: Bands I/III and u.h.f., systems B/G/I. Operation is from a 240V mains supply, an external 12V battery or its own internal rechargeable 12V Nicad stack. Aerial input is via a coaxial adaptor to a 3·5mm mono plug. The price is £69·95. For the address see the company's advertisement.

The first issue of Geoff Arnold's new magazine *Radio Bygones*, mentioned in the August Teletopics, has now appeared. Geoff Arnold was of course previously editor of *Practical Wireless*. It's attractively presented in A4 format, with 32 pages, and contains much information on old radios, test equipment, wartime gear and so on. Coverage of vintage TV matters is planned for later. The first issue as a sample costs £2, a year's subscription (six issues) costing £12 (£13 overseas). For details apply to G.C. Arnold Partners, 8A Corfe View Road, Corfe Mullen, Wimbourne, Dorset BH21 3LZ.

Satellite TV News

PanAmSat at 45°W has been testing two new downlinks, at 11·62GHz and 11·67GHz. The 625-line signals have PAL colour. A sixth horizontal downlink from Intelsat at 1°W has been on test and NRK has been seen from the ECS satellite at 10°E. Various OB links via this satellite were noted during August.

The newly launched DFS Kopernikus satellite at 23·5°E was carrying the following services at the end of August: SAT-1 at 11·53GHz, RTL+ Nord at 11·59GHz, Eins Plus at 11·61GHz and RTL+ German at

11·66GHz. The 11·59GHz link has been seen carrying other services and by the time this is read the downlink menu will certainly have changed! It seems that the German post office DBP will use the satellite to duplicate the TV SAT-2 feed when it becomes fully operational next year. At present the intention is to move the West 3, BR3, SAT, PRO 7 and Tele 5 services from 60°E to Kopernicus DFS-1. Teleclub may also be a DFS customer at a future date.

Ian Waller reports that the signal level from the Intelsat craft at 63°E has increased, suggesting that the craft has been reorientated. Signal levels in the eastern UK are comparable to the German downlinks at 60°E.

The Soviet Gelikon DBS project and the Spanish Hispasat craft are due to come into operation in 1992. A second Hispasat craft at 31°W is due for launch in September 1992. The two Hispasat craft will have two 80W TV channels plus one footprint beamed on the Canaries and another to the Americas.

Following various transponder switch-off problems, all but two of Astra's 19·2°E transponders are now fully operational. NRK has been noted at 11·179GHz from ECS F5 at 10°E and Intelsat 24°W has been noted with carriers at 10·95, 11·003 and 11·67GHz.

Berlin Radio Show Report

George Cole

Some interesting new technology was on show at this year's International Audio and Video Fair (also known as the Berlin Funkausstellung).What follows is but a snapshot of the events since IAVF is very big (398 exhibitors were spread over 25 halls covering 52,000 sq. ft), very crowded (it's a public event that attracts nearly half a million visitors) while most of the language and literature was naturally in German.

Longer VHS Playing Time

Two developments from BASF and Nokia (which owns the ITT Nokia and Salora brands) have extended the recording and playback time of the VHS format. BASF showed an E300 tape which gives a recording time of five hours at the standard play speed and ten hours in the long play mode. The tape has an ultra-thin base film, just 9μm thick compared with the 13μm base film used with E180 tape. Apparently JVC, which holds the VHS patents and licences, is not very happy about this, suggesting that the thinner tape may snap in older or misaligned machines. According to a BASF spokesman however the E300 tape has been test marketed in Austria for a year without any complaints about its durability. BASF says that limited supplies of E300 cassettes will be on sale in the UK before Christmas, priced at £6·99 or less.

One of the "lap-top" VHS VCR plus monitors on show. This is the Panasonic model, with 5in. LCD display.

Nokia introduced a twelve-hour VCR which increases the usable time by running the tape at one third of the normal speed, i.e. 0·78cm/sec – EP speed? According to Nokia the use of a new development called Active Sideband Optimum (ASO) means that the picture quality is better than that of conventional LP operation. ASO eliminates the crosstalk problems from which the dense "EP" tracks would otherwise suffer. Nokia says that the ASO circuitry is relatively inexpensive, which means that it could become a standard VHS feature.

JVC has objected to ASO because "EP" recordings won't play on standard VHS decks offering SP and LP operation. But it seems likely that ASO decks would offer three speeds. Perhaps JVC's objections are the reason why no launch details of ASO machines were announced.

Less contentious was the Hitachi VT-L240 NTSC VCR which uses audio signal compression techniques to provide up to 240 hours of continuous audio recording from a two-hour cassette!

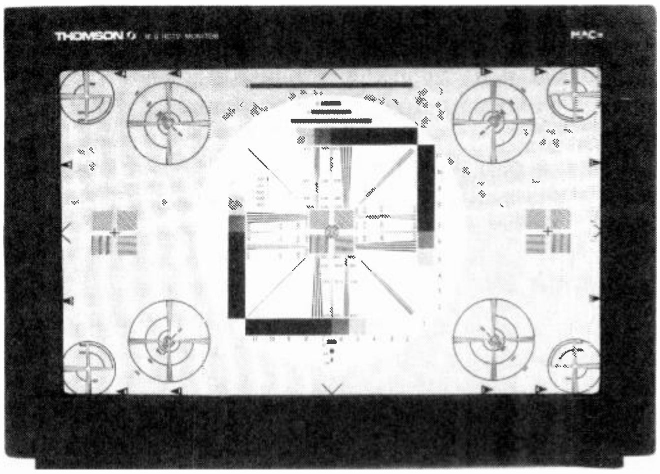
Video Equipment

JVC, Hitachi and Panasonic showed prototype VCRs equipped with the F/C (full/compact) mechanism described in the August issue of *Television* (see pages 774-5). This accepts full-sized VHS and VHS-C cassettes without the need for an adaptor. Surprisingly there isn't a standard for the F/C system: all three manufacturers have developed their own versions.

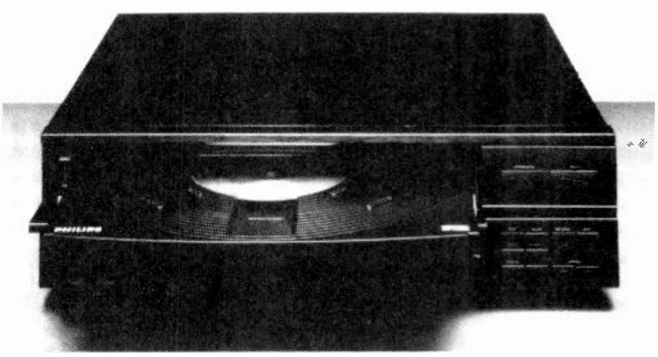
Also on show was the new 45/90 minute VHS-C tape which again should be on sale in the UK by Christmas.

Hitachi and Panasonic have produced portable "lap-top" VHS VCR/monitors. Hitachi's Model VT-LC50EM has a five-inch LCD screen, SP/LP operation and a three-way power supply. Its dimensions are 370mm wide, 89mm high and 214mm deep, the weight being approximately 3·4kg. Panasonic's lap-top machine also has a five-inch LCD screen. It includes a TV tuner and hi-fi stereo sound (through headphones).

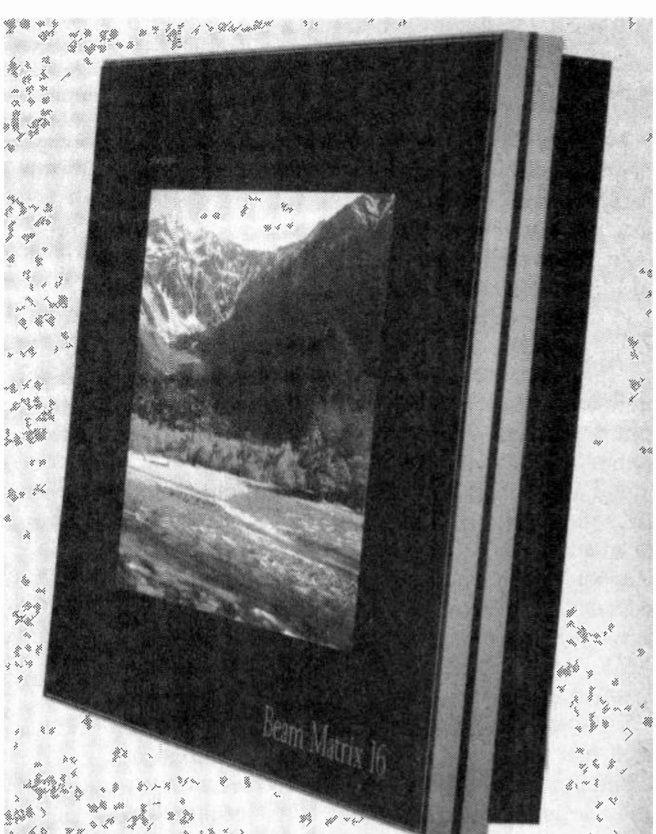
JVC displayed a VHS-C portable system called Com-



A Thomson high-definition monitor with 16:9 aspect ratio display. Note the HD-MAC resolution chart.



The latest Philips CDV player, Model CDV495, is a combi type that plays 8, 12, 20 and 30cm discs.



Panasonic's 16in. beam matrix display, a thermionic flat-screen arrangement that produces 630,000 pixels.

pact C. It consists of camera, LCD monitor, tuner and recorder separates.

Smaller full-function VHS-C camcorders are on the way, thanks to a new ultra-lightweight chassis developed by Panasonic. This is twenty per cent lighter than current types and uses high-density chip mounting technology. A Panasonic spokesman said that full-feature VHS-C camcorders will eventually dip under the 1kg mark.

Two other Panasonic developments are the "Electronic Telephoto Effect", which increases an ×8 zoom to ×16 electronically, and the FIT (frame interline transfer) CCD imager which is claimed to eliminate vertical smearing.

There were a number of VHS and S-VHS camcorders on show. JVC's GR-S707 was the most interesting one. Although it's an S-VHS-C camcorder it uses a full-size (62mm) head drum. JVC says that this improves the picture quality.

CDV Players

Compact disc video (CDV), which combines moving analogue video with CD digital sound, was much in evidence. According to the system's inventor Philips the market for CDV players should soon reach 960,000 a year world wide: projected sales are 60,000 in Europe, 100,000 in the USA and 800,000 in Japan. There are now 7,000 CDV software titles, with 4,000 in the USA and 300 in Europe. Philips expects the European library to increase to 500 by the end of the year. Many of these are music titles, but software companies are showing a greater interest in the medium.

CDV hardware was shown by Philips, Sony, Grundig, Marantz, Pioneer and Matsushita (Panasonic/Technics). The Philips CDV495 is a combi player that handles 8, 12, 20 and 30cm CDV discs. First-generation CDV players incorporated analogue sound circuitry so that the older LaserVision discs could be played. Philips has now removed this but, in response to criticism from LaserVision supporters, has promised that the analogue sound will return with the next generation of players. The CDV495 also has an edit function which makes it easy to copy CD or CDV sound on to audio cassettes. The user simply keys in the tape length (e.g. C90) and the CDV495 calculates the number of tracks that will fit on to it and plays them. I don't know what the music companies will make of this feature.

Sony's MDP515D multi-disc CDV deck offers a horizontal resolution of 440 lines and variable speed playback from 1/90th to ten times normal speed. I was very impressed with the picture quality and the absence of any noise bars during trick play. The MDP515D plays PAL or NTSC discs and the sound track has ×8 oversampling with an 18-bit digital filter. It goes on sale in Germany this autumn at the equivalent of about £730, but there are no plans to date for a UK launch.

JVC showed a graphics player, Model XL-G512, which plays normal CD audio discs and those encoded with simple graphics and text.

Philips held a player demonstration of its CD Interactive (CD-I) system which combines sound, graphics, text, pictures and 1/4 screen motion video on a 12cm disc. CD-I players combine a computer, disc drive and a CD audio player in one unit. Initial plans were for CD-I to go on sale in the USA this year and in Europe next year, but the launch will now be in 1992. The reason for this delay is that Philips and Matsushita are developing

CD-I machines that will provide full-screen, full-motion video.

Looking even farther ahead, Thomson showed an erasable CD disc that uses a magnetic-optical recording system. The disc can store up to four hours of pictures and sound.

High-definition TV

The European high-definition TV project, Eureka 95, was out in force at the IAVF. The Eureka press conference, held in the HD-MAC studio, was packed out and attended by many of Eureka's top officials. What strikes you is how fast the Eureka team has worked to develop HD-MAC. The project was announced in 1986, presented at the 1987 IAVF and first demonstrated at the 1988 International Broadcasting Convention. The first complete production system was shown at this year's Montreux International Television Symposium and the final phase, satellite transmission, was achieved at Berlin.

The plan is to use HD-MAC at the 1990 World Cup finals, with broadcasts beginning for the 1992 Olympic games, though the feeling is that 1995 is a more plausible date. Thirty HD-MAC programmes are available: broadcasting companies in Portugal, Holland, Austria and the UK (the BBC) prepared productions for the HD-MAC studio at Berlin. The idea is to establish a stockpile of programmes before regular HD-MAC broadcasting services begin. The HD-MAC pictures I saw, under less than ideal viewing conditions, looked sharp and clear and didn't seem to suffer from the judder I've noticed with the Japanese Hi-Vision HDTV system. Other journalists commented that the UK provided one of the best HD-MAC demonstrations.

The Japanese haven't given up hope of getting Hi-Vision accepted as the world standard for HDTV. Companies that demonstrated Hi-Vision included Sanyo and Toshiba, and Hi-Vision equipment has been lent to a number of European broadcasting companies.

One of the biggest surprises was Thomson's announcement that it would start to sell wide-screen HD-TV sets with a 16:9 aspect ratio next year, at a price of around £3,000. The general feeling was that this was a little optimistic.

Philips demonstrated a prototype HD-MAC VCR which can also handle D2-MAC, PAL, SECAM and NTSC signals. The HD-MAC signal is sampled at 20·25MHz before being compressed and converted back to analogue form. It undergoes filtering, pre-emphasis and frequency modulation before being recorded on tape as two parallel tracks. Recording time is one hour and twenty five minutes.

It was announced that the Eureka project may be extended a further two years to enable second-generation professional and consumer HD-MAC equipment to be developed.

Improved-definition TV

Many companies including Philips, Grundig, Blaupunkt and Thomson showed Improved Definition (ID-TV) sets. This is a receiver-based system that enhances the conventional broadcast signal, though there doesn't seem to be an official specification. ID-TV sets provide flicker-free pictures by doubling the field frequency to 100Hz. Information on how this is done is sketchy. It seems that the received fields are digitised and stored in a memory. They are then read out at twice the normal field frequency. Some sets use the digital/memory system for freeze frame, picture-in-picture and zoom effects.

Philips demonstrated a wide-screen MAC TV set that automatically adjusts from a 16:9 to a 4:3 aspect ratio and vice versa.

Projection TV

A fair number of companies showed projection TV systems. Grundig's had a 115in. screen, 100Hz field rate and digital trick effects. JVC's super LCD projector consisted of three 1·76in. LCDs that act as filters, each with 210,000 pixels. The horizontal and vertical definition are given as 350 and 450 lines respectively. JVC says that the system doesn't even require a screen, a white wall being sufficient to provide good picture quality. Panasonic's 40in. LCD projector weighs around 100lb and has a depth of 16in.: the three LCDs have 312,000 pixels each. Philips showed a 50in. HD-MAC projector with a claimed resolution of over 1,000 lines.

At the other end of the scale Toshiba showed a 4in. multi-standard LCD TV set while Philips had a combined 3in. LCD TV/radio that weighed just 500g.

Beam Matrix Display

Another Panasonic innovation is Beam Matrix TV, a flat-screen system that gives good picture quality. The system uses 28 linear electrodes about five inches in length instead of a c.r.t. gun. These electrodes produce 3,200 beams that form a small, rectangular display with digital control and drive. A 16in. beam matrix set on show had a display unit with a thickness of just 4in. The power consumption is said to be roughly the same as with a conventional c.r.t.

News Round-up

Another innovation was TOP (table of pages) text, a teletext system that works like a personal computer display. The TOP remote control unit has just four keys that are used to select items from an on-screen menu. TOP is quicker than Fastext, but UK broadcasters are said to be lukewarm about it.

JVC and Hitachi demonstrated VCRs with built-in MAC tuners. As this was Germany, the D2-MAC system predominated. There are also plans for digital satellite radio broadcasts that will give CD-quality sound. Philips plans to launch digital audio satellite tuners in Germany this year.

Still video had a low profile, though Canon showed a still video camera which should be available in Europe for around £500 from the end of September.

Aiwa showed a portable digital audio tape (DAT) recorder that can be attached to an analogue/digital converter and used to copy 1,800 still video images on to DAT tape. Sony demonstrated the Hi8 system and Grundig is now marketing Video 8 equipment.

Toshiba demonstrated a 3D video system. Hitachi went one better with 4D vision using holograms.

Finally, Blaupunkt showed a TV set with an exchangeable front panel. The panel slots into the front of the 55cm set and the user can select the panel that blends best with the domestic decor. How long before we see paint-your-own TVs?!

The High-band 8mm Video System

George Cole

This autumn sees the launch of the European version of the Hi-band (Hi8) video format: Hi8 is Video 8's answer to the Super VHS format.

Video-8 Recap

We'll start with a brief recap on the 8mm video system – for a comprehensive account of this system, see Eugene Trundle's five-part series that started in the April 1987 issue of *Television*. Video 8 is a world standard format that has been adopted by 127 electronics companies. Some people talk of "Sony's Video 8 format", forgetting that it's an international system to whose development numerous companies contributed. Sony must however be given the credit for getting the 8mm system on to the market and keeping it in the spotlight. The format takes advantage of technological advances that have been made since the first half-inch video formats, such as VHS, were launched in the late Seventies. In particular the 8mm system uses new head and tape technology that enables shorter wavelengths to be recorded and higher density recording.

The main features of the 8mm system are: use of metal tape and an audio-size cassette with up to three hours' recording time (PAL LP mode); use of a.t.f. (automatic track following); absence of fixed audio and control heads; f.m. audio (mono) recorded helically at the l.f. end of the spectrum, or alternatively PCM digital audio (mono/stereo) recorded in its own dedicated section (30° rotation) of the helical track. Its basic specification is: f.m. luminance carrier deviation 4·2-5·4MHz ; luminance bandwidth 3MHz; chrominance down-converted to 732·422kHz; f.m. audio 1·5MHz ± 100kHz. The 3MHz luminance bandwidth provides a horizontal resolution of a little over 260 lines. The pictures are slightly sharper than those obtained with the basic VHS system, though the introduction of VHS HQ processing narrowed the gap. Fig. 1 shows the frequency spectra for the 8mm, Hi8 and S-VHS systems.

The launch of the S-VHS system in the NTSC countries in 1987 and in Europe in the following year led to speculation about a Super Video 8 system. The S-VHS system has a luminance bandwidth of over 5MHz, giving a horizontal resolution of over 400 lines. How would the Video 8 camp respond to this?

Enter Hi8

The answer is the Hi8 format, which was announced in March 1988 with the first equipment being launched in Japan last spring. The luminance carrier deviation is 5·7-7·7MHz with a bandwidth of 5·3MHz, giving a horizontal resolution similar to that of the S-VHS system. The deviation is wider however at 2MHz, which improves the signal-to-noise ratio by about 4·4dB in comparison with the basic 8mm format. Another Hi8 improvement is the shorter pre-emphasis time-constant, reduced from 1·3μsec to 0·47μsec, which reduces the edge noise and crosstalk and improves the waveform. The luminance and chroma signals are kept separate to avoid crosstalk, and the same socket configuration is used as with S-VHS, i.e. a 4-pin S-connector provides the full resolution with improved colour while a second socket provides composite video with a resolution of around 380 lines.

The TSS Head

An improved 8mm head has been developed to make possible the shorter Hi8 wavelengths. Both the standard and Hi-band 8mm systems use a tilted sputtered sendust (TSS) head, which is a composite of ferrite and sendust. The ferrite is a mix of iron oxide (Fe203), manganese oxide and zinc oxide. The three are powdered and mixed then heated to 1,200°C and pressed into a rod that forms the source of the ferrite crystals. This rod is placed in a platinum crucible and heated to 1,700°C, at which temperature it melts. Single ferrite crystals are formed as the crucible cools. The ferrite is then sputtered with sendust – a mixture of iron, aluminium and silicon – which improves the recording characteristics. A Hi8 head has a gap of just 0·2 microns, which compares with 0·25 for S-VHS, 0·26 for standard 8mm and 0·3 for VHS. Improved metal powder (MP) or metal evaporated (ME) tape is used – see later.

Compatibility

Compatibility between the Hi8 and standard 8mm systems is as follows: Hi8 equipment can play and record in both the standard and Hi8 modes, but standard equipment cannot play Hi8 recordings. The blank tapes

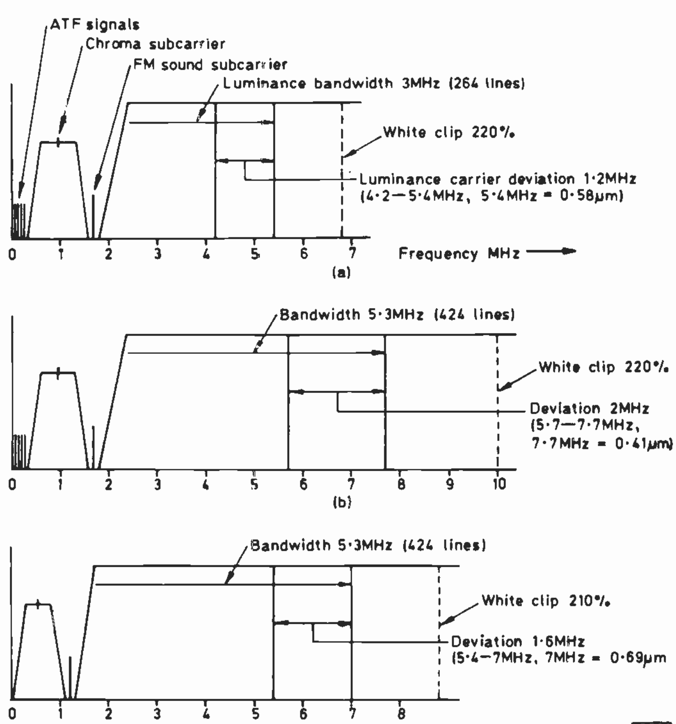


Fig. 1: Comparison of video standards, (a) basic 8mm, (b) Hi-band 8mm, (c) S-VHS.

are fully interchangeable between the two systems, though only Hi8 cassettes can be used to make Hi8 recordings – they have an identification hole. Hi8 machines have an automatic setting which, in the on position, always records in the Hi8 mode – except when a standard tape is inserted. In the off setting the machine always records in the standard mode, regardless of which type of tape is used.

Performance

How does Hi8 look? I had the chance recently to see the system in action in Tokyo, and was suitably impressed. There's a definite improvement over standard 8mm, with better definition, less noise and sharper colour – it certainly matches S-VHS. The standard 8mm chrominance and audio (f.m.) specifications remain unchanged. It seems that it would have been very difficult to design circuitry that could cater for alterations of both the luminance and the chrominance carriers. Other improvements have however been made to the colour signal. Regarding sound, there's to be a new f.m. stereo system for 8mm video but it isn't part of the present official Hi8 specification. It involves an additional audio carrier at 1·7MHz ± 50kHz. The present 1·5MHz carrier will be used for the left channel, with L + R information, while the 1·7MHz carrier will be modulated with L – R information. The system is compatible with mono 8mm equipment which simply reads the L + R information modulated on to the 1·5MHz carrier. Sanyo plans to launch a stereo f.m. Hi8 camcorder this autumn. Cannon has already launched one. Apparently it's simpler and cheaper to add stereo f.m. sound to 8mm camcorders.

ME Tape

Hi8 is the first video format to call for the use of ME tape. Although ME tape was part of the original 8mm specification, production difficulties have kept it off the market until now. This type of tape is essential for European Hi8 use however: with the luminance carrier at 7·7MHz (see Fig. 1) the wavelength is 0·41μm. Conventional ferric oxide tape can record wavelengths down to around 1μm while standard MP tape has a lower limit of 0·5μm. For the NTSC Hi8 system the upper limit of the luminance carrier deviation extends to 0·49μm.

ME tape has other advantages. The carrier-to-noise ratio is some 6dB higher than with MP tape (see Fig. 2).

Table 1: Comparison of tape characteristics

Characteristic	*MP*	*Hi8 MP*	*ME*
Thickness (microns)	10	10	10
Magnetic layer (microns)	3	3	0·2
Base film (microns)	6	6	9
Back coat (microns)	1	1	0·8
Coercivity (Oersteds)	1,450	1,500	1,050
Remanence (Gauss)	2,400	2,500	3,700

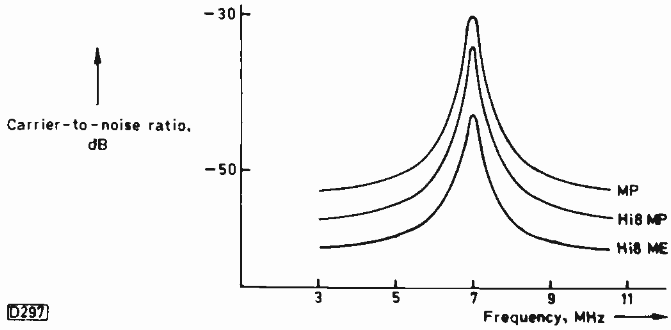


Fig. 2: The carrier-to-noise ratio of different types of metal type.

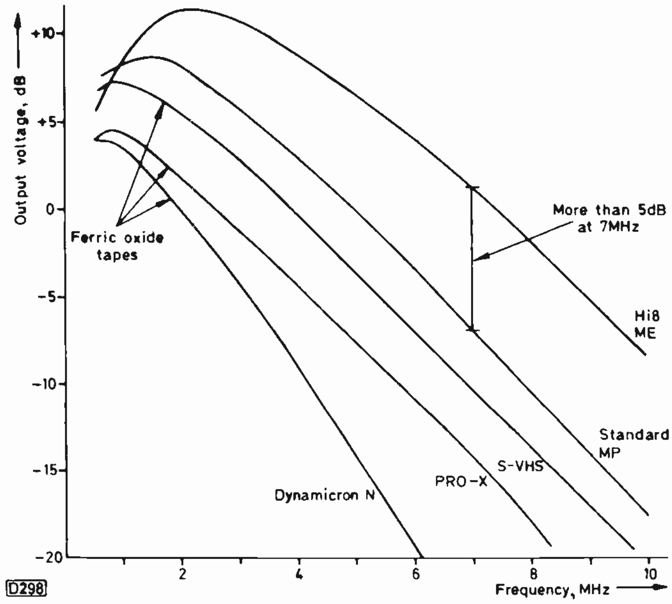


Fig. 3: Typical output curves for different types of tape.

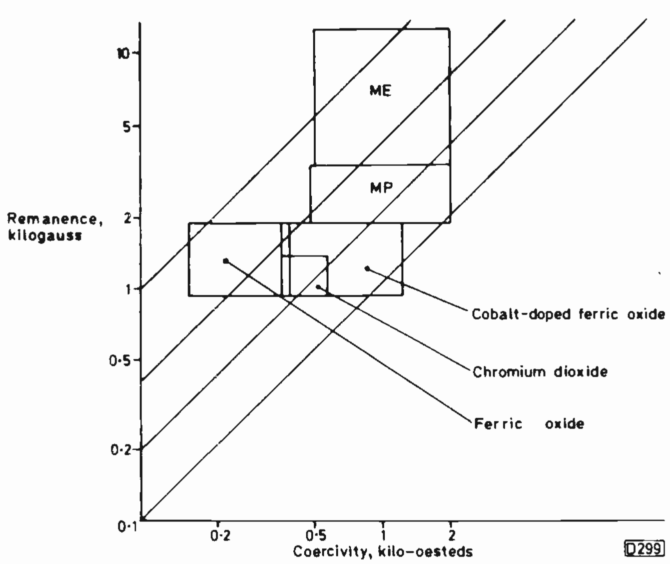


Fig. 4: Comparison of tape characteristics.

Because of its composition it's also a better recording medium. With a conventional tape the magnetic layer includes about 50 per cent of non-magnetic material – solvents, binders and lubricants. This reduces the recording density. The magnetic layer of an ME tape does not contain binders, so there is only about 20 per cent of non-magnetic material. The result is a much higher remanence (around 3,700 Gauss, compared to 2,500

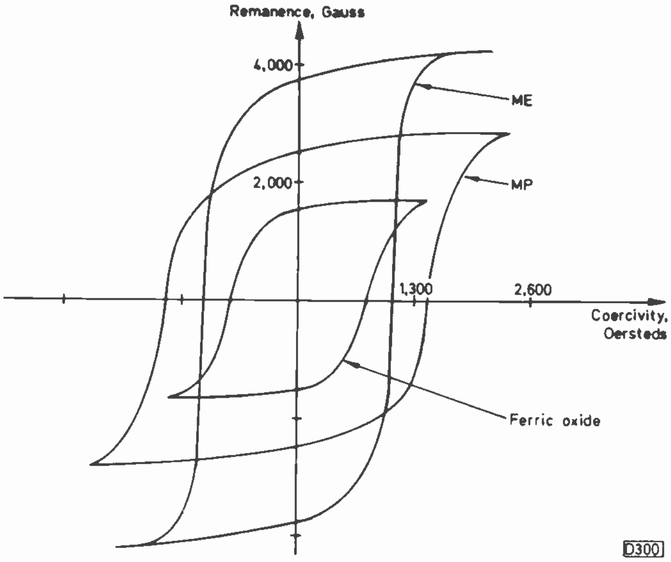


Fig. 5: Hysteresis loop characteristics.

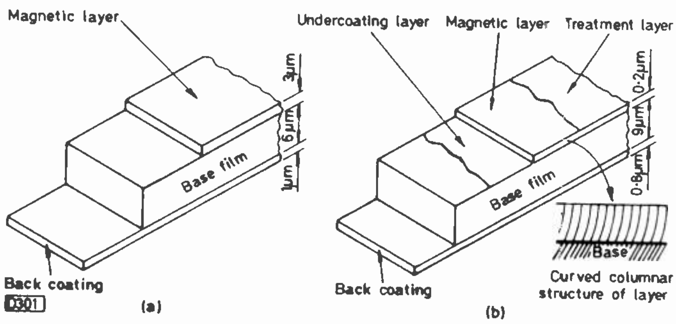


Fig. 6: Structure of MP tape (a) and ME tape (b).

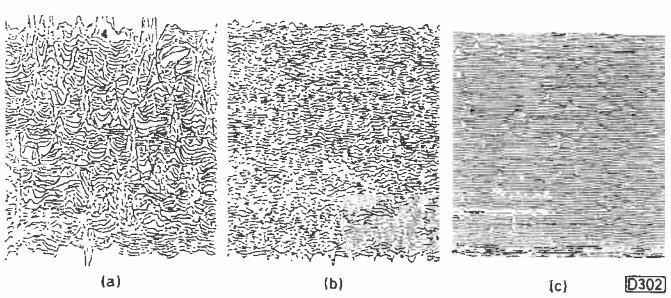


Fig. 7: Surface roughness comparisons, (a) ferric oxide tape, (b) MP tape, (c) ME tape.

Gauss with MP tape), higher coercivity and greater output (at 7MHz the output is 5dB higher than with MP tape, see Fig. 3).

The theoretical improvements provided by ME tape in comparison with standard ferric oxide, chromium dioxide, cobalt-doped ferric oxide (as used for S-VHS equipment) and MP tape are shown in Fig. 4. If you examine the hysteresis loop (Fig. 5) however you'll see that in practice ME tape's coercivity is lower than that of MP tape. This is because the coercivity of ME tape is deliberately reduced during production in order to maintain compatibility between the two types of metal tape. Sony's ME tape has a coercivity of 1,050 Oersteds, while for MP tape the figure is 1,500 Oersteds.

Hi8 MP tape is basically standard MP tape with finer particles and a higher packing density. This increases the coercivity and remanence a little. Table 1 shows the basic specifications of the three types of metal tape. The Hi8 system pushes MP tape to the limits, and the particles are hard pressed to record the highest NTSC

Sony's CCD-V900 Hi8 Camcorder.

frequencies. Sony has no plans to market Hi8 MP tape in Europe – it couldn't cope with the shorter wavelengths of the 625-line Hi8 specification.

ME Tape Production

The basic ingredients of the ME tape made at Sony's Sendai plant are cobalt (80 per cent) and nickel (20 per cent), the main purpose of the nickel being to provide anti-corrosive properties and control the coercivity. The alloy is heated to 2,000°C in a vacuum chamber. At this temperature the metal boils. Controlled amounts of oxygen are added at this time to control the coercivity and to oxidise some of the cobalt to form a protective layer. The metal vapour is guided on to the base film which is cooled to −25°C by liquid Freon. When the vapour touches the base film, which runs at a speed of 40m/sec, it condenses to form a metal film of just 0·2μm thickness.

As a result of this process the particles in the magnetic layer have a curved columnar structure that increases the recording density. This is illustrated in Fig. 6, which shows the structural differences between ME and MP tape. There are magnetic and non-magnetic particles in the ME magnetic layer, the former being cobalt-nickel and the latter oxidised cobalt. To reduce friction, the top surface is treated with a fluoride-based compound. Fig. 7 compares the average roughness of ferric oxide, MP and ME tape. Below the magnetic layer there's a layer of very fine particles to improve the magnetic characteristics and durability. The base film is made of specially treated PET plastic.

Hardware

Sony's first 625-line Hi8 camcorder, Model CCD-V900, will be released this autumn. It has a ⅔in., 420,000 pixel imager giving a horizontal resolution of 450 lines. Minimum illumination is 7 lux. The machine records in the SP mode only but has dual-speed playback (SP and LP). Features include a new dual-capsule microphone which can be switched between a uni- and omni-directional response; six fast shutter speeds (up to 1/10,000 sec); an index search system that can be used in-camera; a ×8 zoom; a digital superimposer; and a line input socket. The CCD-V900 measures 126 × 136 × 352mm, weighs 1·5kg without the battery and cassette and will sell for around £1,300.

Acknowledgment

In conclusion I'd like to thank Sony's Video and Magnetic divisions for their help in the preparation of this article.

TV Fault Finding

Reports from Philip Blundell, Eng. Tech., Jeff Herbert, Mick Dutton, Ian Bowden, Nick Beer, Stephen Leatherbarrow and P. Rafferty

ITT CVC1210 Chassis

We replaced the line output transformer because of insulation breakdown (a hole in the side). This resulted in a blank raster with no picture. After much component checking and replacement we found that C542 (33nF, 250V) in the earthy side of the e.h.t. circuit was open-circuit. This was upsetting the operation of the beam limiter circuit. **J.H.**

Philips K40 Chassis

There was no remote control response and no front keyboard operation with this set. We found that D6103 on the VST tuning module was short-circuit. Another of these sets came in with no picture or teletext. The RGB/status line turned out to be at 2V because T7206 (BC558) on the scart/interface module was short-circuit collector-to-emitter. **P.B.**

Philips CP90 Chassis

One of these sets came in with a dead power supply. The start-up voltage was being lost at the junction of R3661 and R3673 because transistor T7673 was conducting due to a leak between pins 4 and 5 of the CNX62 optocoupler.

On another of these sets there was a power supply fault that confused the microcomputer chip. The symptoms were no results with a pulsing power supply. If a dummy load was connected in place of the line output stage the h.t. produced was low at 60V instead of 95V. The cause turned out to be the BZX79-F6V2 zener diode D6702 in the voltage comparator circuit – it was leaky. Out of curiosity I refitted the faulty diode to find out what was causing the pulsing effect. Thyristor 6726, which conducts in the standby mode, was being intermittently triggered by the microcomputer which was rather confused as it was getting the power fail signal and no reset pulse. **P.B.**

Philips K40 Chassis

This set had no sound or vision and E3 showed on the display. The 141V line was low at 80V and a chirruping noise came from the power supply. The output from the power supply was still low with the loads disconnected and a dummy load provided instead, though it rose to 130V with no load at all. Suspecting a dried-up electrolytic I bridged likely candidates to no avail. Attention was then turned to the regulation stage, where transistor T7121 was found to be open-circuit. According to Philips *Service Link*, transistors T7121/2/3 often suffer when the chopper transistor goes short-circuit. **P.B.**

ITT ST28TX

This set had no sound and a blank raster. The channel display was showing rubbish and didn't respond to remote control commands. I soon found that the reset line to the control microcomputer chip IC701 was stuck at 4V. Both the CCU SEL06 and the MDA2061 were leaky from their reset pins to chassis. New chips brought back the picture and the display but there was still no sound. The mute line was operative as D701 (1N4148) was leaky.

Why had all these items failed? They are all supplied from a three-terminal regulator whose chassis connection goes through a metal screening can which was dry-jointed . . . **P.B.**

ITT Compact 80 110° Chassis

This set came from another engineer with a note saying no results. He'd spent considerable time on it and had changed or checked most of the semiconductor devices and high-value resistors in the power supply. Measurements showed that there was no output at all on the 145V and 24V rails. We lifted D732 and D733 to isolate the power supply from the rest of the set and provided a dummy load with a BY127 diode and a bulb. We now had about 10V across the bulb and spent a considerable time checking through the power supply.

After a break and a fresh look at the circuit diagram we realised that with D732 disconnected there was no supply to the secondary side of the circuit. When D732 was refitted the bulb came on with a healthy voltage across it. The h.t. wasn't the full 145V however as the line oscillator wasn't running. When the line output stage was reconnected the power supply shut down. We checked everything for shorts but couldn't find any, so the line output transformer was condemned. When a new one was obtained and fitted the set sprang to life. Note that although the transformer looks the same as and is pin compatible with the one in the CVC1200 chassis they are not interchangeable. **M.D.**

Philips KT3 Chassis

Rolling and excessive height turned out be due to the field scan coupling capacitor C1521 (470μF). We've since had several more sets with this fault. **M.D.**

Salora 1H Series (Ipsalo 2)

There was an intermittent fault on this set. The picture would suddenly go dark, accompanied by a snick from the back of the set. After this the brightness would recover more slowly. We found that the tube's first anode voltage dropped when the fault occurred. The 1kV supply was o.k. however and didn't vary. The voltage at the supply end of the first anode control on the c.r.t. base panel did drop slightly, as did the voltage at the slider, but the problem was at the earthy side of the control where the voltage dropped from around 250V to nearly zero when the fault was present. This was found to be due to leakage from CH5 (2·2μF). Tracking across beneath this capacitor would momentarily short it out. **I.B.**

Salora 22J20 with Videocolour Tube

The complaint was of a buzzing noise even with the volume turned right down. When the set was first switched on in the workshop we didn't hear anything.

After several hours' running however quite a loud rattling noise could be heard. This came from the bonded scan coils and sounded like something loose inside. After wasting some considerable time removing the coils only to find nothing apparently lose we discovered that one of four metal strips fitted just to the front of where the coil windings fold inwards had become loose. They had originally been held on with yellow adhesive tape, but this had become brittle with age and had let go. The problem was cured by sticking all four on with glue and covering this with silicon rubber. **I.B.**

B and O MX2000 (31XX Series)

This set was brought in for no go – only the channel number indicator was alight. The chopper circuit wasn't working and the 0·39Ω feed resistor RP14 to the line output stage was open-circuit. The obvious conclusion to draw was that the line output transistor was short-circuit, and indeed an in-circuit check showed a very low resistance across all its pins. The transistor itself was o.k. however, the cause of the fault being an internal short from pin 8 of the line output transformer to chassis. A new transformer restored the set to working order. **N.B.**

Salora 21/25/28M87 Series

This set (the 25in. version) was on soak test prior to delivery. We still take this precaution despite the wonderful reliability of modern sets. At some stage I happened to pass the set and noticed that the grey-scale looked even worse than usual with these models. It was decidedly purple. I entered the password and zipped through the menu until I reached the black-level adjustments. Adjustment is made with the volume + and – keys, but it didn't work. A new CCU (CCU-SALO-7 in this case) cured the problem.

The grey-scale was now better and while watching the picture a particularly nubile young lady appeared on the screen. I turned up the sound to hear what was going on – only to be greeted with severely distorted, low-level sound from both speakers. So it was over to the bench with the set. The path of the audio is first as SIF from the i.f. can to the detector in the audio module, then into the ADC ICB101 (type ADC2301E) at pins 4 and 5 where in this case it was undistorted. From here PDM1/2 talk to the APU ICB102 (type APU2470S) whose analogue outputs at pins 22 and 23 were severely distorted. Theoretically any of these four chips could have been at fault, but I suspected the APU (audio processing unit of course) and a burst of freezer applied to it seemed to prove the point. A replacement confirmed that the diagnosis was correct.

It's strange that despite all the advances in audio circuit design the evergreen TBA120 is still used and we still employ a can of freezer for fault-finding! **N.B.**

Hitachi CPT2074 (NP83CQ Chassis)

The fault was very intermittent field jitter, or tiny height variations. No amount of probing or jarring would produce the symptom and the intervals between happenings could be so long, and their duration so short, that both measurement and observation were out of the question. Heat and cooling had no effect. I replaced the field output chip and some likely associated components to no avail.

The set I'd lent the owner then failed, so the Hitachi was demanded back pronto. An answer had to be found there and then! One thing I'd noticed was that the line scream changed pitch when the field fell about. So I now let intuition take over from thought and research (intuition = experience plus inspiration divided by two). Older Hitachi sets sometimes had field trouble due to a couple of tantalum capacitors. I therefore replaced C603 (1μF, 16V), which is associated with the field oscillator, and let the Hitachi loose again. There's been no trouble since, but please remember this set in your prayers! **P.R.**

Sanyo CTP3246 (80P Chassis)

This set was dead with the chopper transistor short-circuit and the mains fuse open-circuit. Replacing these items and the 470kΩ resistor that biases the base of the chopper transistor didn't produce the expected results. A raster of sorts appeared, but the height and width were much reduced and there was much squealing from the discomforted power supply. As expected, the h.t. was low. There were no shorts and no overheating however. A scope check on the drive to the chopper transistor produced a waveform that looked more like a burst signal. The penny then dropped. We next used the scope to check across the 100μF, 400V main reservoir capacitor. The result was a display with masses of nasty ripple. Fitting a replacement put matters right. **S.L.**

Binatone Portable CTV

The design of this set showed a remarkable resemblance to many Amstrad receivers. The 5·6Ω, 5W resistor and the mains fuse were both open-circuit. After replacing these items we checked for shorts across the output rail and found that the so-called "avalanche" protection diode was faulty. This was removed and the set was powered up via a variac to check the regulation. There wasn't any – the output rose and rose past the correct 103V. Good results were obtained when a new STR50103 chip and protection diode were fitted. **S.L.**

Hitachi CPT1556

A dead set with the characteristic squealing usually indicates a loaded power supply. In this case the efficiency diode DN08 (BY228) in the line output stage was short-circuit. **S.L.**

Hitachi CPT2174 (G6P Chassis)

This set was dead with a squealing power supply and a short-circuit reading across the line output transistor. On this occasion the line output transformer was the cause. **S.L.**

Hitachi G8Q Chassis (FST)

There was no sound or raster but the power supply was quiet and provided the normal output. We found that there was no 12V supply as the 12V regulator was open-circuit. **S.L.**

Alba CTV14

We've had various faults on these portables due to print cracks on the front panel — they seem to be very vulnerable to this, particularly at the top left side near the 5V regulator. Symptoms have included no tuning, no sound, full sound, dead set etc. **S.L.**

Servicing Compact Disc Players

Part 9

Joe Cieszynski

In part 5 we saw how the analogue audio information is converted into a stream of 16-bit binary words known as samples. These samples emerge from the decoder in serial form, at a rate of 44,100 per second, alternating between left and right audio information. This month we'll consider how the binary data is converted back into an analogue signal and how the left and right audio signals are separated. We'll also take a look at the filters used to remove the 44·1kHz sampling component and the reasons why the majority of players employ oversampling.

Digital-to-analogue Conversion

When the signal reaches the digital-to-analogue (DA) converter the original 16-bit L/R samples have been recovered and error corrected as necessary. Each sample must now be converted back into an instantaneous voltage equivalent to the corresponding voltage fed to the analogue-to-digital converter during the recording process. The easiest way of understanding DA conversion is to consider the basic weighted-current converter shown in Fig. 1.

Switches S1-8 close when logic ones occur. When an 8-bit word (parallel data) is applied to the data input, a combination of switches will close depending on the number and position of ones in the 8-bit word. As a result, a current Isum flows in the summing circuit. This current value is then stored as a voltage in a sample-and-hold circuit. When the next 8-bit word arrives the switches will toggle accordingly and a new value of Isum will be obtained. You can see from the resistor values that each is twice the value of the previous one, so the current must be exactly half that in the previous leg. This arrangement makes it possible to obtain 256 different values of Isum, each increment being of identical value.

This theory is fine, but in a CD player the samples to be converted consist of sixteen bits. Unfortunately the number of inputs to this type of circuit is limited by the gain of the amplifier. Sixteen inputs would not be possible because the amplifier would saturate with high-value samples. To overcome this problem we can use two converters as shown in Fig. 2, one converter handling the first eight bits of the sample and the other one the second set of eight bits. This second converter provides Isum values that are 256 times lower. This gives us the 65,536 increments required to recover the audio signal from the compact disc faithfully. The two latches are used to convert the incoming serial data to 8-bit parallel form.

The summed outputs from this arrangement are fed to a sample-and-hold circuit that stores each sample until the next one arrives. In a CD player the sample rate is 44·1kHz, so the sample-and-hold output changes at this rate. If an oscilloscope is connected to the sample-and-hold output while the player is reproducing a pure sinusoidal note you will be able to observe the reconstituted sinewave which, for want of a better description, I call a stepped sinewave (even though this is a mathematical impossibility!).

To help in understanding the operation of the circuit shown in Fig. 1, Table 1 shows the outputs for a set of 8-bit binary inputs. You will see from this that each single increment in the binary count produces a 4mV voltage step. On this basis the waveform shown in Fig. 3 has been plotted. This is how the audio would appear on an oscilloscope, except that the steps would be smaller and of much greater number (a CD player uses 65,536 levels while the circuit shown in Fig. 1 has only 256).

There are in practice many types of DA converter, each with their advantages and disadvantages. The arrangement shown in Fig. 1 is very simple and is useful for putting over the principles of DA conversion. It would not however be used for converting audio or video information because it's difficult and expensive to manufacture. The reason for this lies in the values of the input resistors. These are not only awkward (e.g. if R8 is 100kΩ then R1 must be 781·25Ω) but must be made to within very close tolerances otherwise the output steps won't be equal, resulting in serious distortion of the recovered signal.

The Integrating DA Converter

The integrating or ramp counter DA converter is the type normally used in CD players. The principle here is to charge a capacitor at a constant rate for a period determined by the 16-bit data word. See Fig. 4.

Capacitor C is charged by the constant-current sources Io and io when the current switches are closed. The current held by the capacitor is thus Io + io. The 16-bit data words are loaded into two 8-bit counters. Thus each counter is given a binary value. The current switches

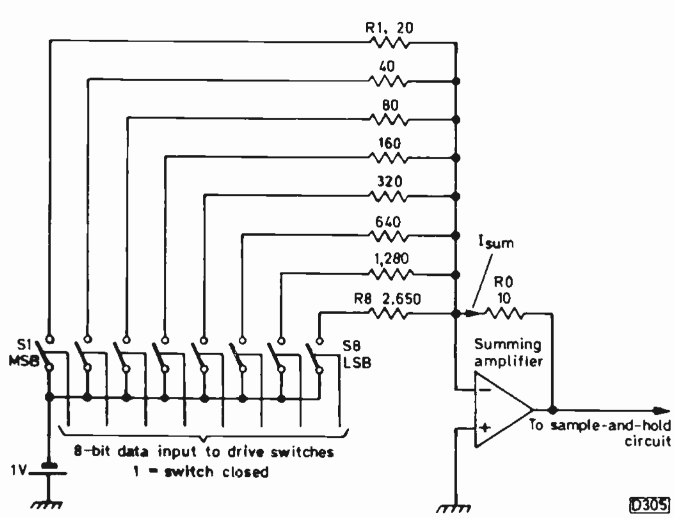


Fig. 1: Simple 8-bit weighted-current DA converter circuit. The output voltage depends on the value of Isum, which in turn depends on the number of switches that close when an 8-bit word is applied to the input. For example, Isum is 391μA with the input word 00000001 and 50mA with the input word 10000000. Remember that the most significant bit (MSB) is the digit on the left, controlling S1. The least significant bit (LSB) is the one on the right. In a practical circuit R8 would be about 100kΩ, making R1 781·25Ω.

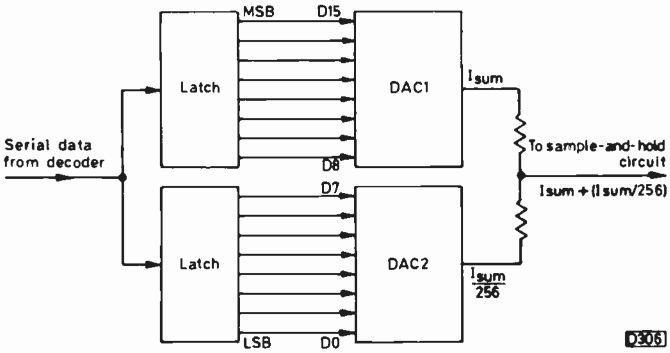


Fig. 2: Method of connecting two 8-bit DA converters to give a total (sum) output: with 16 inputs there are 65,536 possible output levels.

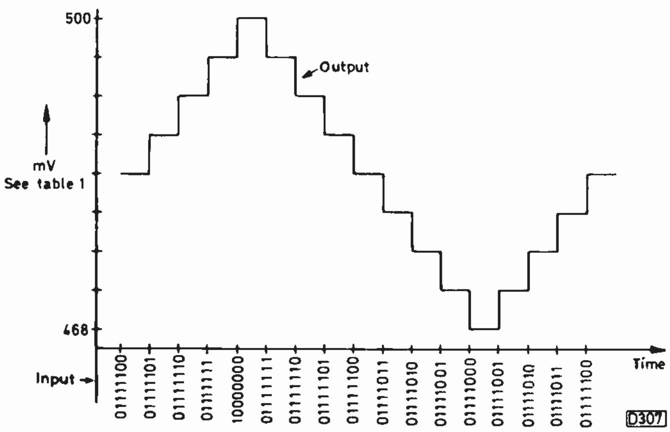


Fig. 3: How a DA converter and sample-and-hold system produce a "stepped sinewave".

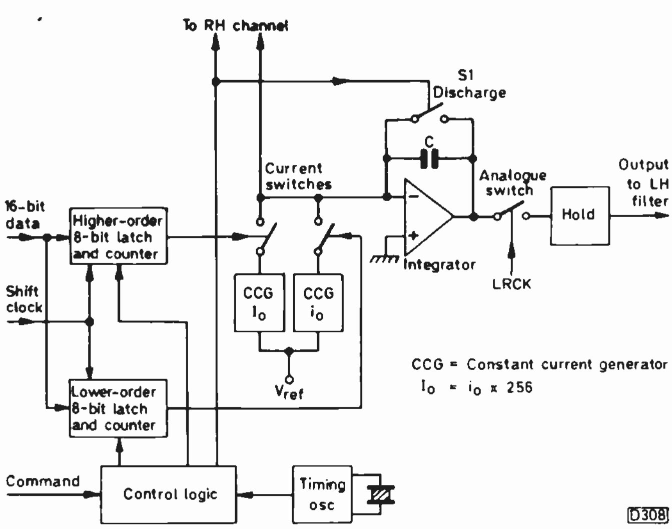


Fig. 4: Operating principle of an integrating type DA converter.

close immediately after the counters have been loaded and the counters then begin to count down to zero at a constant rate which is determined by the timing oscillator. When each counter reaches zero the corresponding current switch is opened: when both counters are at zero the charge held by the capacitor will be equal to the original audio sample present during AD conversion. The capacitor's potential is fed to a hold circuit. Electronic switch S1 discharges the integrating capacitor between each sample.

The reason for using two 8-bit counters instead of one 16-bit counter is that the clock frequency would be too high. By counting down the two halves of the word

Table 1: DA conversion with a weighted-current converter.

8-bit input	*Decimal equivalent*	*Output voltage*
10000000	128	500mV
01111111	127	496mV
01111110	126	492mV
01111101	125	488mV
01111100	124	484mV
01111011	123	480mV
01111010	122	476mV
01111001	121	472mV
01111000	120	468mV

For the converter shown in Fig. 1 the output voltage is calculated using the formula Vout = Vin × (R0/Rin).

simultaneously and summing the currents the same result can be obtained at half the clock frequency. Notice that the value of the current Io is 256 times that of io in order to obtain the required 65,536 increments.

Practical arrangements use two integrating capacitors, one for each of the stereo channels. Each is charged in turn from a constant-current source. The left and right samples are then fed alternately to the relevant hold circuits via analogue switches. These are toggled by the LRCK (left/right clock) signal which is derived from the PLL oscillator in the main decoder.

Fig. 5 shows a simplified block diagram of a practical example, the Sony CX20017 DA converter chip. Separate left/right charging currents for the integrating capacitors are fed out at pins 17 and 18. Pins 15 and 23 control the discharge switches. The block labelled "clock buffer" is a crystal oscillator that controls the counting. Pin 7 receives the LRCK signal from the decoder. It passes through a D-type flip-flop before going on to the analogue switches in the sample-and-hold chip. The purpose of this flip-flop is to remove from the LRCK signal any jitter that would otherwise cause conversion errors.

Most players use a single DA converter that has to alternate between left and right channel information. The disadvantage of this arrangement is that because the

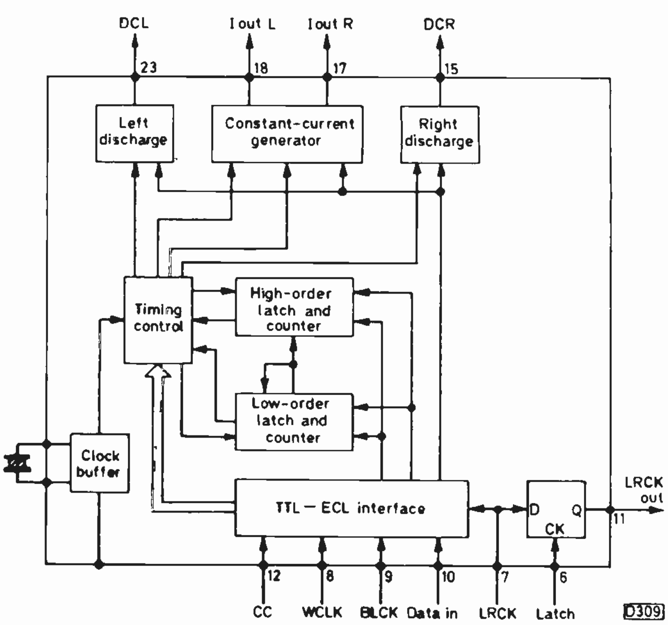


Fig. 5: Simplified block diagram of the Sony CX20017 DAC.

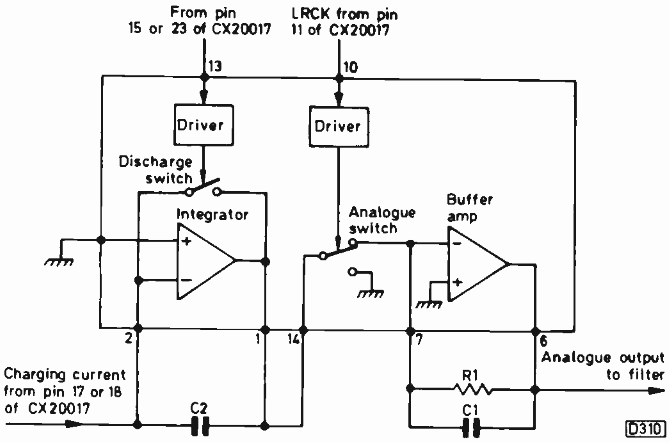


Fig. 6: The Sony M51008P chip incorporates an integrator to obtain the sample, an analogue switch and a store circuit where the sample level is held. Together, the integrator and hold system form a sample-and-hold arrangement.

signals are being processed alternately there's a time difference between the left and right audio signals. This difference is about 11·3μsec, which results in a phase shift of 82° at 20kHz. Most manufacturers don't consider this to be a problem, but you do occasionally come across a player that uses two DA converters, one for each channel, enabling both signals to emerge simultaneously. This luxury is generally reserved for top of the range players.

Hold Circuit

Because the integrating capacitor is being constantly charged and discharged, each sample must be stored until the next one arrives. Storage is done by a hold circuit, the integrator and hold arrangement together forming what has come to be known as a sample-and-hold circuit. Fig. 6 shows a simplified block diagram of an integrator (sampler), analogue switch and hold system, based on the Sony M51008P chip which complements the CX20017. A CD player employs two of these chips, one for each channel. The charging current for the integration circuit is applied to pin 2, which is one input of an operational amplifier used, in conjunction with the external capacitor C2, as an integrator. At the same instant that the charging current ceases the analogue switch operates, connecting the sample stored in C2 to the hold circuit connected between pins 6 and 7. The time-constant of C1 and R1 is short, enabling the circuit to respond rapidly to the next sample level when it arrives. This ensures sharp rise and fall times in the stepped output waveform. The operation of the circuit is outlined in the timing diagram shown in Fig. 7.

Fault Finding

Problems in the DA converter and hold section of the circuit are uncommon. When they do occur they are not too difficult to pin down. The symptom will depend on the part of the circuit that's failed, but here are some guidelines.

In the event of distorted sound in one channel, if possible play back a test disc with a single audio tone and scope the signal from the preamplifier back through the filter to the output of the hold amplifier. If you've had no luck up to this point, scope the charging current, e.g. at pins 17/18 of the arrangement shown in Fig. 5, and compare the conditions in the two channels. If this current waveform is distorted, suspect the converter chip. We found the CX20017 chip to be the cause of the trouble in one player that displayed this symptom.

Distorted sound on both channels is unlikely to be due to the sample-and-hold system unless both are in the same chip. The most probable causes of this trouble are the DA converter, the RAM or the RAM address. Scope the RAM address lines to ensure that one has not failed. Scope the data entering the converter: if this is a clear waveform, suspect the converter – you may have to locate the cause of this fault by component substitution. Don't be tempted to go for the decoder chip unless you are desperate – when faulty this chip usually gives no sound and often results in disc speed problems.

No sound on either channel is perhaps the most common symptom with CD players. If the disc speed is correct and you've gone through the usual servo adjustments (which we've not yet covered in this series), check the data entering the DA converter. But beware: in the fault condition it's often possible to pick up clock pulses at this point and to mistake these for data. As a general guide, clock pulses appear as a stable waveform whilst a data stream appears "fuzzy".

Before you get too involved, do remember to check

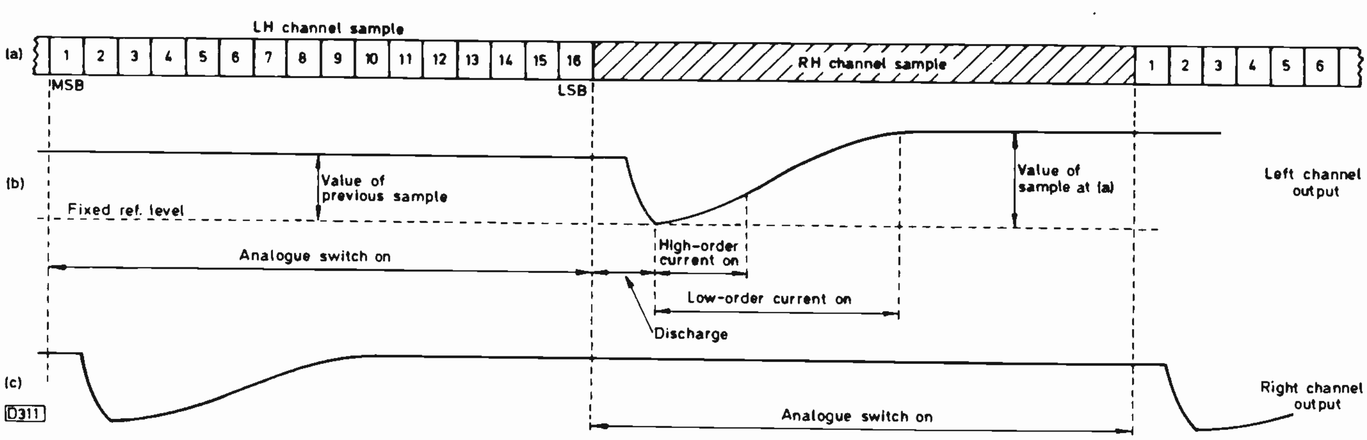


Fig. 7: Timing diagram showing the operation of the circuits shown in Figs. 5 and 6. A 16-bit input word is latched into the counters, the eight most significant bits followed by the eight least significant bits. If the current waveform shown at (b) is taken to be the left-hand signal, then during this period the right-hand integrator will be charging. Soon after the last bit has been latched in, the analogue switch opens and the discharge switch closes to remove the previous sample. When the discharge has taken place the counters begin their count down to zero. During this time the integrating capacitor recharges. The analogue switch closes again immediately after the last right-hand bit has been latched in, and the cycle repeats.

the power supply rails. CD players are full of those notorious circuit protectors that seem to keep many service engineers in business today.

Filtering

The final step in the recovery of the audio signal is to pass the coarse output from the sample-and-hold system through an analogue filter. If we analyse the signal shown in Fig. 3 we see that it contains the fundamental audio signal plus 44·1kHz sampling components (in simple English, steps). The frequency spectrum of this waveform is shown in Fig. 8. From this it's clear that if all the sampling components are to be removed the filter must have a sharp roll-off at 20kHz. Early players used such filters, which have become known as brick-wall filters, but unfortunately the result is that signal components above 15kHz suffer severe phase distortion that detracts from the high performance expected of a digital audio system.

Oversampling

The solution is to use a digital filtering technique known as oversampling. The idea is to make the task of the analogue filter simpler by moving the sampling components away from the audio range, see Fig. 9.

Oversampling takes place before DA conversion, i.e. in the digital part of the system. It's easier to explain the principle by looking at the analogue signal that emerges from the sample-and-hold circuit however.

Fig. 10 compares the effect of basic sampling at 44·1kHz and four times oversampling at 176·4kHz. For each sample at 44·1kHz there are four levels at 176·4kHz. But how, you may ask, is it possible to have a sample rate of 176·4kHz when the rate of the data coming from the disc is 44·1kHz? The technique used is interpolation, in a similar manner to the way in which large data dropouts are covered in the error correction process (see Part 6). The original samples are used to calculate new intermediate sample levels. From Fig. 10 you can envisage how this is accomplished. But let me re-emphasise that this process is carried out before DA conversion and is really a mathematical calculation based on the 16-bit binary words that make up the L/R audio samples.

Those familiar with CD players from different manufacturers will know that some use ×2 oversampling, some use ×4 while a few use ×8. Is there any difference? Most people agree that under normal listening conditions ×2 oversampling gives a marked improvement in comparison to the results obtained from a player that doesn't use any oversampling. Fewer people can discern between the performance achieved with ×2 and ×4 oversampling – personally I think that I can just about discern some difference. I have never had the opportunity to hear a player with ×8 oversampling, but those who have assure me that they cannot tell the difference between this and ×4 oversampling. Perhaps I should mention that those I refer to are service engineers rather than hi-fi connoisseurs, who might perhaps tell us a different story. In practice most manufacturers seem to be adopting ×4 oversampling.

From the spectrum shown in Fig. 9 you may wonder why there's any improvement at all between ×2 oversampling and higher oversampling rates. Look again at Fig. 10 however and consider the action of a passive

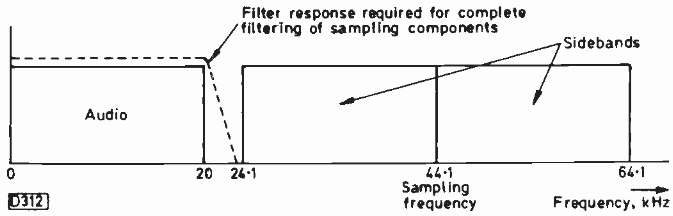


Fig. 8: Frequency spectrum of the audio and a 44·1kHz sampling signal. With a 20Hz-20kHz audio range the analogue filter must have a completely flat response up to 20kHz and then fall off before 24kHz. This calls for a roll-off of −80dB/octave.

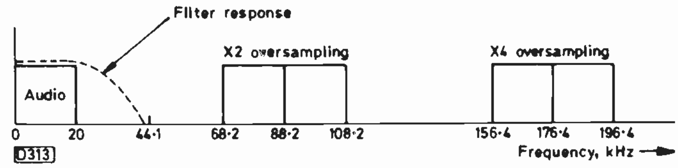


Fig. 9: Frequency spectrum for two times (88·2kHz) and four times (176·4kHz) oversampling. By moving the sampling signal components away from the audio signal, the analogue filter's roll-off does not have to be so severe. The problem of phase distortion at around 20kHz is thus overcome.

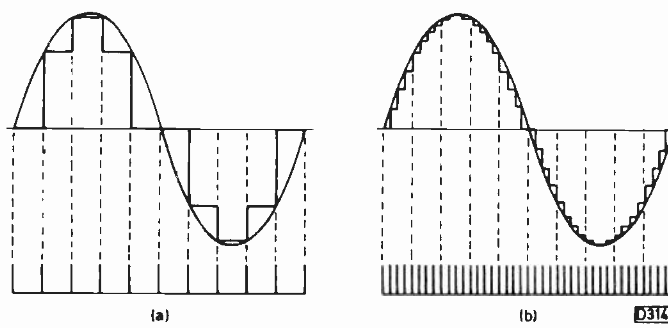


Fig. 10: Sample-and-hold outputs obtained with a sampling rate of 44·1kHz (a) and 176·4kHz (b).

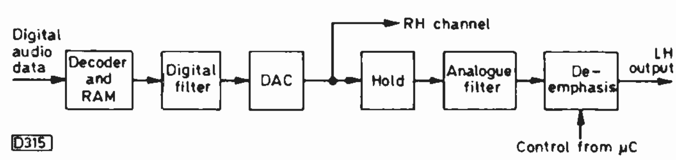


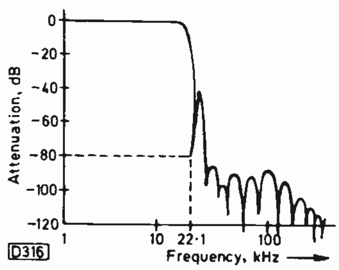
Fig. 11: Block diagram showing the signal path in a player that employs a digital filter.

filter on both the waveforms. Clearly the more steps there are the better the integrated output from the filter will be, but as I've said sampling rates above 176·4kHz do not seem to provide any subjective improvement as far as the average listener is concerned.

To complete the picture of oversampling, Fig. 11 shows in block diagram form the area of a CD player that employs digital filtering.

Fourteen-bit Converters

Engineers familiar with earlier Philips CD players will know that many models employed 14-bit instead of 16-bit DA converters. Since all discs carry 16-bit sample words, how did this work? The problem was that many of the early 16-bit converters were not as accurate as they should have been theoretically. They would often incorrectly translate the two least significant bits. In view of this Philips chose to ignore the last two bits in each word. Despite this the company claimed that the resolution of its DA converter was better than that of



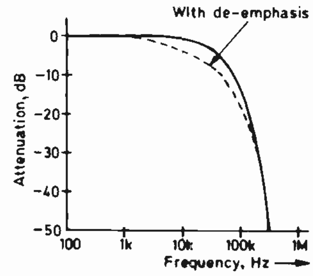


Fig. 12 (left): Response of a "brick wall" filter. The output falls by 80dB between 20kHz and 22kHz.

Fig. 13 (right): Frequency response of a filter for use in a player that employs four times oversampling.

rival 16-bit versions, because the errors introduced by 16-bit converters were random.

In theory, ignoring the last two bits of each sample would worsen the signal-to-noise ratio by 12dB. Philips overcame this by introducing four times oversampling plus a technique of cancelling out the error introduced by the omission of the two bits by feeding the error back in antiphase. What it mounted to was a claim that Philips' 14-bit converter with oversampling produced a marginally better signal-to-noise ratio than that of a 16-bit converter without oversampling. At the time it was not easy to introduce oversampling with 16-bit converters because of their faster speed of operation. Eventually of course the inevitable happened: players were produced with 16-bit converters and oversampling. In practice this is all rather academic considering that the signal-to-noise ratio is around 96dB.

Analogue Filters

The ultimate sound quality produced by a particular CD player depends very much on the analogue filter used. If this cannot remove the sampling components completely, i.e. the steps in the waveform, or if it introduces severe phase distortion, the sound quality will be impaired.

Most players without oversampling use a filter that consists of a passive integrator followed by an active, frequency-selective filter. With this arrangement the cut-off point is determined primarily by the time-constant of the passive filter. Fig. 12 shows the response of one of these filters.

As we've seen, when oversampling is employed the need for such severe filtering is removed and the roll-off can be much more gentle. Fig. 13 shows the response of a Philips Bessel filter used in a player with four times oversampling. It introduces 50dB of attenuation at 156·4kHz: this frequency is 176·4 – 20kHz, the lowest sample component in the spectrum (see Fig. 9).

More upmarket players have a switched de-emphasis network in the vicinity of the analogue filter. In Part 7 of this series we mentioned that the Q subcode data contains information to tell the control microcomputer whether the disc being played has pre-emphasis. In such a player the microcomputer chip will operate switches in the audio stages to control the 50μsec time-constant de-emphasis networks. These introduce a 6dB/octave attenuation at frequencies in the range 3·2-10·6kHz.

Because the filter has such a great bearing on the final sound quality, manufacturers have produced many circuit designs. From the point of view of the service engineer however one is very much the same as another. The filters are usually contained in a sealed module, making them very reliable. Should you ever have to replace one, be careful that it's of the correct type otherwise you could end up with a mismatch in the sound from the left and right channels.

We have now covered all the signal processing sections of the CD player. In the next instalment we'll begin to look at what is perhaps the most troublesome area in CD players, the servos.

Servicing Aids

Nick Beer

We've recently bought a couple of very useful servicing aids from RS Components. They are probably targetted at the telecoms and computer engineering markets – RS is more and more moving away from our end of things – but we have nevertheless found them to be helpful in our domestic consumer electronics servicing activities.

The first is an anti-static kit for field servicing. It's a portable version of the kit that we built into our workshop anti-static station some time back – see *Television* December 1988 – enabling static-sensitive devices to be replaced safely in the field. We decided to try it since the workshop unit had been so successful. The amount of outside work that involves static-sensitive devices is ever increasing. The tendency would have been for such work to be brought into the workshop, but our aim is to avoid this if possible. In addition to repairs a certain amount of upgrading work is involved – for example microcomputer chips in certain Bang and Olufsen units have to be changed when a system is expanded. We find it more efficient to do as much work as possible in the field.

An alternative or extra use for the kit, particularly if you don't have a workshop anti-static facility, is for on-bench use. It's a help when you have a heavy unit that's not easy to transport to the anti-static station, or when the equipment being serviced has been dismantled into many parts that are only loosely connected.

The mat is in the form of a large tool roll with coiled leads that connect the mat to the engineer's wrist and a suitable earth. These leads are bright yellow, contrasting with the black colour of the main side of the mat. I say main side because there are pockets, as with a tool roll, in which to store components etc. The other side is bright blue. While the black side is volume conductive (surface resistivity $10^5\Omega$/sq.) the blue side is static dissipative (surface resistivity $10^8\Omega$/sq.).

It's a well made kit that serves its purpose well. As with a tool roll it can be rolled up and is thus easy to transport and store. With savings in labour and damaged components it should recoup the initial cost in no time. Remember that static damage does not always lead to immediate component failure – the damage can lead to failure of the device days, weeks or even months later. Always treat with care any device about which you are uncertain. For example, do you take anti-static precautions when replacing the optical units in compact disc players? You can't be too careful.

The trade price of the kit, order code 552-911, is £42·53 plus VAT – there's a discount for more than nine! Spare leads and wrist straps are available. The workshop kit for bench fitting is available at £82·41 trade plus VAT under order code 550-022.

Introduced with the latest RS catalogue (July-October) is a surface mount development kit. This is aimed at designers and testers working on pre-production and prototype PCBs that use surface-mounted devices. It contains items – also available separately – that are very useful to us when repairing assemblies with surface-mounted components.

The kit is available under order code 567-840 at a trade price of £39·40 plus VAT (discount on five or more) and may be worth considering for the larger workshop. Individual items worth having if you service units with surface-mounted components are solder cream (syringe) 551-693, surface-mount adhesive 567-581 and a rework solder flux aerosol 567-597. The latter is useful for replenishing solder braid that has lost its powdered flux, making it highly efficient again, as well as for its uses with SM components. The kit also contains solder braid, lint-free wipes etc., a low-residue solder (567-531), aerosol solvent cleaner (567-660) and aerosol modified silicone conformal coating (567-682). The latter is a protective coating for PCBs' offering many properties not really essential for domestic equipment but vital for defence and aeronautical applications. I remain in favour of solder cream over traditional solder for soldering many-legged devices, but care is required in its application to prevent short-circuits.

RS Components Ltd., PO Box 99, Corby, Northants NN17 9RS. Telephone 0536 201 234.

Dealing in Second-hand VCRs

Malcolm Burrell

From an early age an old friend of mine used to poach my spares and knowledge. By sheer patience and hard graft he'd make almost anything work. I was horrified however when he diversified into video. My advice to anyone who is thinking about entering this trade, and in particular the regular sale of second-hand consumer electronics products, is simple: don't! There are however those diehards who simply won't be put off.

Since VCRs have been popular for ten years or so an inevitable surplus has built up. The warehouses have lots of them. In order to make a profit out of reselling them you must give a little thought to the potential market. Right now, with rising interest rates, there are plenty of people thinking seriously about buying a reliable second-hand machine. Most people aren't interested in making their own programmes. They just want to spend Saturday evening watching the fare from the local video shop or recording the late night film for viewing next day. Remote control and freeze frame are nice little extras to have, but the trimmings like insert edit and even stereo sound are seldom necessary. It's best therefore to concentrate on basic machines. If they are well serviced and presented they'll seldom reappear in your workshop. This is easier to achieve if you specialise in one or two models.

All stock faults should be corrected on a flow-line basis. Don't wait for them to occur. You'll inevitably find that you've the odd rogue machine on your hands. Put it aside. It will be of use for difficult or obsolete items and will provide an invaluable source of replacements for missing or damaged knobs and trim – even the cabinet itself. It will also assist by enabling you to localise elusive faults by temporarily swapping over panels.

It's important to have a first class aerial input signal available. Loose plugs and jointed leads can result in surprising losses and patterning. Remember that patterning is often the result of beating between the VCR modulator's output and that from a local transmitter. Find the best channel to use in your area, then tune your workshop monitor to it. Channel 36 is usually, but not always, best. Subsequently tune all incoming VCRs to the monitor, but tell customers to tune their receivers to the VCRs. With this procedure local installations at least will usually be free of complaints about off-air viewing.

It's a good idea to become known at your local warehouse(s). Staff are unlikely to be dishonest with a regular customer. Keep a known good test card recording for test purposes, and use part of the tape for making test recordings. When inspecting a machine, check all functions such as fast forward and rewind. If possible remove the top cover and inspect the interior. A nice thin layer of undisturbed dust is a good sign. Solder blobs and unplugged connectors are bad ones. Odd or missing screws could indicate a chequered history. Is the cabinet clean and unblemished?

If you decide against purchase, replace the cover and all the screws. Don't pilfer! Mutual trust is the key to a good relationship with your supplier.

Buying "off the pile" usually means purchasing a non-worker. Inspect as carefully as you can. We've all seen the backroom graveyards of obsolete and uneconomical to repair machines. No rental company is going to give away its assets. A warehouse will soon complain however if the majority of the goods it receives are substandard, though a degree of wastage is accepted with bulk deals.

Essential peripherals such as r.f. leads and mains connectors will often be missing. While trade prices can be reasonable it's often cheaper to make up your own. The VCRs you sell should be ready for instant use.

We all know that a clean car sells more easily than one that looks as if it has been neglected. In the same way an additional polish improves the saleability of a VCR. Certain types of control benefit from a scrub in soapy water followed by a final clean with metal polish. Plastic fascias are often of a colour different from that of the base material. They tend to become worn around frequently used controls. If you have several machines you could remove the fascias and spray them with silver or bronze enamel, then apply dry-print lettering or symbols to replace lost indications. With large quantities it might be an idea to discuss with a local screen printer the cost of producing an artwork and screen for the job. You could even include your own logo.

It's best to remove all rental identification labels – some of your customers may have had an unhappy association with a particular company.

Your price will have to reflect any guarantee given. Try to avoid giving an extended guarantee – it can amount to selling your soul! – but at least agree to free maintenance for a reasonable period. Also try to avoid terminology such as "reconditioned" or "engineered" which could lead to argument. Simply concentrate on building customer confidence and providing value for money.

VCR Clinic

Reports from Philip Blundell, Eng. Tech., A. Farnborough, Joe Cieszynski, Ian Bowden, Nick Beer, Stephen Leatherbarrow, Alfred Damp and William C. Lockitt

Grundig VS200

The symptoms with this machine were as follows: no E-E or record sound, a rolling picture with its own recordings, and the search tuning didn't stop when a station was found. I couldn't see how there could be a common cause for these varied symptoms and therefore decided to check the ribbon cable connectors to the sequence control module. The contacts were o.k. but someone had fitted plug CP1 on back-to-front. Yes, the phantom fiddler had struck again!

For problems such as loss of tuning information or cannot memorise the clock or date check the CMOS battery on the tuning board. It can go open- or short-circuit. When it's short-circuit you can't store information even when the machine is powered up. **P.B.**

Mitsubishi B10/B20

We've had the following fault experiences with these machines.

(1) Failure of R9B5 (5·6Ω) on the control PCB, connected to connector CN. This results in no standby 5V supply and shut down of all functions including the clock display. The cause can be a short-circuit on the sensor panel. Although sufficient clearance is provided for board fixing, the 5V is close to one particular screw that has been known to short this rail to chassis. A fibre washer to provide insulation is all that's needed.

(2) No blue screen with the E-E and playback video level approximately 10dB down can be caused by a dry-joint on L5A0, adjacent to IC5A2.

(3) No blue screen has also been caused by an inactive 17·7MHz crystal – X5A0.

(4) Complete loss of video has been traced to breakdown of Q5B4.

All these faults have been on the control PCB. **A.F.**

Grundig VS180

Total picture dropout at the top of the screen clearly indicated that there was a tape-path problem at the entry point to the drum – bear in mind that his model uses the Beta format U-wrap. Scoping the f.m. waveform confirmed this diagnosis. The fault cleared when slight pressure was applied to the tape at the entry point.

The entry height and angle are set by two guide poles that are located on either side of the full erase head. They were still tightly secured by the original locking paint. Having cleaned everything to no avail I inspected the entry guide poles closely and noticed very slight wear on the one closest to the drum. The pole consists of a collar placed over a fixed pillar and secured. Removing the collar and turning the worn side away from the tape cured the fault, though I must add that realignment of the entry poles called for some patience. **J.C.**

Panasonic NV-FS1

The tuning on all channels would drift after several hours' use. When we'd removed the complete main circuit board assembly to make measurements around the tuner's BT supply circuit we were faced with what appeared to be a different fault: there was no or very weak vision in the E-E mode. A check on the buffer transistor Q703 at the output of the TV demodulator CBA showed that it was reverse biased – its emitter voltage was slightly higher than that at its base. As the collector resistor of this emitter-follower is only 180Ω you'd expect the value of the emitter load resistor to be fairly low. In fact the reading was about 200kΩ. No emitter resistor is shown on this page of the manual (3-94/5/6) so we had to trace the route the "video out" takes.

From the TV demodulator block CBA it passes through the sub-nicam decoder section (and the 12Ω resistor R792) then through the TV demodulator interface CBA to the channel select area, from there to the luminance/chrominance area and on to the input select section. It's here that the two series 75Ω emitter resistors R3906 and R3909 are mounted. They go to a connection marked "GND (TUNER,VIDEO)" which is pin 2 of the pack connection to the main circuit board. In fact this ground is actually a black lead which isn't connected to the main CBA ground but ends in an eyelet. This should be connected to a chassis point on the TV demodulator interface CBA but is disconnected when you remove the screw that attaches it to ground as this also holds the CBA. With the eyelet soldered to the board we were back with the original fault.

When the tuning drifted, there was a slight change in the tuning voltage BT. This is produced by the channel select pack from the digital DAC signal that comes from the tuning/timer chip IC7501. We noticed at once that the BT voltage at the tuner was about 2V lower than that at pin 8 (BT output) of IC7551. The drop was across a series 10kΩ resistor R7555, one end of which is connected to pin 8 of the chip and the other via a 1kΩ resistor to the output from the pack (connection 8). An 0·01μF decoupling capacitor (C7555) is connected from the output end of R7555 to chassis. It was leaky – around 120kΩ – and it was this that caused the drifting. **I.B.**

B and O VCR60/70

These machines sometimes switch to the still mode during play or picture search, with noise bars on the frame. The cause is failure of the cassette switch (part 210). **N.B.**

B and O VHS65/90

If one of these machines suffers from poor remote control sensitivity, connect an 0·001μF capacitor between the collector and emitter of Q924. **N.B.**

Panasonic NV-G25

Premature failure of the heads is common enough with these machines and I didn't doubt for a moment that this was the cause of intermittent loss of the output from one of the heads on record or playback. When the drum was removed however the true cause became apparent – broken leads on the connection pins to the rotary transformer. We've had this on more than one occasion.

Another of these machines would accept a cassette, thread it to the half-laced position as normally but would then unload and eject the cassette. The green cassette-in light never came on. The cause of the trouble was a faulty cassette insert switch – it's a slide switch on the side of the carriage. **N.B.**

Panasonic NV-G40

The problem was with the digital bar scanner for programming the timer. An LCD screen gives confirmation of the information read. When the information was read in the usual order the display would go dim and many of the previously lit segments would go out as soon as the date was reached. If programming was done out of order, with the date selected last, everything was o.k. The cause of the fault was soon traced to two pins on the LCD panel being bridged with solder. **N.B.**

Hitachi VT410

This machine would unload and shut down almost immediately after the load sequence had been completed. It seemed logical to start by checking the flip-flop signal to the microcomputer chip. Careful observation of the screen during the very brief period of time when this signal was visible gave a further clue. Lines on the screen indicated incorrect drum speed. Replacing the lower drum cured the fault. **S.L.**

Ferguson FV11/FV20 etc

These machines have a similar signal processing circuit though there are some differences of course. No playback picture and weak or no luminance in the E-E mode, with the sound o.k., should lead to a check on the signals at LPF702. It's becoming common for this filter to distort the incoming signal badly. I've had the fault three times in three weeks, though I don't see a lot of this equipment. **S.L.**

Sanyo VHR3000

Absence of signals was traced to the scan/memory can. A 12V supply for the tuner is produced within this can. One of the chips in the can produces a switching signal via a couple of transistors and this wasn't happening. We decided to replace the can as a whole to be sure – the customer was one of those difficult ones! **S.L.**

JVC HRD320/HRD700

It's becoming increasingly common to find one of these machines dead with a faulty STK5481 power supply chip. You may or may not find one or more of the CPs that protect the supply lines open-circuit. **S.L.**

Amstrad 4600/4700/TVR3

If the machine shuts down after a couple of seconds suspect no counter operation. The reason of course is no reel pulses, usually due to the reel sensor. Check at pin 21 of the syscon chip (type varies) for the tell-tale squarewave. If this is present the syscon chip is almost certainly faulty, but check the amplitude of the squarewave. If the squarewave is missing the causes, in order of likelihood, are the reel sensor, HIC401 and the capacitor that couples the signal to the syscon chip.

The drum – the lower one in particular – is often the cause of poor pictures, low f.m. on record, poor LP playback and variations of the f.m. due to phase/speed errors in the drum's rotation.

An unusual fault with a 4700/TVR3 was virtually no f.m. from one head when playing back a recording. The cause was eventually traced to the fact that 14DN210/300 produced a switching pulse with an unequal mark-space ratio.

No chroma is always HIC101.

Poor or no luminance is usually HIC201. **S.L.**

JVC HRD230

The fault was intermittent field roll when any tape it had recorded was played back by this machine. It was o.k. in the E-E mode. The f.m. waveform was checked first. This cleared the drum input and output guides of any blame. Attention was then turned to the video processing chip IC101. The output at pin 24 was correct. It's fed back to pin 5 where the field sync pulses were found to be crushed. The culprit was the coupling capacitor C134 (2·2μF, 50V). **A.D.**

Ferguson 3V24/JVC HR2200

If this machine was switched on and then left in the stop mode it would, after about five seconds, go into the alarm mode. If it was switched on and play was immediately selected the machine would work correctly until stop was selected. Then, again after about five seconds, it would go into the alarm mode. Intermittent alarm faults on these machines are usually caused by dry-joints on the front mechacon board. Before attacking this however it's as well to check the operation of the leaf switches under the deck. These are the pinch, brake, after-loading and unloading switches. In this particular case the pinch switch had lost its springyness and stayed closed in the stop position, thus invoking the alarm mode. An inspection of the mechacon board revealed that there were several suspect looking joints here. The best way of dealing with this is to carry out blanket resoldering on both sides of the board. **A.D.**

Sanyo VTC5000

This machine would load when a cassette was inserted. It would then start to play. After about five seconds it would stop, with the tape fully loaded. The only function that then worked was stop. The tape could then be unloaded. Our main problem was that this fault was very intermittent. We had to spend a lot of time trying to instigate it.

Attention was centred on the system control circuit. We found that when the fault was present there was no waveform at pin 39 of IC3001. The input waveform at pin 2 of S3003 was correct and the culprit turned out to be Q3012. **W.G.L.**

Ferguson 3V36/JVC HRD225

This machine produced a picture that looked as though the line hold was off frequency. You could see that the head drum was revolving too fast. After a few seconds the tape stopped and unloaded.

Our first check was on the drum FG pulses at pin 4 of IC404. The waveform here and also at pins 6 and 11 was correct. Moving on to IC406 we found that the voltages at pins 15 and 13 varied while there was zero voltage at pin 14. The 12V zener diode D412 was short-circuit. **W.G.L.**

ECONOMIC DEVICES PO BOX 15, WOLVERHAMPTON, WV2 4AZ

15/80H	2.72
15/85R	3.28
17052	5.61
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	0.15
1N5408	0.14
1N914	0.04
1S1555	0.31
1S44	0.10
1S921	0.10
2N2219A	0.37
2N3053	0.35
2N3054	0.99
2N3055	0.79
2N3442	1.16
2N3702	0.14
2N3703	0.18
2N3705	0.16
2N3706	0.14
2N3707	0.16
2N3711	0.11
2N3771	2.04
2N3772	1.55
2N3773	2.20
2N3819	0.40
2N3823	1.17
2N3904	0.15
2N3908	0.62
2N4101	1.33
2N4240	2.00
2N4444	0.90
2N5293	0.50
2N5294	0.50
2N5296	0.48
2N5297	0.50
2N5298	0.61
2N6109	1.58
2N6130	0.85
2N6133	1.25
2N6180	0.73
2N6292	1.65
2SA1006	1.50
2SA1011	1.65
2SA1015	0.49
2SA1012	1.25
2SA1020Y	0.80
2SA1027R	0.45
2SA473	0.75
2SA766S	4.95
2SC1173Y	1.25
2SC1474	1.25
2SC1509	1.36
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	4.88
2SA628	0.37
2SA639S	1.75
2SA659	0.49
2SA673	1.50
2SA684	1.20
2SA697	0.80
2SA699	1.25
2SA715	0.95
2SA748	1.95
2SA817	0.18
2SA835	2.50
2SA836	0.89
2SA844	0.65
2SA872	0.59
2SA884	2.15
2SA937R	0.97
2SA940	2.23
2SA940-2	2.14
2SA950	0.72
2SA951	1.75
2SA966-Y	0.85
2SA999	0.75
2SB774	0.65
2SB185	1.13
2SB375	3.87
2SB400	0.40
2SB405	1.03
2SB511	2.65
2SB54	1.39
2SB546	0.56
2SB56	2.80
2SB618A	2.22
2SB631	2.00
2SB643	0.50
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	1.98
2SC1317	0.50
2SC1364	0.49
2SC1383	1.20
2SC1391	2.45
2SC1398	0.75
2SC1413A	5.00
2SC1446	1.25
2SC1447	2.07
2SC1475	0.80
2SC1505	1.00
2SC1514	1.37
2SC1573Q	1.63
2SC1583	0.34
2SC1617	3.89

2SC1678	1.92
2SC1741	1.25
2SC1810	1.70
2SC1815	0.20
2SC1826	0.67
2SC1829	2.25
2SC1875	4.50
2SC1893	3.02
2SC1906	0.90
2SC1921	1.37
2SC1923	0.30
2SC1929	2.25
2SC1942	1.98
2SC1959	0.26
2SC1957	0.95
2SC1953	1.93
2SC1962	1.93
2SC1969	1.78
2SC1983	3.28
2SC1985	1.55
2SC2009	0.34
2SC2029	2.33
2SC2028	2.11
2SC2063	0.99
2SC2078	3.39
2SC2073	1.54
2SC2085-Q	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	3.84
2SC2570	0.80
2SC2577	1.60
2SC2578	6.75
2SC2671	0.91
2SC288A	1.85
2SC3153	6.50
2SC372	1.40
2SC373	1.16
2SC383	1.33
2SC388	1.27
2SC394V	0.81
2SC403C	0.60
2SC458	0.34
2SC495	0.92
2SC515A	1.85
2SC535	0.79
2SC536	0.10
2SC537	0.54
2SC606L	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	3.04
2SC876	0.96
2SC930	0.54
2SC935	4.13
2SC940	4.68
2SD1128	2.90
2SD1138	0.94
2SD1273	1.30
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	2.65
2SD325D	2.26
2SD350	3.05
2SD353	7.50
2SD389	2.41
2SD401	1.40
2SD414	1.98
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	0.60
2SD811	7.63
2SD823	1.98
2SD837	1.48
2SD841	2.00
2SD856	1.00
2SD857Q	1.84
2SD882	1.15
2SD894	1.75
2SD898	0.82
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	0.30
AD162	0.45
AF114	2.47
AF115	1.24
AF118	1.20
AF127	0.65
AF139	0.40
AF178	1.45
AF179	0.55
AF180	0.55
AF181	0.53
AF186	0.53
AF239	0.53
AF279	0.88
AN115	3.98
AN155	1.89
AN206	2.58
AN208	3.55
AN210	2.28
AN211	3.25

AN214Q	2.40
AN234	5.09
AN236	3.33
AN240P	0.99
AN241	1.71
AN245	4.90
AN253	1.80
AN260	3.85
AN272	7.92
AN295	5.52
AN301	2.45
AN302	3.09
AN305	8.88
AN315	2.46
AN316	5.53
AN318	9.35
AN320	5.47
AN321	2.25
AN322	6.78
AN337	5.37
AN340P	1.53
AN355	5.98
AN362	1.50
AN370	3.95
AN5111	3.43
AN5120N	4.50
AN5132	4.42
AN5250	4.40
AN5610	7.43
AN5612	2.07
AN5613	4.20
AN5630	3.95
AN5701N	1.66
AN6250	2.95
AN6300	4.40
AN6310	4.54
AN6340	6.46
AN6341	1.42
AN6363	16.00
AN6531	1.95
AN6551	0.50
AN6552	0.68
AN6610	1.65
AN7111	1.25
AN7115	2.52
AN7145	2.80
AN7146	9.90
AN7151	2.37
AN7156	2.85
AN7158	2.34
AN7218	0.80
AN7223	4.55
AU107	5.87
AU110	5.69
AU113	6.95
AY105K	2.08
AY106	1.09
BA524	8.94
BA310	0.14
BA1310	1.98
BA1320	1.38
BA1322	3.95
BA1330	2.75
BA145	0.19
BA148	0.25
BA154	0.40
BA155	0.12
BA156	0.05
BA159	0.09
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	1.65
BA333	1.37
BA335	6.27
BA5102A	2.50
BA511	1.95
BA514	1.00
BA521	1.20
BA524	8.94
BA526	7.98
BA527	2.98
BA532	1.50
BA536	1.70
BA6209	3.10
BA656	1.00
BA7100	11.35
BA841A	28.98
BA843	3.96
BA854	5.76
BAV18	0.06
BAV19	0.11
BAV20	0.35
BAV21	0.12
BAW62	0.11
BAX12	0.11
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	0.45
BC141	0.34
BC142	0.23
BC143	0.34
BC147	0.11
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	0.26
BC184	0.13
BC184LB	0.26
BC186	0.25
BC187	0.28
BC204	0.16

BC207	0.14
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	0.35
BC301	0.23
BC302	0.53
BC303	0.30
BC307A	0.06
BC308A	0.11
BC309	0.17
BC317A	0.13
BC327	0.33
BC328	0.11
BC337	0.09
BC338	0.12
BC368	0.18
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	0.17
BC547	0.10
BC548	0.10
BC549	0.10
BC550	0.10
BC556	0.16
BC557	0.10
BC558	0.10
BC559	0.10
BC560C	0.14
BC635	0.34
BC636	0.20
BC637	0.24
BC639	0.36
BC640	0.24
BCX34	0.40
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	0.26
BD138	0.28
BD139	0.34
BD140	0.32
BD144	1.43
BD150	0.75
BD157	0.67
BD160	1.60
BD163	0.71
BD166	0.42
BD175	0.28
BD179	0.30
BD181	0.99
BD182	0.99
BD183	0.99
BD184	1.21
BD187	0.53
BD189	0.69
BD190	0.69
BD201	0.49
BD202	0.60
BD203	0.46
BD204	0.41
BD207	1.79
BD208	1.23
BD222	0.50
BD225	0.46
BD228	0.63
BD229	1.05
BD232	0.49
BD234	0.42
BD237	0.47
BD238	0.28
BD239	0.45
BD240	0.57
BD241	0.39
BD242	0.50
BD243A	0.37
BD243C	0.50
BD244	0.31
BD244C	0.72
BD245C	0.70
BD246C	0.80
BD253	1.05
BD278A	0.70
BD317	1.20
BD318	2.72
BD375	0.42
BD380	0.76
BD410	0.49
BD433	0.44
BD434	0.45
BD435	0.49
BD436	0.60
BD437	0.41
BD438	0.52
BD441	0.59
BD442	0.66
BD509	1.42
BD510	0.75
BD519	0.98
BD529	0.60
BD530	0.80
BD533	0.67
BD534	0.52
BD535	0.45
BD536	0.50
BD537	0.50
BD538	0.67
BD544B	0.83
BD677	0.40
BD679	0.57
BD680	0.52
BD681	1.48
BD696	2.47
BD699	1.85
BD700	3.70
BD707	0.60
BD709	0.60
BD710	0.80
BD809	0.80
BD810	0.69
BD879	0.74
BD895	2.18
BD901	0.99
BD902	0.65
BDW83C	0.99
BDW84C	0.99
BDX32	1.88
BDX53A	4.93
BDX53B	3.35

BDX54B	0.31
BDX62A	1.96
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	0.13
BF137	0.29
BF153	0.58
BF154	0.26
BF157	0.33
BF158	0.18
BF159	0.18
BF160	0.31
BF167	0.38
BF173	0.34
BF177	0.55
BF178	0.40
BF179	0.36
BF180	0.36
BF181	0.32
BF182	0.34
BF183	0.39
BF184	0.43
BF185	0.39
BF194	0.14
BF195	0.14
BF196	0.17
BF197	0.16
BF198	0.17
BF199	0.17
BF200	0.37
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	0.28
BF257	0.34
BF258	0.33
BF259	0.34
BF262	0.57
BF263	0.57
BF271	0.34
BF273	0.20
BF274	0.20
BF324	0.23
BF336	0.33
BF337	0.45
BF338	0.40
BF355	0.49
BF362	0.60
BF363	0.50
BF371	0.50
BF391	0.25
BF417	0.84
BF418	1.87
BF422	0.30
BF423	0.33
BF450	0.35
BF451	0.29
BF457	0.41
BF458	0.49
BF459	0.52
BF460	0.99
BF469	0.28
BF470	0.26
BF471	0.33
BF472	0.33
BF479	0.61
BF480	1.79
BF491	0.50
BF506	0.43
BF532	0.24
BF596	0.18
BF597	0.27
BF694	0.22
BF757	0.59
BF759	0.47
BF761	1.05
BF762	0.34
BF869	0.49
BF870	0.30
BF959	0.42
BF960	0.49
BF970	0.50
BFR39	0.44
BFR61	0.92
BFR62	0.50
BFR79	0.29
BFR81	0.29
BFR86	1.08
BFR89	1.63
BFR90A	0.85
BFX29	0.34
BFX84	0.37
BFX85	0.41
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	0.42
BLY49	2.20
BR100	0.22
BR101	0.70
BR103	0.66
BR303	1.15
BRC84	2.08
BRX44	0.60
BRX49	0.34
BRY39	0.69
BSS38	0.67
BSTBD140G	4.93
BSTC0246	8.64
BSTC0233	6.12
BSTCC0143	3.07
BSTD1043	2.85
BSV57B	3.91
BSW68	0.60
BSX19	0.34
BSX20	0.19
BSY52	0.50
BSY79	0.51
BT108	1.45
BT119	1.76
BT120	2.17
BT121	2.48
BT123	1.98
BT151-800R	1.03
BTT6018	2.42
BU106	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
BU208/02	1.88
BU208A	1.12
BU208D	1.43
BU209	1.93
BU226	2.45
BU326A	0.99
BU406	1.49
BU406D	1.53
BU407	0.82
BU412	5.29
BU426A	1.67
BU500	1.45
BU508A	1.89
BU536	1.65
BU608	1.65
BU705	2.50
BU806	0.85
BU807	1.40
BU826A	1.95
BUW84	1.39
BUX84	0.50
BUX85	0.69
BY126	0.13
BY127	0.13
BY133	0.06
BY164	0.44
BY176	0.52
BY179	1.42
BY182	1.05
BY187	0.77
BY189	1.76
BY198	1.62
BY207	0.22
BY208	1.11
BY210-400	0.18
BY210-600	0.27
BY210-800	0.19
BY223	1.43
BY224-600	1.88
BY226	0.25
BY227	0.20
BY228	0.60
BY229-1000	1.12
BY229-600	0.92
BY255	0.13
BY295-600	1.03
BY298	0.20
BY299	0.60
BY407	0.90
BY409	1.49
BY448	1.35
BY713	0.65
BYW56	0.14
BYX55-600	0.23
BYX71-600	0.85
BYX71-350	0.62
BYY56	1.20
BZY93C30	1.86
C106D	0.37
C106M	0.76
CA3046	1.55
CA3089	0.83
CA3090AQ	3.25
CA3094	2.20
CA3131EM	2.95
CD4001	0.34
CD4002	0.27
CD4008	1.35
CD4011	0.29
CD4012	0.24
CD4013	0.33
CD4016	0.36
CD4017	0.40
CD4020	1.23
CD4021	0.39
CD4023	0.28
CD4025	0.64
CD4028	0.84
CD4040B	0.60
CD4047	1.06
CD4049	0.24
CD4052	0.64
CD4066	0.21
CD4069	0.29
CD4070	0.25
CD4081	0.14
CD4093	0.40
CD4511	1.10
CD4528	2.04
CD4556	1.47
CR02AM-8	1.70
CV12E	4.09
CX095D	3.14
CX104	8.77
CX108	12.48
CX109	7.86
CX130	8.76
CX134	11.10
CX136	11.49
CX139	11.83
CX157	5.52
CX158	5.50
CX177	8.75
CX187	5.26
CX755	12.95
CX885A	6.85
E1222	0.40
E5024	0.28
E5386	0.25
GD243	4.34
GF758	0.84
HA11215	1.75
HA11211	2.53
HA11225	4.29
HA11229	3.46
HA11235	1.75
HA11124	5.25
HA1125	4.29
HA1137W	1.38
HA1138	5.03
HA11414	5.65
HA1156	1.16
HA1160	4.79
HA1166X	6.60
HA1167	6.45
HA11706	3.61
HA11705	8.00
HA11703	4.22
HA11701	4.56
HA11710	3.45
HA11713	2.90
HA11711	2.00
HA11715	9.90
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	7.87
HA13342	2.65
HA13365	4.02
HA1366WR	1.38
HA1367	2.75
HA1368R	2.45
HA1368	2.07
HA1370	3.71
HA1374	1.80
AA117	9
HA1377	1.75
HA1389R	2.05
HA1389	2.39
HA1392	1.38
HA1394	2.37
HA1397	3.76
HA1398	2.95
HA1406	2.07
HA1452	0.85
HD14538	2.07
HD38702-A2	7.95
HD38750A53	5.77
HD38750A-7	7.25
HD38800A50	14.09
HD44801A05	12.50
HISH1010	8.59
HISH1004	6.00
HISH1002	9.50
HM6231	9.81
HM6232	10.95
HM6251	5.25
HM7103	4.85
HM9032	4.00
HM9012	3.22
HM9015	3.24
HT4207	13.25
HT4208	20.65
KA2101	1.00
KC581C	7.68
KC582C	4.85
L200CV	1.69
LA1201	0.75
LA1210	1.56
LA1230	1.44
LA1320	2.87
LA1357N	9.00
LA1363	1.05
LA1364	3.02
LA1365J	1.15
LA1385	1.53
LA1387	5.95
LA3350	1.43
LA3361	1.60
LA3390	5.52
LA4032P	2.35
LA4100	1.25
LA4101	1.30
LA4102	0.75
LA4112	0.56
LA4125	2.25
LA4138	4.98
LA4140	0.70
LA4192	1.50
LA4220	1.25
LA4420	1.72
LA4422	1.00
LA4430	1.29
LA4440	1.35
LA4445	1.80
LA4460	1.75
LA4461	1.70
LA5112N	1.18
LA7020	13.86
LA7025	11.97
LA7027	10.92
LA7040	9.20
LA7042	3.90
LA7800	1.03
LA7801	0.90
LB1274	3.61
LC7800	9.20
LD3120	1.13
LD3150	2.75
LM1017N	1.81
LM1877	3.50
LM2808	5.94
LM2877	7.45
LM317CKC	1.08
LM324N	0.98
LM339N	0.41
LM340K	11.85
LM348N	2.15
LM380N	2.80
LM567CN	1.71
LM6402/011	10.23
LM6402A093	10.15
LM748	0.69
LM8360	3.87
LM8361	3.57
LR3419	9.37
LR3471	9.37
LU1141	7.27
LU52012	5.95
LU52011	14.95
LU03112	12.37
M193	6.83
M21C	1.30
M23C	1.98
M293	6.71
M51102L	1.69
M5115P	5.24
M51203L	3.15
M51231P	3.07
M5134-9341	4.13
M51353P	5.25
M51381P	5.98
M51393AP	9.48
M51394P	12.50
M5142P	6.85
M5144P	3.77
M51513L	2.55
M51515BL	2.75
M51517L	2.90
M5192	2.20
M5194AP	5.74
M5231L	4.80
M53274P	1.33
M54532P	1.50
M54544L	1.22
M58478P	6.75
M58485P	12.75
MA06	1.07
MA8001	0.82
MA8003	1.16
MB3705	1.98
MB3712	1.85
MB3713	1.69
MB3730	2.09
MC13002	3.90
MC1310P	2.25
MC1327P	1.33

MC1330P	1.98
MC1350P	0.90
MC1351P	1.32
MC1352P	1.40
MC1357P	2.15
MC1358P	1.48
MC14493P	4.20
MC14494P	2.15
MC14497	3.46
MC14510BAL	3.75
MC14511BCP	1.10
MC14528BCP	2.15
MC1712	3.88
MC5192	19.50
MC7724CP	3.49
MCR106-5/6	1.23
MCR220/7	2.28
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	1.89
MJE3055	1.25
MJE340	0.49
MJE520	0.49
ML231	0.99
ML232B	3.01
ML237B	2.51
ML238	5.77
ML923	3.10
ML926	3.58
MM5314N	8.99
MM5316N	9.16
MM5318N	3.11
MM5369N	2.01
MM5387AA/N	6.20
MM5841N	6.64
MN1400VL	13.65
MN1405	7.92
MN1435VX	9.50
MP1192	5.07
MP2794	4.00
MP2812	5.07
MP8512	1.57
MPC596	2.13
MPF256C	0.60
MPS6570	0.48
MPSA42	0.35
MPSA56	0.08
MPSA92	0.45
MPSU05	0.86
MPSU10	1.56
MPSU56	0.60
MPSU60	1.33
MR818	0.33
MR854	0.50
MR914	1.20
MSM5816RS	17.35
MSM5840H	13.95
MVS460-02	0.34
NE542	2.65
NE555	0.19
NE556	0.65
NP1106	11.51
OA202	0.11
OA47	0.16
OA91	0.14
OA95	0.09
OC28	2.52
OC29	2.15
OC36	7.53
OC44	0.35
OC45	0.18
OC72	0.44
OC75	0.44
ON236	1.06
ON782	1.98
OT121	1.45
PT6042	2.45
PT8504	4.98
R1038	2.19
R1039	2.19
R2008B	1.33
R2009	1.98
R2010B	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	1.91
R2540X	3.30
R2615	0.67
RCA2060	2.00
RGP01-15	0.70
RGP10	0.30
RGP30M	0.28
RT402	1.58
RT905A	2.38
S1299	5.34
S2800D	1.84
S2802	2.90
S2818	4.05
S3702S	5.21
S40W	13.10
S6080B	9.98
SA8063	5.17
SAA1006	1.85
SAA1020	4.76
SAA1025	4.40
SAA1024	2.81
SAA1075	4.25
SAA1121	7.44
SAA1124	2.45
SAA1130	4.99
SAA1174	7.77
SAA1250	3.95
SAA1251	3.20
SAA1351	8.11
SAA3027P	2.55
SAA5000	3.25
SAA5010	4.40
SAA5012	5.50
SAA5020	5.78
SAA5030	6.33
SAA5050	7.74
SAB1009B	5.98
SAB3011	7.34
SAB3013	2.47
SAB3021	7.90
SAB3024	6.36
SAB3209	5.82
SAB3210	3.10
SAF1032P	3.58
SAF1039	1.95
SAS5010	8.39
SAS560S	1.66

SAS560T	5.42
SAS570T	5.42
SAS570S	2.61
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	17.95
SDA2112/2	10.28
SG264A	5.26
SG613	8.75
SG629	8.27
SG6533	10.31
SI1125H	7.50
SI1630HD	20.50
SKE2F1/04	1.39
SKE2G3/04	0.85
SKE4F1/06	0.35
SKE4F2/08	1.07
SKE4F2/06	0.80
SKE4F2/10	1.33
SKE4G2/02	0.96
SKE5F3/10	1.60
SKS1/10	2.15
SL1310	3.14
SL1430T	2.31
SL414	3.69
SL432A	3.44
SL439	2.48
SL471	2.88
SL480	3.14
SL490	2.37
SL901B	8.32
SL918A	9.07
SN16861AN0	0.82
SN16862AN	2.98
SN16966N	10.25
SN29717N	7.19
SN29716N	3.66
SN29715N	6.04
SN29722	11.95
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SN29764AN	2.38
SN29767	3.90
SN29770BN	3.69
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SN7400N	0.61
SN7401N	0.36
SN7402N	0.65
SN7404N	0.52
SN7408N	0.27
SN7410N	0.27
SN74121	1.60
SN7413N	0.37
SN74141N	2.65
SN74151AN	1.51
SN74154N	1.27
SN74190	1.35
SN7420N	0.34
SN7430	0.49
SN7440N	0.27
SN7472	1.54
SN7474N	0.44
SN7490AN	0.93
SN74LS26N	1.45
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SN76013ND	3.50
SN76023N	2.97
SN76023ND	3.91
SN76033N	5.54
SN76110N	0.90
SN76115AN	1.61
SN76131	0.82
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SN76228N	3.27
SN76242	5.23
SN76243	5.23
SN76396	2.90
SN76533N	2.47
SN76532N	0.91
SN76545	4.87
SN76546N	3.47
SN76549	2.45
SN76570	3.08
SN76611	2.59
SN76620	2.59
SN76660N	2.48
SN76666N	1.41
SN75708	4.86
SN76709N	5.94
SN75707N	1.23
SN75705N	6.60
SN76730	5.54
SN75810N	0.60
SN76832N	1.35
SN94041	5.54
SN94042	4.35
SPS5384	1.98
ST1702L	0.99
STA401	2.50
STA441C	3.10
STA471C	7.95
STK0029	5.54
STK0050	7.72
STK016	6.91
STK022	5.25
STK031	12.95
STK040	13.34
STK054	3.95
STK058	27.50
STK077	7.67
STK1039	5.75
STK2110	7.33
STK2145	16.95
STK2240	16.65
STK2250	18.95
STK3042	4.95
STK3044	5.75
STK4019	4.50
STK433	4.78
STK4332	6.25
STK435	4.95
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STK436	7.21
STK437	7.50
STK4372	13.13
STK460	7.02
STK465	11.77
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STK501	6.32
STK502	7.25
STK5314	12.40
STK5730	3.20
STK7216	13.10
STK772	3.71

STR1096	4.98
STR4090	9.52
STR440	5.37
STR451	4.93
STR453	8.16
STR454	4.95
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T6035V	0.73
T6036	0.67
T6037	2.11
T6044V	0.97
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T6052V	0.87
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TA7054	2.55
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TA7074P	1.98
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TA7089P	3.10
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TA7102P	5.88
TA7108P	1.61
TA7109	3.71
TA7122B/P	0.87
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TA7129P	1.50
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TA7136AP	1.89
TA7137P	0.98
TA7141AP	3.87
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TA7148P	1.67
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TA7152P	2.72
TA7161P	4.50
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TA7172P	1.41
TA7176P	1.75
TA7193P	4.80
TA7204P	2.16
TA7206P	12.49
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TA7208P	2.15
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TA7313AP	0.65
TA7314	5.94
TA7323P	3.15
TA7325P	1.15
TA7339P	1.85
TA7340P	5.95
TA7607AP	2.10
TA7609	2.65
TA7611AP	2.32
TA7616P	5.25
TA7622AP	8.94
TA7628P	2.50
TA7629P	7.50
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TBA940	1.87
TBA950	1.56

TBA970	3.06
TBA990	1.98
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TCA420A	2.16
TCA440	2.25
TCA530	2.24
TCA640	2.25
TCA650	3.05
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TCA730	3.81
TCA750	2.25
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TCA890	5.44
TCA900	2.04
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TCA940E	2.93
TD3F800R	3.67
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TDA1003A	1.79
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TDA1006A	7.00
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TDA1010	1.02
TDA1011A	1.51
TDA1028	2.45
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TDA1035S	2.95
TDA1035T	2.55
TDA1037	1.95
TDA1037D	2.05
TDA1044	1.95
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TDA1054M	1.21
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TDA1190	2.11
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TDA1270	3.74
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TDA1420	1.52
TDA1440	3.45
TDA1470	2.90
TDA1470P	4.25
TDA1506	6.58
TDA1510	4.60
TDA1512	2.89
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TDA1559	3.15
TDA1670	4.48
TDA1770	2.75
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TDA2003	1.00
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TDA2140	2.14
TDA2150	6.20
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TDA2160	4.01
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TDA2170	4.50
TDA2270	3.96
TDA2520	2.25
TDA2522	2.50
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TDA2578A	2.73
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TDA2581	1.60
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TDA2612Q	4.68
TDA2611A	1.25
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TDA2631	2.73
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TDA2652	8.25
TDA2653	6.18
TDA2654	4.73
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TDA2680	3.20
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TEA1009	0.80
TEA1014	1.50
TEA1020SP	4.93
TIC106C	0.61
TIC106M	0.77
TIC44	0.72
TIC45	0.56
TIC47	0.77
TIP120	1.55
TIP110	0.53
TIP112	0.34
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TIP132	0.99
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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	0.30
TIP32A	0.35
TIP32B	0.46
TIP32C	0.28
TIP33	0.85
TIP33A	1.02
TIP33C	0.80
TIP34	0.75
TIP41A	0.49
TIP41B	0.31
TIP41C	0.68
TIP42A	0.60
TIP42B	0.79
TIP42C	0.82
TIP47	0.65
TIS43	1.43
TIS90	0.21
TL011CP	1.56
TL494CN	8.95
TL072CP	1.45
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TMS1024NLL	10.50
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TMS3720ANS	5.25
TMS3748NS	14.95
TMS3755	13.65
TMS3894NL	19.25
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TY6010B	2.97
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UPC1003	5.95
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UPC32C	4.95
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UPC41C	4.10
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UPC580C	6.60
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
X0022CE	5.75
X0029CE	7.09
X0031CE	6.32
X0035TA	6.18
X0040TA	4.50
X0042CE	4.35
X0043CE	2.75
X0056CE	6.25
X0057GE	6.00
X0065CE	5.77
X0074GE	10.00
X0077GE	15.96
X0079CE	4.95
X0092CE	4.95
X0096CE	5.95
X0109CE	11.25
X0113CE	2.07
X0195CE	7.50
X0204CE	8.74
X0261CE	8.98
ZPY120	3.25

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Ferguson's SRA1 Satellite TV Receiver

J. LeJeune

The SRA1 was launched by Ferguson for reception of the Astra satellite's transmissions. Previous Ferguson satellite TV equipment had been designed for use with the lower-power transmissions from the Eutelsat/Intelsat craft. Reception from these calls for a fair-sized dish to provide an adequate signal-to-noise ratio with the techniques available about three years ago when most receivers were designed.

Construction of the SRA1 is simple. A single PCB carries everything apart from a regulator chip which is bolted to the metal cabinet. The PCB is fitted to a metal tray that forms the unit's base and back panel. A moulded Perspex fascia forms the front, and a sheet-metal top cover with five screws holds the whole assembly together.

Rear panel connectors include a u.h.f. aerial input socket, an r.f. output socket and two scart connectors. One of the latter is for coupling to a scart-equipped TV receiver, the other to provide a link with a descrambling unit. An F socket is used for the input from the LNB. There is no power switch and there are no front-panel controls. An infra-red remote control system is used for all commands. There are some variations: for example some units have filament lamps instead of LEDs for front panel indication, and in some units all the power regulators are on the one printed panel. It's understood that the unit is built for Ferguson by Pace Electronics.

A block diagram of the SRA1 is shown in Fig. 1. Microcomputer chip IC4 controls the unit. One of IC4's functions is channel selection, which involves setting the correct polarity, audio frequency and contrast level, using programmed-in instructions from the EEPROM IC3. There are separate video amplifier chains for the PAL and MAC signals, with provision for MAC decoding and for descrambling. The audio signal is detected by a phase-locked loop system. This is tunable over 5-8MHz. The unit is for monophonic sound only.

On-screen graphics to indicate the status of the receiver and permit changes to be made can be summoned by remote control. The graphics generator IC9 must be synchronised to the incoming video of course – this is done by the sync separator circuit.

The mains transformer has three secondary windings that feed bridge rectifiers. These are followed by static regulators (four) that provide 5V, 12V and 18V supplies. With this arrangement the unit may be found to run on the hot side, but given adequate ventilation no problems should arise. Indeed it's an achievement for so much to be packed into a small, neat box. Units that employ filament lamps seem to run warmer than those with LED indicators. On standby however most SRA1s run only pleasantly warm. Each secondary winding on the transformer is linked to the associated bridge rectifier via a fusible resistor to provide protection. The primary winding seems to be unfused, so fit a 2A fuse in the mains plug to be really safe.

With its Marconi LNB and a 70cm dish the receiver is capable of providing excellent results – all Astra channels are free of sparklies here in the North Midlands. The r.f. circuitry is contained within a tinplate box which is called the satellite tuner. This is controlled by a phase-locked loop in the SAB3035 CITAC chip IC5. The channel tuning data is stored in IC3, being read out by IC4 on command from the remote control system. IC4 passes the 15-bit data to the CITAC chip IC5 where it's stored in a buffer stage. The tuner's local oscillator frequency is divided by 256 in a prescaler within the tuner. This divided down signal is applied to a 15-bit counter within IC5, via a gating circuit that's opened every 6·4msec (4MHz/25,600) for a period of time determined by the Time Reference counter. A comparator circuit then compares the counted-down local oscillator signal and the contents of the buffer, producing an error voltage which is used to adjust the tuning until the error falls to zero. The tuner also contains the phase-locked loop demodulator, which appears to work at around 470-480MHz as some patterning can occur on chs. 21 and 22 when a TV set is operated with its own loop aerial or a set-top aerial within about a metre of the SRA1.

Once the required channel has been tuned in the digital tuning system is bypassed and a.f.c. from pin 11 of IC5 takes control. If drift in the LNB's local oscillator (10GHz) or the SRA1's tuner exceeds the capture range of the a.f.c. the digital tuning system is reactivated until correct tuning is restored.

The demodulated video and audio/teletext subcarriers are passed to two video amplifiers, one for PAL and one for MAC. The MAC video amplifier handles the full video spectrum from the demodulator. The PAL video signal is pre-emphasised at the transmitter, so de-emphasis is required in the PAL video channel. In addition a gain-controlled amplifier is included in this channel, the gain being adjustable in three pre-set steps which are programmed in along with the tuning data and audio carrier frequency during the setting-up procedure. The gain control system is shown in Fig. 2 – its effect is to adjust the contrast level. This is done by adding extra resistors in parallel with R124, Q30's emitter resistor. Selection of these extra resistors is carried out by two switches in IC7 (4053), under the control of inputs from the CITAC chip IC5. The PAL signal is then filtered to remove the subcarriers and fed to the video selector in IC2. A further video amplifier and clamping circuit restore the d.c. level. The video signal is then passed through another switch (IC8, another 4053) which takes care of graphics insertion, after which the signal passes directly to the modulator.

The audio carriers are tapped from the buffer amplifier that follows the tuner. A single broadband transistor amplifier stage couples them to the phase-locked loop audio detector in IC1. The system can handle carriers in the range 5-8MHz. IC1, type XR215CN, contains a voltage-controlled oscillator and an operational-amplifier comparator circuit. The incoming f.m. signal is fed to one input of the comparator and the VCO's signal to the other. Differences in the frequency and phase of the two inputs produce an error output – this is the detected audio. Tuning to the required subcarrier is accomplished by setting the VCO's frequency so that it coincides with the centre-frequency of the required subcarrier. The control voltage for this purpose is

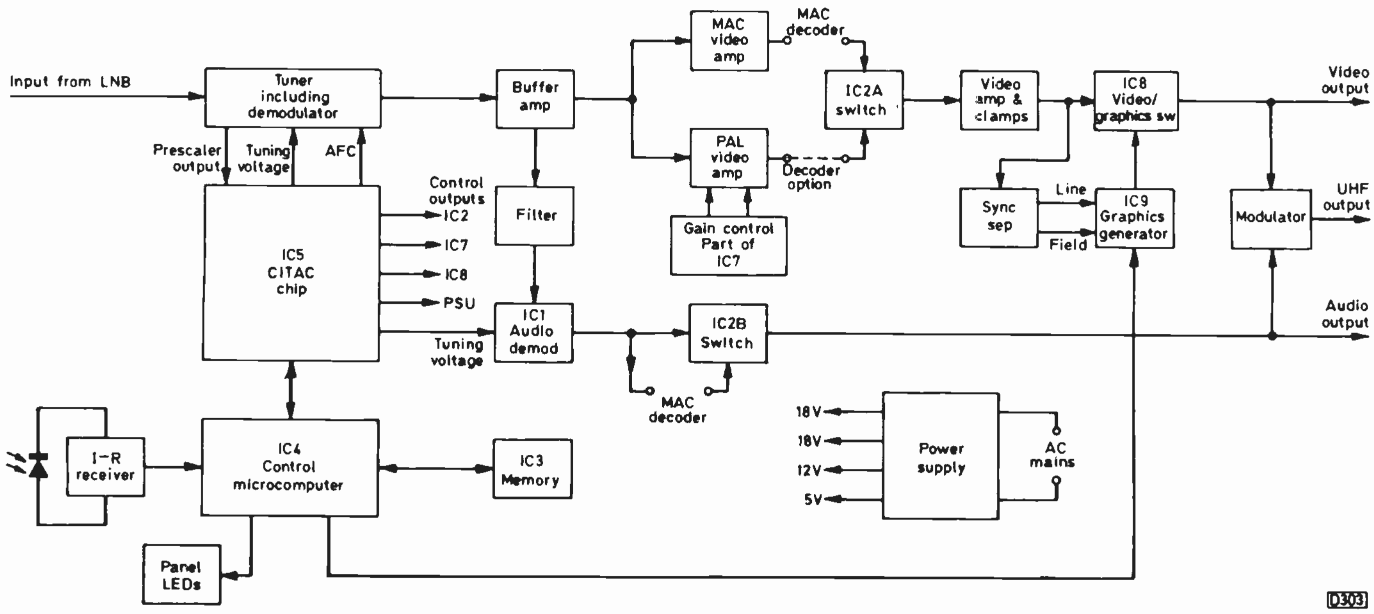

Fig. 1: Block diagram of the Ferguson SRA1 satellite TV receiver.

supplied by the CITAC chip IC5.

The detected audio from pin 8 of IC1 is buffered by an emitter-follower and is then passed to the decoder socket and to the audio selector switching in IC2. The output from this switch is passed to the modulator and to the TV/VCR scart socket.

Setting Up

The modulator contains mixing facilities for terrestrial u.h.f. TV signals. Its output is factory preset to ch. 38 but this can be altered by means of a rotary control on the rear panel.

A nice feature is the set-up signal, which is like that provided by most VCRs. This is of considerable help in the initial stages of installation and in basic fault diagnosis.

The on-screen graphics are another aid to installation. They are produced when SETUP, 1, 4, 7 on the remote control handset are pressed in quick succession. The graphics show the downlink frequency, polarity, audio frequency log (frequency is not displayed directly), contrast setting, decoder type and A/V source choice. You end the setup sequence by pressing both store buttons together twice. Although the receiver is pre-programmed on delivery, it may on occasions require tweaking in order to cater for i.f. variations with particular LNBs. This may occur on initial installation or when either the receiver unit or the LNB is changed.

A tuning frequency error may introduce sparklies and/or sound birdies. By pressing SETUP, 2, 5, 9 and using the up and down arrow keys the error can be eliminated, leaving sparklie-free pictures and sound free of background burbles. Pressing both store keys together once removes the graphics and stores the setting. When experimenting with the unit I found that SETUP, 3, 6, 9 results in the receiver sweeping through the band. Pressing N restores everything to normal.

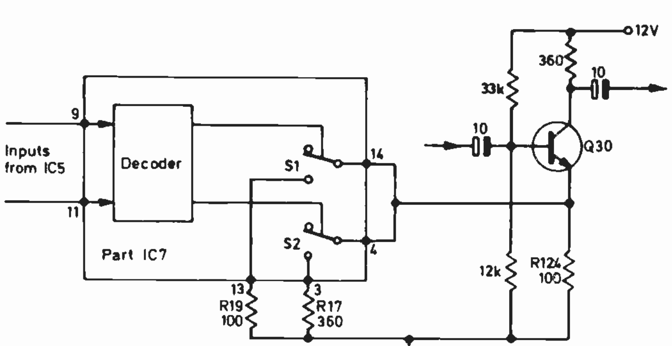

Fig. 2: The contrast control system. S1 and S2 open gives minimum contrast, S1 open with S2 closed gives medium contrast, S1 closed with S2 open gives maximum contrast.

Performance

The SRA1 gives a good account of itself once it has been set-up properly and provided the ventilation is good. Other points worth care are the F connectors at the receiver and the LNB. I found that the best way to ensure a watertight connection at the LNB is to fit a three-inch length of shrink-fit sleeving over the F connector and then apply heat from a good hairdryer or an electric paint stripper. The effort is worthwhile and this system has withstood some heavy downpours of rain. At the receiver end it's as well to use a good-quality F connector that can withstand movement of the receiver unit for cleaning: the crimped-on type is recommended. In my own installation I use an F connector to Belling-Lee adaptor which is of sturdy construction and facilitates removal of the unit for any reason.

The infra-red remote control system has a good range and is fast. It is however affected by line-frequency radiation from some TV sets. There's a small modification to cure this. Remove the outer case from the receiver to gain access to the infra-red detector unit – it's in a small tinplate box at the right-hand front end of the PCB. Then solder two small pieces of thin wire vertically across the rectangular opening at the front of the box. This is all that's necessary – and from experience it works!

Had the SRA1 been equipped for stereo sound it would have made the perfect addition to any domestic home-entertainment installation. For the average home with TV as the major source of entertainment it is nevertheless a neat and simple-to-use satellite TV receiver.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £2 cheque or postal order (made out to IPC Magazines Ltd.), the query coupon and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

GRUNDIG CUC2401 CHASSIS

There is no sound despite replacing the TBA130 chip in the sound section. The circuit is not very clear, with its SDA and SCL lines.

SDA and SCL are the serial data and clock lines in the I2C bus that distributes control and command information around the chassis. Inject a signal at pin 8 of the TDA1905 chip IC365. If there's no response, check that the supply voltage is present at pin 2 and that, with the set switched off, you get a crackle from the speaker when an ohmmeter is connected between pin 1 of the chip and chassis. If so the chip is suspect. If the audio channel is live from pin 8 of IC365 it may be that the sound is being muted inside the TBA130 chip. This is governed by the data on the SDA line from the microcomputer chip IC2800.

TAPE BACK-TENSION

We understand that tentelometer readings can be converted to cassette gauge (JVC PUJ48076) readings by multiplying the former by three. This works for the Panasonic NV333/366 but doesn't work out for many service manuals that give both tentelometer and cassette gauge figures. This makes us wonder whether to use the calculation for any tentelometer readings regardless of VCR make.

Torque is tension multiplied by the radius of the reel. Thus you can multiply by three only if there's 3cm of tape on the reel. With 2cm of tape, multiply by two, etc.

FERGUSON 3V35/JVC HRD120

In a VCR Clinic item some time back it was reported that failure to record the sound could be cured by changing the oscillator transistor Q8 from type 2SD638R to type 2SD638S and adding a 5·6nF capacitor across C48. The 2SD638S does not appear to be available however – JVC supply the original 2SD638R.

We understand that there was a batch problem with the original 2SD638R transistors. Provided the capacitor modification is carried out the 2SD638R transistors now being supplied work correctly.

AMSTRAD VCR4600 Mk II

We have two of these machines with the same intermittent fault – it may not occur for days. In the fault condition the rewind and fast forward functions don't work. When selecting either of them the arrow indication on the display flashes as normal but there's no tape movement and after a couple of seconds the machine goes into standby off – the function switch has to be pressed again. In the fault condition play and record are o.k. I've noticed that when the fault is present the reel brake is not disengaged. Disengagement is activated by the small loading motor via levers and cogs. It seems that the trouble is due to this motor not being activated for long enough – its on time is definitely shorter. Presumably the solution is a new loading motor.

Before replacing the loading motor check for friction in the mechanism it drives, for slippage in the loading belt and for incorrect positioning of or faults in the loading switch at CN-E.

FERGUSON TX10 CHASSIS

There are vertical striations on the left- and right-hand sides of the screen. Those on the left are evenly spaced, 0·3in. apart, and after some seven lines become very faint. Those on the right-hand side are not so even. The fusible resistor R833 that damps the line linearity coil is intact.

Though R833 is intact it's worth making an ohmmeter check – it could have gone high in value or open-circuit internally. Also check that the c.r.t.'s Aquadag coating is properly earthed. If these points are in order, check C831 (scan coupling) by substitution. If necessary, then check C833 and C726. If the problem persists, examine the 12V line for the presence of line-rate pulses. IC621 or C612 could be responsible if such pulses are present.

HITACHI CPT2174 with GEC V4008

When prerecorded tapes are played there are bent verticals at the top of the screen despite using the AV buttons. The verticals are virtually straight with the machine's own recordings.

With this Hitachi set the AV mode is obtained by selecting programme 11 or 12. Check that the collector of transistor Q1103 goes low under these circumstances. If so the time-constant of IC501 is being altered to suit the VCR signals and suspicion falls on the VCR for excessive timing jitter. Check the head drum bearings, free-running of guides etc.

RANK T26 CHASSIS

The top half of the screen is blanked out. All we get is about four inches of picture at the bottom of the screen. Replacing the field output i.c. made no difference.

First disconnect R51 on the signals panel. If this restores a full picture, suspect D10 (ZF22P) and D12 (1N4148) on this panel. Also if necessary check D13 (1N4148). If removing R51 makes no difference turn attention to the timebase panel, particularly the diodes and electrolytics associated with IC2 (TDA2653).

TOSHIBA V83

This machine goes into the stop mode very intermittently during play or record – the fault can occur with manual or timed recordings. The clock display is not affected but any programming is lost. When restarted the machine runs perfectly, often for several hours.

There are two known causes of this trouble. If the mode switch is the original one it could well be responsible. Otherwise the reel motor is suspect. First check the mains connection, plug and wall socket.

TEST CASE

323

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.

It's autumn and the lads in the sales department wait with bated breath for the rush of customers, allegedly preoccupied during the summer with gardens, holidays and worries about high mortgage rates, to pour through the doors to buy Astra receivers. Meanwhile the service department continues to look after those already sold. Now that most of the initial production bugs have been sorted out the problems that crop up don't seem to be too difficult to cope with: faulty stabiliser chips in the power supplies, the odd signal or control chip or tea spilt into a remote control unit – there's nothing new under the sun, as they say . . .

David the Downtrodden was given the job of going out to attend to Mr. Todd's satellite TV receiver. He'd complained about sparklies. On arrival at the Todd residence David found that the pictures were indeed much marred by sparklies. He then discovered that the receiver was not properly tuned. Each channel required a dab on the tune-down key. After treating all the available channels in this way, and committing the tuning points to memory, David departed for the next call in a swirl of leaves.

David's face fell when, next morning, he was asked to return to Mr. Todd and his satellite TV outfit. The call had come before eleven o'clock: same trouble, and the customer angry. On site, Mr. Todd watched as David again retuned the satellite box. Once more the signals came in nicely with adjustment of the tuning controls. David then removed the set's outer case and inspected the PCB carefully, looking in particular for poor joints. He was unable to get into the heavily screened tuner/i.f. section but resoldered some joints on the mother board, beat a tattoo on the entire assembly with a screwdriver (while Mr. Todd was answering the doorbell!) and, finding no drift, pronounced the receiver fit and well. Mr. Todd was not convinced but, with the set working and correctly tuned, there was little he could do – especially as David had suggested that the problem could have been due to poor ventilation in the tuner's original position on top of a warm VCR. They'd found another place for it.

Experienced Test Case readers could probably write the next bit for themselves. Of course the tuning drift continued, the annoyance being mitigated to some extent by the fact that Mr. Todd had learnt how to chase the drift up and down with the tuning controls, having watched David do this. Mr. Todd was free in his opinion of David and the receiver when he next contacted the shop manager about the problem. Arrangements were made to collect the set and bring it back to the workshop during three days when Mr. T. would be away on business. David was pleased to hear about this: no more carpet confrontations.

When the receiver came into the workshop it was immediately found to need slight retuning. Once this was done the receiver remained spot-on all day. The tuning was still correct next day when the set was switched on from cold, with sparkly-free test cards, Lifestyle and the rest. What to do next? Cool it with freezer, heat it with the Pifco hairdryer, then knock seven bells out of it with a heavy-handled screwdriver. In the face of this thermo-mechanical onslaught the receiver acquitted itself well, only drifting a mite when its innards were at egg-frying temperature. The service department was wasting its time. Why?

ANSWER TO TEST CASE 322
– page 945 last month –

When you stay at the Bay View guest-house, in the first-floor front room, you can now have the benefit of clear and pure colour pictures from the 20in. Mitsubishi set that played the leading role in last month's puzzle. It had been afflicted with a localised area of impurity that wouldn't go away despite repeated degaussing, and remained when the scan yoke was changed. The picture tube was thus suspected, but a new one wouldn't have cured the trouble either!

The affected area of the picture was right beside the loudspeaker, and the fault had started when a sound fault had been cured. These two factors had sent the homeward-bound bench engineer back to the workshop, an unprecedented happening. Sure enough he found that the loudspeaker had been replaced with the wrong type. Whoever had last serviced the set had fitted a speaker from some hi-fi system. It had a huge magnet and a proportionately huge stray magnetic field.

The speakers fitted in colour TV sets have a low external magnetic field so that they don't upset the beam-landing in the c.r.t. With the right speaker fitted the purity was restored and good sound was maintained. Luckily for Bay View and Reg!

QUERY COUPON

Available until 15th November 1989. One coupon, plus a £2 (inc. VAT) cheque or postal order, must accompany EACH PROBLEM sent in accordance with the notice on page 48.

TELEVISION NOVEMBER 1989

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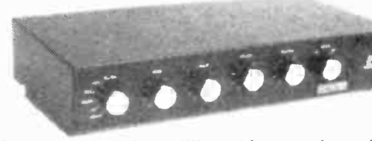

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TV SOUND TUNER

In the cut-throat world of consumer electronics, one of the questions designers apparently ponder over is "Will anyone notice if we save money by chopping this out?" In the domestic TV set, one of the first casualties seems to be the sound quality. Small speakers and no tone controls are quite common and that really is quite sad, as the TV companies do their best to transmit the highest quality sound. Given this background a compact independent TV tuner that connects direct to your Hi-FI is a must for quality reproduction. The unit is mains operated. This TV SOUND TUNER offers full UHF coverage with 5 pre-selected tuning controls. It can also be used in conjunction with your video recorder.

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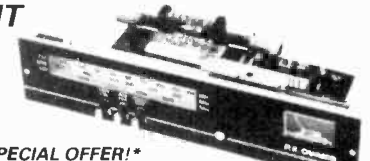
Size: 270×192×65mm. **£35.90** +£2.50 p&p

A.M. F.M. STEREO TUNER KIT



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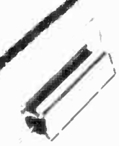

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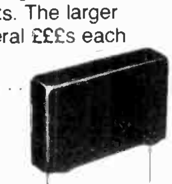

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UPC1263C	£2.50
UPC1277H	£2.75
UPC1278H	£2.75
UPC1363C	£2.75
UPC1364C	£4.75
UPC1365C	£3.60
UPC1384C	£3.50
UPC1387C	£2.50
UPC1391H	£1.50
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BRY56	£0.20
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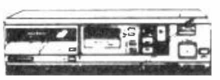

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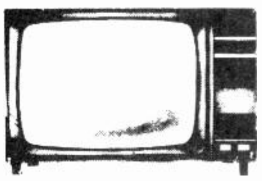

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TA7230P	200p
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TA7240AP	290p
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2SC-941	30p
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2SC-1403	150p
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2SC-2482	50p
2SC-2501	85p
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2SC-2537	450p
2SC-2546	20p
2SC-2550	75p
2SC-2555	175p
2SC-2564	250p
2SC-2565	280p
2SC-2575	25p
2SC-2577	150p
2SC-2579	130p
2SC-2611	50p
2SC-2581	200p
2SC-3078	40p
2SC-3182	250p
2SC-3284	150p
2SC-3298	150p
2SC-3506	230p
2SC-3519	150p
2SD-1265	100p
2SD-198	200p
2SD-200	310p
2SD-235	40p
2SD-288	80p
2SD-299	160p
2SD-313	40p
2SD-315	75p
2SD-325	45p
2SD-352	50p
2SD-357	40p
2SD-358	40p
2SD-381	90p
2SD-386	80p
2SD-388	180p
2SD-389	100p
2SD-400	20p
2SD-401	50p
2SD-426	150p
2SD-428	150p
2SD-438	50p
2SD-468	30p
2SD-476	60p
2SD-478	100p
2SD-525	75p
2SD-526	75p
2SD-600	90p
2SD-612	40p
2SD-613	100p
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2SD-716	125p
2SD-718	125p
2SD 733	230p
2SD-745	250p
2SD-748	150p
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BOOKS & PUB's

VIDEO SERVICING 1987-88

AVAILABLE 1st NOVEMBER

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FINLUX	VR1010, VR1020, VR1025, VR1030, VR2005SW, VR2010, VR2020G, VR2020W, VR2025G, VR2025W, VR2040
GOLDSTAR	GHV12401, GHV12441, GHV12461, GHV12481, VCP41301
GOODMANS	VCR2000
GRANADA	VHSEH2, VHSEH3, VHSES2, VHSEY1, VHSEY2, VHSF63
GRUNDIG	VS400, VS440, VS450
HITACHI	VT410E, VT420E, VT430E, VT450E
I.T.T.	VR3918, VR3919, VR3938
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N.E.C.	DX1000K, N9053, N9055, N9210
NORDMENDE	V1001, V1005, V1015, V1025, V1035, V1041, V1205, V1235
NORDMENDE	V1245, V1305, V1403, V2405, V3005, V3105, V3405, V4405, V5005
NIKKAI	NVR100, NVR500
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PHILIPS	VR6462, VR6463, VR6467, VR6468, VR6561, VR6760, VR6761, VR6843
PIONEER	VR505, VR515, VR707
PROLINE	5000, 7000, 9000, 9100
PYE	DV464, DV468, DV562, DV761
QUESTAR	100, 200
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SAMSUNG	VI611, VI616, VI621
SAMSUNG	VI626, VB900, VB910, VB910
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SOLAVOX	NCVR1000, NCVR5000
TASHIKO	VVE922, VVE931, VVE932, VVF933, VVF934
TATUNG	TVR6111, VRH8350, VRH8490, VRH8495, VRH8550
TELEFUNKEN	VR2920, VR2925, VR2930, VR2931, VR2935, VR2941, VR2971, VR2935, VR2945, VR2975
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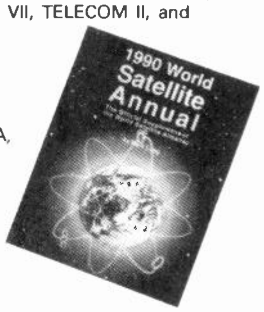

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TIC 226E	30p
TIC 226m	30p
TIC 236m	30p
TAG 226/600	30p
TICV 106D	
(T092 case 2A/400V)	10p
TIP 29	25p
TIP 30	25p
TIP 30A	25p
TIP 30B	25p
TIP 30C	25p
TIP 31	25p
TIP 32	25p
TIP 33B	50p
TIP 33C	70p
TIP 34A	50p
TIP 34B	60p
TIP 34C	70p
TIP 35B	50p
TIP 35C	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 110	20p
TIP 100	30p
TIP 102	30p
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
T 6032	30p
T 6036	40p
T 6040	40p
T 6047	40p
T 6049	40p
T 6051	40p

T 6052	40p
T 6054	40p
T 6068V	50p
T 6070V	£1.00
T 9004	40p
T 9005	40p
T 9051V	£1.00
ZTX 107	10p
ZTX 108c	10p
ZTX 109k	5p
ZTX 213	5p
ZTX 341	10p
ZTX 342	10p
ZTX 384	10p
ZTX 451	10p
ZTX 550	10p
MJ 2253	60p
MJE 3040	60p
MJE 2209	10p
SP 8385	50p
SAB 3205	£1.00
SAB 4209	£1.00
300M + 700 320V	£1.80
200 + 100 + 100 + 50 300V	50p
150 + 200 + 250M 300V	50p

Computer Transformer 20v/2.25A; 20v/1.5A; 17/.5A; 19/.5A; 28/.05A £3

PHILIPS METERS
4T5003-SBC 851 Analogue Multimeter £22.00

GEC
20AX MkI Power Supply PC818 £10

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
BYX49/600R	75p
BYX 55/350	10p
BYX 55/600 (Bead)	10p
BYX 71/350	20p
BYX 71/600	50p
BYX 72/300	20p
BYX 36/600	50p
BYV 95B	10p
BVY 95C	12p
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
BZV 15/18	30p
BZV 15/30	30p
BZW 70c6v2	10p
BZX 79.3v	10p

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

Infra red led LD57CA 15p
15K-20 turn pots 20p
Thorn 3500 2A cut out 50p

BRIDGES

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

MAINS MICRO SWITCH
GEC & Double etc. £1

Varta Batteries 2.4V 100M/A 50p

TV Battery 1.2V NC, 2.4V NC 50p each

4 amp-1.2V Nickel Cadmium Battery D Cell £1.00

3.25V Battery 50p
12V Video Battery Packs 4Amp U2 Cells £10

24V 4Amp (100VA) Trans £4.00

Mains 240V (100VA) to 240V out fully shrouded £5.00

ITT CVC45 8 way resistor unit for v/cap £3

CVC40 8 button unit with mains lead & slider pots with sockets £10.00

Book on An Introduction to Satellite TV £5.95 No VAT

Book TV DX Handbook by R. Bunney £5.95 No VAT

Electronics Hobbyists Handbook £4.95 No VAT

NI.CD 5 Hours Battery Charger with battery test £6

Hill Deluxe Universal Ni-Cad Charger £6

Nickel Cadmium Battery Charger AA-C-D-PP9 £4.50

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

6 Push Button Unit for GEC 2100 Series Replacement for Touch Button Unit £8

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

PHILIPS' MIN. HEAD PHONES £1.50

Electronic Buzzer 6 volt, 12 volt 40p

15V, 015V, 1A Print Type Trans £1

12v DC Relay 1½×1½×2 print type 10 amp D.P. Changeover £1

Regulated Power Supply 3-12 volts 1 amp in box with switch and mains lead £4

Philips' Video Cleaning Cassette SBC461 £6

Philips' Headphones Compact Disc Stereo Type £10

ITT Display Tube 58705 50p

8 Seg Display FND500 20p

Model 3000 Pocket Personal D.M.M. Volts range AC, DC 200M/V to 400V Res 2000Km £20

Export PYE731 6 Push Button unit with (UHF-VHF) band switch £4

ITT Micro Phone M5 50p with switch

1½ Volt Sub Min Relays 25p

Philips Solar Scientific SBC1730 Calculator £12

15v-0-15v 1 Amp Transformers £1

RGP30K	10p
RGP30G	8p
RGP10B	5p
RGP15	10p
RGP15G	6p
T6024WG1	10p
GP10	5p
GP15O	5p

THORN RGP80G 30p
DUBLE 7 SEG Displays 15p
LN5 26RA or 10 for £1

Philips Digital Multimeter with memory and auto ranging 5BC812 £63.00

PHILIPS
25 Watt Solder Iron £4.00

Various Tools and Accessories

Self adjusting cutter stripper	£5.00
10 mixed tube bars	£4.00
5000 Diodes-Resistors	£3 pack
T/V V/Aerial 300Ω or 75Ω	£1.50
• 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 Neon Lamps for TV sets	5p
Freeze Philips	£1.20
Foam Cleaner Philips	£1.20
Contact Cleaner Philips	£1.20
Cans of Anti Static, Degrease Cleaner and Anti Corona	All at £1.40
Lorlin Full Remote Relay Switch fit most T/V sets, mains 4 tag, 2 tag 12 volt	£1.00
Mains timer, 13 amp — up to 2 hours: easy to use, plugs into socket	£3.00
Screen locking agent, large can	£1.50
Red E.H.T. LEAD and Anode Cap	£1.00
Weller solder iron 25 watt	£4.00
Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V	60p
100 Coax Plugs	£12.00
De-solder pump + 2 nozzles Philips	£4.00
Flat Red LED and Green	5p
500gm 60/40 solder reel	£6
Solder 1 kilo reel	£5.50
Dual v/u meter -20 – +10db	£1
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

HILLS
Miniature Linesman Pliers £2.20
Miniature Side Cutters £2.20
Miniature Pliers £2.20
Miniature End Cutters £2.20

KT3 PANELS
Sound Output RGB Output Chroma Panel, I.F. Panel and Line OSC £7.00 each

PYE 6 Key Switch & Panel G11 Front Panel £10

SONY 1400KV Chroma Panel £6
SONY 1400KV Touch button unit £3.50

GEC Decoder Panel PC772A3 PC446A5 £6

12 Volt Mains Trans 500M/A £1.00

NEW TX9 CHASSIS New Type Thorn £15.00

Quantity Reductions

BY204/4	25 for £1.00
BY206	25 for £1.00
KT3 touch button black	6 for £1
G11 touch button red	6 for £1
K30 full remote Dawer Ass with 3 I.C.	£7.00
K30 VHF. UHF Dawer Ass	£6.00
BY298 3 amp/fast/R	20 for £1.50
BU126	10 for £6.00
BU205	10 for £8.00
BU105	10 for £6.00
BF458	10 for £1.00
BF224	20 for £1.40
OA90	40 for £1.00
50 Ceramic Condensers	£1.50
Mixed Mounting Kit for Power Transistors	50p
300 Condensers	£1.50
300 Resistors	£1.50
150 Electrolytics	£2.00
15 Bulbs Philips	40p
GEC-Hitachi Thick Film Frame	£5

MOD KIT PHILIPS VHS VCR
VR6467 or VR6760 and derived types gear box £19.50

Mixed Packs

TO66 12 Power Trans RCA 16182 NPN Replacement for BD124 and Mounting Kits	£1.00
25 Panel Mount Bulbs & Neons 10A	£1.50
	£1.50
25 LED red/yellow/green	£1.50
20I/C Holders	£1.20
20 Large LED Red	£1.00
20 Small LED Red	£1.00
10×20 Turn 100K Pots	£1.00

Red & Green LED on Panel 1p each

Mixed 100 Transistor B.F. and B.C. and PET £1.50 1000 for £10.00

12 Volt 4 Amp Video Battery Pack 10 of Type D Cells £8.50

40 glass reed switch £1
10 press to make switch 70p
40 Pots £1.50
With Focus Pin, 10 Tube Bases, mixed £2.00
1,000 Diodes, Condensers, Resistors on Bandolier £1.00
20mm Fuse Holders
Chassis Mount 20 for £1
EHT Diodes, small 20 for £1

300 Mixed Diodes £2

100 500M/A Fuse £1
Mixed V/Cap Pots ITT-GEC-Hitachi-Philips etc. 20 for £1
ITT Mains Switch with Remont CMC113 £1

12v DC relay 1½×1½×2 print type 10 amp D.P. change over £1

SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

LA11440	£1

TAA7750	50p
HA 411485	£1
UPC1373	50p
M58657P	£1
M491BB1	£3
M50441/550	£1
M58658P	£1

Receiver TX100 Panel
I.C. No. SAB3035
—MAB8440P D066
—SAA1060
—PCF8571P

New Model Philips Meter	£25.00

C Cam Decoder with TDA3591	£5
Toshiba VHF/UHF EG522F	£6

Mitsumi MECI-F51	£5

Thorn Spares

New 9000 Decoder	£8.50
9000 Frame panel	£8
9000 Cyclops panel	£1.50
8800 convergence panel	£6
8500 convergence panel	£6
4000 Power supply	£3
1600 Mains lead, switch	
T605 IvNPN T066 80v/6A	10p
9000 Sound output panel	£1
3500 Focus unit	£1.50
3500 Mains Trans	£4
3500 cut outs	10 for £4
3500 IF panel	£2
3500 Frame panel	£3
3500 A1 Diode	20p
4000 Tube base	£4
3500 A1 pots	50p
Beam limiter panel	£1.50
3500 Power panel with Y969	£1
3 Way regulated adaptor 240V 6V/7 5/9V/300mA	£3.50
Rank Toshiba preh unit 0354	£9.50
4 Push button unit preh	£1.00
6 Push button VHF/UHF for v/cap. GEC-Decca type	£7.00
7 Push button for CVC5 ITT	£8.00
KT3 12 Push button unit	£2.00
KT3 (Export) 12 P.B.u	£2
6 Push button Unit Thorn	£1.00
6 Push button GRC	£6.00
6 Push button PYE 731	£6.00
Hearing aid unit	£3.00
Rank Z718 4 P/B/Unit MECH	£4.00
7 Button Unit GEC with Lamps	£7.00
697 Push Button Unit	£6.00
Z916B panel	£5.00
T513AP panel	£5.00

Video Tuner

V.6100/05 T/V and Tel/Text unit and hand set £90.00
Send for data.

TT14 GEC TEX-DECODER

13 IC Panel with cable form £9.50

PHILIPS

K40 Text Panel £8.00

KT3-K30

OF-425		
OF-550	E W	10p
OF-513	correction	10p
OF-557		50p

DIODES

BY 126	10p
BY 127	10p
BY 133	10p
BY 134	10p
BY 176	25p
BY 179	40p
BY 184	25p
BY 187	10p
BY 190	40p
BY 196	30p
BY 198	10p
BY 204/4	8p
BY 206 – BY 407 Lqv	8p
BY 208/800	8p
BY 210/400	5p
BY 210/800	10p
BY 223	60p
BY 224/600, 4.8A/600v bridge	50p
BY 226	15p
BY 227	15p
BY 228 1500v	20p
Flat BY229 black	15p
BY 299 Red	20p
BY 229/400	30p
BY 299/60p Tag	30p
BY 237	5p
BY 254	10p
BY 255	30p
BY 298	10p
BY 299	10p
BY 406	8p
BY 527	20p
BY 407a	10p
BY 448	10p
BY 527	10p
BY 602	10p
BYV 26C	10p
F 247	10p
GP20G	5p
GRP80G (TX10)	30p
XK 3102	50p
BYV 28/200	20p
Bridge TX10 800/3 amps	30p
KBPC35-02 Bridge	£1.50
Bridge Rec D35B10	40p

K35 Decoder	£8.00
K35 Sound OP	£4.00
Thick Film Daughter KT3 3122-127-43891	£3
12 CH K30 Tex Rec Front Panel with I C	£5
K35 IF	£5.00

Plug In

K4 Focus Pot £1.00

Fidelity Tube Base with transitor & focus pot	£1.50
Bush Tube Base on panel	£1.00
TX10 Tube Base on Panel	£3.00
1100 L O P T Green Spot	
TX100 Thorn	

Line Transformers

G8 Lopt	£5.00
G9 Lopt	£4.00
6 Diode Tripler, Mullard	75p
Line O P Trans Mono T X 12"-14"	
Philips G8	
27482	£10
4822	£10
10273	£10
Thorn 1690 LOPT	£7.50
2 1 Pots 3,500 1 off each type	£3.00
G8 Trans. Philips	£7.00
GII Split Diode	£12.00
CVC820 Split Diode ITT	£10.00
Thorn B W AD5308F + Stik + Lead	£1.50
GEC 2040	£3.00
GEC 2110	£7.00
Mullard AT 2036	£1.50
Pye 169 Line Trans	£3.00
Pye mono	£3.00
Rank mono T704A	£3.50
Split Diode Trans	£7.00
GEC 20 AX Rank Z522	£3.00
Rank L O P T Z970	£3.00
CVC800 Line Trans	£6.00
CVC825 Split Diode	£10.00
CVC 45	£5.00
GEC Portable G1OT2041	£3.00
GEC Portable G10T2046	£3.00
EHT Split Diode Leads ITT	£1.00
3500 L O P T, & HT Trans	each £2.00
LOPT Rank Z763	£5.00
K35 Split Diode 3122/13835930	£10.00

Universal Tripler

with small focus pot Green type £7.00

Black Triplers

KT3 Triplers	£6.00
S T C. Universal Tripler	£6.00
IT THF	£2.50
IT TGA	£2.00
ITT CVC 5-8-9	£3.50
Rank T25LE Tripler	£2.00
Rank ITTCP A823	£3.50
TU 25 30K Rank	£3.00
IT TT Z 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
ITTBQ Pye 731	£3.00
ITTHY	£4.00
D22 for Pye 18" colour portable	£4.00
LP 1193/63	£4.00
BG 100/41	£3.25
FRO Tripler print type with leads PO7 BG2087	£5
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
GII E W Transformer	50p
GII E W coils	£1.00
GII Transient Suppressors 245V	20p
GII Scan Coils	£5.00
GII 100K tuner pots	12 for £1
KT3 IF panel	£6.00
KT3 line OSC transformer	£1
KT3/K30 infra-red receiver head	£1
K30 drawer unit with IC's (home)	£10
K30 drawer unit with IC's (export)	£10
KT3 AL Sockets	50p
KT3 receiver panel	£8
KT3 line driver transformer	50p
Pye, K30, GEC, etc Pre-mains stand-by switch	£1
Decca 80/100 IF panel	£5
NPN PNP 80V 6 Amp TO66 O P Trans	pair 25p
5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 560T/570T	£7.00
Control panel 5 sliders + mains lead	£1.50
GII 8 touch button unit replaces old 6 P B U	£24
Tube base + base unit for 820 Euro chassis	£4.00
GEC Line O/P Trans & Rec Stick for Portable	£3.00
CVC 20/25/30/35/40 decoder panel	£10
CVC 20/25/30/35/40 decoder panel (untested)	£5
CVC 40/45 IF panel	£5
40K Transducer	50p
PHILIPS NE511N	£1.20
LM337M Reg	30p
20 GEC Black Spark Gaps	£1.00
KT3 Front Panel Control Assy	£2.50
BTW 30/50	50p

International Rectifier EHT Diodes G770/HV34 6KV			3 for 8p
6A/600V Stud Diodes	20p	BTW 92/800R	£3
6A/1000V Stud Diodes	20p	25A473 PNP C/P	10p

Thorn TX90 Chassis with Line Linearity Width P C B. PC1183	£20.00

S4471	£1.00
2SD1878	£1.00
TDA4443/C3	£1.00
TDA3506	£1.00
SAA5241 P/A	£5.00
SAA7020 /01	£3.00
HD614080SA90	£4.00

225m + .25m 380v	£1.00
220m 385v	£1.00
240m 400v	£1.00
GII 470m 250v	£2.00
400m 400v	£1.00
175m/100m/100m 350v	£1.00
TX9 500m + 500m 175v	£1.00

C7 Hand Set	£6.00

G8 LOPT Panel	£7.00
G8 Tuner Unit + Panel	£4.00
G8 IF & Chroma	£6.00
G8 Chroma	£3.00

GII Chroma Panel	£4.00
GII LOPT Panel	£6.00
GII IF Panel	£5.00

GII IF Detector	£3.00
GII Selector gain module	£3
Pye GII Front panel with transducer, pots, tuner pots, 6 pb switch+lead	£5.00
Pye 6 button switch portable	£1.00
GEC V/cap VHF/UHF tuner and IF+ sound O/P PC 706B3 (Export)	£12.00
GEC Line O/P PC 659B3	£6.00
2110 GEC Power Panel	£8.00
CVC 20 Front panel with sliders + mains input panel	£4

CVC 40 PUSH BUTTON ASSY with sliders; complete with lamp assy + pots 8 button units	£9.00
Universal Focus Fits Pye, Thorn and Decca Units	
1147 Rank tube base on panel	£1.00
Z718 Focus Unit	£1.50
T20 Focus Unit	£1.00
Large Type	75p
Decca Small	75p
KT3 Focus Unit	75p
K30 Focus Pot	75p
K30 Tube base on panel	£1.00
TX10 Focus Units	£8.50
CVC 32 Focus Unit	75p
Fidelity Focus Unit 14R–14S	30p
3500 Thorn Focus Unit	£1.00
ITT Small for use with Split	
Z718 Bush Focus	£2.00
Diode	50p
Remo TV12SP	50p
1600 Thorn EHT Rec and Lead	50p
TV14	50p
TV20	£1.00
TV45	50p

TX9 8 Button Unit	£6.00
TX90 8 Button Unit	£6.00
TX90-TX925 8 Button	
TX100 8 Button Unit	£6.00
TX10 8 Button Unit	£10.00
TX10/TX100 16 Button UHF-VHF BAND S.W	£10.00
GII 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)	£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	£5.00
Philips Coaxial Cable Stripper SBC325	£7.50

560M 400V	£50p
420M 400V	£1.00
470M 380V	£1.00
220/400V	£1.00
1200PF 15KV	10p
01 2KV	10p
150m-385v	50p
1000m-160v TX90	£1.00
1+1 MFD Mains Filter ITT 3 Pin	15p
1/100 × 10	30p
22/100	10p
4.7M/100 6800pf-1000v	5p
470/100	20p
4700/100	75p
47/160	10p
300 300/300V in 1.6KV	80p
800/160	50p
.1/250 Pulse	5p
2.2 250v	10p
7N5 1500V	15p
3n3/250 A.C	10p
33/250V	20p
39/250V	15p
4n7/250 tested 5KV	25p
22/250	15p
47 250	10p
100/250	20p
GEC600/250	60p
700/250	£1
2 200PF-2Kv	10p
300+300 MFD 350v	£1.00
800/250	40p
32/300	20p
4/350	5p
8/350	8p
4 7M/350v	10p
33/350	20p
220/350	30p
300/350	40p
400/350	50p
22/375	15p
220/385 (ITT)	75p
330/385 CVC 820HT	60p
0 1/400	15p
KT3 E/W .39/400	15p
56K 400v	20p
4700pf/400	10p
22/400	10p
8/400	15p
33/400	20p
400/400	40p
394K/400V	20p
1000m-160v	£1.00
220/450	40p
47/500	25p
0 1/600	15p
0 1/1200V wire end	20p
0.1/450 A/C wire end	20p
22/1000	20p
047/600	15p
0.047 1000	10p
0.01/1000	10p
0 11/1600v	
150m/385v	£1.00
47/1000v	65p
47/250V A C	10p
001K 1250	10p
0 0047/1500	10p
005/1500	10p
0105 1500	10p
1n8/1500	15p
2n2/1500	15p
01/1600	15p
GEI 8200/2KV	15p
0 1/2KV	20p
3n9/2KV	15p
0 0015/2KV	10p
6n2/2KV	15p
2n2/2KV	15p
470pf 4KV	10p
7500pf/2KV	10p
3000PF/3000V	10p
4n7/2KV	15p
6n2/2KV	10p
7n1/1500V	10p
8n2/1500V	10p
9n1/2000V	10p
8n2/2KV	10p
0 0082/2500	15p
150/3500	15p
1800/4KV	5p
4 7nf/5KV	10p
170/8KV	10p
180/8KV	10p
210/8KV	10p
1000/10KV	10p
47/100V	80p
Tube Thermpath 167	£1.00
Rank Secam Decoder Panel UHF & VHF T115A	£13.00
10 off 91 CAP GII	£2.00
Philips K4 CAP 150M/385V	50p
Philips Coaxial Cable Stripper SBC325	

CVC 20-25-30 Mains Switches	60p
Infra Red and Ultrasonic GII Teletext Decoder Panel	£30
RANK & ITT Mains Remote On-Off Switch (720R)	£1.50
RANK & ITT Remote Switch 2800 ohm	£1.50
GII Mains Switch	50p
4 amp Mains Switch	25p
GEC Mains Switch 4 amp	30p
KT3 Mainswitch	£1.00
G8 Mains Switch	75p
GII Preh Red LED P Button for CH Change	20p
RANK TOSHIBA Transductors TPC-2011	50p
Mains Switch ITT Long Type Print	75p
Mains Switch Philip Long Type TAG	75p
Mains Switch GEC Long Type TAG	75p
2000 Chassis Fidelity Mains Switch (4 TAG)	60p
250V/4A White Lorlin Mains Switch	60p
KT3-K30-K35 Full Remote Mains Switch (6 TAG)	£1
Teletext Adaptor Kit TY-500 Panasonic	£12
Philips Battery Tester All Types and charger vis	£6
Philips K4 Mains Switch with standby	80p

SENDZ

Philips Handset IC	£3.00
SAA3010P	£3
MAB8461/WO63	£3

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-1001	£3.00

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 IC mains switch etc	£5.00
CMD 800 Decoder	£8.00
GII I I C Receiver Panel	£1.50
3 I C Power Supply GII Full Remote Receiver Panel	£3.00

PHILIPS SBC 469 Stereo Microphone	£23.00
Meters Hills 520	£17.00
Meters Hills 420	£10.00
Hills HD5000 Digital Meter 1000V DC 750AC 10 Amp 20 MRG Rangers	£28

HT100 Multimeter	£6.75
HT300 Multimeter	£7.75
HT500 Multimeter	£9.00
HT700	£15.00
HD1000 Digital	£20.00
HD3000 Digital	£25.00
HD5000 Digital	£25.00
HD5500	£29.00
HD6000 Digital	£32.00
HD8000 Digital	£37.00
HD9500 Digital with capacity Temp Trans Volts Ohms and Amps ranges	£60

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	£7.00
CT9176	£7.00
CT9133	£7.00

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 VCR Handset	£15.00
GEC Ultrasonic 8CH Full Remote	£10.00

GII Full Remote Ultrasonic	£32.00
GII Ultrasonic Teletext Handset	£20.00
8 CH Ultrasonic GEC Full Remote C2014H/C2219H	£15.00
New Replacement for GII Ultrasonic Full Remote	£12.00
Thorn 4000 insert with 7 buttons	£5.00
Decca RC 11	£14.00
Decca RC 12	£14.00
GII 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, 16C928/20C934, 7228/7324, K12 26C 797/45T 66K 1826	£12.00
GII, Full remote top button assy	£12.00
GII, Full remote repair service (exchange unit)	£18.00
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 each	10p
Pye & Philips handset KT3-K30 chassis No RC5150-RC5176-RC5171 RC5177 **Special Price**	£13.00
RC 4001 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

RC 5353	£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

RC 5171 £12.00

K35-K4 HAND SET
Repaired for £5.00