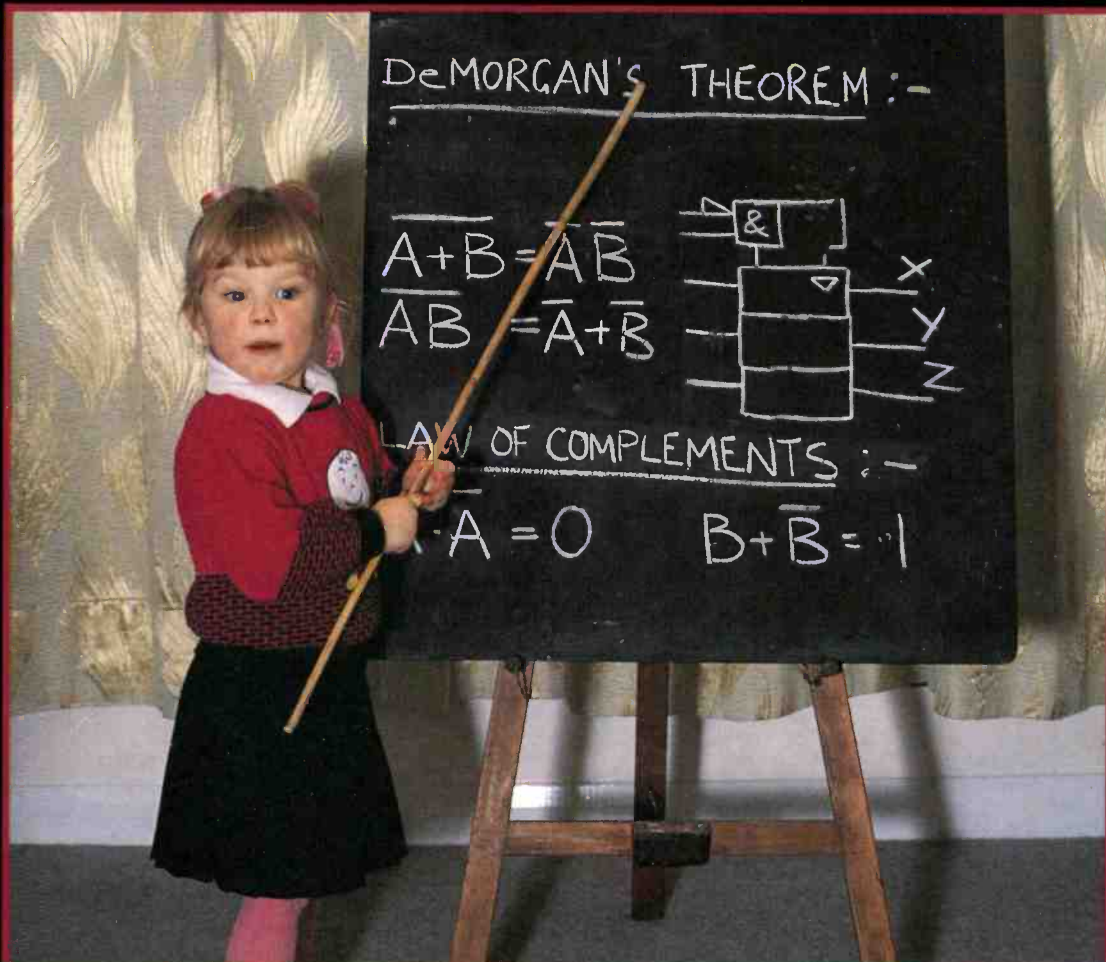
OCTOBER 1990 £1·60

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

Free Screwdriver with integral wire stripper



Practical Digital Logic • DX-TV
Decoding NICAM Sound Signals
Scrapbox Logic Probe • Test Report
Satellite TV Test Signal Source
VCR Clinic • TV Fault Finding

See page 979
for details of
next month's issue

TELEVISION

October 1990 — **Vol. 40, No. 12 Issue 480**

On sale September 19th

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

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

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

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.

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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.

this month

OUR NEXT ISSUE DATED NOVEMBER WILL BE PUBLISHED ON OCTOBER 17

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	40p
AF379	45p
ASZ15	100p
ASZ17	100p
BA145	10p
BA148	10p
BA154	6p
BA157	12p
BA526	188p
BB105B	18p
BB205B	24p
BC107	8p
BC108	8p
BC109	8p
BC109C	10p
BC115	10p
BC118	11p
BC140	20p
BC141	20p
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BC640	20p
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BD371	30p
BD410	50p
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BD977	50p
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BDX33	60p
BDX53	60p
BDX65	80p
BDW23	55p
BDW24	55p
BDW93	50p
BDW94	50p
BDY20	100p
BDY92	100p
BF137	35p
BF154	25p
BF167	30p
BF173	40p
BF178	30p
BF180	16p
BF181	18p
BF183	20p
BF185	20p
BF194	7p
BF195	7p
BF196	8p
BF197	10p
BF198	10p
BF199	8p
BF200	16p
BF225	30p
BF240	18p
BF245	20p
BF254	15p
BF255	12p
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BF257	18p
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BF461	60p
BF462	62p
BF469	30p
BF470	28p
BF471	28p
BF472	28p
BF479	30p
BF493	18p
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BF495	16p
BF506	28p
BF595	16p
BF596	18p
BF615	30p
BF617	30p
BF757	40p
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BF760	40p
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BF871	22p
BF872	23p
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BRY49	38p
BRY56	33p
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BUX84	50p
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J300	50p
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ME4103	12p
ME6001	12p
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ME8001	16p
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MR856	38p
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OC35	250p
OC36	250p
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OC71	30p
OC72	50p
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R2010B	100p
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TIP142	90p
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TIP151	90p
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TIS93	20p
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VN.10KM	60p
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VN.88AF	118p
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ZTX108	11p
ZTX109	12p
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ZTX301	16p
ZTX302	18p
ZTX303	24p
ZTX304	17p
ZTX320	29p
ZTX500	13p
ZTX501	13p
ZTX502	18p
ZTX503	18p
ZTX504	25p
ZTX550	24p
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2N.697	22p
2N.698	40p
2N.706	22p
2N.708	22p
2N.914	28p
2N.930	18p
2N.1131	28p
2N.1132	28p
2N.1613	24p
2N.1711	24p
2N.1893	30p
2N.2102	50p
2N.2218A	24p
2N.2219	24p
2N.2221	23p
2N.2222	23p
2N.2369	18p
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
2N.3440	58p
2N.3442	85p
2N.3583	90p
2N.3585	120p
2N.3702	9p
2N.3703	9p
2N.3704	9p
2N.3705	9p
2N.3706	9p
2N.3707	9p
2N.3708	9p
2N.3710	12p
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2N.3772	90p
2N.3773	110p
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2N.3819	29p
2N.3866	68p
2N.3903	11p
2N.3904	11p
2N.3905	11p
2N.3906	11p
2N.4031	25p
2N.4036	25p
2N.4037	25p
2N.4062	12p
2N.4064	100p
2N.4401	12p
2N.4403	12p
2N.4443	76p
2N.4444	76p
2N.5061	20p
2N.5088	20p
2N.5163	45p
2N.5192	50p
2N.5241	500p
2N.5245	45p
2N.5294	30p
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	120p
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	125p
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	25p
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	670p
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	100p
ECC84	70p
ECC85	80p
ECH81	100p
ECH84	70p
ECL80	65p
ECL82	80p
ECL84	100p
ECL85	70p
ECL86	90p
EF80	65p
EF85	65p
EF89	85p
EF183	75p
EF184	85p
EL34	280p
EL36	90p
EL84	100p
EL95	85p
EL500	100p
EL504	130p
EY86	45p
EY87	45p
EY88	65p
EZ35	60p
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	100p
PCL86	100p
PCL805	100p
PFL200	110p
PL36	120p
PL82	60p
PL83	60p
PL84	80p
PL95	180p
PL500	110p
PL504	120p
PL508	200p
PL519	450p
PY81	60p
PY88	60p
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-253	150p
AN-259	250p
AN-262	140p
AN-264	230p
AN-271	480p
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	180p
AN-5151	600p
AN-5612	400p
AN-5620	330p
AN-5712	350p
AN-5722	140p
AN-5730	150p
AN-5732	160p
AN-5753	170p
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AN-6300	600p
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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	650p
AN-6811	130p
AN-6876	270p
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AN-7114	150p
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AN-7410	250p
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AN-7140	450p
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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
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BA-514	160p
BA-516	150p
BA-521	160p
BA-524	240p
BA-526	188p
BA-527	95p
BA-532	140p
BA-534	290p
BA-536	180p
BA-546	180p
BA-612	160p
BA-656	150p
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TDA-5800	600p
TDA-5820	480p
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
UPC-596	190p
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UPC-1167CL	170p
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UPC-1187	150p
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UPC-1197	140p
UPC-1200	325p
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UPC-1373	85p
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UPC-1420CA	500p
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UPC-1470	200p
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UPC-1505C	400p
UPC-1517CA	400p
UPC-1525C	400p
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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-973	60p
2SD-973A	70p
2SD-985	120p
2SD-986	120p
2SD-1012	120p
2SD-1021	120p
2SD-1022	400p
2SD-1024	130p
2SD-1031	130p
2SD-1046	200p
2SD-1051	130p
2SD-1060	130p
2SD-1064	250p
2SD-1071	450p
2SD-1073	350p
2SD-1094	520p
2SD-1111	60p
2SD-1128	200p
2SD-1135	150p
2SD-1138	80p
2SD-1159	90p
2SD-1160	150p
2SD-1163A	220p
2SD-1164	120p
2SD-1168	425p
2SD-1169	280p
2SD-1185	400p
2SD-1186	400p
2SD-1189	125p
2SD-1190	150p
2SD-1196	150p
2SD-1207	50p
2SD-1210	280p
2SD-1211	120p
2SD-1225	120p
2SD-1229	250p
2SD-1237	300p
2SD-1248	270p
2SD-1251	180p
2SD-1266	180p
2SD-1272	200p
2SD-1273	100p
2SD-1275	160p
2SD-1276	200p
2SD-1277	190p
2SD-1279	600p
2SD-1289	300p
2SD-1291	400p
2SD-1292	60p
2SD-1297	425p
2SD-1308	140p
2SD-1309	140p
2SD-1310	140p
2SD-1326	200p
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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
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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
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2SD-1429	410p
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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-1609	100p
2SD-1632	500p
2SD-1649	260p
2SD-1651	270p
2SD-1663	450p
2SD-1666	120p
2SD-1667	120p
2SD-1668	120p
2SD-1677	300p
2SD-1739	450p
2SD-1783	100p
2SD-1815	100p
2SD-1825	120p
2SD-1843	100p
2SD-1846	350p
2SD-1884	300p
2SD-1910	280p
2SD-1941	500p
2SD-1984	150p
2SJ-49	425p
2SJ-50	425p
2SJ-77	350p
2SK-19	45p
2SK-49	50p
2SK-55	100p
2SK-68	100p
2SK-134	415p
2SK-135	415p
2SK-147	160p
2SK-192	45p
2SK-195	150p
2SK-197	140p
2SK-312	750p
2SK-323	130p
3SK-88	70p

BRIDGE RECTIFIERS

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

TRIACS

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

THYRISTORS (SCR's)

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

UHF TUNERS

U322LO	600p
U341	500p
U342	500p

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

VIDEO LAMP FOR PANASONIC — 60p

CASSETTE DC MOTORS

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12V CW	240p
12V CCW	240p
13.2V CW	290p
13.2V CCW	290p

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STEREO HEAD	150p
MINI HEAD	230p
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SONY ON/OFF SWITCHES	200p
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GOLDSTAR

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JVC 3HSSL PIN

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FERGUSON 3HSSL PIN

8904/8924/8941/8943/8944/3V16/3V23/3V24/3V31/ 3V35/3V36/3V38/3V29/3V49	£8.50

JVC 3HSSVA

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FERGUSON

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8950/8951/3V64/FV10/FV11	£23.00
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3V43/3V53	£39.50

JVC

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LOGIK

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NATIONAL PANASONIC 4HSS-3HSSN

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NATIONAL

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NV366	£24.00
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ORION

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SAISHO

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VR3200	£21.25
VR3300/VR3600	£21.25

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6900/370097	£27.00

SANYO

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VTC9100/VTC9300/VTC9455/VTC9500	£28.80
VTC9350/VTC9355	£28.80
VTC5500	£30.50
VHR1110/VHR1150/VHR1300/VHR1700/VHR2300	£21.75
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VHR1200	£22.00
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SHARP

VC300/VC381/VC383/VC386/VC387/VC388/VC482/VC483/VC486/VC3300/VC8381/VC9100/VC9300/VC9500/VC9700	£17.00
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VC600/VC6300/VC7300/VC7700/VC7750/VC8300	£40.50

SONY

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V5470/V5480	£18.00

TRIUMPH

VR9501/VR9511/VR9592	£22.25

VCR PINCHROLLERS

AKAI

VS9300, VS9500, VS9700, VS9800	280p
VS1, VS2, VS3, VS4, VS5, VS6, VS9, VS10	360p
VS105, VS112, VS115, VS116, VS126, VS244, VS245, VS247, VS248, VS515, VS516	280p
VS201, VS301, VS303, VS304, VS603, VS606, VS607, VP58-P82	280p
VS125, VS155, VS165, VS220, VS240, VS250, VS512, VSX9	280p

AMSTRAD

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

FERGUSON

3V00, 3V16, 3V22, 3V23	280p
3V29, 3V30, 3V31, 3V32	280p
3V35, 3V36, 3V38, 3V39, 3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 3V58, 3V59, 3V64, 3V65, FV10, FV11, FV12, FV14	280p

FISHER

FVHP420, FVHP520, FVHP530	360p
FVHP615, FVHP710, FVHP715, FVHP716, FVHP722, FVHP725, FVHP830	360p
FVHP905, FVHP970, FVHP980, FVHP990	360p

HITACHI

VT11, VT33	280p
VT61, VT62, VT63, VT64, VT65, VT86, VT88, VT110, VT122, VT120, VT128, VT130, VT135, VT138, VT150, VT168, VT220	280p
VT5000, VT8000, VT9300, VT9500	280p

ITT

VR3605, VR3905, VR3935, VR3985, VR3986, VR3993, VR3994	360p
VR3913, VR3914, VR3943, VR3954, VR3963, VR3984	360p

JVC

HR300, HR3330, HR3360, HR3660, HR4100, HR7700	280p
HR7200, HR7300, HR7600, HR7610, HR7650, HR7655	280p
HRD110, HRD111, HRD120, HRD121, HRD140, HRD150, HRD160, HRD225, HRD455, HRD565, HRD725	280p

MITSUBISHI

HS200, HS300, HS301, HS302, HS303, HS304, HS310, HS320, HS700	280p
HS306, HS307, HS400, HS710	280p

NATIONAL

NV100, NV180, NV300, NV333, NV340, NV366, NV600, NV688, NV777, NV788	280p
NV230, NV370, NV430, NV460, NV730, NV810, NV830, NV850, NV870, NV890, NV2000, NV2010, NV3000, NV7000, NV7200, NV7800, NV8600, NV8610, NV8620, NVG14	280p
NVG7, NVG19, NVG12, NVG18	360p
NVG21, NVG25, NVH65	360p

PHILIPS

VR6460	280p
VR2020, VR2021, VR2022, VR2023, VR2024	360p

SANYO

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

SHARP

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

SONY

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

VCR BELT KITS

AKAI

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

AMSTRAD

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

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FERGUSON

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

FISHER

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

GEC

4005	150p

HITACHI

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

ITT

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

JVC

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

MITSUBISHI

HS-200	200p

NATIONAL

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

PHILIPS

VR-6460	170p

SANYO

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

SHARP

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

SONY

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

TOSHIBA

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

MOD KIT TAPE CREASING
AMSTRAD

VCR450, 4600, 4700	620p

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FERGUSON

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

JVC

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

VIDEO MOTORS

AMSTRAD

VCR-7000 REEL MOTOR	1700p

FERGUSON & JVC

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

NATIONAL

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

SANYO

REEL MOTOR 4-529V-10800	630p

SHARP

REEL MOTOR RMTOV 1008 GEZZ	1350p

SONY

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

VIDEO LAMPS

VIDEO LAMPS UNIVERSAL 12V60mA (300mm WIRES)	30p
PANASONIC VIDEO LAMPS	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
REW. PULLEY A-6706-391-A/B	300p

SERVICE AIDS

SERVISOL PRODUCTS

V. HEAD CLEANER	125p
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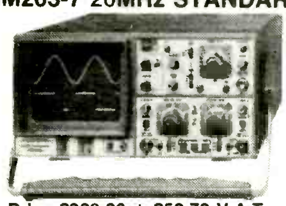
HM203-7 20MHz STANDARD

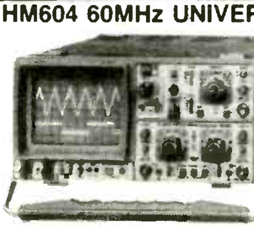


SPECIFICATION
* 2 Channels
* Bandwidth: DC-20MHz
* Sens: Ch1., Ch2., 2mV/cm
* Timebase: 0.2s-20ns/cm
* Triggering: DC-40MHz
* Active TV-Sync-Separator
* Variable hold-off
* Trigger LED indicator
* Calibrator: 1KHz Square wave
* Component tester
* Plus many features

Price £338.00 + £50.70 V.A.T. **FREE Securicor Delivery**

HM604 60MHz UNIVERSAL

SPECIFICATION
* 2 Channels
* Bandwidth: DC-60MHz
* Sens: Ch1., Ch2., 1mV/cm
* Timebase: 2.5s-5ns/cm
* Triggering: DC-80MHz
* Active TV-Sync-Separator
* After delay trigger
* Sweep delay * Delay line
* Trigger LED indicator
* Calibrator: 1KHz & 1MHz Sq. Wave
* Component tester
* Plus many more superb features



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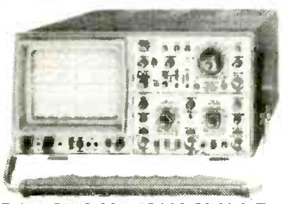

SPECIFICATION
* 3 Channels
* Bandwidth: DC-100MHz
* Sens: Ch1., Ch2., Ch3., 1mV/cm
* Timebase A: 2.5s-5ns/cm
* Timebase B: 0.2s-5ns/cm
* Triggering: DC-130MHz
* After delay trigger * Delay line
* Trigger LED indicator
* Overescan LED indicator
* Active TV-Sync-Separator
* Calibrator: 1KHz & 1MHz Sq. Wave
* Plus many more excellent features

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SPECIFICATION
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* Analogue real time (Same as 203-6)
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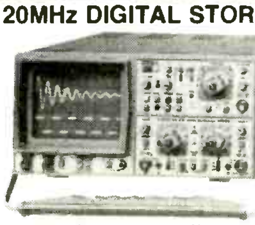
* Sens: Ch1., Ch2., 2mV/cm
* Timebase Analogue: 0.2s-20ns/cm
* Timebase Digital: 5s-2μs/cm
* Triggering DC-40MHz
* Active TV-Sync-Separator
* Max sampling rate: 2×5MHz
* Memory: 2×1024×8 Bit
* Dot joiner
* Printer/plotter output
* Component tester
* Plus many more useful features



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FEATURES

* Covering FM and all TV bands (UHF/VHF) including CATV freq.
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* Accurate 10 turn tuning potentiometer.
* Built-in loudspeaker enables monitoring of sound in AM/FM.
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* Continuity tester 0-500 ohms.
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* Sturdy carry case.

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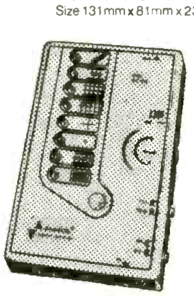

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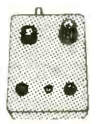

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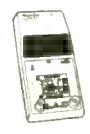
200MHz DIG. FREQ. METER



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* Sensitivity 10mV

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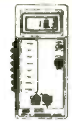

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* Accuracy ±0·5%
* Full scale ±1 digit

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* Measuring Range 0-100Mohm
* Centre scale 2Mohm

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BC640	.20
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BD677	.65
BF337	.30
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BF423	.35
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Tension Band	1.95
Video Head	12.95
3V35/39	
Belt Kit	1.95
Capstan Motor	22.95
Cassette Housing	25.95
Mains Transformer	21.95
Pinch Roller	3.95
Reel Idler	2.85
Take-Up Clutch	2.45
Take-Up Idler	1.40
Tension Band	1.95
Video Head	12.95
3V44/45	
Belt Kit	1.95
Cassette Housing	25.95
Pinch Roller	3.95
Take-Up Clutch	2.95
Video Head	22.95
3V64/65	
Cassette Housing	29.95
Clutch Assembly	11.95
Pinch Roller	3.95
Reel Idler	1.95
Video Head	29.95

HITACHI SPARES

HM6232	5.95
HM6251	5.50

VIDEO SPARES

VT8000	
Belt Kit	1.95
Capstan Motor	31.95
FF/Rew Idler	2.65
FF/Rew Pulley	.85
Pinch Roller	3.95
Play Idler	4.50
Video Head	19.95
VT9300/9500	
Belt Kit	1.95
Capstan Motor	31.95
FF/Rew Idler	1.95
FF/Rew Pulley	.85
Pinch Roller	3.95
Play Idler	3.95
Video Head	19.95
VT11/VT33/63E	
Belt Kit	1.95
Capstan Motor (VT11)	28.95
Capstan Motor (VT33)	29.95
Capstan Motor (VT63)	27.50
Clutch Assy (VT11/33)	7.95
FF/Rew Idler	2.50
Pinch Roller	3.95
Video Head (VT11/33)	19.95

PANASONIC VIDEO SPARES

NV230	
Belt Kit	1.95
Complete Maintenance Kit (Genuine)	12.95
Pinch Roller	3.95
Reel Idler (Genuine)	2.95
Tension Band	1.95
Video Head	27.50
NV333/366	
Belt Kit	1.95
Complete Maintenance Kit (Genuine)	13.75
Pinch Roller	3.95
Play Idler (Genuine)	4.95
Reel Idler (Genuine)	1.25
NV333/366 Cont.	
Reel Motor (Genuine)	17.95
Reel Pulley Unit	4.95
Tension Band	1.95
Video Head (NV333)	12.95
Video Head (NV366)	29.95
NV370	
Complete Maintenance Kit (Genuine)	12.95
Belt Kit	1.95
Pinch Roller	3.95
Reel Idler (Genuine)	2.95
Tension Band	1.95
Video Head	16.95
NV730	
Complete Maintenance Kit (Genuine)	12.95
Belt Kit	1.95
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Tension Band	1.95
Video Head	29.95
NV777	
Complete Maintenance Kit (Genuine)	12.95
Belt Kit	1.95
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Tension Band	1.95
Video Head	27.50
NV2000/2010	
Complete Maintenance Kit (Genuine)	21.50
Belt Kit	1.95
Pinch Roller	3.95
Play Idler (Genuine)	1.25
Reel Idler (Genuine)	1.25
Video Head	12.95
NV7000/7200	
Complete Maintenance Kit (Genuine)	17.50
Belt Kit	1.95
Pinch Roller	3.95
Play Clutch (Genuine)	4.95
Reel Idler (Genuine)	1.25
Video Head	12.95

PHILIPS VIDEO SPARES

VR6460/6520	
Belt Kit	1.95
Loading Motor	9.95
Pinch Roller	3.95
Reel Idler	2.95
Tension Band	1.95
Video Head	16.95
VR6462/6560	
Belt Kit	1.95
Cassette Housing	17.50
Pinch Roller	4.50
Reel Idler	3.95
Reel Motor	39.50
Tension Band	1.95
Video Head	42.95
VR6467	
Belt Kit	2.45
Cassette Housing	19.95
Pinch Roller Assy	17.50
Reel Idler Assy	11.95
Remote Control	22.95
Video Head	42.95
VR6760	
Belt Kit	1.95
Clutch Assembly	7.95
Pinch Roller Assy	17.50
Remote Control	19.95
Video Head	49.95

SANYO/FISHER VIDEO SPARES

VTC5000	
Belt Kit	1.00
Reel Idler (Genuine)	5.70
Reel Motor (Genuine)	7.95
FVH-P615	
Belt Kit	1.95
Clutch Assembly	5.95
Pinch Roller	4.50
Reel Idler	5.95
Video Head	19.95
FVH-P905	
Belt Kit	1.95
Reel Idler	5.95
Clutch Assembly	5.95

SERVICE MANUALS GENUINE

Ferguson TX85	9.95
Ferguson TX90	14.95
Ferguson TX100	18.95
Fidelity AVS1600	5.95
Fidelity AVS2000	5.95
Fidelity CTV14R	5.95
Fidelity CTV20T	5.95
Philips CTX-E	3.50
Philips CTX-S	3.50
Philips KT4/40	9.95
Philips 2A	6.95
VIDEO	
Ferguson 3V44/45	11.95
Ferguson 3V54/55	11.95
Ferguson 3V64/65	11.95
Ferguson FV11	9.95
Ferguson FV12	9.95
Philips VR6467	7.95
Philips VR6542	9.95
Philips VR6560	7.95
Philips VR6760	9.95

SHARP SPARES

VC9300/381	
Belt Kit	2.45
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Reel Motor (Genuine)	16.95
VC481	
Belt Kit	2.50
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Reel Motor (Genuine)	17.95

SONY SPARES

C5/6/7	
Pinch Roller	3.95
Rewind Kit C5/7	4.95
Rewind Kit C6	3.95
Video Head	18.50

VIDEO LAMPS

Ferguson 3V23	.80
Ferguson 3V29	.80
Panasonic NV2000	.70
Sharp 9300	1.95
Universal	.50

★ ★ SPECIALS ★ ★

Alba Back Up Capacitor 1F 5V5	2.50
Alba 4000 FF/Rew Pulley	1.75
Amstrad Modification Creasing Kit	6.95
Ferguson 3V44/55 Upper & Lower Drum	24.95
Ferguson FV11 Power Supply	14.75
Philips Back Up Battery (Small) 1V2	3.95
Philips Back Up Battery (Large) 2V4	4.95
Portasol Gas Soldering Iron	14.95
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Video Copying Kit	5.95

TUNERS

ELC1043/05	10.95
U321	9.95
U341	7.95
U411 Phono or Coax	11.95

VIDEO BELT KITS

Akai VS1/5	1.95
Amstrad 4500	1.95
Amstrad 4600	1.95
Hitachi VT120/130	1.95
Mitsubishi HS302	2.50
Sharp 7300	2.50
Sharp 8300	2.50
Sony C5/7	2.50
Sony C6	1.95

ORDERING

Please add 75p for p/p U.K.
Add 15% VAT to this total.
Service Manuals £1.00 p/p each.
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Delivery by return on stock items.
Minimum Order £5.00

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FULL OF NEW LINES AND SPECIAL OFFERS AND FREE GIFT, ALL WITH PRE PAID ENVELOPE

PLEASE ADD £1.50 P&P TO ALL ORDERS

HOME ALARM PACKAGE

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

ONLY £115 £3.50 + CARRIAGE (Phone for further details)

SWITCH MODE P.S.U. SPECIAL

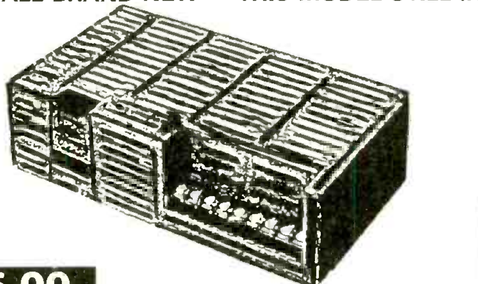
WEIR— HIGH PERFORMANCE SWITCHED MODE POWER SUPPLY TYPE: HSS 100/11

Probably the highest quality switched mode power supply on the market!
The unit is operable on 110 or 240V ac and capable of 100W output is convection cooled or 150W with forced air cooling. (Minimum air-flow rate 20CFM). Overvoltage protection is provided on output 1 by a latch circuit. Full spec. sheets available upon request.

WEIR MODEL = HSS 100/11 REMEMBER: ALL BRAND NEW — THIS MODEL STILL IN PRODUCTION!

- ★ Input — 110-240V ac 50-60Hz
- ★ Output — 1 +5V at 12A
  2 −12V at 1.3A
  3 +12V at 3.5A
  150Watt max (forced air cooled)
- ★ Size — 214 × 117 × 60mm
- ★ Weight — 1.2Kg *BT approved
- ★ Fully enclosed with mains terminal shroud.

Normal list price is £121.00 each!!!
ORDER CODE: SO/WEIR
PRICE



£35.00 (HURRY HURRY, only a few hundred available)

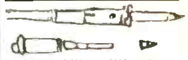
LOGIC PROBE

Y132A **£17.50** M625

Logic probe/pulser, suitable for detecting the logic state of each gate of TTL, CMOS, etc. devices. Pulser function can be used to inject a pulse into the circuit to aid fault finding.

Working voltage	5-15Vdc
Thresholds. Hi	70%Vac
Lo	15%Vac
Input impedance	120kΩ
Max. input frequency	50MHz
Output pulse rate	0.5 or 400Hz
Pulse width	10µS

PROBES — X1, X10



Useful set of X1 and X10 probes. One unit which is switchable. BNC connectors.

Price £14.95

DESOLDERING PUMP

£2.99

ORDER CODE TOOL/DESOL

RESISTOR KITS – each value individually packed

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

ADDITIONAL KITS

DISC CERAMIC 50V	125 pieces	£3.99
ZENER DIODES 5ea	55 pieces	£3.99
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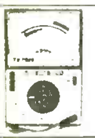
FUSES Q/BLOW 20mm	80 pieces	£4.75
FUSES T/DELAY 20mm	80 pieces	£8.50
PRE-SET POTS.Hor.	120 pieces	£7.75
PRE-SET POTS.Vert.	120 pieces	£7.75



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

VIDEO HEADS

AKAI	
VP 77	£19.99
VP 88	£19.99
VP-7100	£19.99
VS-1	£19.99
VS-2	£19.99
VS-3	£19.99
VS-5	£19.99
VS-10	£19.99
VS 77	£19.99
VS 9300	£19.99
VS-9500	£19.99
VS-9700	£19.99
VS-9800	£19.99
FERGUSON	
3V00	£19.99
3V01	£19.99
3V16	£19.99
3V22	£19.99
3V23	£19.99
3V24	£19.99
3V29	£19.99
3V30	£19.99
3V31	£19.99
3V35	£19.99
3V36	£19.99
3V38	£19.99
3V39	£19.99
8903	£19.99
FISHER	
FVE-P615	£40.50
FVE-P910	£40.50
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VT4000	£29.99
VT4200	£29.99
VT5000	£29.99
VT6500	£29.99
VT7000	£29.99
VT8000	£29.99
VT8500	£29.99
VT9000	£29.99
VT9300	£29.99
VT9500	£29.99
VT9700	£29.99
VT9900	£29.99
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HRD120	£19.99
HRD121	£19.99
HRD225	£19.99
HR2200	£19.99
HR3300	£19.99
HR3330	£19.99
HR3660	£19.99
HR4100	£19.99
HR7200	£19.99
HR7600	£19.99
HR7610	£19.99
HR7650	£19.99
HR7700	£19.99
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N832	£19.99
N833	£19.99
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NV100	£29.99
NV220	£42.50
NV300	£19.99
NV322	£19.99
NV330	£42.50
NV333	£19.99
NV340	£19.99
NV366	£49.99
NV370	£29.99
NV380	£29.99
NV430	£27.99
NV450	£42.50
NV470	£42.50
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NV730	£48.95
NV2000	£19.99
NV3000	£19.99
NV7000	£19.99
NV7200	£19.99
NV7500	£19.99
NV7800	£19.99
NATIONAL (Cont.)	
NV7850	£19.99
NV8170	£19.99
NV8200	£19.99
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NV8600	£19.99
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VH-1	£19.99
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SANYO	
VTC-3000	£29.99
VTC-5000	£45.00
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SHARP	
VC200/300/482/3300/9100 9300/9400/9500/9600/9700	£30.99
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SONY	
SL-C5	£22.50
SL-C6	£22.50
SL-C7	£22.50
SL-C9	£48.60
SL-C20	£34.50
SL-C24	£34.50
SL-C30	£34.50
SL-C33	£34.50
SL-C44	£34.50
SL-F1	£34.50
SL-F30	£34.50
SL-3000	£28.50
SL-8000	£28.50
SL-8080	£28.50
TELEFUNKEN	POA
THOMSON	POA
TOSHIBA	
V31	£35.00
V33	£35.00
V55	£19.99
V57	£19.99
V5470	£29.99
V9600	£35.00

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CTV1405	£17.50
CTV2200	£17.50
CTV2210	£17.50
TV/VID-TVR1	£17.50
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VCR7000	£12.00
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80/10-NON TEXT (RC1)	£24.50
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FERGUSON	
TX9/10 NON TEXT	£15.95
TX9/10 TEXT	£15.95
TX9/10 TEXT/STEREO	£15.95
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FD09193 TEXT	£15.95
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TP400 TELETEXT	£15.95
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ITT	
RG305	£15.95
RG306	£15.95
JVC	
3V23	£15.95
3V31	£15.95
3V35	£15.95
PHILIPS	
G11 TEXT	£15.95
KT3/K30 TEXT	£15.95
KT3/K30 NON TEXT	£15.95
RC5 STD	£15.95

CASSETTE LAMP

— UNIVERSAL

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

TRIPLERS

TRIPLERS Universal	5.75
PHILIPS KT3	8.50

★ ★ NEW LINE! ★ ★

VIDEO REPAIR KITS

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

PINCH ROLLERS

AKAI	1EG/2EG/4EG/5EG/6EG/9EG/SC15EG	£3.99
	VS9700	£4.35
FERGUSON	3V00/3V24	£3.99
	3V29/3V32	£5.25
HITACHI	ALL	£3.99
J.V.C.	HR2200/3300/3330/3660/4100/7700	£3.99
N.E.C.	N830/N833	£3.99
ORION	VH 1/2	£3.99
PANASONIC	NV100/180/332/333/366/600E/777/778	£4.95
	2000/230/3000/370/430/460/485/7000/7200/7300/780/810/8200/830/8400/850/8600/8610/870/890	£3.99
PHILIPS	VR 6460	£3.99
	VR 6560	£3.99
SANYO	VTC3000	4.20
	VTC5000/5150/5300/5350/5400/5500/6000/6500/9100/9300/M10/11/20/21/30/31/M50	£4.25
SHARP	200/381/384/385/386/388/390/3300/2300/6000/5200/6300/7300/7700/7750/8000/8300/9300/9500/9700	£3.99
SONY	SL C5/6/7	£4.20
TOSHIBA	V5	£3.99

VIDEO BELT KITS

AKAI	VS 9300/9500	2.10
FISHER	MOST	2.50
HITACHI	VT5000E/5500/3000	2.75
	VT/7000/8000/8500/9300 VT/9500/9700	1.50
	VT11/VD88	3.75
JVC/FERG	3V00/3V22	2.10
	3V29/3V30	1.50
JVC/THORN	3V35/3V39	1.50
JVC	3300/3330/3360	2.10
	7200	2.00
	7600/7610/7650/7655	2.25
NAT. PAN.	NV7000/7200/777/7800	1.75
	NV2000/3000	2.75
	NV332/333/366	1.99
	NV8600/8610	3.75
SANYO	VTC5150/6000/5000	1.20
	VTC9100/9300	2.80
SHARP	2300/381/384/385/386/390/9300/9500	1.50
	VC7300/7700/7750	1.75
	VC6300	2.25
SONY	SLC5	2.05
	SL-C6	2.30
	SL-C8000	2.30
TOSHIBA	V31 & 33	6.30
	V55 & 57	1.50
	V66/67/9600	1.20

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

IDLERS

FISHER	143-0-4204-00400	3.85
FISHER	GEAR IDLER 143-0-4904-00900	6.00
FERG/JVC	TAKE UP IDLER PU51402/A	1.70
HITACHI	6886971	1.99
PANASONIC	VXP 0344	2.30
PANASONIC	VXP 0521	2.50
SANYO	REEL DRIVE PULLEY VTC 5150 143-0-662T 01201	6.50
SHARP	NIDL 0005 GE22	1.90
SHARP	NIDL 0006 GE22	2.10
THORN/JVC	PU48967B	2.99

MAINS SWITCHES

PB3008 Decca/GEC	0.99
SONY (Universal)	4.05
PB5030 Rank Remote	1.50
PB3003 Philips G8 Plastic	0.95
PHILIPS KT3 (Remote)	1.99
5031 PHILIPS G11 Remote	1.40
285/1 ITT CVC5/CV20	1.40
PB3005 PHILIPS G11	0.95
THORN TX90 0DE2 158-001	0.95

20mm FUSES

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

TIME DELAY – 50mA, 60, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1A, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3, 10 — 1.20/10

14" QUICK BLOW FUSES

500mA, 1A 1.25A, 2A, 12A — 50p/10

MOTORS

Reel Motor SANYO VTC 5150 4-529V-10800	9.20
Reel Motor SHARP VC93000/9800RMOTV 1008 GE22	18.95
Capstan Motor – FERG/JVC 3V35 PU55371V/M	27.50
Audio Motor Recorder 12V CW 34mm	4.20
Audio Motor 9V CW 34mm	4.20

VALVES

Type	Price (£)
DAF96	0.70
DF96	0.72
DK96	3.10
DY86/87	0.80
DY802	0.98
E88CC	4.75
EABC80	0.85
EAF42	1.78
EB91	0.65
EBC41	1.45
EBC81	1.10
EBF80	0.60
EBF83	1.35
EBF89	0.85
EC92	2.10
ECC81	1.75
ECC82	1.08
ECC83	1.40
ECC84	0.65
ECC85	1.20
ECC86	3.25
ECC88	1.50
ECC189	1.75
ECF80	1.35
ECF82	1.35
ECF83	2.25
ECH35	4.35
ECH42	1.75
ECH81	1.15
ECL80	0.80
ECL82	2.11
ECL83	3.80
ECL84	1.25
ECL85	1.20
ECL86	1.25
EF37A	4.25
EF80	0.50
EF85	0.50
EF86	2.65
EF95	0.80
EF183	0.52
EF184	0.64
EH90	0.45
EL34	3.95
EL36	1.60
EL81	8.05
EL84	1.30
EL86	1.45
EL509	7.25
EL519	7.25
EM80	1.50
EM84	1.10
EM87	4.75
EY51	1.10
EY86/87	0.85
EY88	0.85
EY500A	2.55
EZ41	3.45
GY501	1.65
GZ32	2.45
GZ34	3.80
KT88 (GEC Mullard)	43.50
KT88 (Foreign)	18.80
PC86	0.55
PCC84	0.50
PCC85	0.92
PCC88	0.85
PCC89	0.85
PCC189	0.85
PCF80	1.35
PCF82	0.75
PCF86	1.35
PCF87	1.35
PCF200	2.75
PCF800	1.05
PCF801	1.50
PCF802	1.10
PCF805	1.65
PCH200	1.45
PCL82	1.35
PCL83	2.95
PCL84	0.95
PCL86	1.15
PCL88	2.95
PCL805	1.20
PD500	3.75
PFL200	1.15
PL33	1.80
PL84	1.20
PL504	1.80
PL508	1.35
PL519/509	5.55
PL802	8.40
PY81/800	1.35
PY88	0.85
PY500A	2.35
PY801	1.35
UABC80	0.55
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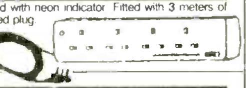

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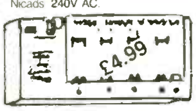

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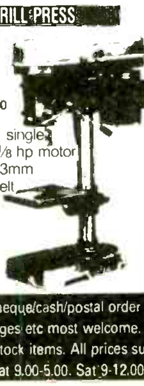

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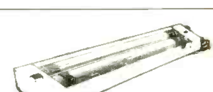

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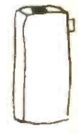

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COVER PHOTO
The young lady in this month's cover photograph is helping us to appreciate Boolean algebra! It was taken by Steve Oldis. See article on page 926.

CORRECTIONS
Oh dear, your editor really did boob last month. The item in VCR Clinic under the heading Philips VR6720 actually relates to a TV set, Model V6720 (K40 chassis), and should therefore have appeared in the TV Fault Finding section.

The photographs in the article on BBC tuning signals, pages 862-5 last month, are from the authors' private collection and were reproduced by kind permission of the BBC. Our apologies for omitting this acknowledgement.

A further correction appears in a letter on page 918.

The Importance of the BBC

Extreme liberalism and deregulation seem to be the accepted economic strategy of the present time. Even the USSR appears to be headed in this direction. Let everyone compete freely, and hope for the best. There are many arguments in favour of this course. Perhaps the most telling one is that systems which rely on state control or intervention to any extent, save to promote free trade, have been found wanting. But then so has economic liberalism in the past. Those who favour it today say that conditions have changed. Of course they have. I suppose that we shall have to live with the present liberalism until someone comes up with something better. Deregulation can have mischievous results however. Look for example at airlines in the USA. Deregulation was first applied in this particular field some years ago. What happened? A new breed of entrepreneurs rushed in, cut costs, and in consequence fares. Good news for the traveller. The problem is that most of the US airlines are now virtually bankrupt, which is not a particularly good omen for future development. The idea, I suppose, is that the best will survive. What then? Back up with the prices? Oh no, because along will come more entrepreneurial bright sparks. This is all very well, but development is necessary in any field – new equipment, new products and so on. This calls for investment, which in turn requires profitability. You may notice that the more successful economies, such as those in West Germany and Japan, don't follow the more extreme liberal economic creed. They have developed means of ensuring stable, profitable economic activity with a built-in tendency to invest in innovation for the future. There are other benefits such as lower interest rates. Getting the balance right is a difficult task, and there are those who maintain that these economies manage to mask a certain amount of inefficiency, in particular in the retail sector. It's difficult to know whether the English-speaking world has gone too far in the direction of total deregulation of economic activity. It's even more difficult to suggest how a better balance between liberalism and dirigism could be established. To this observer at least it seems probable that at some time the pendulum will move back, if only because of the damage that total deregulation can do. One thinks of recent events in the City. These explain the need for controls – in addition to the basic framework provided by the law. The question is what sort of regulation is required, and how it should best be provided and itself kept under surveillance, which is ultimately the job of government.

What has all this got to do with television? Well, until fairly recently television in the UK was a very closely controlled activity. Controlled by the built-in systems in the BBC and by the IBA. The duopoly nevertheless enabled competition to live and, depending solely on the presence in the industry of creative people, to thrive. There are many who feel that with this system the UK got its broadcasting arrangements about right. They do not, it was evident from an early stage, include the present government.

The advent of Sky Television was a major move towards deregulation. Dismantling of the IBA and its replacement with the ITC could be a further major step in this process. This leaves the BBC standing out rather like a relic from the past. In particular its method of funding: why oh why, cry the economic liberals, can't it be like every other decent modern organisation – sell advertising space, sell its services, get into subscription financing and so on. Why does it have to rely on what has been described as a form of poll tax?

It is deeply unfashionable today to say that publishing is different, i.e. different from other types of public endeavour. Equally to suggest that this is true of television. Yet publishing – much of it, anyway – and television mean more than the provision of services to the public. To understand their position in the scheme of things one has to appreciate their significance as major elements in our culture. This is particularly so of the BBC, with its magnificent history of achievements as a cultural medium. It's strange that one should have to make a point of this: but then we live in a fast-moving era, when what was once obvious can all too easily be overlooked. I suggest that this is precisely the case with those who, simply to keep everything moving in the direction of economic liberalism, seem to feel that it's essential to move to a different method of funding the BBC. Or could it be something deeper – a dislike for what the BBC stands for?

One doesn't have to be an uncritical devotee of the BBC to recognise its significance. It has, for most of the time, stood for what is best in broadcasting. It thus provides a standard against which the efforts of others can be judged. One could argue that maintaining standards is the job of bodies set up to do just this. But the BBC exists as a living example. That's its vital significance, along with its independent status. The latter can only be compromised by insistence on a move to a more commercial financial footing.

Over the years the BBC has shown that it's possible to provide services that are neither dull through excessive regulation on the one hand nor banal as a result of aiming at the widest audience on the other. Towards the end of his article on a later page in this issue Geoff Lewis, following a recent visit to Canada, makes a chilling comment on the parlous state of public service broadcasting in North America. Could it happen here he asks? Indeed it could, and this is the crucial reason to avoid experiments in the way in which the BBC is funded. The licence fee is a sound method that works well, despite being an embarrassment whenever its rate comes up for review. It's a small price to pay for a vital institution. It should be left as it is.

Letters

BACK INJURY

My wife and I would like to thank all those engineers/readers who kindly contacted us over the past few years in response to our letters in *Television* on the subject of back injury in the TV trade due to lifting and carrying TV sets, and to let you all know that we recently secured in the High Court an out-of-court settlement from Radio Rentals.

Our ordeal in fighting for justice over the past ten years has made it very clear that a lifting problem exists in the TV trade. The many points raised in the court by lifting experts have confirmed this. The risk to engineers is unacceptable and is known by those whose duty it is to provide a safe working environment – the employers! Even the court attendants complained about the weight and awkwardness of the sets they were expected to carry in and out of court. These consisted of 20, 22 and 26in. models, and all expressed surprise that one man was expected to lift such items into and out of people's homes. The court attendants are issued with a carrier on wheels just to move books into and out of court. There's no comparison between books and TV sets, but their employers deem it necessary for safety reasons to provide mechanical assistance.

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Having done our bit, we'd like to say that it's up to the rest of you in the trade. We appreciate that many engineers have been reluctant to speak out for fear of losing their jobs – this has been clear to us after meeting so many trade people. But remember that your back is important, and that once damaged there will always be a weakness that can affect you at any time in the future.

Harry and Pam Todd, c/o 5 Crownhill Road,
Woodford Bridge, Essex IG8 8JF.
Telephone 081 504 3281.

Editorial Note: The Telelift is available, at under £100, from SEME Ltd., Units 2E and 2F, Saxby Road Industrial Estate, Melton Mowbray, Leics LE13 1BS.

SEQUENTIAL vs INTERLACED SCANNING

In his comments on my letter on sequential and interlaced scanning Keith Cummins seems to find a problem in reconciling my statement, comparing a 312-line sequential with a 625-line interlaced TV picture, that "the vertical resolution is virtually the same" and my later statement that with the 312-line system "the line structure is quite noticeable". In fact there's no conflict between the two.

A TV monitor or receiver usually has a c.r.t. scanning spot of about the same size as the line pitch. Thus for a 625-line system the spot diameter will be about 1/575th of the screen height (there are 575 active lines in a 625-line picture). If the scanning is converted to 312-line sequential, it's clear that there will be a line-width gap between the lines and hence the line structure will become visible. Defocusing the spot to twice its size will cure this effect but will result in serious degradation of the horizontal resolution. In a camera tube on the other hand the scanning spot diameter is larger than the line pitch and overlaps the lines on either side. Thus even when the scanning is changed to sequential no part of the photosensitive material is left unscanned. This wider spot in the camera limits the camera's vertical resolution to about 150 cycles per picture height regardless of whether interlaced or sequential scanning is used.

To the obvious question of why the camera tube's spot diameter is so large, the answer is because the resulting picture looks better that way. If the camera is redesigned in an attempt to provide a better vertical resolution, not only will an unacceptable amount of interline twitter be apparent but other spurious signals, such as moiré patterning on fine detail, will become apparent. It's noticeable that really irritating twitter occurs only with electronically generated horizontal lines, such as those used on TV sports results, where this low-pass filter effect of the camera is not present.

Keith Cummins' experience with 405-line receivers that failed to interlace properly is not really relevant since such a display, sourced as it was from an interlaced camera signal, had both the twittering of an interlaced display and the line-structure of a sequential one. He then mentions the fact that the idea of interlacing came from the original EMI team who developed the 405-line system in the Thirties and adds "I think it unlikely that any great revelation is going to contradict their theory". Actually a fair bit has changed since then. Not only is the theory of TV scanning far better understood today, but the brightness of c.r.t.s has increased dramatically. It's well known that the visibility of flicker is critically dependent on brightness.

A further point is that interlacing complicates the use of digital processing of TV pictures in such items as standards converters and special-effects generators. Because interlacing confuses vertical detail with movement (adjacent lines differ not only in space but are also one field period apart in time), it has held back the development of field-store converters in TV sets. Use of such converters can remove the visible line structure and the flicker completely, by interpolating additional lines and fields between transmitted ones.

In case anyone thinks that I'm alone in my dislike of interlacing, I would like to quote from a paper by John Baldwin of the IBA ("Enhanced Television – a Progressive Experience", the *SMPTE Journal*, September 1985): "for MAC signals, the most significant cause of impairments is the use of an interlaced display".

David T. Losser,
Harkstead, Ipswich.

UNDERRATED REGULATORS

I must protest strongly at Nick Beer's habit of vetting what other contributors write (Service Commentary, page 868 last month). My earlier letter (August) was simply intended to give helpful guidance on TV and video refurbishment. I did not suggest using the cheapest head drums, but emphasised that drums are now cheap. Giving plugs for particular firms is not in my opinion necessary – the mark ups are big enough for suppliers to be able to do without this free advertising.

My remark about replacing cheap voltage regulators with beefier ones is perfectly valid. All too often now-

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adays you see a burnt patch of printed panel showing where a very under-rated regulator has been fitted by a manufacturer in order to keep the cost down. A very well known video manufacturer whom I contacted only the other day about overheating of a regulator suggested that I find a good solid metal area to bolt it on to. This cured the trouble – after using better components in place of those listed in the manufacturer's manual. Most electronic goods today are manufactured very cheaply to meet the needs of the big multiples rather than those of the public and independent dealers.
Hugh MacMullen,
Newquay, Cornwall.

ELECTRIC SHOCKS FROM TV SETS

I read with interest E. Trundle's letter in the August issue because the same thing has happened to me. What, I wonder, was the source of the shock that resulted in his colleague dropping the set? It's very unlikely that any charge remaining on the reservoir capacitor would appear at the pins of the set's mains plug. In a usable set the rectifier diodes will be reverse biased by any such charge, and even if one of the bridge diodes did happen to have a slight reverse leak any voltage appearing across the plug pins would be plotted down to a harmless level by the low resistance of the set's degaussing circuit. The same applies to the mains filter capacitor fitted across the set side of the on-off switch.

The cause of my own accident (the c.r.t. was saved!) was a residual charge on the c.r.t.'s faceplate. After repairing the set I had cleaned this while the set was running and thus removed the static charge on the screen. After switching the set off by unplugging it I lifted it off the bench, tube towards me, to take it to the soak test rack. At this point the plug hit my knee. The potential I'd picked up from the c.r.t. faceplate arced across to my leg, stimulating various muscles I didn't even know I had, and I dropped the set.

The explanation for all this is to do with the potential difference that exists between the inner and outer surfaces of the c.r.t. faceplate and might need an article of considerable length to explain. Suffice it to say that if the charge is removed from the screen of a working set, at switch-off the outer surface of the screen will assume a negative potential with respect to chassis of nearly that of the set's e.h.t. voltage. This potential can be picked up by anyone carrying the set, and you know the rest.

To prevent this kind of accident my advice to readers is to switch off a set on test by using its own mains switch, to wipe the static from the screen after switch-off and, when carrying it, to keep your hands well clear of mains connectors and aerial and auxiliary sockets.
Richard Flowerday, G3ZHH,
Harborne TV Services, Birmingham.

SATELLITE TV RECEPTION AT VHF

To test Les Sage's second theory for satellite TV reception on the v.h.f. band of an old TV set I asked a friend to put a low-band converter near the u.h.f. output of his satellite TV receiver. It picked up a lot of vision buzz at about 70MHz. So I favour Les Sage's second explanation. The u.h.f. aerial plugs into a splitter at the satellite TV receiver's u.h.f. output: this aerial is radiating signals at 70MHz or thereabouts. The TV set is picking this up, with its vision demodulator providing slope detection.

Now here's a point to contemplate. A friend brought along for repair a Ferguson set fitted with the 9600 chassis. He'd already had a "free estimate" from a local firm. They'd sent out a van (six miles) to pick it up, kept it all day, then returned it with no charge saying that they couldn't repair it. I put a 500mA fuse in and the set was o.k. It worries me that there are people collecting sets, doing several trips, picking and choosing until they find one to do. The customer must be paying for all this toing and froing.
Jim Littler,
Wigan, Lancs.

CORRECT TUBE PRICES

I read with interest last month's letter (page 865) on the cost of replacement TV tubes. While I'm in full agreement with L.J. Pitts regarding the price of new tubes generally in relation to the retail cost of the original receiver, I fell that he has been the victim of a parts distributor who has quoted in excess of the correct trade price. The cost of a replacement tube for the Philips 21CE1251 as a genuine spare part, as supplied by Philips, is £217·38 (£189·03 plus VAT). We can supply these tubes ex stock under order code 22155. This may be only £23 or so cheaper than the price quoted to Mr. Pitts, but it is the *correct price.*

If Mr. Pitts would like to contact us direct in future he'll be quoted the correct trade price and will not have to wait several days for a card to arrive by post, as in most cases my staff can immediately give him the information he requires.
P.J. Bartlett, Willow Vale Electronics Ltd.,
11 Arkwright Road, Reading, Berks RG2 0LU.

CONSUMER FRIENDLY?

I've been in the TV/video business for over twenty five years and read with dismay your article in the July issue on the Ferguson FV30's power supply. It strikes me as technical madness to produce a circuit that's so vulnerable to mains spikes, surges etc., especially when it operates continuously, the result being such destruction of the semiconductor devices.

It seems that we have said goodbye to a golden VCR age, with models such as the Ferguson 3V29-36, the Panasonic NV370 and many more. There are now lots of flimsy models, a large number of which originate in Europe.

For operational purposes the voltages used in a VCR seldom exceed 18V. In my opinion a transformer and regulator perform the task of providing such a supply in the most efficient and reliable way. Chopper power supplies are better suited to higher voltage, lower current requirements.

Regarding cabinet design and "confuse-a-customer", current remote control handsets have too many buttons. I used to enjoy installation work but now find that I often have to sit down and explain to the customer how to operate a unified handset where one button performs as many as six functions! Can anyone explain to me why a customer should require sweep tuning and memory store functions via the handset? I've had many recalls to reset the tuning etc. where clients have twiddled the lot. In addition, handbooks are very poor at explaining set operation. You try explaining to someone over the phone at 5·30p.m. on Saturday night how to regain BBC1 on channel 26 (we've got ITV on all 99 channels)!

Why can't handsets have a lock-out function to disable

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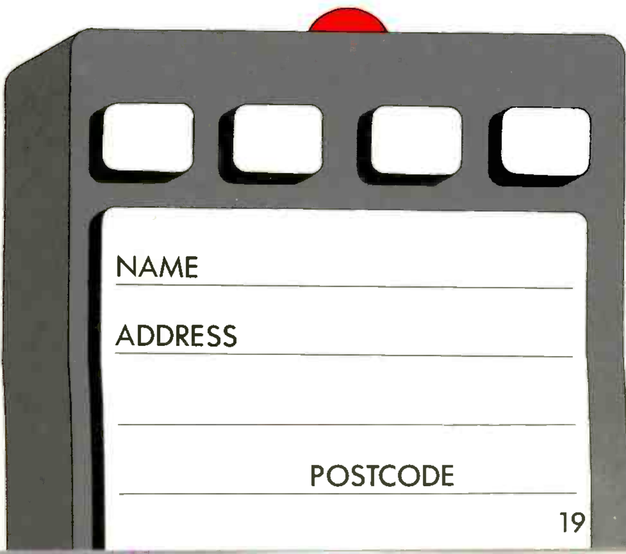

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the commands that non-technical users don't require? Let's have a bit of sense back in setmakers' design departments! The basic requirments are a reasonable cabinet with a front-facing loudspeaker and a handset with fewer buttons. The latter would clear the handset of clutter and enable larger buttons to be used for the essential functions, so that arthritic or "truck-driver" fingers could operate one button at a time.

Modern electronics have brought us first-class equipment that's cheaper and more reliable that ever before. But I'd like to take those responsible for the over complication around in my delivery van to witness at first hand the difficulties that arise.

J.C. Wakely, Television and Video,
Colliers Wood, London SW19.

VALVED RADIOS AND SECAM DECODERS

I would like to make a few comments following Geoff Davies' letter (August) on valve radio repairs/renovation.

As he says, with most of these sets the tone is decidedly muffled, and a high level of background hum is common. In most cases these two complaints can be alleviated by carrying out a simple modification – introducing a modest amount of negative feedback in the output stage. A typical valve radio output stage before modification is shown at (a) in Fig. 1. The rearrangement to introduce negative feedback is shown at (b). The polarity of the feedback depends on the connections to the transformer's secondary winding: the correct sense must be found by trial and error. Usually you'll find that the set will squeal if the wires are connected the wrong way round. If the set has a live chassis any connections to external loudspeaker sockets should be removed, or the sockets covered over (whoever uses them anyway?). An additional benefit obtained by carrying out this modification is a modest reduction in distortion. Some sets have a tone control network (variable resistor and capacitor in series) connected across the output transformer's primary winding. Introducing negative feedback greatly reduces the range, which is usually very much to the good. For those who actually like their radio to sound as if it's playing through a heavy mattress the simplest solution is to increase the value of the capacitor.

Two courses of action are possible if hum is still a problem. First, improve the output valve's screen grid decoupling, either by moving the connection to a better decoupled part of the h.t. line or by fitting a feed resistor and decoupling capacitor – say 4.7kΩ and 10μF. Secondly, increase the value of the main h.t. electrolytics – but don't add too much value to the reservoir capacitor without first checking the maximum permitted value in the valve manual. When most of these sets were made high-value electrolytics were hard to come by, so there's usually plenty of scope for an increase. A few sets use a hum-cancelling arrangement, with a tap part-way down the output transformer's primary winding. With these sets changing the value of anything other than the reservoir capacitor will not improve matters. Incidentally when first testing such modifictions *never* look directly at the electrolytics: mistakes can lead to explosions and jets of hot electrolyte.

I was a bit puzzled by the reference to the "SECAM reference oscillator frequency" in Richard Edeson's article on adding SECAM decoding to the TX9 chassis as the system doesn't use a reference oscillator. I worked on SECAM decoders at Panasonic's Cardiff factory for four years and as far as I can remember the symptoms as

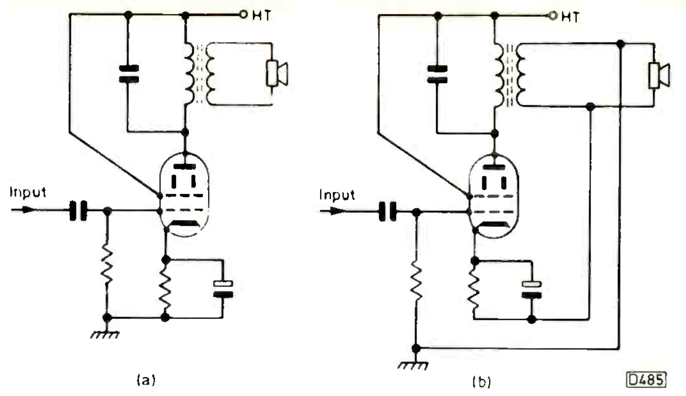


Fig. 1: Typical valve radio receiver audio output stage (a). A means of adding a modest amount of negative feedback to obtain improved performance is shown at (b). You may find that one side of the output transformer's secondary winding is already connected to chassis. There are other possible variations, so check the circuit out first.

described when tuning L1 resulted, in the Panasonic sets, from maladjustment of the R – Y or B – Y demodulator coils. An alternative to waiting for a monochrome film would be to adjust for correct rendering of monchrome portions of the PM5544 test pattern – assuming that one can be found. Success is achieved when varying the colour saturation control's setting leaves the monochrome areas unaffected.

In conclusion, can any reader help me identify either of the following diode-split line output transformers: FS 51477/DOK 8322 and MHF 028-17? The first *conclusive* identification will in each case be rewarded with a free transformer by return of post.

Philip Lane, Springfield, Lampeter Road,
Aberaeron, Dyfed SA46 0ED.
Telephone 0545 570 162.

SERVICING NEED

I've been following with great interest the various letters relating to valve wireless sets since in today's high-tech world very few engineers seem to be willing to deal with these fine, and sometimes valuable, receivers. "You can't get the valves" seems to be the usual excuse. When I opened my business some eighteen months ago I soon found that there were a great many collectors who had literally nowhere to go for service.

With a current stock of over 2,000 valves (from 1922-1966), plus data and specialist knowledge, my customer list had grown from six to approximately two hundred. This is a considerable reflection on the so-called throwaway world in which we live. Should I be able to assist any reader with a vintage problem, my 28 years of experience is at their disposal.

Nigel Rogerson, Proprietor, Anode Electronics,
8 Wilderness Road, Plymouth PL3 4RN.
Telephone 0752 673 356.

METEOROLOGICAL SATELLITE SYSTEMS

Many schools now have meteorological satellite systems that require servicing, having been fitted two-three years ago. They are similar to satellite TV systems but download a digital signal for decoding by a computer.

I was recently called to a system which didn't supply an output to the computer. This is usually indicated by a flashing green LED on the receiver. My first step was to

check whether there was a signal at the LNB. The satellite is due south and the dish appeared to be correctly aligned. I removed the connector from the LNB and attached a Uno-ohm signal-strength meter to its output. The spectrum display showed that all was well with the dish and the LNB. A check on the voltage at the LNB connector then showed that there was no supply for the LNB. This is fed into an interface, usually close by. This interface was fed by a five-pin cable from the room in which the receiver is situated. There were two five-pin DIN sockets at the rear of the receiver, one marked "tape" for prerecorded information and the other marked "signal". The cause of the fault turned out to be a dry-joint on the earth screen connection of the signal DIN plug.
J. Fenton,
Hull.

CORRECTION

Your recent articles and the Casebook items on CD players are well presented and give good practical advice. There was a slip on page 836 of the September issue however, under the heading Technics SLP-222. The part number for the pad to prevent the radial arm sticking should have been quoted as RMZ0103, not RMQ0042. The latter is a dust cover used to prevent, or help prevent, skipping with the SLP-350/770/990 etc. Maybe N.B.'s own SLP-310 could benefit from its use.
Gerald Gutteridge,
Panasonic Technician, Midland Branch.

WASTED HEADS

I wonder how many heads in VCRs are mistakenly replaced just because the earthing point on the axis of the head drum is dirty or has worked loose so that static cannot be released?
M. Alter,
Londong N15.

INFERIOR PLASTICS

Recent letters on cabinet design and sound quality prompt me to air some similar criticisms about the use of inferior plastics in current consumer products. Here are some examples.

After many years of excellent service my mains-operated electric shaver had to be replaced. The present day equivalent that I purchased from the same manufacturer is made of vastly inferior plastic. It feels awkward in use because it's far too light and relatively puny: when gripped normally the plastic body literally flexes at the seams. The three cutters float in a removable plastic top that's as skeletal as a free plastic toy in a cereal packet: the older versions had a metal top.

The 35mm compact camera I bought two years ago at a well-known discount store failed the first time is was used. Because the frame-counter ceased to operate the film was a write-off. The store immediately provided a replacement, but this second camera recently became unusable: the minuscule plastic ratchet system inside the camera slipped out of synchronisation so that the film was exposed to light whenever it was advanced – without touching the shutter release button! Luckily I was able to strip down the camera, using a jeweller's screwdriver, rectify the fault and then reassemble it.

The midi stereo system I bought last year was selected because it seemed to be better and stronger than the alternatives with their extremely flimsy lids. When it arrived, in the maker's sealed cartons, I found that the lid was shattered. The store didn't seem to be at all surprised and provided a replacement that same day. I must however say that the sound system works very well.

We've had similar problems with other equipment that's far less well built than the products of a few years back.

Finally I'd like to thank those who wrote offering advice on the subject of medium-wave interference.
Ivor Nathan,
Southgate, London N14.

HELP WANTED

Can anyone supply a Toshiba projection tube, type E2884(R)? It's the red c.r.t. used in the Grundig Model 9030. All expenses would be paid.
C. Mellor, Hignett (Electrical) Ltd.,
71/73 Rocky Lane, Liverpool L6 4BB.
Telephone 051 263 5287.

Can anyone supply a circuit diagram for the HMV Model 425; a pre-1950 valve radio receiver?
John Edwards, 12 Fferm Goch, Llangan,
Nr. Bridgend, S. Glamorgan CF35 5DR.
Telephone 0656 862 559.

Can anyone supply a line output transformer for the Toshiba Model 221R3B? It's type TFB4009AM, part number 23226470, and is no longer available from Toshiba. We need it to repair an elderly widow's six-year old set.

We have for disposal a tube, complete with scan coils, front frame and protective glass, for a Rigonda M.
M. Hutchinson, Reymal Electronics,
139 Salisbury Avenue, Warden Hill,
Cheltenham, Glos. GL51 5BZ.
Telephone 0242 514 168.

Can anyone supply the scan coils for the tube (type 560ETB22) in a Toshiba Model C2290B1? Toshiba will supply only coils plus tube at £213 trade. Coils from a scrap set would do.
G.S Riley, 4 Kestrel Bank, Netherton,
Huddersfield, W. Yorks HD4 7LD.
Telephone 0484 663 114.

I'm an electronics graduate who is extremely interested in learning about TV/video servicing. Would anyone in this area be willing to provide training in return for voluntary labour on my part, possibly on a Saturday? The aim is to acquire skills rather than qualifications.
Tim W. Wan, 38 Britannia Road,
Southsea, Portsmouth, Hants PO5 1SN.
Telephone 0705 824 572.

I have here in Australia two magnificent Philips hybrid colour receivers that date from the early Seventies, a K70 and a K80. They continue to work, with regunned tubes. Could anyone supply (a) a line output transformer for the K70 (part no. 4822-140-10107) and (b) a service manual for the K80 (with tripler e.h.t. output)? Understandably, both items appear to be unavailable from Philips.
W.F. Gadd, 25 Heytesbury Road,
Subiaco, Western Australia, 6008.

A Satellite TV Test Signal Source

Richard Flowerday, G3ZHH

Along came satellite TV. Then an influx of faulty satellite TV receivers came into our workshop. These have been mainly Ferguson SAP-1 and SRA-1 units. Their faults have ranged from dead (mains transformer primary winding open-circuit) to various intermittent problems generally caused by dry-joints. With some of the faults we've had to soak test the receiver. This prompted me to sort out an alternative signal source that was cheap and effective, to avoid tying up our only Astra dish.

Basic Concept

The device described in this article is based on the r.f. modulator used in the Ferguson 3V00/JVC HR3330 and similar VCRs. By making a few simple alterations the u.h.f. oscillator can be modified for modulation by a video input signal. The third harmonic of the output is strong enough to produce noise-free pictures when fed to a satellite receiver's r.f. input. A varicap diode is added to apply f.m. to the oscillator, and the unit's video preamplifier is used to provide drive. The fact that the PCB carries the manufacturer's component reference markings makes it simple to describe the modifications. A circuit diagram of the relevant part of the modulator (the audio section is not used) is shown in Fig. 1. The full circuit of the modulator in its original form can be found in the service manual for the Hitachi VT5000.

Modifications

Begin by removing the top and bottom covers of the modulator. Then unsolder the top of the oscillator's screening can. Remove the wire link in the *straight* brass tube on the underside of the unit. Next remove and discard the following components: C10, C21, C22, C23, R20, R21, R23 and transformer T1.

Within the oscillator section, remove C19. It's a ceramic capacitor that's connected between the hot end of the oscillator's Lecher line and the tuning capacitor TC1. In place of this capacitor fit a BB105 or similar varicap diode, with its cathode to TC1 – see Fig. 2. Solder a 10kΩ resistor to the junction of the diode's cathode and TC1. Connect the other end of this resistor via a 1kΩ resistor to the oscillator block's supply input feedthrough capacitor pin.

Fit a wire link between the pin of T1 nearest the oscillator block and the outer end of R23 (see Fig. 2). Also link together, on the print side of the board, the collector of TR3 and the junction of R20 and C21 (previously removed). Connect the negative side of a 10μF electrolytic capacitor to this point on top of the board, soldering the other end to the junction of the 10kΩ and 1kΩ resistors added inside the oscillator block. Finally, change the value of R6 from 220Ω to 100Ω.

The modified unit was housed inside an Eddystone diecast box, though any convenient casing can be used. The modulator was secured to the case by bolting its top cover to the bottom of the box and clipping it in when the wiring was completed.

Fig. 3 shows the wiring and pin connections. Be sure to earth the screen of the r.f. output lead at both the modulator and the front panel socket. Fit an isolating capacitor in series with the output, as shown – otherwise any LNB supply from the receiver will be fed to the modulator's output, with disastrous results!

Power Supply

An ancient 12V c.r.t. booster transformer with a bridge rectifier, a 2,000μF reservoir capacitor and a 7812 regulator were used to obtain the 12V supply required. BNC sockets taken from scrap VCRs provide the video input and r.f. output connections for the completed unit. Any available 12V power source could be used.

Setting Up

Setting up is easy. Supply a video signal to the input. If a pattern generator is not available the video output from a VCR can be used. Link the r.f. output to the input of a receiver, then switch on.

Tuning the receiver should produce a picture of sorts. It appears at around channel five on our workshop Sakura unit. Adjust the modulator's output frequency to obtain a picture free from sparklies. If necessary monitor the receiver's a.f.c. line to obtain the correct tuning point. Connect a scope to the receiver's video output and adjust the d.c. level control VR2 so that the video signal sits half way between the points where either the peak whites or the sync tips are clipped. To achieve this is may be

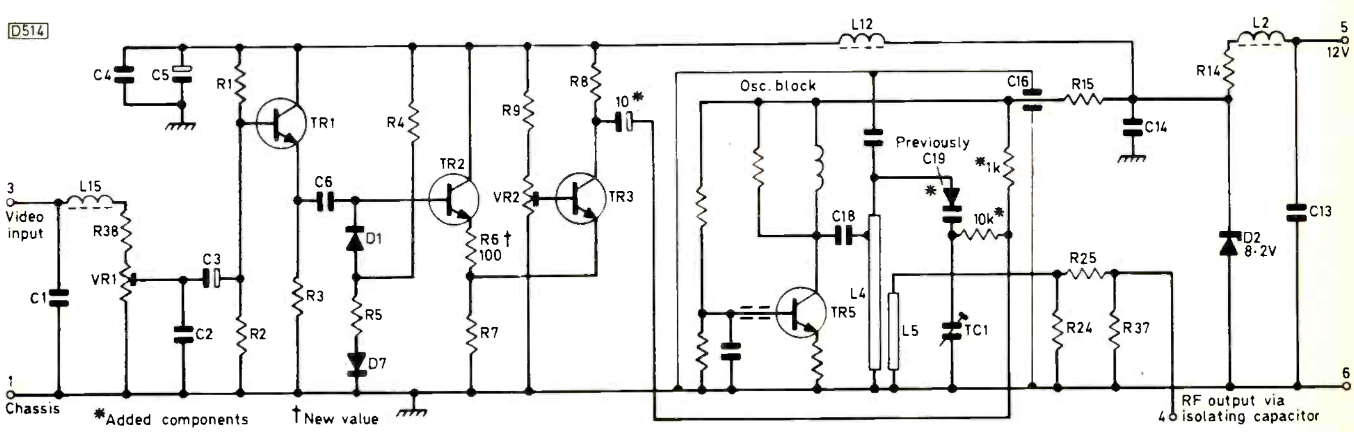


Fig. 1: Circuit of the video section of the modulator, after modification.

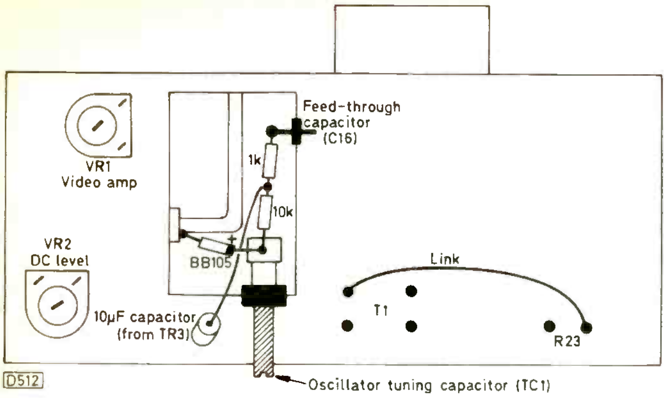


Fig. 2: Modulator shown from the component side.

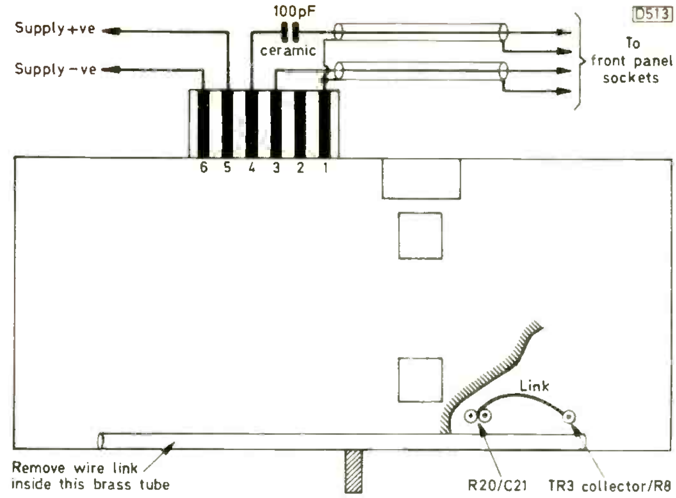


Fig. 3: Modulator shown from the print side. The pin connections are as follows: 1 chassis; 2 audio in (not used); 3 video in; 4 r.f. output; 5 12V in; 6 chassis.

necessary to back off the video gain control VR1. Finally, adjust VR1 for the desired picture contrast level.

In Conclusion

Although the unit is very basic it works well and the design is repeatable – we now have one in both our workshops. No effort has been made so far to overcome the varicap diode's non-linearity or to add sound. Doubtless someone out there will have time to sort these out. The unit has certainly been a boon in my workshop – I can now listen to MTV all day and still repair satellite TV receivers!

Test Report: The Philips Model SBC812 DMM

Philip Blundell, AMIEIE

One Monday someone – not me! – tried measuring the resistance of the mains supply with our Avo 8 and damaged the meter's movement. It's quite expensive to repair, so I started to cast around for a suitable replacement.

From past experience with test equipment I've found that hands-on experience for a few days, if possible for a week, is a must for making an informed decision on whether or not to purchase it. The item concerned may work all right under some conditions, but is it satisfactory for the ones that you encounter? My boss has in the past brought me meters that were less than satisfactory in use. One had no diode test, so that you couldn't check semiconductor devices; another was autoranging but took five seconds to decide on the range; yet another used the battery as a reference, as a result of which it began to read high as the battery aged – and there was no low-battery indication! So when the Philips representative offered to lend me the meter of my choice I accepted eagerly.

A quick look at the specification of the SBC812 showed that it would stand 500V a.c. on all ranges except the low-current one, which is protected by a 500mA fuse. So it should stand up well to what killed its predecessor. Like the Beckman meter I use it has a low probe voltage on the ohms range: thus in-circuit tests can be made around transistors without the risk of the junction conducting and upsetting the reading. With the range set to diode test, transistors can be checked in circuit (the display shows the 0·6V junction voltage): unless any parallel resistors have a very low value they don't cause errors.

The bar-graph display is up-dated ten times faster than the numerical display. It's useful for tracing crackles and flickering voltages that confuse other digital meters. The autoranging works quickly: if necessary it can be overridden by pressing the range button. The autorange on ohms saves a lot of button twiddling when you've reached desperation point and are checking every component in sight! The low ohms range has a continuity buzzer that's useful when changing surface-mounted chips – you can check say 40 pins for continuity to their pads and freedom from shorts to the next pin in no time at all. Others in the workshop could be irritated by the noise, so you might find that an empty can of freezer is aimed at your head if you make excessive use of this feature!

The meter has an auto power down circuit. This puts it into the low-current mode if the function switch isn't used for an hour. It's o.k. for the absent-minded who forget to switch the meter off when they go home, but it also works if you leave the meter connected to a piece of equipment on test. Irritating! It could be worse though – some of the meters on the market power down after only ten minutes. The test current is 400mA (10A if the probe lead is moved to the other socket). As I'm used to a standard 2A this has resulted in a few blown fuses, but I suppose that I'll get used to it.

The probe leads are of useful length and the battery life is good – 1,500 hours with an AAA size battery.

There are some features for which I haven't so far found a use (suggestions on the back of a ten pound note only please!). These include the memory. You can memorise only one reading. I can do that! Now if it was forty readings in sequence . . . Similarly the data hold could be useful if the van's ignition packed up on the M42 in the dark (so that you could take the meter inside to read it), but otherwise I can't think of anything.

Verdict

These few niggles aside, I'm more than happy with the SBC812, which is priced at £69·95 plus VAT. Why don't you leave your *Television* open at this page for a few days where the boss can see it?

Teletopics

DAT'S UK LAUNCH

Several companies plan to launch digital audio tape (DAT) recorders in the UK by Christmas. The technology has similarities to that used in VCRs, with helical scanning, and gives audio quality similar to that of the compact disc. Its launch in the domestic European market has been delayed for four years by a dispute between music and hardware companies. This was eventually resolved with the agreement that all European recorders will incorporate a "serial copy management system" (SCMS) which prevents second-generation digital dubbing.

Aiwa is the first company to announce a DAT recorder officially, Model HD-S1. It's a portable unit measuring just 95 × 38·1 × 146·4mm and weighing 610g with battery. The audio circuits incorporate new one-bit AD and DA converters. Features include selectable 32kHz, 44·1kHz and 48kHz sampling frequencies, 120 times normal speed search, a three-way power supply and remote control. The suggested retail price will be around £600.

BACK INJURIES

Harry Todd's case against Radio Rentals, in which he claimed compensation for back injury due to lifting TV sets, has been resolved by means of an out-of-court settlement. Mr. Todd started the case in 1981 and was granted legal aid in 1984. It's understood that the compensation amounted to £20,000 plus costs. Radio Rentals has not accepted liability. The agreement between the parties was reached on day three of the High Court hearing, on July 25th. In an earlier case Radio Rentals reached an out-of-court settlement with a former service engineer in Northern Ireland.

Injury can arise when a heavy, cumbersome set is carried single-handedly, especially if there are awkward areas to negotiate. Mr. Todd says that if an aid such as the Telelift is not used two people should be provided. A letter from Mr. Todd appears on page 914.

BROADCASTING NEWS

Nicam sound is now being radiated by the IBA's Belmont, Rowridge and Sandy Heath transmitters. The service is also available from Belmont's relay at Weaverthorpe and the relays served by Rowridge and Sandy Heath. BSB's second satellite Marcopolo-2 has been successfully launched. It's expected to reach the final orbital position at 31°W by the first week in December. Prior to this there will be tests at a temporary position – 50°W.

The government plans to add an amendment to the Broadcasting Bill making it a criminal offence to make, import, sell, let or hire unauthorised satellite TV decoders. It would also be a criminal offence to descramble programmes with intent to avoid payment for a service. According to the Home Office the amendment has resulted from the import of pirate decoders for the Filmnet satellite TV channel which shows many films to which the ITV companies, the BBC, BSB and Sky Television have the English-language rights.

Following a Commons Public Committee report which came to the conclusion that the level of television licence dodging is unacceptable the Home Office is to step up its campaign against dodgers. The Home Office estimates that there are about 1·7m who fail to pay the correct licence fee, representing a loss of £130m a year. A campaign in the mid-80s made little impact. Licence fees produced a total of £1,145m in 1988-89.

NEW VIDEOTAPES

Panasonic has introduced a 45-minute VHS-C tape, type NV-EC45EHG – the company already markets extended-play S-VHS-C tape.

TDK is to launch an S-VHS hi-fi tape giving improved picture and sound performance. The new tape has a dual magnetic recording layer, with a top layer just 0·3 microns thick and a bottom layer 3·2 microns thick. The top layer has a coercivity of 960 Oersteds and records the luminance signal, the 700 Oe lower level being used for the chrominance and f.m. audio signals. The company has also launched a longer running S-VHS-C tape that gives up to 45 minutes recording time in the standard mode or 90 minutes in the LP mode: the SE-C45 tape has a suggested price of £7·99. On the Video-8 front TDK has launched a metal-particle tape, type E-HG (extra high grade), which is priced at £7·99 with a running time of 90 minutes. The company also has a metal evaporated tape for the Hi-8 format, the price of the 90-minute cassette being £17·99. In addition TDK has introduced a still video floppy disc priced at £4·99.

VIDEO EQUIPMENT NEWS

Panasonic has launched a new S-VHS-C camcorder, Model NV-MS70, which replaces the NV-MC30. It uses a new compact mechanism and is 23 per cent lighter. In addition to S-VHS picture quality there's hi-fi sound, an artificial intelligence auto-focus system, compatibility with the VITC (vertical interval time code) editing system and numerous other features. The company's Model NF-FV1 is a portable "lap-top" recorder with 5in. LCD screen, PAL tuner and an NTSC playback facility, also hi-fi sound.

Panasonic has released further details on two of the prototype recorders shown at last year's Chicago Consumer Electronics show (see *Television* August 1989). Model NV-W1 is a multi-standard S-VHS/VHS machine that can play and record in the PAL, M-PAL, SECAM, MESECAM and NTSC modes. It contains no tuner however, being used simply for recording and playing videotapes. Digital processing is used to convert 525 line/60 field pictures to the 625 line/50 field standard and vice versa. The front panel displays a world atlas that's used to select the broadcast standards of both the input and output signals. Thus users don't need a multi-standard TV set nor a modern PAL set that will lock to 525 line/60 field signals. As it will dub tapes into any broadcast standard the machine can be used as a standards converter.

The NV-V8000 is an S-VHS/S-VHS-C edit deck with an F/C (full/compact) mechanism that accepts full-sized VHS and VHS-C cassettes. An intelligent quest (IQ) mechanism reduces tape jitter and allows an E-180 tape to be rewound in 1·5 minutes. There's a digital timebase corrector and a laminated amorphous head whose gap has been reduced from 35 to 26 microns – according to Panasonic this reduces cross-talk noise by 4dB. The deck has a background video (BGV) function that allows the user to record video over a previously recorded hi-fi sound tack, plus fader and colour level controls.

Both these models are due for release in Europe early next year. No prices have been announced.

Amongst various new VHS products released by JVC in Japan the ultra-compact GR-LT5 camcorder, weighing just 750g, is of note. Features inlcude a times 6 zoom, an encore function that instantly replays a ten-second scene, and a wide-screen effect that adds black bars at the top and bottom of the screen!

On the Hi-8 front Canon has introduced a camcorder, Model E800-Hi, whose features include a fuzzy-logic auto-tracking system that keeps moving subjects in sharp focus. An auto white balance system splits the image into 25 smaller areas and analyses them separately for correct colour balance. Suggested price is around £1,100.

SCHNEIDER SPARES FROM WIZARD

Schneider UK has appointed Wizard Distributors, Empress Street Works, Empress Street, Manchester M16 9EN official supplier of audio-video spare parts for all non-account and cash customers. Wizard's telephone no. is 061 872 5438, fax no. 061 873 7365. Customers who hold an account with Schneider/Zarlec should continue to deal direct with Zarlec at Northampton.

NEW CATALOGUES

The latest HRS catalogue, for 1990/91, has a brand new format and over 2,500 illustrations, many in full colour. HRS has gone to great lengths to update and improve the layout of this catalogue, making it user friendly. Its presentation is in fact similar to that of the famed RS catalogue. One of the major improvements is a 56 section index for quick reference to any product category. Another helpful feature is the listing of i.c. functions. As well as electronic components for TV sets, microwave ovens and video and audio equipment there are 230 pages of manufacturers specific spares, over 60 pages of test equipment etc. and 100 pages of communications and PA equipment. In all there are 656 pages. Details are available from HRS Electronics plc, Garretts Green Lane, Birmingham B33 0UE. Telephone 021 789 7575 (sales), 021 789 7171 (general).

The latest Tandy 1990-91 electronic catalogue is now available free of charge from over 500 Tandy stores and authorised dealers throughout the UK.

VCR ALIGNMENT KITS

Televideo Services, Unit 3 Plessey Business Park, Technology Drive, Beeston, Nottingham NG9 2ND, has introduced two new VCR alignment kits. The simpler one, containing the basic essentials for those involved in VCR repairs, costs £189 plus VAT. For those involved in full-time VCR work the Professional kit costs £298·98 plus VAT. In both cases Securicor delivery can be arranged at £5 plus VAT extra. These are certainly competitive prices. The company has been supplying VCR spares for over ten years.

SATELLITE TV TRAINING PROGRAMME

Microforge Ltd., 339 Clifton Drive South, St. Annes-on-Sea, Lancashire FY8 1LP (telephone 0253 725 499) has introduced a training programme covering satellite TV installation and servicing. It consists of a 45-minute videocassette (available in VHS, Beta, V2000 or Video-8 format) and a 46-page textbook with photographs, diagrams, charts and formulae. The programme costs £79·50 inclusive of VAT, postage and packing. It provides a step-by-step guide to satellite TV in a format that should be helpful to all those wishing to become involved in this new aspect of the TV/video business.

TV Fault Finding

Reports from Philip Blundell, AMIEIE, V.W. Cox, Steve Cannon, Mick Dutton, Ray Dunleavy, Andy Worrall, Paul Hardy, Ed Rowland, J.K. Potts and G. Grieve.

Philips 2A Chassis

This set had been a long-term inhabitant of the soak-test bench. The problem was intermittent crackling on sound with line tearing. It occurred even with the focus and c.h.t. leads disconnected, suggesting a fault in the line scan circuit. We changed components one by one and finally proved that the flyback tuning capacitor C2618 (1.5nF) was the culprit. **P.B.**

Philips KT4/K40 Chassis

No colour isn't a common problem these days. Thus lack of familiarity can make fault-finding difficult. There was no colour at all with this set, even when the colour-killer was overridden by connecting a 470Ω resistor between pins 1 and 6 of the TDA3561 colour decoder chip. The sandcastle pulse was present and correct, but there was no signal at pin 28 of the chip. Checks with a working set whose reference oscillator was misadjusted showed that the burst signal should be present at pin 28 with the colour killer operating and that burst and chroma should be apparent with it overridden. Time to check the chroma input at pin 3. It was low, being lost across C2135 (120pF) which was open-circuit. **P.B.**

Alba CTV12

The customer complained of a dead set, but only on occasions. Yet the power-on light always showed. The circuit is quite involved, but everything seemed to be o.k. in the switch-mode power supply. TR301 seems to operate in a delayed manner due to R303 charging C307, with discharge via R304 with D306 as a reset between switching off and on. The problem was that R304 had gone high in value. As a result the circuit locked on and starting current didn't reach TR302, via R301-5, to get it all going. This is Murphy's Law, isn't it? The worse it looks the simpler the remedy! **V.W.C.**

GoldStar CIT2175X

We've had two of these sets with the same fault, the symptoms being poor height and linearity. In both cases the faulty component was C202 (0.22μF) which is connected to pin 2 of the TDA4502 chip. From the symptoms you would have expected the cause of the fault to lie in the field output or driver stage, but C202 is part of the field oscillator circuit. **S.C.**

Panasonic TX2480 (Alpha 1W Chassis)

There was no sound or raster, with squealing from the power supply. We found that the 155V h.t. line protection diode D854 was short-circuit, the reason for this being obvious when we fitted a replacement – the h.t. was high at 180V. This suggested that the line output stage wasn't working, and sure enough there was no drive at the base of the line output transistor. The line drive was o.k. at pin 26 of the TDA4505 chip and at the base of the line driver transistor. The waveform at the collector of this transistor wasn't correct however and the d.c. voltage was 21V instead of 26V. Checks at pins S1 and S2 of the driver transformer produced readings of 21V and 26V respectively, which meant that the transformer was dropping 5V d.c.! A resistance check between these pins didn't reveal anything so a new transformer was fitted. To our amazement the set started up, with all the voltages correct. **S.C.**

Sony KV2212

The customer's complaint was that the sides of the picture "went funny" after about half an hour. Since I expected to see an east/west fault I was quite surprised to find that the red/green convergence at the sides of the screen jumped out than flicked back to normal. It happened again five minutes later and soon became permanent until the set was switched off and allowed to cool. The back was removed and, armed with a can of freezer and the hot-air gun, in I delved. After much freezing and frying it seemed that the fault was around Q551/552. Using a piecc of paper as a shield I then froze a few individual components in this area. After some effort the culprit turned out to be coil L551. It should be 27mH but the nearest we could find, from a scrap chassis, was 10mH. This restored normal operation. **S.C.**

Grundig P37-342 (CUC3400 Chassis)

This set wouldn't start. There was h.t. at the chopper transistor and a slight ticking noise from the transformer. All the voltages at the control chip seemed to be about right, and there were no obvious shorts. We were about to put the set on the shelf and order a new chip when we thought that it might be a good idea to check the chopper transistor's drive waveform. A scope check showed that its frequency was very low. C653 (4·7nF), which is connected to pin 15 of the i.c., sets the frequency. When it was replaced the set started up normally. **M.D.**

Ferguson TX100 Chassis

The customer's complaint was of intermittent channel changing and going into standby. On the bench the set wouldn't come out of standby. We found that the voltage at pin 20 of the remote control processor chip IC901 was very low at 2V instead of 9V. When we checked back to the regulator transistor TR901 we discovered that all three legs were dry-jointed. Resoldering them provided a cure to all the intermittent problems. **M.D.**

Toshiba 202R5B

The complaint was no sound. We established that the output stage was working all right then concentrated on the TA7608AP chip IC101 which houses the f.m. detector. The voltage at pin 22 was absent and C603 was found to have a substantial leak. Its value (10nF) is fairly critical if vision buzz on sound is to be avoided. **R.D.**

Hitachi NP81CQ Chassis

The problem was intermittent colour: sometimes the colour would flash on in parts of the picture. We noted that where there was colour it was of correct frequency and phase. Quite some time was wasted making checks around the colour decoder chip. Not until the dual-trace scope was hooked up to the display the incoming chroma signal and the burst gating pulse was all revealed. The gating pulse didn't coincide with the centre of the ten cycles of burst on the back porch of the sync pulse. In fact the line pulse wasn't being delayed. Replacing L506 completely cured the problem – this little choke, which in this case had its green plastic cover missing, is used to delay the burst gating pulse. We were lucky to have a similar set to hand, enabling us to make comparative checks. **R.D.**

Philips CF1 Chassis

This little portable produced just a blank, unmodulated raster, with no sound. We found that there was no output from the TDA2541 i.f. chip, so this was replaced. There were still no signals. A check on the components around this chip then revealed that C2147, a disc capacitor, was leaky. Replacing this restored normal operation. **R.D.**

ITT CT3326 (Monoprint B)

The customer's complaint was that the set occasionally didn't come on. When we switched on nothing happened. Only after trying a few times did the set reluctantly start up. On taking a look around the power supply we found that C701 was in a state of decay.

Incidentally the line output transformer in the monoprint B version doesn't fit the non-remote monoprint A version and vice versa. **R.D.**

Grundig CUC120 Chassis

This set took five-ten minutes to start up, during which time all voltages read low. Once the switch-mode power supply got going you couldn't get the fault to return by applying freezer: the set had to be switched off for several hours before the fault reappeared. We removed and tested the bridge rectifier's reservoir capacitor C626 and it gave a satisfactory indication. But fitting a replacement cured the fault. When C626 was retested we found that it had gone open-circuit. **A.W.**

Amstrad CTM640/CPC464

The monitor's power supply would cut out intermittently, power being restored when the main PCB was flexed. The cause of the fault was dry-joints around the STK7308 switch-mode power supply chip IC501. Note that the monitor is similar to Amstrad's CTV1400 colour TV set, with which we've experienced similar faults.

When the monitor was connected to the computer and switched on we found that the convergence was out. Investigation revealed that the plastic clips which hold the static ring assembly in place had broken, allowing it to move. We reset the rings are glued them in place. **A.W.**

Panasonic TC2213 (U3W Chassis)

This set suffered from corrugated verticals at switch on, with horrible noises coming from the power supply. After several minutes everything became normal. Use of freezer revealed that the cause of the trouble was C809 (1μF, 350V), a replacement providing a complete cure.

Another of these sets came in because of field collapse. A colleague had fitted new TIP31A field output transistors, but the result was field scan over only the top half of the screen. It turned out that one of the transistors, Q403 (2SD837), is a Darlington device. This is not obvious from the circuit diagram, as Panasonic has used a single transistor symbol. Using a BD645 in this position restored full scan. **P.H.**

Grundig A7410 (CUC220 Chassis)

This set failed to produce a picture at power up. When the picture finally appeared it had corrugated verticals, which disappeared after about ten minutes. It seemed as if the set was off tune: there were no sync pulses and the picture contained inverted video. The cause of the fault was eventually traced to C2221 (1μF, 63V) which is connected to pin 4 of the TDA5500 chip in the tuner/i.f. unit. You may get this fault with other models that use the same module. **P.H.**

Ferguson TX100 Chassis

Dealing with the dead set symptom is usually fairly straightforward with this chassis. In this case a new BU508A line output transistor and BC372 line driver transistor brought the screen back to life, but with lack of width – about an inch down each side. Unfortunately the line output transformer proved to be at fault, making it an expensive repair. **E.R.**

Sharp C1410

The only result when this set was switched on was a whining noise from the power supply. Checks were made on the chopper power supply outputs and a dead short was measured across the 115V line. The over-voltage protection diode D601, a 152V zener diode, proved to be the culprit. **J.K.P.**

Philips 2A Chassis

Do check beyond the bridge rectifier when you find that the 2AT fuse 1651 has blown. The usual cause is diode 6664 (BYD335). C2664 (1·5nF) should also be replaced. **G.G.**

Philips 12TX3512

There are four separate connections to/from a camera. First one packed up then another until only one still worked. At the good output there was 15V but only 5·5V at the others. All four BD136 stabiliser transistors TS211, TS221, TS231 and TS241 were replaced, using BD140 transistors. This cured the problems. **G.G.**

Philips K40 Chassis

Some people cause extra faults by delaying a service call. As we all know this is especially the case with arcing etc. The usual cause of arcing in these sets is the soldering at pin 15 of the line output transformer. In this case the print was burnt beyond repair, R3166 (1·5kΩ) was cooked and R3192 (680Ω) was open-circuit. R3192 is hard to find first time round, on both the circuit diagram and the chassis. It's on power panel 1001, the horizontal PCB. **G.G.**

Philips 17GR2540 (G90AE Chassis)

After two hours plus the picture may darken slightly with remote control commands having no effect. When channel change at the set itself is tried the display may show the quick diagnosis code. With the fault present the display shows F4 or F7. Replacing IC7720 will restore normal operation. On occasions the fault comes to notice only when a remote control command is issued. **G.G.**

Practical Digital Logic

Part 1: Gates and Boolean Algebra

David Botto

Peter glared in disgust at the circuit diagram in front of him on the bench. It was full of the newer and mysterious logic symbols that defied his interpretation. "Why do they have to keep changing everything?" he grumbled. "What was wrong with the old logic symbols?"

We can sympathise with Pete's reaction to the more recently introduced logic symbols. Every engineer I've asked seems to prefer the old ones – but I'm told that computers love the new ones! However this may be it's essential for the TV/video engineer to be able to understand both the old and the new. Both are widely used in service data. There seem to be some good reasons for the new symbols, though it looks as though the conventional symbols will continue to be used for a long time.

Ever increasingly complex blocks of digital circuitry are used in many of the latest TV sets, VCRs and camcorders. Trouble-shooting in such circuits can be a real headache. Remember too that microprocessor and microcomputer chips largely consist of complex blocks of basically simple digital circuit gates. All this circuitry is used to handle changing binary values at high speed.

Basic Gates

By now most readers of *Television* will probably be reasonably familiar with logic circuitry. Articles dealing with the use of logic probes and pulsers for practical servicing appeared in the November 1985, August 1987 and January 1989 issues. The well-known conventional logic symbols are shown in Fig. 1. Table 1 shows the basic truth tables. You may however not recognise the newer logic symbols shown in Fig. 2.

For effective servicing it's best to memorise the various logic gate conditions. It saves you the time and trouble involved in referring to truth tables. For the sake of completeness we'll briefly summarise the rules. An inverter or not gate simply inverts the logic signal state from H (high – binary one) to L (low – binary zero) or vice versa. With an and gate all the inputs (there can be several) must be high to produce a high output. With a nand gate all the inputs must be high to produce a low output. With an or gate a high output will be present when any one or more of the inputs is high. A nor gate produces a low output when any one or more of the inputs is high. An exclusive-or gate gives a high output only when one input is high, while an exclusive-nor gate gives a low output only when one input is high.

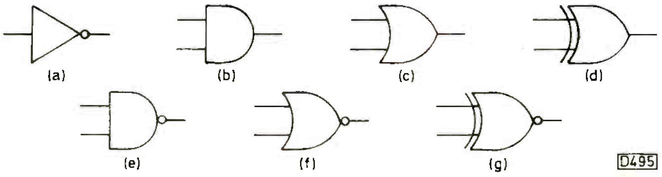


Fig. 1: Conventional logic symbols: (a) inverter, (b) and gate, (c) or gate, (d) exclusive-or gate, (e) nand gate, (f) nor gate, (g) exclusive-nor gate.

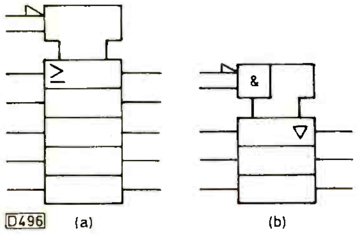


Fig. 2: Examples of the new style of logic symbols. All will be revealed in Part 2.

We'll be looking at the newer logic symbols in Part 2 next month. In addition to a knowledge of the symbols it's important to have a reasonable understanding of the operation of circuitry made up from the various gates – often referred to as combinational logic circuitry. It's vital that this understanding includes a basic knowledge of Boolean algebra, which is our main concern in this part. Then you'll have programmed into your mind the basic knowledge that will serve you well when you are confronted with involved logic circuit faults. It makes all the difference in practical TV/video servicing.

Boolean Algebra

There's nothing mysterious about Boolean algebra, which is based on simple mathematical laws devised by George Boole. It's easy to learn – you don't need a knowledge of advanced mathematics or complex standard algebra in order to understand it. It serves as the language of digital logic circuitry.

The first point to note is that many of the rules of Boolean algebra differ from those of ordinary algebra. With conventional algebra the letters used represent numbers, either known or unknown. With Boolean algebra the letters can represent only one or zero. A Boolean algebra equation expresses the output of a logic circuit in relation to its input(s).

With positive logic, which is almost always used in commercial equipment, a binary one is high and zero is low (with negative logic this is reversed, one being low and zero high). Most service manuals, though not all, show the binary one state as an H and the zero binary state as an L. In discussing Boolean algebra it's simpler to use one or zero, so that's what we'll do here.

Table 1: Logic gate truth tables.

And gate

A	B	C
0	0	0
0	1	0
1	0	0
1	1	1

Nand gate

A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

Or gate

A	B	C
0	0	0
0	1	1
1	0	1
1	1	1

Nor gate

A	B	C
0	0	1
0	1	0
1	0	0
1	1	0

Exclusive-or gate

A	B	C
0	0	0
0	1	1
1	0	1
1	1	0

Exclusive-nor gate

A	B	C
0	0	1
0	1	0
1	0	0
1	1	1

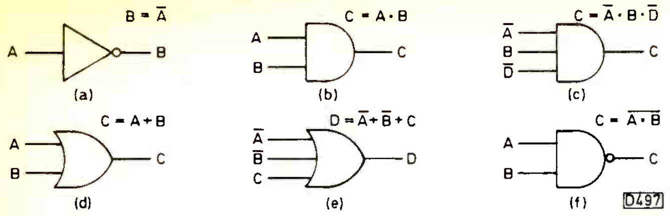


Fig. 3: Examples of Boolean equations for single gate arrangements, relating the output to the input(s).

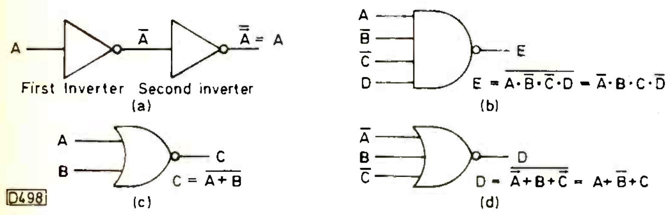


Fig. 4: The law of double negative (a) and its application to various gate arrangements.

With the inverter shown in Fig. 3(a) the input is labelled A and the output B. The Boolean equation is simply $B = \bar{A}$, which means that if the inverter is working correctly the use of a logic probe will show that the output is the opposite of the input. Whatever the state of the signal at A (one or zero) the signal at B is inverted or, as we say, complemented. The bar over the letter indicates inversion – one to zero or zero to one. It's important to note than in Boolean algebra the bar does not mean zero, it simply means inversion in relation to a preceding signal. This is in contrast to the practice in service manuals and circuit diagrams of placing a bar over a letter or group of letters to indicate that the relevant line goes low (zero) to produce the intended action.

The inputs to the two-input and gate shown in Fig. 3(b) are labelled A and B while the output is labelled C. The Boolean equation is $C = A \cdot B$, the dot indicating the and function (in practice the dot is often omitted). With the three-input and gate shown in Fig. 3(c) the inputs have been labelled $\bar{A}$, B and $\bar{D}$ (the bars over A and D indicating that inversion has previously taken place) while the output is labelled C. The Boolean equation is $C = \bar{A} \cdot B \cdot \bar{D}$.

With the or gate shown in Fig. 3(d) the inputs are again A and B and the output C. The Boolean equation is $C = A + B$, the plus sign indicating the or function – don't mistake it for the plus sign used in standard arithmetic or ordinary algebra. The Boolean equation for the three-input or gate shown in Fig. 3(e) with the conditions as shown is $D = \bar{A} + \bar{B} + C$.

Fig. 3(f) shows the commonly-used nand gate, which is simply an and gate followed by an inverter. Since inversion takes place in the gate the Boolean equation is $C = \overline{A \cdot B}$.

Basic Laws

The basic laws of Boolean algebra can be illustrated by means of logic diagrams. They are quite straightforward and easy to remember. Though these rules differ from those of ordinary algebra, bear in mind that many of the rules of ordinary algebra still apply.

Law of Double Negative

First, the law of double negative, illustrated in Fig. 4(a), is that $\bar{\bar{A}} = A$. The input signal A is inverted by the first inverter and is then inverted again, so there's no effect on the signal (apart from a slight delay of a few nanoseconds). Let's see how it applies to the four-input nand gate shown in Fig. 4(b). With the conditions shown the Boolean equation is

$$E = \overline{A \cdot \bar{B} \cdot \bar{C} \cdot D}.$$

When the law of double negative is applied the double inversion bars cancel and the equation becomes $E = \bar{A} \cdot B \cdot C \cdot \bar{D}$.

With the two-input nor gate shown in Fig. 4(c) the basic Boolean equation is $C = \overline{A + B}$. With the three-input nor gate shown in Fig. 4(d) the law of double negative again applies in relation to the conditions shown, so that

$$D = \overline{\bar{A} + B + \bar{C}} \text{ becomes } D = A + \bar{B} + C.$$

Laws of Intersection

The laws of intersection state that

$$A \cdot 0 = 0 \text{ and } A \cdot 1 = A.$$

They apply to and gates. Remember that the letter A can represent one or zero. Fig. 5(a) illustrates the Boolean equation $A \cdot 0 = 0$. Whatever the value of A, the output is zero. Fig. 5(b) illustrates the other equation $A \cdot 1 = A$. In this case if A is one the output will be one while if A is zero the output is zero. So X will always equal A. Compare these diagrams with the and gate truth table.

Laws of Union

The laws of union apply to or gates and are illustrated in Fig. 6. They state that

$$A + 1 = 1 \text{ and } A + 0 = A.$$

Again A can be one or zero. Compare with the or gate truth table.

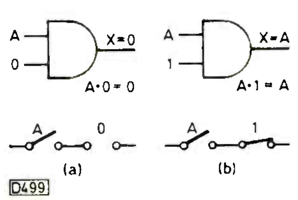
The switches shown in Figs. 5 and 6 show the electromechanical equivalents of digital and and or gates.

Laws of Tautology

The laws of tautology – tautology simply means a repetition of the same thing – are

$$A \cdot A = A \text{ and } A + A = A.$$

Thus $A \cdot A \cdot A \cdot A = A$, $A + A + A + A + A = A$ and so on. You can sum this up by saying that if the same logic signals are applied to all the inputs of an and or an or gate the output will be the same as the inputs.



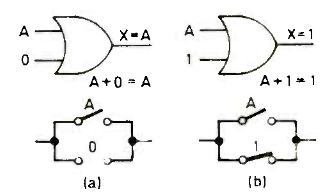
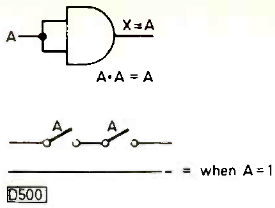


Fig. 5 (left): The laws of intersection, illustrated here, apply to and gates.

Fig. 6 (right): The laws of union, applicable to or gates.

By linking the two inputs of a two-input and gate (Fig. 7) the signal A is applied to both and the output X = A. If all the inputs of an or gate (Fig. 8) have the same input A then again the output X = A. With both of these circuits when A = 1 the electromechanical equivalent circuit is a piece of wire!



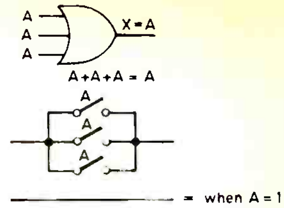


Fig. 7 (left): The law of tautology with an and gate.

Fig. 8 (right): The law of tautology with an or gate.

Law of Complements

The law of complements is illustrated in Fig. 9, where (a) relates to an and gate and (b) to an or gate. For an and gate the equation is $A \cdot \bar{A} = 0$. In Fig. 9(a) signal A is fed direct to one input of and gate Y and to both inputs of nand gate X which inverts it to $\bar{A}$. Thus the inputs to gate Y are A and $\bar{A}$ and its output X = 0. Nand and nor gates are often used as inverters simply by connecting their inputs together. For an or gate the equation is $A + \bar{A} = 1$. Fig. 9(b) shows an or gate Z with a nor gate W acting as an inverter to produce $\bar{A}$. Since Z is an or gate its output will under these conditions be one.

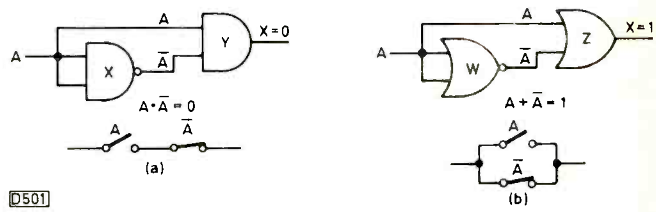


Fig. 9: The laws of complements in relation to an and gate (a) and an or gate (b).

Law of Commutation

The law of commutation says that in whatever order you apply the same individual logic signals to the inputs of an and or an or gate the outputs will be the same. This is similar to ordinary algebra. For an and gate the law states that $A \cdot B = B \cdot A$, as shown in Fig. 10. With an or gate the law is A + B = B + A. These laws hold for any number of inputs, as shown in Fig. 11.

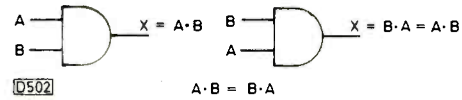


Fig. 10: The law of commutation for and gates.

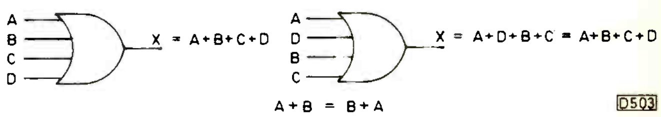


Fig. 11: The law of commutation for or gates.

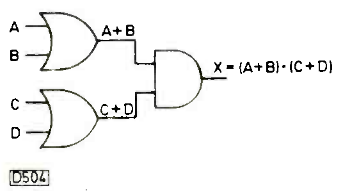
Products

A combinational logic circuit whose output is taken from an and gate is called a *product of sums* circuit. If the output is taken from an or gate the circuit is called a *sum of products* circuit. You'll find plenty of both in TV and VCR circuits.

In Fig. 12 two or gates feed the two inputs of an and gate. With the initial inputs A, B, C and D, the and gate's inputs are A + B and C + D. Its output X is $(A + B) \cdot (C + D)$.

The sum of products circuit shown in Fig. 13 is a bit more complicated, with three and gates feeding the three inputs of an or gate. The final output obtained is $X = (A \cdot \bar{B} \cdot C) + (D \cdot \bar{E}) + (\bar{F} \cdot G)$. It's common practice to omit the dots and write $X = A\bar{B}C + D\bar{E} + \bar{F}G$.

To use truth tables to find the outputs of the circuits shown in Figs. 12 and 13 would be far more laborious than using the Boolean equations given here.



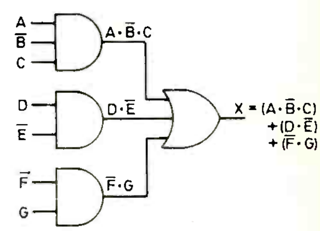


Fig. 12 (left): Basic product of sums circuit.

Fig. 13 (right): An example of a sum or products circuit.

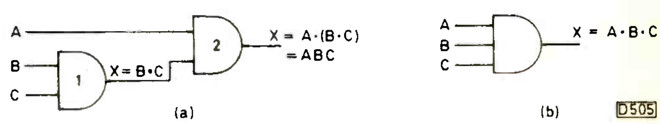


Fig. 14: The first law of association.

Laws of Association

The laws of association are used to simplify digital logic circuitry. They are obviously relevant to TV and VCR circuitry where circuit and i.c. designers have made use of them.

The first of these laws states that

$$(A \cdot B) \cdot C = A \cdot (B \cdot C) = ABC.$$

Fig. 14 illustrates its relevance. The inputs are A, B and C. Gate one produces an output $X = B \cdot C$. The output from gate two is $A \cdot (B \cdot C)$. You'll immediately see from the first law of association that this is equal to ABC, which means that the single three-input and gate shown in Fig. 14(b) can replace the two separate two-input and gates shown in Fig. 14(a).

The second of the laws of association states that

$$A + (B + C) = (A + B) + C = A + B + C.$$

Let's look at a practical example, where this law is used in the Panasonic Model NV688 VCR. Fig. 15(a) shows a combination of three or gates with inputs AB, CD, EF and GH, the final output X being AB + CD + EF + GH. Fig. 15(b) shows a section of the a.f.c. rotary phase generator used in the NV688, where a single four-input or gate replaces the separate or gates in Fig. 15(a).

Laws of Distribution

The first law of distribution states that

$$AB + AC = A(B + C).$$

The combinational logic circuit shown in Fig. 16(a) has three inputs A, B and C. The two outputs from the and gates are $X = A \cdot B$ and $Y = A \cdot C$. Output Z from the or gate is $Z = (A \cdot B) + (A \cdot C)$ which from the first law of distribution is equal to $A(B + C)$. A practical example of the simplification possible is shown in Fig. 16(b), which is a small section of the syscon circuitry used in the popular Panasonic NV7000 VCR. Here the same output has been obtained by using two instead of three gates, in this case an or and an and gate.

The second law of distribution states that

$$(A + B)(A + C) = A + BC.$$

Fig. 17(a) shows two or gates feeding A + B and A + C to an and gate whose output is thus $(A + B)(A + C) = A + BC$. The simplification made possible by the second law of distribution means that, as shown in Fig. 17(b), we can use just two gates to produce the same output.

Laws of Absorption

The laws of absorption also help to introduce simplification. There are four, as follows

$$AB + \overline{B} = A + \overline{B}, \qquad A\overline{B} + B = A + B,$$

$$A(A + B) = A \text{ and } A(\overline{A} + B) = AB.$$

DeMorgan's Theorem

The final Boolean law we'll mention is DeMorgan's theorem, which is very important. It comes in two forms as follows

$$\overline{AB} = \overline{A} + \overline{B} \text{ and } \overline{A + B} = \overline{A}\,\overline{B}$$

It provides a further aid to circuit simplification.

Nand and Nor Gates

In practice most of the logic circuitry you come across in TV sets and VCRs is made up from nand and nor gates and inverters. One reason for this is that the inverters used in all these devices act as buffers to prevent the various gates overloading each other. As a result, logic circuitry built up from nand and nor gates operates at a far higher speed than circuitry that uses and and or gates.

Nand gates can be used to provide the or and and functions. In Fig. 18(a) two nand inverters produce $\overline{A}$ and $\overline{B}$ ouputs which are the inputs to a further nand gate. From this we get the output

$$C = \overline{\overline{A} \cdot \overline{B}}, \text{ i.e. } \overline{\overline{A}\,\overline{B}}.$$

From DeMorgan's first law

$$\overline{\overline{A}\,\overline{B}} = \overline{\overline{A}} + \overline{\overline{B}}$$

and from the law of double negatives the double bars cancel giving us A + B. Thus the circuit acts as an or gate.

Fig. 18(b) shows the output of a nand gate fed to a second nand gate acting as an inverter. The A and B inputs become $\overline{A \cdot B}$ at the output from the first gate and $\overline{\overline{A \cdot B}}$ at the output from the second gate. Again from the law of double negatives this is $A \cdot B$, i.e. the circuit acts as an and gate.

You can work it all out from truth tables, but Boolean algebra is easier to use, especially when the circuitry is complex.

Fig. 19 shows at (a) and (b) respectively how, by applying the same laws, nor gates can be used to provide the and and or functions.

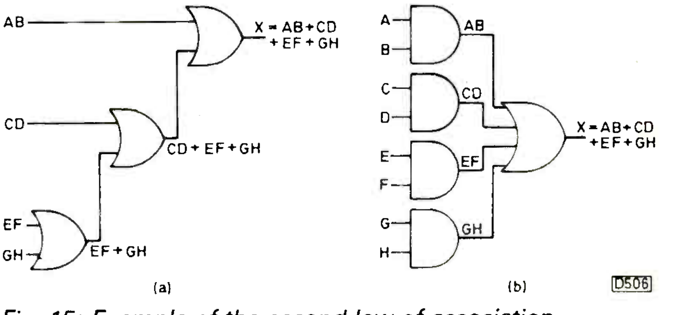


Fig. 15: Example of the second law of association.

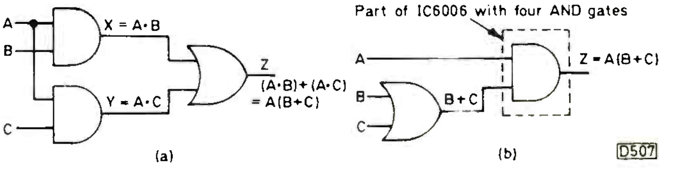


Fig. 16: Examples of the first law of distribution.

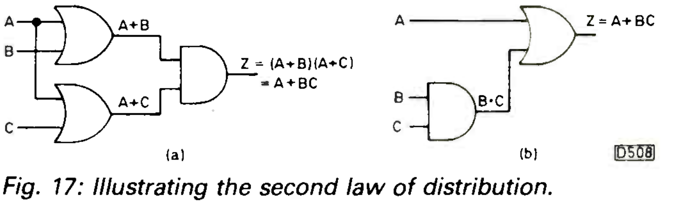


Fig. 17: Illustrating the second law of distribution.

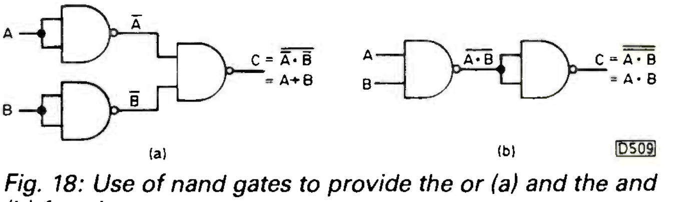


Fig. 18: Use of nand gates to provide the or (a) and the and (b) functions.

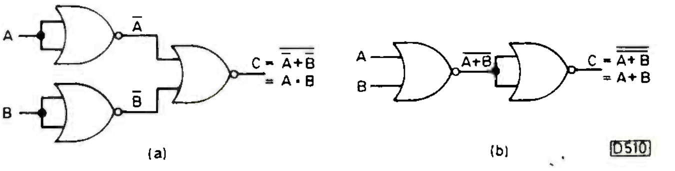


Fig. 19: Use of nor gates to provide the and (a) and the or (b) functions.

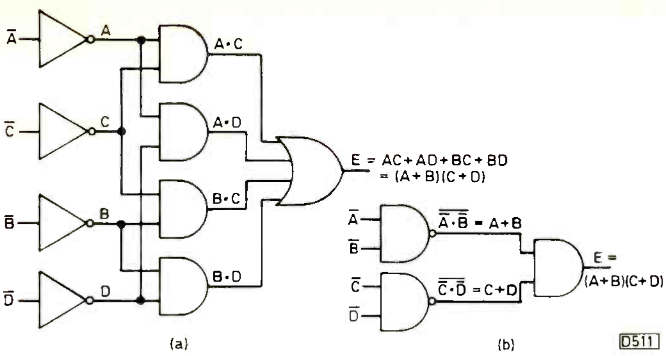


Fig. 20: How Boolean algebra can simplify a combinational logic circuit.

Much of the logic circuitry used in TV sets and VCRs uses nand and nor gates to provide and and or gating.

Circuit Simplification

Finally this month let's see how Boolean algebra can be used to reduce the number of gates in a logic circuit from, as in the example shown in Fig. 20, nine to three. The inputs to the circuit shown at (a) are $\overline{A}$, $\overline{B}$, $\overline{C}$ and $\overline{D}$. These are first inverted to A, B, C and D and then fed to four and gates whose outputs are A · C, A · D, B · C and B · D. These form the inputs to a four-input or gate whose output E is AC + AD + BC + BD.

By the law of commutation this can be re-arranged as AC + BC + AD + BD.

Using the first law of distribution this becomes C(A + B) + D(A + B).

By the laws of tautology (A + B) + (A + B) becomes (A + B), which gives us

$$E = (C + D)(A + B).$$

By the law of commutation we can rearrange this as (A + B) (C + D).

This same output can be produced from the same inputs by using the much simpler circuit shown at (b). Here two nand gates give us

$$\overline{\overline{A} \cdot \overline{B}} \text{ and } \overline{\overline{C} \cdot \overline{D}}$$

which as we've seen can be simplified to A + B and C + D. These form the two inputs to an and gate whose output is (A + B) (C + D), the same as before.

This reduction in the number of logic gates holds true whatever the logic levels of the four input signals. See if you can work out the output value E for both circuits if the four input signals are changed to $\overline{A}$, B, C and D and then again to A, $\overline{B}$, C and $\overline{D}$. The correct answers will be given in Part 2.

Summary

In this article we've discussed the basics of Boolean algebra as they affect TV and VCR circuitry. Boolean algebra may be new to you. If so I'd recommend that you read through this article very thoroughly to make sure that you appreciate the various laws and their relevance. As digital circuitry becomes ever more complex in the years ahead you'll be glad you took the time to do so.

In Part 2 we'll look at the newer logic symbols now in use. We'll also consider the Boolean equations for exclusive-or and exclusive-nor gates.

The North American HD-TV Scene

Geoff Lewis, B.A., M.Sc.

The HD-TV '90 Colloquium held in Ottawa at the end of June was, in comparison with other international TV conferences and exhibitions, very delegate friendly. The exhibition was small enough for comfortable access to the displays, and engineers who had been involved in the developments were on hand and prepared to discuss the relative merits of their systems. Some sixty technical papers were presented at the conference. They provided a good insight into technical and political developments around the world.

FCC Stipulations

The North American approach to HD-TV has changed significantly since 1987. Previously HD-TV was seen as being acceptable only if it was compatible with the NTSC system, using an augmentation channel. The reason for this was the high level of existing investment by both viewers and broadcasters. In March 1990 however the FCC declared that the approach was not spectrum friendly and decreed that HD-TV could only be introduced using the simulcast technique. This means that provided a broadcaster continues to transmit NTSC signals he would in addition be allocated a second v.h.f./u.h.f. channel for non-compatible HD-TV broadcasting, with the stipulation that the new service must be carried in a standard 6MHz channel.

The extra channels that suddenly appear to be available are the so-called "taboo channels" that have been kept idle to avoid inter-channel interference. It was decided that these could be used provided the new system had a more even power distribution within each channel – this should be possible since most interference arises because of the high level of energy in the spectrum close to the carrier frequency. Thus the new system would also have to use a non-compatible form of modulation. The change over to HD-TV could then occur in a natural way, and ultimately the existing NTSC channels would become redundant.

Firm proposals for a North American HD-TV standard had to be submitted to the FCC by June 3rd, 1990. Each system has to be demonstrated, under normal working conditions using common programme software designed to provide a high visual standard, by the end of August 1992. The FCC will then consider the results and select the best system by the second quarter of 1993. This will allow enough time for submission of the chosen system to the CCIR's 1994 Plenary Session. Six solutions to the problem were presented and discussed during HD-TV '90's technical sessions.

The competing systems include NHK Japan's Narrow Muse, a Channel Compatible System from the Massachusetts Institute of Technology (MIT), an Advanced Compatible TV System from a consortium comprising Sarnoff Laboratories, Thomson, Philips and NBC (ARTC), a Spectrum Compatible System from the Zenith

Corporation, the Digicipher system from General Instruments Corporation and Super NTSC from Faroudja Laboratories.

Narrow Muse

The source signal for Narrow Muse originates from the already widely known standard Muse system which uses 1,125 lines and a 60Hz field rate. Encoding reduces the number of lines to 750 and Muse subsampling reduces the base bandwidth to 4·86MHz. The receiver has to restore the missing lines by interpolation, i.e. averaging to produce three lines from every two transmitted. Four high-quality digital audio channels are multiplexed into the field blanking interval. It's claimed that the signal fits into a standard 6MHz channel and provides about twice the resolution at present obtainable with NTSC. An advantage of this scheme is that Muse has already been proved to be NTSC compatible by means of a Muse-to-NTSC converter. The latter has now been reduced to roughly VCR size through the use of specially developed chips. The conversion quality still leaves much to be desired however, as horizontal and diagonal motion produce annoying effects. Incidentally, the eight-field sequence means that a Muse-to-PAL converter remains in the future.

Channel Compatible System

MIT's Channel Compatible System uses an analogue/digital approach to maximise bandwidth use and the signal-to-noise ratio in line with the well-known Shannon Theorem. The video signal is filtered into high- and low-frequency components. The lows are then digitally coded and the highs are compressed so that their amplitude doesn't exceed 25 per cent of the digital component. The two signals are added together and then modulate the r.f. carrier. Since the added highs will look to the receiver like noise on the digital signal an error correction coding system is used to increase its robustness. Expansion of the highs in the receiver helps to reduce the noise level, improving the signal quality in the video frequency range where the eye is less sensitive to noise.

Advanced Compatible System

The Advanced Compatible TV System's display is based on the use of 1,050 lines and a 59·94Hz field rate, with an aspect ratio of 16:9. The system can be made compatible with a standard NTSC receiver by making use of the normal overscan. This is achieved by the use of clever filtering, signal processing and multiplexing, which also enable a high-definition interlaced or progressive scan picture to be compressed into a standard 6MHz channel. Typical video signal component bandwidths are luminance 12·5MHz with I and Q chrominance 3·75 and 1·25MHz respectively. These signals are separated and processed into three components as follows.

Component one is the central portion of the image, containing the main NTSC signal, together with the time-compressed side panels obtained by increasing the aspect ratio from 4:3 to 16:9. The active line period is 52μsec.

Component two consists of the high-frequency luminance signals and the Q signal component from the side panels, time expanded to 49μsec. The wider bandwidth I signal is similarly expanded. These two signals quadrature amplitude modulate a subcarrier, using suppressed carrier techniques.

Component three consists of the fine detail from the luminance signal, in the frequency range 4·5-7·16MHz. This modulates a 3·579545MHz subcarrier. Filters select one in every four lines, and this is then time expanded by a factor of four so that the signal energy now lies in the range 230-750kHz.

Components one and two are then added to form, with component three, the two signals that quadrature amplitude modulate the final r.f. carrier.

Spectrum Compatible System

Zenith Corporation's Spectrum Compatible System has 787·5 lines per frame and 59·94 frames per second, which means that the line frequency is 47·203kHz, exactly three times that of the NTSC system. The aspect ratio is 16:9, and with 1,280 pixels per line the resolution is equal to that of a 1,050-line interlaced system. Analogue and digital signal processing are used to squeeze the video signal into two 3MHz basebands. These quadrature amplitude modulate a single suppressed carrier, so that the transmission occupies a 6MHz channel. The carrier is thus placed at band centre. Since no carriers or subcarriers are transmitted the signal power is more evenly distributed throughout the channel, reducing inter-channel interference. In addition, analogue signal compression is used to reduce the peak transmitted power. The expansion required at the receiver improves the signal-to-noise ratio.

The luminance and chrominance signals are derived from 37MHz bandwidth RGB components. The luminance signal is filtered to extract the d.c./l.f. components which are then digitised, time compressed and multiplexed with digital audio and data signals for transmission during the frame blanking interval. The high luminance frequencies and the two colour-difference components are time compressed and multiplexed together for transmission as an analogue signal. The transmitted frame and line sync pulses do not exceed in amplitude 25 per cent of the average video level. It's anticipated that a handful of special VLSI chips at the transmitter and receiver ends of the chain could be used to implement the system. Thus the cost to the viewer would be minimal.

Digicipher System

The General Instruments' Digicipher system is completely new and all digital. It's designed for v.h.f., u.h.f. or satellite use, is VCR compatible and includes ghost cancelling, encryption and controlled access plus CD quality sound and a data/teletext service. The basic parameters are 1,050 lines, a 59·94Hz field rate, 2:1 interlacing, a 16:9 aspect ratio and luminance and chrominance bandwidths of 22MHz and 5·5MHz respectively. The luminance and colour-difference signals are sampled at 51·8MHz and then multiplexed into a single bit stream. Forward error correction bits are added to give a bit error rate that's better than one uncorrected error in 24 hours.

Bit-rate compression is achieved by means of a complex discrete cosine transform (DCT). This is a technique that's likely to become more familiar to us in Europe – a similar technique has been used in a codec data compressor developed within the Eureka programme by Telletra of Italy for videoconferencing. In the GI system the image area is subdivided into blocks of pixels and the amplitude of each is replaced by a DCT coefficient. Further processing uses differencing to identify the changing areas in the image. Information on this is run-length coded so that only changing data bits need to be transmitted.

Frame sync information is transmitted as a unique 24-bit data pattern while line sync data is obtained by counting. The r.f. carrier is 16-QAM digitally modulated – each symbol represents four bits at a symbol rate of 4·86MHz. As with the other systems, it's anticipated that this complex signal processing will be done by specially designed VLSI chips.

Super NTSC

It's at present unclear whether the Faroudja Laboratories' Super NTSC system is to be included in the tests. As it's NTSC it is unlikely to be taboo-channel friendly. The technique uses accurate comb filtering of the luminance and chrominance signal components before coding at the transmitter. Similar comb filters are used in the receiver to separate the signals without generating the familiar cross-colour and -luminance effects that impair conventionally encoded signals. The scanning can be converted to sequential at a 1,050-line rate at the receiver by using field stores, giving a vastly improved image quality.

HD-B-MAC

While all this is going on in North America and the MAC concept is under attack by Astra and Sky Television it's particularly interesting to find that HD-B-MAC, as developed by Scientific Atlanta and Digital Video Systems Corporation, is continuing to find market applications around the world. The system as demonstrated is compatible with the B-MAC system already in use in Europe for the British Racing Services. Because of its 10·7MHz base bandwidth it's not being considered as an HD-TV system in the USA. Basically it consists of a modified B-MAC encoder which has extended frequency filtering to provide a higher definition image and a preprocessor stage. The latter uses horizontal and vertical filtering, producing a spectrum that folds about 7MHz. The encoder compresses this and adds the usual MAC signal components, giving a bandwidth of 10·7MHz.

A standard B-MAC decoder removes the folded component, selects the central 4:3 aspect ratio section and converts the HD signal into standard NTSC form. The HD-B-MAC decoder processes the same signal but yields a 16:9 aspect ratio, with 525 lines scanned sequentially and a 59·94Hz field rate. By using a field store converter this can be doubled to 1,050 lines.

Gas Plasma Panel

It was generally agreed that HD-TV makes viewer sense only when displayed on a large, bright screen. Also that the large c.r.t. approach is unlikely to be acceptable in the average home. The paper presented by a team of research engineers from NHK, Japan seems to offer a solution. It described a 33in. diagonal helium/xenon gas-plasma discharge panel which is 6mm thick and weighs 6kg. It has an array of 1,024 × 800 cells, using thick-film and photolithographic techniques, a technology that's already well established. The cells are driven line sequentially, using negative-going cathode pulses of about 200μA amplitude. Although the brightness level is not yet acceptable, good colour rendition has been achieved. The device is to form the basis of further development with a view to using such panels for HD-TV displays.

3D TV

As an example of the Japanese commitment to television, NHK Research Laboratories were not content to provide just high-definition television images. They also presented a 3D high-definition demonstration. This was provided by two 1,125-line HD-TV VCRs whose outputs were switched alternately and displayed on a projection TV screen through horizontally and vertically polarised optical filters. The viewer had to use glasses with similar filters. I found that the depth of field of focus and the 3D effect were very realistic and a significant improvement on the red/green images of previous demonstrations. Wearing glasses is not the answer to 3D TV however. In this case rolling the head produced some strange visual effects.

LCD Projection System

The Japanese Sharp Corporation demonstrated a new solid-state projection TV system of small dimensions and with low consumption. The latter was achieved by using LCD panels to provide RGB light switching. High brightness, good colour images were displayed on a 110in. diagonal screen. Unfortunately the display was marred by a random line pairing effect, due perhaps to imperfections in the LCD panels or lack of frequency response somewhere. When these problems have been overcome the traditional projection TV manufacturers will find that they have a new, very serious contender.

Ghost Cancellation

Ghost cancellation is a feature that's appearing in a number of new NTSC receiver designs that include extended definition. Encoder modifications involve adding a reference signal in lines 18 and 281. These alternate as black and white levels for about 45μsec in an eight-field sequence. The receiver uses a microcomputer controlled adaptive transversal filter and a synchronous video detector to process these signals. The black and white signals are averaged over the eight-line period and compared with the expected level and timing of each 45μsec pulse to generate the ghost-cancelling signal. This can lock the receiver over a range of $\pm$45μsec.

In General

In addition to attending the Colloquium my visit to Canada gave me an opportunity to see how television is developing in North America. People there seem to be more aware of HD-TV than we are in the UK. How many viewers watched the Waddington Experiment? Does the pan and scan technique adopted for wide-screen films shown on TV help, or would a letter-box appearance give the viewer more insight into high-definition images?

As regards satellite TV, backyard dishes in cities and larger towns are rapidly disappearing as cable TV coverage is extended. Dishes continue in use in the rural areas. They are typically 1·5m types for both the C and Ku bands. Some of the older C band LNBs are massive – about 5in. in diameter and up to a foot long. The cost of such equipment is now higher than in the UK.

After watching an interesting documentary film transmitted by a Public Service Broadcast station it was surprising to hear an appeal for funds from viewers who had enjoyed the programme. According to my host this is a common feature with PSB stations which are always strapped for cash. Could this happen in the UK?

Long-distance Television

Roger Bunney

As these lines are being typed in early August temperatures have soared to record levels, reaching nearly 100°F. The period from July into August produced good weather in the UK, with clear days, as a result of a stable high-pressure system. Another result was enhanced tropospheric reception: a classic textbook situation. German, French, Benelux, Danish and Scandinavian Band III/u.h.f. signals were widely received in the UK over the period July 11-15th. Those in the West Country received similar signals from Spain. A second period of tropospheric enhancement started on the 18th and continued through to August. This time there was also reception of Irish Band III/u.h.f. signals. Interesting that the new Canal Plus Belgique signal, with scrambled PAL, was received during late July on chs. E50/58. Simon Hamer in North Wales received RTVE (Spain) on ch.E7, with signal enhancement by aircraft scatter! The final period of tropospheric enhancement started on July 31st. This is when temperatures of around 90°F were experienced for long periods, with the roads melting – and much of the population too!

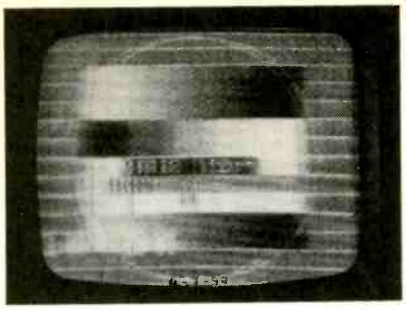
With these enhanced tropospheric openings and good periods of Sporadic E propagation DXers have received signals throughout most of the month. The SpE log is as follows:

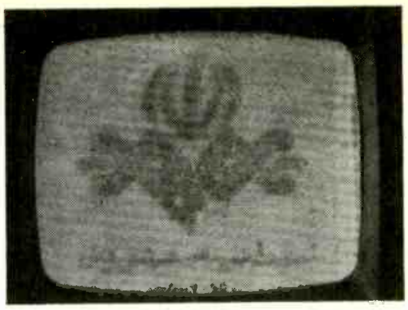
4/7/90	RTVE (Spain) chs. E2, 3, 4; RAI (Italy) chs. IA, B; ARD (West Germany) E2; +PPT (Switzerland) E2; JRT (Yugoslavia) E3, 4; SVT (Sweden) E2; TSS (USSR) R1, 2.
5/7/90	RTVE E2, 3, 4; RTVE-2 E2; RTP (Portugal) E2, 3; RAI IA, B; ARD E4; RUV (Iceland) E4; TSS R1, 2; RTM (Morocco) E4.
6/7/90	RAI IA, B; RTVE E2, 3, 4; RTVE-2 E2; RUV E3, 4; TSS R1, 2, 3; RTP E3; RTE (Eire) B.
7/7/90	RAI IA, B; MTV (Hungary) R1; JRT E3, 4; TSS R1, 2; CST (Czechoslovakia) R1, 2; TVP (Poland) R1; NRK (Norway) E2, 3, 4.
9/7/90	RAI IA, B; RTVE E2, 3; RTP E3; CST R2; TSS R1; JRT E3, 4; +PTT E2, 3, 4; ARD E2; C+ (Canal Plus, France) L3.
11/7/90	RTVE E2, 3, 4; TVE-2 E2; +PTT E3; RAI IA; JRT E3, 4; RTP E2, 3; DR (Denmark) E3; TSS R1, 2, 3; CST R1, 2.
12/7/90	RTVE E2, 3, 4; +PPT E2, 3; RAI IA, B; C+ L2, 3; CST R1; JRT E3, 4; RTP E3; TSS R1, 2, 3, 4, 5; TVP R2.
13/7/90	ARD E2; ORF (Austria) E2a; C+ L2; MTV R1, 2; JRT E3, 4; RAI IA, B; RTVE E2, 3, 4; RTP E3; SVT E3, 4; NRK E2, 3, 4, CST R2; TSS R1.
14/7/90	SVT E2, 3, 4; NRK E2, 3, 4; YLE (Finland) E3, 4; TSS R1, 2, 3, 4, 5; ARD E2,3, 4; TVP R1, 2; CST R1, 2, 4; RAI IA, B, E2; RTSH (Albania) IC; RTVE E2, 3, 4; RTP E3; RUV E3; MTV R1, 2; TVRL (Rumania) R2.
15/7/90	TSS R1, 2, 3; NRK E2, 3; ARD E3; YLE E3; RAI IA, B; RTVE E4; +PTT E3.
16/7/90	RTVE E2, 3; RAI IA; RTP E3.
17/7/90	RTVE E2, 3, 4; RAI IA, B; C+ L3.
18/7/90	RTVE E2, 3, 4; RAI IA, B; RTP E3; CST R1.
19/7/90	RTVE-2 E2; RTP E2, 3; RAI IA, B, C.
21/7/90	RTVE E2, 3, 4; RAI IA.
22/7/90	RTVE E2, 3; RTP E3; RAI IA, B; C+ L2, 4.
24/7/90	RTVE E3; RAI IA; +PTT E2.
25/7/90	RAI IA, B; RTVE E2, 3, 4; C+ L2, 3, 4; JRT E3; +PTT E2, 4; TSS R1, 2.
26/7/90	RTVE E2, 3, 4; RTP E2, 3; RAI IA, B; +PTT E4; CST R2; JRT E3.
27/7/90	TSS R1, 2; CST R1, 2; MTV R1; JRT E4; RTVE E2, 3, 4; RAI IA, B; C+ L4.
28/7/90	RAI IA, B; +PTT E2, 3, 4; RTVE E2, 3, 4; MTV R1, 2; TSS R2; CST R2; TVRL R1; JRT E3, 4; NRK E3.
29/7/90	+PTT E2, 3; RTVE E2; RAI IA.
30/7/90	SVT E2.
31/7/90	+PTT E2; RAI IA, B; RTVE E2, 3, 4; RTP E3; RTVE-2 E2; C+ L3; MTV R1.

Despite this long list the overall view of DXers is that the present SpE season is not particularly good. Many comment on days with no reception. The SpE activity is normal for a period when sunspots are at a maximum, i.e. fair to poor. SpE propagation is generally best when there's low sunspot activity. Unfortunately there's an increasing problem of interference from 49MHz equipment such as computers etc. This doesn't help.

Our thanks to the following for sending in reception reports: Simon Hamer (Powys), Peter Schubert (Rainham), Iain Menzies (Aberdeen), Roger Fussell (Torpoint), Bill Cotterill (Tipton), David Oliver (Birmingham) and David Glenday (Arbroath).

A letter from Jaroslav Cerny reports that satellite TV has really taken off in Czechoslovakia. The most popular system is the Amstrad SRX200E, though Cambridge, Samsung and Uniden equipment is also available, along with pirate Filmnet and RTL-V decoders.





Left: Iranian ch. E4 test pattern received in Holland via SpE on July 4th. Centre: Iranian ch. E4 caption received on the same day. Right: Lebanon ch. E2 news announcer received on July 2nd. All reception by Ryn Muntjewerff.

Dalibor Frkovic (Yugoslavia) reports that Tele-Liban (Lebanon) starts programmes at 1200 local time. Prior to this colour bars (eight colours) are transmitted, with the lower third in monochrome. This is TL-1 on ch. E2 and TL-2 on ch. E4. He comments that Egypt has also been seen on test using a colour-bar pattern (seven colours) with a grey-scale in the lower section, both with white on the left-hand side. There are three overlapping pyramids at the top right-hand corner on test patterns and programmes as an identification logo. Use of a blank PM5544 pattern has been dropped. In Yugoslavia itself Radio Televizija Zagreb (RTZ) is now Hrvatski Radio (HR) and Televizija Zagreb (TVZ) Hrzatski Televizija (HTV). Thus FUBK test patterns carry identifications such as HRTV HTV 1, HRTV HTV 2 and HRTV HRV 3. Dalibor has seen local Hungarian stations using PAL!

News Items

West Germany: The American broadcasting station RIAS is being taken over by ZDF, including the local West Berlin station on ch. E25. ARD has been refused channels in East Germany.

Stereo sound: BRT Belgium is testing with Nicam. RTVE (Spain) is to start Nicam tests by the end of the year.

Ghost cancelling: A demonstration of a Japanese ghost-cancelling system for NTSC was given during the NAB '90 show at Atlanta. Over 200 Japanese stations now use the system, which employs a "ghost-cancelling reference signal" (GCR). Receivers incorporating a special ghost-filtering circuit react to direct and delayed signals with digital sampling and filtering. The receiving equipment is at present priced at around $700 and is mainly intended for cable operators. The GCR signal is transmitted during the field blanking period.

50MHz Amateur Radio: A 50MHz allocation is expected to be introduced in Spain, with appropriate protection in ch. E2 areas. Application has been made to the authorities in Baghdad for a 50MHz allocation and beacon.

Satellite TV

There's to be a shuttle mission to rescue the failed Intelsat VI F3. Intelsat VI F4 has proved popular, with BTI having booked ten of the transponders and others having been leased, including some for satellite news gathering use.

Other recent Ariane launches include DFS-2 (Kopernikus) and TDF-2 on July 24th. DFS-2 is at 28.5° and TDF-2 19°. The following flight launched the first higher-powered Eutelsat II craft into orbit at 13°E. It will operate in the Ku and telecom bands and tests should start in late September/early October. Once the F1 craft is confirmed as operating satisfactorily Eutelsat I F4 will move to 4°E. Later when Eutelsat II F2 is at 10°E I F5 will be moved to 21.5°E.

Indian readers in the UK may be interested to know that Arabsat at 24°E is now carrying Indian TV at 4.75GHz (Band C), with programming from the Delhi and Hyderabad centres. Three downlinks are in operation but only one can be received in the UK. A 6m dish is required for broadcast quality reception, a 4m dish providing domestic quality signals.

Filmnet has tested digital sound. We understand that it's to continue on Astra, with the new scrambling system, aiming for the Scandinavian market. Meanwhile Filmnet-Benelux will use Eutelsat at 13°E with the present system.

RAI-UNO is to make available decoders for its partially scrambled services. The only programmes that will not be in the clear will then be films and copyrighted material.

On the domestic front I've installed on my 1.5m prime-focus dish an additional LNB to give both Ku and telecom band capability – with the potential to add an offset-mounted LNB for Band C. Unfortunately problems were experienced with the Chaparrel Twister (an 11/12GHz combined OMT/polariser) – it was impossible to obtain optimum setting. Eventually I opted for the Connexions wideband OMT and an outboard Racal wideband polariser which have provided satisfactory results. I'd be interested to hear of the results obtained by readers using various satellite TV equipment, including modifications etc.

The European Business Channel folded at the end of June. There are rumours that Russia is thinking of taking a channel on the new Astra 1B craft!

Sunspot Cycle 22

Authorities on the subject feel that the present sunspot cycle has not yet passed its peak, the peak in this cycle having a plateau-type profile with high-level activity expected at times through to 1992. In theory the peak occurred in March when the smoothed count was 165. Average predictions for the next few months are August 200, September 240, October 230, November 200 and December 200.

Book Review

I recently reviewed (August, page 767) the Frank Bayling publication *World Satellite TV and Scrambling Methods*. The price quoted was unfortunately incorrect. It should have been given as £27 inclusive of postage in the

UK – add £2 postage for mainland Europe.

Since then Baylin has sent for review another massive tome, *Ku-band Satellite TV Theory, Installation and Repair* (third edition). There are some 420 pages, 8½×11in. The book contains a wealth of information, covering installation in several sections part by part, the theory and practice of satellite signal transmission and reception, and repair. There are lots of photographs, charts, etc. Although of US origin the book covers all parts of the globe in depth. I was pleased to see discussion of i.f. bandwidth filtering with threshold extension, polarisers and the pros and cons of fitting scalar rings. I would highly recommend this book: it's not full of maths but is heavily biased towards description and practical matters. One of the authors is Brent Gale, director of engineering at Echosphere Corporation. The price in the UK is £23 inclusive of postage, again plus £2 for postage to the Continent. For a full list of this firm's satellite TV publications send a stamped A5 sized envelope to Baylin Publications, 24 River Gardens, Purley, Reading, Berks RG8 8BX.

New EBU Listings

France: Bordeaux-Bouliac M6 ch. E43 10kW hor.; Carcassone La 5 ch. E46 40kW hor.
West Germany: Koeln WDR-1 ch. E11, 3kW hor., new relay.
Iceland: Reykjavik ch. E10 20kW hor.

Norwegian Local TV

We have received from the Benelux DX Club and the Norwegian DX Club some details of Norwegian local TV stations.

TV Oslo operates on chs. E46 (100W) and E58 (50W) from transmitters at Tryvann and Furuseth. It's owned by twenty local firms and transmissions are in the clear.

Radio Fakta transmits in the Drammen area on ch. E48.

TV Ringerike operates on ch. E57 at Honefoss.

TV Halden operates on ch. E55.

TV-Sor/Kristiansand TV (KTV) operates at irregular intervals on ch. E43 at 50W. It's run by students at a local college.

Nordmore Lokal-TV operates on ch. E44.

Egersund, Dalane TV on chs. E45 and E48 at 100W operates for short periods daily. Transmissions are Pay-TV using the Philips Discret type line-rotation scrambling.

TV West, Stavanger operates on ch. E51 at 100W. Operation is over 24 hours and is scrambled (Cryptovision).

The Karmov region has a ch. E46 transmitter at Skudeneshavn.

TV-Bergen has transmitters on chs. E45 (50W), E48 (10W), E51 (10W) and E56 (5W). Transmission hours are 1900-2130, longer at weekends. Cryptovision is used for films, local programmes being in the clear.

Marsynet operates in Volda on ch. E43.

TV-Trondheim operates on ch. E47. There are other stations in this area.

Alesund operates on ch. E41. Levanger has TNM-TV on ch. E46. Tromso has ACEM-TV and Tromso Lokal-TV on ch. E43. Batsfjord Nar-TV operates on ch. E45.

The information is sketchy to say the least, but gives an idea of what is going on.

Service Bureau

BUSH BC6004

The problem with this 14in. colour set is that it shuts down then starts up again every few minutes.

This is usually due to dry-joints around the line output stage. Carefully check the connections to the line output transformer Tr725 and the components on the "voltage module" that's plugged into it (rectifiers for the line output transformer derived supplies and their associated components), then if necesary the connections to the line driver transformer Tr682. If these are all in order replace D687 (SKE4F1/10).

GRUNDIG CUC220 CHASSIS

The problem is a horizontal shake on the picture. It's worst when the set is switched on from cold, becoming nearly normal after about a quarter of an hour. The TDA2594 chip on the deflection panel has been replaced and I find that fine tuning helps a little but doesn't provide a cure.

We suggest you check C2742 (1,000μF) which smooths the supply to pin 2 of the TDA2594 chip, then if neccesary C2733 (0·15μF) in the flywheel sync filter circuit. If the effect varies with the setting of the brightness control however check the earthing of the tube's external conductive coating then suspect the tripler.

ITT DIGI-3 CHASSIS

The fault with this set is picture instability, like line and field lock being lost, that occurs in sympathy with whatever sound is being transmitted on channels higher than 27. If no sound is being transmitted, e.g. at the end of the advertisements, there is good lock momentarily. All the main chassis daughter boards have been substituted with ones from a known good chassis, but the fault persists.

The symptom of sync varying with sound on channels above 27 very strongly suggests that one of the supply lines is at the wrong voltage or poorly decoupled. Check supply lines I-XI and if necessary the 33V tuning supply with a digital voltmeter. If the d.c. voltage readings are correct, check the lines with an oscilloscope for audio or timebase hash. If present, check relevant capacitors, stabiliser chips etc.

NICAM Digital Stereo Sound

Part 2: Decoding NICAM transmissions

Eugene Trundle

For many years it has been the practice to obtain an intercarrier sound signal from the vision demodulator. It consists of the beat product of the vision and sound i.f. carriers, at 6MHz. Most TV sets and VCRs continue to use this system, which works perfectly well and produces a spot-on 6MHz carrier regardless of any tuner drift that may be present.

The IF Strip

For Nicam an alternative system, the quasi-parallel technique, is preferred. Fig. 12 shows the arrangement in block diagram form. A special SAW filter provides separate vision and sound carrier outputs. As usual the vision carrier is at 39·5MHz, the bandwidth of this section of the SAW filter being such that the vision sidebands are passed but a sharp cut-off removes the sound carriers at around 33MHz. There's a separate sound path through the SAW filter, with a response centred at 33·25MHz to pass both the f.m. and the Nicam carriers and a second, narrow peak at 39·5MHz to pass the vision carrier.

The sound i.f. output from the SAWF is fed to a special sound demodulator chip which beats the vision i.f. carrier and the f.m. sound i.f. carrier to produce a 6MHz f.m. carrier in the usual way and also beats the vision i.f. carrier with the Nicam i.f. carrier to produce a Nicam carrier at 6·552MHz. Sharply tuned filters in either ceramic or *LC* form separate the two sound carriers at the chip's output. The 6MHz signal goes to a conventional f.m. demodulator whose mono output we'll come back to later. The 6·552MHz digital sound carrier passes to the receiver's Nicam section. This consists of three basic parts. First there's a DQPSK demodulator which recovers the 728kHz data stream from the 6·552MHz carrier. Next comes the Nicam decoder which descrambles, de-interleaves and expands the data stream back to real-time 14-bit words. And finally there's a DA converter from which the analogue L and R audio signals are recovered. There are also peripheral bits in the form of memories, filters and switches: we'll look at these as we go along.

DQPSK Demodulation

At the time of writing this article all commercial Nicam TV sets and VCRs use the Toshiba TA8662N chip for DQPSK demodulation, though the Philips TDA8732 has been introduced as an alternative. We'll look at the operation of the more common Toshiba device here (see Fig. 13): similar arrangements are used in all such chips.

The 6·552MHz carrier enters at pin 4, its level being about 150mV peak-to-peak. After passing through an amplifier to which a.g.c. is applied the signal is sampled by two detectors, A and B. One looks for in-phase (cosine) signal components while the other looks for quadrature (sine) components. The system is reminiscent of the U and V chroma-signal demodulators used in a PAL decoder, i.e. there are two synchronous detectors working in quadrature, the reference subcarrier in this case being at 6·552MHz instead of 4·43MHz. The outputs from these demodulators, at pins 10 and 11, go to data-spectrum shaping filters whose low-pass characteristic is −3dB at 182Hz, the same as the transmission shaping filter mentioned last month. These filters remove the harmonic components of the demodulator's output and, with the carrier input filter, optimise the noise immunity of the decoder. The filtered baseband signals re-enter the chip at pins 19 and 20. Here they are fed to two adaptive data slicers which are similar to those used in teletext decoders – their operating points move continually to accommodate changes in signal level, ensuring that the slicing levels remain symmetrical around the signal's mid-point. The outputs from the slicers go to two circuits, first a matrix whose output completes the first phase-locked loop (PLL) in the chip and secondly a differential decoder.

This decoder operates with a second PLL to provide data recovery. It samples the inputs to see whether a logic one or zero is present. The outputs from this "block" consist of the pairs of bits (symbols) that are presented to the DQPSK modulator at the transmitter. These bit pairs, at a rate of 364kHz, are then presented to a parallel-to-serial converter, which is simply a two-way switch driven at bit rate, looking alternately at each symbol. The Nicam data stream has now been demodulated and appears at pin 29 of the chip.

Oscillator/clock Signals

The crystal oscillator in the second PLL in this chip operates at 5·824MHz, which is eight times the bit rate (728kHz). Its output is divided by eight to provide a bit clock signal for the following demultiplexer chip (output at pin 27) and a drive for the parallel-to-serial converter switch. A further division by two provides a drive for the 364kHz symbol decoder and an input to a phase detector

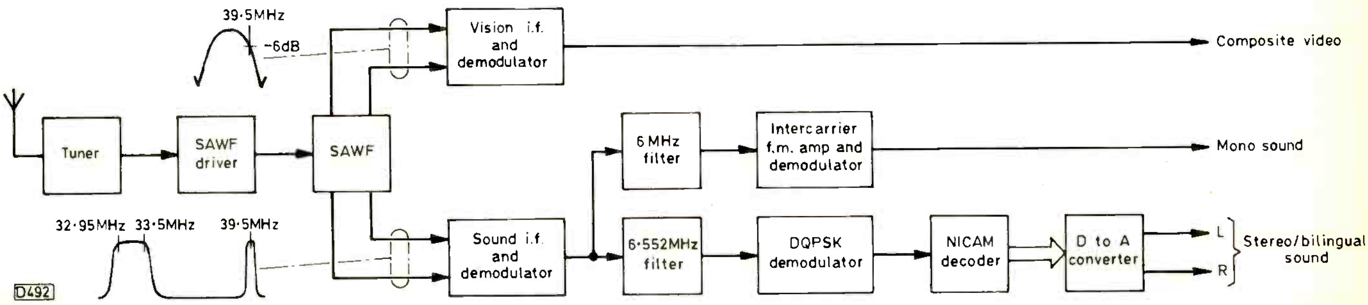


Fig. 12: Block diagram of a quasi-parallel i.f. system, using a "split" SAWF feeding separate sound and vision i.f. channels – this is the preferred system with Nicam sound.

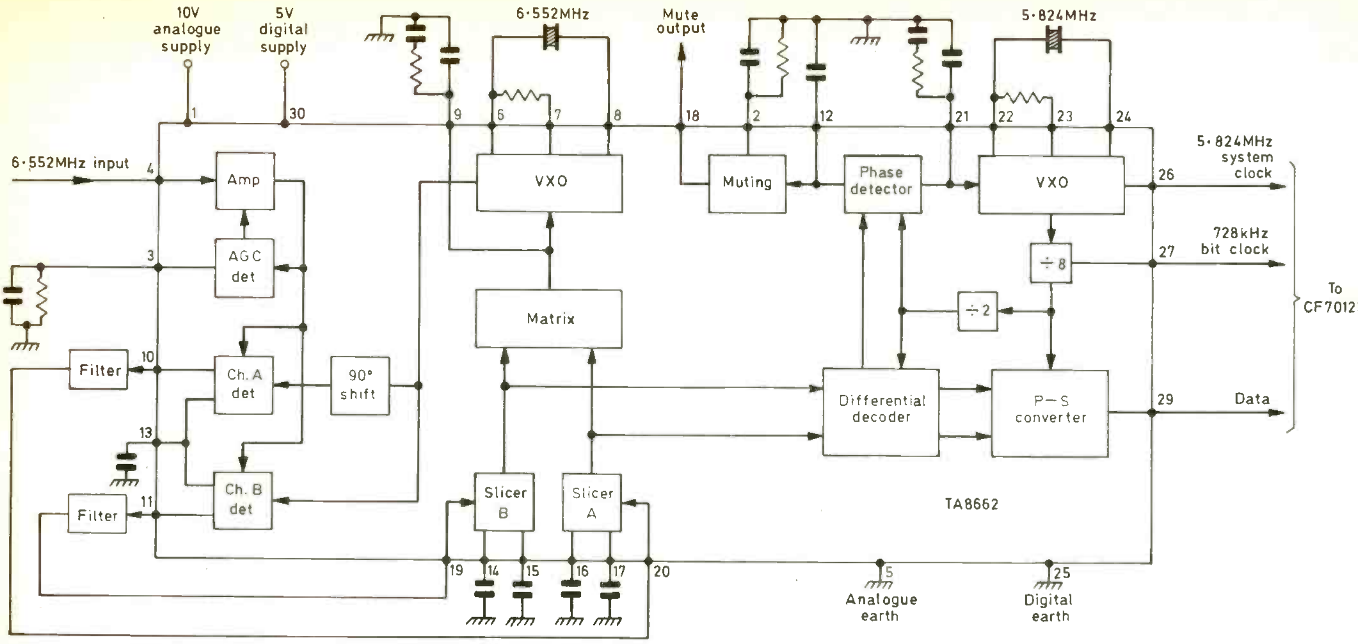


Fig. 13: Simplified block diagram of the Toshiba TA8662 DQPSK Nicam-sound demodulator chip.

which completes the PLL. The loop also provides a muting output at pin 18.

The Demultiplexer Chip

The following Nicam demultiplexer chip requires inputs at 5·824MHz (system clock, obtained from pin 26 of the demodulator chip), 728kHz (bit clock) and of course the data input. Setmakers now have a choice of demultiplexer chips. They work on similar lines but differ in detail. We'll look at the popular Texas Instruments' CF70123 chip, which was designed by Ferguson Ltd., then go on to describe briefly the alternatives. It uses the Texas two micron standard cell technology. See Fig. 14.

The demultiplexer chip descrambles, de-interleaves and reformats the encoded digital data, providing data, clock and ident outputs which can be fed to an industry-standard digital-to-analogue converter chip. It also provides information about the broadcast data and gives language selection during bilingual transmissions. For versatility and to provide for future applications the complete Nicam encoded data stream is available, after descrambling, off-chip. Provision is included for linking an external PRSG and for muting the Nicam signal (reversion to f.m. sound via external switching) in the event of bad data or errors. The chip incorporates the frame memories required, and can be controlled by simple pin switching or by a three-wire (ident/clock/data) Intermetall IM bus, typically linked to the main control microcomputer chip in the TV set or VCR in which the Nicam decoder is fitted. The package operates with a 5V supply, dissipating about 250mW. It has 40 pins.

The demodulated but still encoded data enters at pin 23 and is split two ways. One input goes to the FAW detector which consists of an 8-bit serial register and comparator feeding an 8-input exclusive-or gate. Once a FAW has been recognised, the PRSG generator, whose operation was described last month, is reset and started. Its output is added to the input data stream to provide descrambling, so that the data stream that emerges from the adder is descrambled. This output again follows two paths, to the control-bit decoder to provide housekeeping services, and to the serial-to-parallel converter to make available simultaneously the 64 bits of two companded blocks of data. These are loaded into 64 × 11-bit memories for readout in the correct sequence to de-interleave the bits – readout is controlled by a "memory manager" which holds in ROM the interleaving code and manipulates the memory address sequences to achieve its aim. Two memories are required, one to write data into while a second one is being read from. This caters for stereo use. A third 64 × 11-bit memory is incorporated for use with bilingual (two mono) transmissions, where each language occupies alternate blocks as shown in Fig. 6 last month.

Having restored each eleven-bit word to its correct order we next need to expand it back to the original 14-bit form. The range information (see Fig. 3 and Table 1 last month) is read out from the parity bits which have been extracted, assembled and interrogated for the purpose. Then, with reference to the 3-bit range code, the original 14-bit word is reconstituted. This is followed by the error-correction section, where the parity bits are used for signal truth testing and repair, and the protection-range data (carried by the range code) is used for more sophisticated error correction of the sound data stream.

The digital processing is now almost complete. Data leaves the demultiplexer chip at pin 3, accompanied by an ident (left/right channel) signal at pin 33 and a synchronous clock signal at pin 4. This 3-line bus goes to the DA converter chip. There are two possible bus-line formats. First S-bus, which is used with ITT DAC chips such as the APU2470, and secondly I2S bus, which is used with the Philips SAA7280 and TDA1541 chips. Selection of the bus format is made by taking pin 18 (DACSEL) low for S and high for I2S.

We have not so far considered the clock arrangements used in the CF70123 chip. As shown in Fig. 14, a 728kHz bit-rate clock signal enters at pin 22. It's used primarily for FAW detection and gating. The main (system) clock within the chip runs at 5·824MHz. Where the Toshiba TA8662 demodulator chip is used this clock signal enters at pin 28. Pins 29 and 31 make provision for adding a phase-locked crystal oscillator when other demodulator chips are used. This clock is used throughout the chip for the various Nicam decoding functions. A further clock, using a 16·384MHz crystal, is linked to pins 9, 11 and 12. This clock's output is for use by the DA converter chip – for obvious reasons it's referred to as DACOSC. There are outputs at pin 40 and pin 4 – the latter is at 16·384MHz for the S bus and at 8·192MHz for the I2S bus.

Finally we come to the chip's control section, which receives the other output from the descrambler. For correct data diversion and output formatting it derives data from the control bits C0-C4. Pins 35-39 indicate the states of the C0-C4 bits, these outputs being used to indicate to other parts of the system whether the transmission is stereo, mono or bilingual. This control data also appears on the bidirectional IM bus (pin 14) for optional use by the set's main microcomputer chip and any other relevant chips connected to the bus. Fig. 14 shows the main pin functions of the demultiplexer chip: we'll be returning to some of them when we come to consider fault diagnosis and setting up.

Alternative Demultiplexer Chips

Philips has recently introduced the SAA7280 demultiplexer chip. This 28-pin chip is in many ways similar to the CF70123. It has on-board memories for data deinterleaving and offers S and I2S bus outputs to a DAC. The widely used and well known I2C bidirectional two-line control bus is used to control it. There's an optional times-3 digital oversampling facility.

Two longer-established demultiplexer chips are the Toshiba TC6011N and the VC2050 used by JVC. These use an external RAM for data interleaving, typically an 8K × 8 static type, and do not have a control bus line like IM or I2C for bidirectional communication with the rest of the set. As with the other chips the output to the DAC is via a 3-line (data/ident/clock) bus.

DA Conversion

Digital-to-analogue conversion is by now a well-known process used in all PCM audio equipment. Service technicians will be most familiar with it in CD players. Indeed converters designed for CD player use have been pressed into service in Nicam decoders. It's easy to adapt them to the 14-bit format by for example repeating twice the LSB of the data word.

Most current Nicam decoder designs use a single DAC that works on alternate L and R words. The integrating type, in which a precision capacitor is charged from a constant-current source for a period determined by the data in the 14-bit word, is invariably used. The L/R ident signal from the demultiplexer chip alternately and synchronously selects separate integrating capacitors for the left and right signals: a hold circuit is used with each to maintain the level between samples. The principle was described in detail by Joe Cieszynski on pages 36-38 of the November 1989 issue of *Television,* along with fault-finding suggestions.

The DAC outputs are low-pass filtered, generally with circuits that cut off sharply above 15kHz, in order to smooth out the quantising steps in the recovered analogue waveform. High-quality Nicam decoders avoid the use of a very steep filter response by using oversampling, as in many CD players – times three or four oversampling is typical with a Nicam decoder. The Philips SAA7220 digital filter chip has this facility, also the ability to interpolate in the event of an erroneous sample indicated by an error flag output from a chip such as the CF70123 (pin 8) or the Philips SAA7280.

Audio Signal Processing

The baseband audio signals must next be de-emphasised to restore the correct response, and reduce noise in so doing. As the J17 de-emphasis characteristic differs from the conventional f.m. sound de-emphasis characteristic separate networks are required.

This restores the signal to ordinary audio form ready for tone control and amplification to a suitable level to drive the loudspeakers. Some fairly complex switching arrangements are used in sophisticated TV sets and VCRs, ringing the changes between Nicam, f.m. and auxiliary inputs with control by the syscon microcomputer, by the Nicam decoder itself or by manual means.

The ICC5 Chassis

The Thomson/Ferguson ICC5 chassis employs an unusual arrangement in this area. Because the volume, balance, stereo-wide and tone controls are handled by a custom-made chip (IS09, see Fig. 15) which incorporates the DAC, the f.m. TV sound and auxiliary inputs from the scart socket etc. are AD converted by another chip (IS08) so that they can be presented in PDM (pulse-density modulation) form to the DAC/processing chip IS09. Choice of the sampling frequency for this ADC chip is crucial to avoid beats with pilot tones and line-scan rate multiples. For use with the mono f.m. TV sound signal the sampling rate is 46·17kHz, keeping beat products outside the audible range. The sampling pulses are derived from a 17·73MHz crystal, being divided

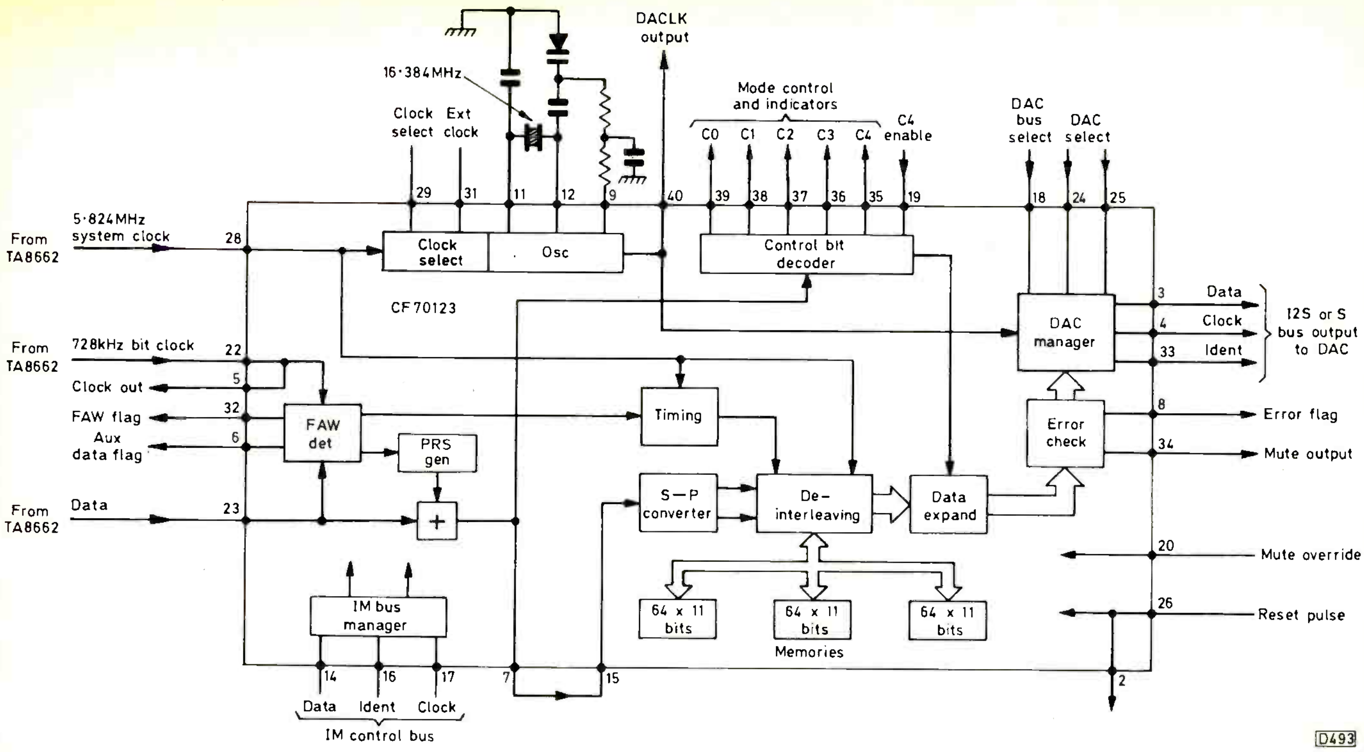


Fig. 14: Simplified block diagram of the Texas CF70123 Nicam demultiplexer chip. The block diagrams in Figs. 13-14 have been drawn in a manner to assist with fault diagnosis and receiver setting up, showing the interconnections and pin numbers which will be referred to in Part 3.

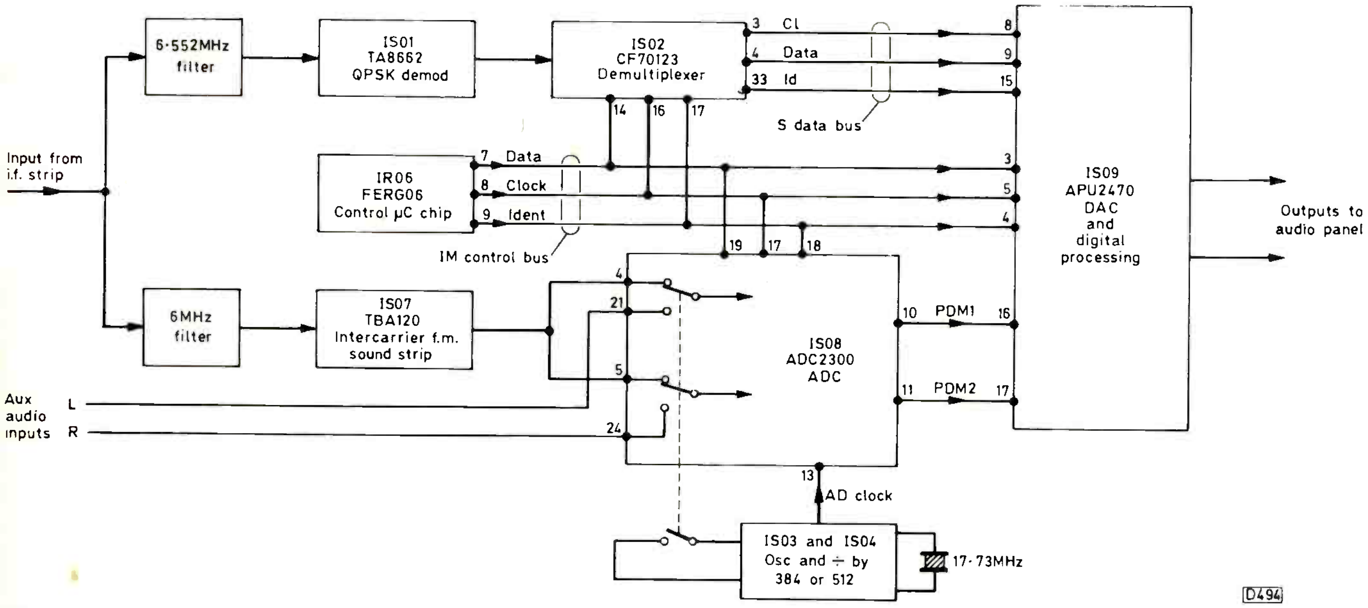


Fig. 15: Block diagram showing the audio signal routing and processing in the Thomson/Ferguson ICC5 chassis. All signals are processed in digital form, so that AD conversion is required in some of the signal paths.

down by a pair of 7402 quad 2-input nor gate chips (IS03 and IS04). The DAC/processor chip can handle the mono sound signal in PDM form at this rate but cannot perform stereo processing so quickly. So for stereo inputs from scart or auxiliary sources the 17·73MHz clock rate divider is switched to provide a 34·62kHz sampling signal. There's little risk of beat products arising in this case since external audio signals are unlikely to contain TV-scan or picture-related components.

Baseband Outputs

All Nicam-equipped TV sets and VCRs have audio output sockets so that the baseband signals can be fed to external amplifiers or processors.

Corrections

Finally this month a couple of corrections to Part 1. In the second paragraph under the heading "housekeeping" the data rate should have been given as 728kbits/sec, not 728Kbits/sec. In the third paragraph under the heading "modulation and transmission" the 2-bit data rate should have been given as 364kbits/sec, not 346Kbits/sec.

In the concluding instalment next month we'll deal with setting up and fault diagnosis, also add-on units.

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AMSTRAD
Machine Nos.: VCR4500 VCR5200 VCR9000 — **VHS T**
Machine Nos.: VCR7000 — **VHS R**
VCR4600 — **9VH4600**

FERGUSON/JVC
Machine Nos.: 3292 8903 3V00 3V01 3V06 3V16 3V22 3V23 3V24 3V29 3V30 3V31 3V35 3V36 3V38 3V39 3V49 — **VHS A**

FISHER
Machine Nos.: FVH — D520 D530 D620 D720 P420 P510 P520 P530 P615 P620 P622 P710 P720 P721 P722 — **VHS U**

GEC
Head Part Nos.: 5458161 5458165
Machine Nos.: 4000H 4001H 4002H — **VHS I**
Head Part Nos.: 5458282 5458413 5458415 5458992
Machine Nos.: 4001H 4004H — **VHS K**

HITACHI
Machine Nos.: VT3000 — **VHS A**
Head Part Nos.: 5458104
Machine Nos.: VT4000 VT4200 VT5000 VT5500 — **VHS H**
Head Part Nos.: 5458161 5458165
Machine Nos.: VT6500 VT7000 VT8000 VT8040 VT8100 VT8500 VT8700 VT9000 VT9300 VT9500 VT9700 VT9900 — **VHS I**
Head Part Nos.: 5458282 5458413 5458415 5458992
Machine Nos.: VT11 V14 VT33 VT34 VT330 VT340 VT5030 VTP10 VTP30 — **VHS K**

ITT
Machine Nos.: VR3605 VR3033 VR3905 VR3913 VR3914 VR3935 VR3943 VR3963 VR3993 VR3975 VR3985 VR3986 VR3833 — **VHS A**

JVC (see also Ferguson)
Machine Nos.: HP4000 HR3300 HR3320 HR3330 HR3350 HR3360 HR3750 HR3860 HR4100 HR7200 HR7600 — **VHS A**

MITSUBISHI
Machine No.: HS200 — **VHS A**
HS700 HS303 HS304 — **VH700**

NATIONAL PANASONIC
Head Part Nos.: VEH0099 0103 0115 0121 0131
Machine Nos.: NV300 NV322 NV332 NV333 NV340 NV390 NV2000 NV3000 NV7000 NV7200 NV7500 NV7800 NV7850 NV8170 NV8200 NV8400 NV8600 NV8610 NV8620 — **VHS B**
Head Part Nos.: VEH0171 VEH0218
Machine No.: NV370 NV3708 — **VHS M**
Head Part Nos.: VEH0171
Machine Nos.: NV330 NV777 — **VHS N**
Head Part Nos.: VEH0286
Machine No.: NV430 — **VHS W**
Head Part Nos.: VEH0174
Machine No.: NV366 — **VHS X**

SHARP
Head Part Nos.: DDRMU 0002 HE17/21/27
Machine No.: VC581/2/3 651 681/2/3/5 659 699 — **VHS S**
Head Part Nos.: DDRMU 0001 HE00 0002 HE02 04 05 06
Machine No.: 2C9 VC110 VC200 VC220 VC300 VC381 VC384 VC386 VC387 VC388 VC477 VC481 VC482 VC930 VC970 VC3300 VC9100 VC9300 VC9400 VC9500 VC9600 VC9700 — **VHS C**
Head Part Nos.: DDRMU 0001 HE09
Machine No.: VC7300 VC7700 VC7750 — **VHS D**
Head Part Nos.: DDRMU 0001 HE10
Machine No.: VC6300 — **VHS E**
Head Part Nos.: DDRMU 0001 HE12
Machine No.: VC8300 — **VHS L**
Head Part Nos.: DDRMU 0001 HE14
Machine No.: VC2300 — **VHS F**

SANYO
Head Part Nos.: 1430242 T01700 1430242 T22300
Machine No.: VTC5000 VTC5150 VTC5300 VTC5400 — **BETA D**
Head Part Nos.: 1430242 T02200
Machine No.: VTC5350 VTC5500 — **BETA D**
Head Part Nos.: 1430762 T02000
Machine No.: VTC9300 VTC9455 VTC9500 — **BETA X**
Head Part Nos.: 143072 T02100
Machine No.: VTC9300PS VTC9350 — **BETA X**

SONY
Head Part Nos.: A6762 044A, 044B, 054A, 147A
Machine No.: SL3000, 8000, 8080, SLT 6Me, 7, 7E, 7ME — **BETA A**
Head Part Nos.: A6762 012A, 038A, 055A, 129A
Machine No.: SL5W, 5000 5100 SLC5, C6, C7 — **BETA B**
Head Part Nos.: A6762 072A, 122A, 136A, 139A, 213A
Machine No.: SLC20, C30, C33, C40, C44 SLF1, F30, HF72, T20, T30 — **BETA W**

Please see next col. for prices.

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01X0 033 825	£47.05
01X0 040 002	£48.32
01X0 056 013	£61.55
01X0 057 002	£31.36
01X0 082 001	£46.02
01X0 083 063	£66.03
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691 200 54	£49.68
691 200 98	£62.02
691 201 12	£61.66
691 201 66	£61.93
691 201 78	£49.96
691 202 87	£55.37

FERGUSON/JVC

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VID2	01X0-018-024	Take up idler T3292/PU47752	6.73
VID3	01X0-018-025	Rewind idler assembly T3V16/PU49282	6.20
VID4	01X0-018-729	Take up idler T3V00/PU49280	7.96
VID5	01X0-040-006	Loading belt T3V29/30/PU48941-2	0.26
VID6	01X0-033-454	Roller Assy. (cass. Housing) T3V23/PU49042	4.50
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GEC/HITACHI

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NATIONAL PANASONIC

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VID21	VXP0463	Reel Idler NV777	4.30
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SANYO/FISHER

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SHARP

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VS 9500	DBK103	£1.42
VS 9700	DBK102	£1.96
VS 9800	DBK103	£1.42

JVC

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FERGUSON

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NATIONAL PANASONIC

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GEC

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SONY

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SLC 6	VID7519	£1.65
SLC 7	DBK100	£1.95
SLC 9	DBK130	£2.00
SLJ 7	DBK100	£1.95
SLT 7 ME	DBK100	£1.95
SLT 7 MER	DBK100	£1.95

SANYO

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VTC 5300	DBK105	£1.15
VTC 5400	DBK105	£1.15
VTC 5500	DBK106	£1.95
VTC 6500	VID7533	£1.00
VTC 9300	DBK104	£3.12
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VTC M50	VID7809	£0.61

TOSHIBA

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VCR Clinic

Reports from Philip Blundell, AMIEIE, Eugene Trundle, Ed Rowland, Alfred Damp, Stephen Leatherbarrow, Nick Beer and Jeff Herbert

Philips VR6760

This machine had come from another dealer. He'd cleaned the tape path because of intermittent hi-fi sound, but when he returned it the customer complained that it wouldn't play any of his previous recordings in hi-fi at all. New recordings were o.k., as were prerecorded tapes. We found that with the old recordings the hi-fi sound faded in and out though the picture remained perfect. On inspection we discovered a lot of tape oxide by the capstan, suggesting tape crinkling at the last guide, 256. Yes, it was another case of a faulty pinch roller. **P.B.**

Philips DMP Series Decks

There have been a lot of changes during the production of these decks. When ordering parts, look at the paper label on the inside left-hand side of the metal chassis – the label is easier to read with the tray in the lowered position. Note the type number (DMP 2-2) and the week number (WD. .) and check in supplement 4822 726 14564 whether the part you want has been changed – some have been modified twice. The IDM series deck is similar to the DMP type in appearance but many of the lift and threading parts differ and are not interchangeable. There's a different manual for this deck. **P.B.**

Grundig VS300

This machine would accept a tape but would't initialise and wouldn't play or wind. F7 was flashing in the display. The capstan motor had a dead spot, but before fitting a replacement I turned the motor a few times and tried a test recording. This revealed that the recorded sound was weak and that the colour from the previous picture showed through. The customer had had a quick look, had accidentally pulled off plug L14 and had then fitted it back-to-front. This meant that the erase head wasn't connected and the sound bias was excessive. **P.B.**

Philips Service Manuals

Philips video and TV manuals can be difficult to store: the paper is too thin to last long in a ring binder and staples tend to rip the next manual in the pile. I've lately been raiding the office for plastic slide binders. As they hold the length of the page they spread the load better – and you can also dismantle the manual to add the inevitable supplements! **P.B.**

Ferguson 3V56

This play-only machine – a rare breed – refused to come out of standby whether the "on" request came from the front-panel key or the remote control handset. The power supply module was intact but got no PWR CTL command from the syscon control chip IC601. This i.c. was without its supply because the 5.6V zener diode D616 in the voltage regulator that provides it was short-circuit. **E.T.**

JVC HRD520

The symptom with this machine was no playback sound. We found that the sound system was muted because the /EE control line was low at 2.6V – it should have been at over 10V during playback. The source of this control line is pin 32 of the microcomputer chip IC601. Leakage inside this chip was pulling the line down – we proved this by disconnecting the pin, whereupon the line rose to 10.4V. Replacing IC601 cured the trouble but the curious thing was that the chrominance, luminance and other sections of the VCR still functioned in the playback mode despite the /EE line being at 2.6V. **E.T.**

Ferguson FV30B

This machine has a slightly unusual syscon, with responsibility for deck control being shared between the main microcomputer chip and the one on the front panel. The deck shutdown symptom after a few seconds in any mode can be caused by faulty reel-rotation sensors, even though the output pulses may look all right. Use the modified types PU60271 and PU61088 for replacement, changing both these optocouplers at the same time. **E.T.**

Matsui VX800/Saisho VR1000

Intermittent failure to eject a tape as a result of carriage overshoot is a common fault with these machines. Carry out the following modification to overcome this problem. Remove the blue lead from the cassette loading motor and replace it with a BY127 diode (cathode to the motor), with a 27Ω, 0.25W resistor in parallel with the diode. **E.R.**

Logik VR950

The symptoms were intermittent loss of the signals from the tuner. Investigation revealed that there were several dry-joints on the tuner's pins. Resoldering these restored normal working. We've since had two more of these machines with the same problem. **E.R.**

Matsui VX820/Saisho VR1200

A faulty mode switch proved to be the cause of no functions with a Matsui VX820. To replace the switch the carriage must first be removed. The switch can then be taken out by releasing the retaining screw and unsoldering the three leads that are attached to it. Reassembly is the reverse of this procedure. Take care to align the two slots on the switch. **E.R.**

Hitachi VT33

This machine played prerecorded tapes reasonably well but the sound on its own recordings was extremely poor. As cleaning the audio-control head failed to improve matters a replacement head was fitted. This cured the problem. **E.R.**

Akai VS23

This machine came in with the complaint "not working". On removing the top cover we found that the loading arms were in the fully loaded position but the cassette house was in the eject position. There were comments in the workshop about how the cassette could have been removed, and that the problem looked like being a difficult one. We removed the loading block, reset the timing and then left the machine to play. Later that day another VS23 came into the workshop in the same state. It responded to the same treatment, working after the loading block had been removed and the mode timing reset. Taking no chances, as both machines were still within the guarantee period, we ordered and fitted new mode switches. Neither machine has been seen since. **A.D.**

Panasonic NV370

In the E-E mode this machine displayed a half black/half white screen. The cause of the fault was traced to C1102 (2,200μF, 25V) being open-circuit. **A.D.**

GoldStar GHV1290

There was no playback: the fault gave the impression that the video heads were dirty, but cleaning them proved that this wasn't the cause of the problem. We traced the playback f.m. signal to pin 3 or IC302 then found that there was no output at pin 15. Replacing IC302 restored normal results. **A.D.**

Akai VS4

There was distorted video in the playback and E-E modes with this machine. The symptoms suggested a fault on the video panel, where most of the signal processing is carried out. On screen the "picture" lacked contrast, with no sync. A scope check showed that the sync pulses were badly crushed. We found that TR31 was short-circuit all ways. The 2SA1115 fitted in this position was replaced with a BC212L. **S.L.**

Philips VR6293

These VCRs have a separate chopper power supply contained in its own tin house at the rear of the machine. In a recent case the BUT11A chopper transistor was short-circuit, the feed resistor R109 was open-circuit and the 2AT mains fuse had blown. At switch-on our replacements went the same way as the originals. The cause of the trouble was the CNX83A optoisolator chip IC124. We understand that it's policy to change this whenever the chopper transistor is found to be defective. **S.L**

Sharp VC383

The reel motor in this machine ran continuously. As the STA471C reel drive chip had obviously been under stress it was replaced. The new chip also ran hot. We found that the root cause was the 2SA733 transistor Q7754 which was open-circuit. **S.L.**

Toshiba V93

I'm sorry to be vague about this one, but we don't have the manual. The basic fault was no clock or other display, though the deck functions were o.k. ZL62, a Wickman fuse on the bottom panel, was found to be open-circuit, replacement bringing the machine back to life. There's a small can, beneath which an oscillator resides, on this panel (timer–2/i.f. and prescaler). The coil has a little metal top hat as screening, glued into place. This cap falls off. I'm not sure whether a change of inductance occurs to open-circuit the fuse or whether it's simply a matter of a short-circuit due to the metal contacting something in the circuit. I'm led to believe that the problem is a common one. Perhaps another contributor would care to fill in the details? **S.L.**

Ferguson 3V30/JVC HR7300

We still see a large number of these excellent and on the whole reliable machines. With this particular one the drum would stop after a few minutes and wouldn't restart. An initial check on the supplies (we all do that, don't we?) proved to be a good move as the 12.5V rail read 15V. It's derived from Q1 on the power supply board. This was o.k. but farther back the sensing transistor Q3 and its emitter zener diode D5 were faulty. **S.L.**

Panasonic NV-MS50

The problem we've had with two of these camcorders has been no E-E or recorded sound, playback of good recordings being o.k. It's not difficult to trace the cause – the microphone is faulty. A fair amount of dismantling is required to replace it. **N.B.**

Panasonic NV-G21/G25

A few of these machines have come in recently because of no on-off LED indication, although the switching works – indicated by the appearance of the counter display and the beep. The other problem has been no deck functions. The cause of these symptoms is that the 12V output from pin 6 of the STK5338 regulator chip IC1001 has fallen to about 7V. Replacing the chip puts matters right. **N.B.**

Ferguson FV31R/FV32L

A problem we've had with these machines is ticking over the playback sound. It's due to pick up on the audio/control head loom to the PCB because of insufficient screening. A modified lead with braided instead of spiralled screening is available and this cures the problem.

We've also had a couple of faults in the r.f. converters. The problem with one machine was intermittent low gain. The other intermittently lost the E-E and V-V vision. In both cases the cause was dry-joints – and in both cases the fault could be instigated or cleared by applying minute pressure anywhere on the signals panel on which the converter is mounted. **N.B.**

Panasonic NV-GD48

The symptoms were no deck functions, unable to switch the machine to standby, takes tape in then locks up and won't eject. The MN15283VPY clock chip IC7501 was faulty, though the clock display functions were all normal. **J.H.**

Ferguson FV26D and Equivalents

We've had this fault several times – very low remote handset range due to a dry-joint on the infra-red amplifier subpanel where it's soldered into the clock panel. **J.H.**

NEC PX1200K

There was no drum rotation, also a burning smell. D3 in the power supply was short-circuit. If the drum rotates after replacing this diode but the capstan doesn't run you'll probably find that the UPC324 chip IC605 is faulty as a result of excessive a.c. on the 18V supply line. **J.H.**

CD Player Casebook

Reports from Mike Leach, Philip Blundell, AMIEIE, Mick Dutton and Nick Beer

Denon DCD1500 MK II

This very up-market Denon machine suffered from a laser problem. The focusing was intermittent, and occasionally the machine wouldn't read discs. So I replaced the laser assembly, which is a little tricky with these players. They have a linear motor, the laser assembly screwing on to the two motor coils on the left- and right-hand side. When changing a laser assembly you have to be careful in this respect: always unsolder the connections on the laser assembly's flexi PCB before loosening the screws. Yes, you're right, yours truly didn't do this and broke the very fine wires of the left-hand motor coil. These wires are far too thin to repair so a new coil had to be ordered. Well, at least I've owned up! The new coil and laser assembly restored normal operation. **M.L.**

Sansui PC-V100

This Yamaha-based machine skipped and jumped right the way through the disc. The cause of the problem was the turntable motor which had a dead spot. This produced a glitch at each revolution of the disc, causing a slight error in the turntable speed. The error could be seen in the r.f. eye pattern, towards the right-band side of the waveform, where it appeared to shake from left to right at each revolution. It's possible to strip, clean and repair these motors, but this isn't advisable. The best course of action is to replace both the motor and the turntable.

The hole through the centre of the plastic turntable tends to become slightly enlarged when you remove the turntable from the motor. As a result the fitting is somewhat loose when it's placed back on the motor. That's why it's best to replace both items. Yamaha, and presumably Sansui, supply a jig for setting the correct turntable height. **M.L.**

JVC XL-E300

This player would work for several minutes after which a click could be heard from the mechanism and it would revert to the stop mode. I knew that click: it's the sound that's produced by the laser unit when the focus is making hard work of it! Cleaning and setting up made no difference. Fitting an Optima 45 laser assembly restored normal operation. **M.L.**

Pioneer Multiplay Machines

I agree with R.J. Wood of Pioneer (Letters, July) about changing lasers "on spec". I've done it myself when dealing with a really nasty fault and I'm sure that many other engineers have too. Here's a dodge that I've found to be invaluable on several occasions with Pioneer multiplay machines. The most recent case was with a PDZ-81M that wouldn't read discs. On inspection I could see that the disc spun very slowly and didn't reach the correct speed before the machine returned to the stop mode. On a previous occasion the laser had been at fault but quite often this symptom is due to a faulty turntable motor. How to tell which of these is the cause? Here's the dodge.

If the disc spins slowly, switch the machine off. Disconnect from the mains supply or you run the risk of touching the mains connections at the back of the machine. Disconnect both leads from the turntable motor. Next apply *no more* than 2·5V d.c. to the motor – I usually use a Philips KT4 backup battery. Let the motor spin for approximately ten seconds. Reconnect the motor and run up the machine. At this point you'll usually find that the player works normally. If so, change the turntable motor. If the player doesn't work normally you've probably got a fault elsewhere in the machine. But I've usually found that the turntable motor is the cause of this problem and that running the motor for a few seconds with an external supply can prove the point. **M.L.**

Philips CD104

This machine wouldn't spin the disc for the TOC readout. The disc couldn't even be turned by hand! After stripping the turntable motor, cleaning and relubricating the shaft and bearings, the machine worked normally. For good measure I cleaned the laser lens and set up the laser current – recommended now that these machines are a few years old. I also resoldered the usual earth-through connections. After this the player was almost as good as new. **M.L.**

Philips FCD762

There were unusual symptoms with this machine. It read the TOC all right and played discs, but it kept jumping tracks every few seconds, sometimes forwards and sometimes backwards. There was a lot of activity around the TDA5709 tracking chip when the fault occurred, but which was the cause and which the effect? When in play there was a burst of signal from pin 10 (DAC), which should operate only during skip or search. The TDA5709 was faulty. **P.B.**

Pye CST428/35

This player had all the symptoms of a confused microcomputer chip. It tried to focus, the tray moved in and out, the turntable was rotating backwards and the display showed random characters. All this without a disc. Our first action was to check the supplies. We found that the 5V line was at 10V as regulator IC07 was short-circuit. Luckily no other damage had been done. **P.B.**

Sony CPD35

I've had two cases recently of no sound output with these machines. There was an occasional burst of crackle on each channel and the disc rotated normally, with the correct time indication in the display. The cause in both cases was IC704. **M.D.**

Sharp DX-150H

The complaint was simply failure to operate. When a disc was inserted the player didn't find the table of contents. We stripped the machine down and found that the laser wasn't on due to a no-laser-on signal from the microcomputer chip. As there didn't seem to be an obvious reason for this we were about to order a replacement chip when we noticed that the laser assembly was positioned at approximately the centre of the disc: it hadn't moved to the inside as it should have done at switch on. On investigation we found that the slide motor had seized solid. After removing and freeing it the player worked. A replacement was fitted to prevent further problems. **M.D.**

Pioneer PD-M500

This multiplayer required a new optical unit – the r.f. was low and mucky and couldn't be resolved by adjustment. A new PWY1009 type was fitted but we couldn't set it up and the r.f. level was extremely low at about 300mV. Laser power adjustment did little to improve it and the tangential adjustment been been optimised. The r.f. offset couldn't be reduced below 200mV. As work continued in the test mode the unit decided to stop focusing. The new optical unit was faulty, another replacement putting everything right. **N.B.**

Pioneer PD-M6

This is one of the original multi-disc players. The complaint was that it didn't register that any discs were inserted and thus didn't play them. A focus problem naturally came to mind, but on test the unit performed faultlessly except for some skipping. Thoughts that the customer may have inserted the discs upside down (right way up, if you see what I mean) were discounted as he'd been using the player for about three years. A common cause of such intermittencies in all CD players is a break in the optical unit's flexi PCB. Sure enough when we flexed it the fault occurred. The skipping was due to an extremely worn traverse motor. We also replaced the belt, along with the optical unit. **N.B.**

A Scrapbox Logic Probe

Derek Boyt

Since digital circuitry is being found more and more in TV sets, VCRs and CD players there's a need for a low-cost logic probe as a servicing aid. The probe described in this article makes use of items from the scrapbox. It has the feature of not giving a logic one when a chip's output is tri-state – this is a common failing with home-made probes.

Circuit Operation

The circuit of the probe is shown in Fig. 1. With no voltage applied to the probe tip the circuit is in a stable state. Diodes D1 and D2 establish a voltage of 1·4V at the emitters of transistors Tr1 and Tr4, while the base voltage of these transistors is set at·1·38V by the potential divider network R2/3. Thus Tr1 and Tr4 are cut off and there's no drive to transistors Tr3 and Tr2.

When a logic one is applied to the probe tip Tr1, being a pnp device, will be reverse biased and will remain cut off. The npn transistor Tr4 will be forward biased however and in turning on will also make Tr2 conduct. Thus the green LED2 will light.

When a logic zero is applied to the probe tip Tr1 and Tr3 will conduct and the red LED1 will light.

If the voltage at the probe tip is between approximately 0·8V and 2V there will be insufficient bias for either Tr1 or Tr4 to switch on. This voltage range of 0·8-2V is taken as the tri-state output.

Fig. 2 shows a plot of input current against input voltage at the probe tip. With a logic one input of 5V the current drawn is 280μA. This is just above the loading (200μA) of an LS gate input, but as the fan-out of an LS device is ten (or 2mA) the probe will not overload a device's output.

Fig. 3 shows the LED switching conditions. There are two input voltage states, between 0·8-0·85V and 2-2·05V, when the probe is not in a stable state. Use of the probe has shown that this is not a problem.

Suitable Components

The components used in the circuit should be available from your general stock. In the prototype probe 2N2222 npn and 2N2905 pnp transistors were used, but any transistor with a reasonable gain could be used instead (the types used have a gain of 100-300). It's possible for the probe to be made small enough to be fitted into a plastic cigar tube but anything, such as an old remote control unit, could easily be adapted as a housing.

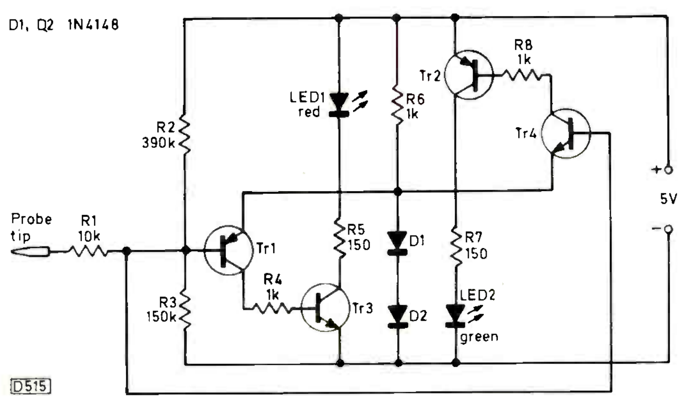
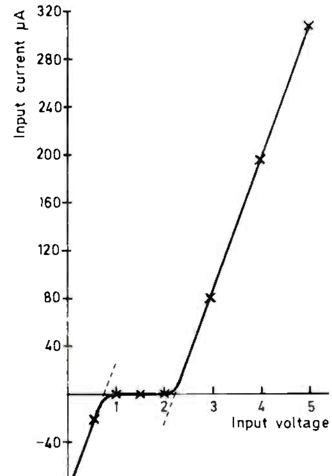


Fig. 1: Circuit diagram of the probe.



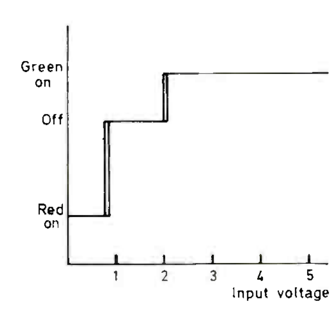


Fig. 2 (left): Input voltage/current characteristic.
Fig. 3 (right): Input voltage/LED state plot.

The Tatung TRX2801 BSB Receiver

Eugene Trundle

The advent of satellite TV broadcasting has brought with it new channels, new transmission systems and of course new receiving hardware. By contrast with Astra the manufacture, use and distribution of BSB hardware is closely controlled. Every viewing household is registered, and only four manufacturers are licensed to produce the receivers – to a very rigid specification. Tatung is perhaps the most independent and least known of the four. Its receivers are designed and produced in the UK, and distribution is via independent dealers. For the reasons just mentioned the receivers are in many ways similar to those of Tatung's competitors, reviewed in the last three issues of *Television*.

Description

Following the current fashion in AV equipment the TRX2801 has a black plastic case with round feet and gold trim. It's operated via the remote control system, leaving just two controls on the front panel – standby and test. There's also a single seven-segment LED display that indicates status and mode, not channel number. The dimensions are 420mm wide, 233mm deep and 68mm high. Buyers can specify a 35cm dish or 40cm Squarial (Matsushita type), the latter at a £10 premium.

The remote control unit is small and uncluttered, with 19 keys. Very early production models came with a "bubble-key" handset (RB90) which is similar to those used with the company's Astra tuner, but the design – which was not liked by the trade or its customers due to poor reliability – was soon changed to a more conventional button type, the RB91/92. The remote control codes seem to be reasonably immune to those of other makes and models, an important point these days when nearly every AV product comes with a remote-control gun and crosstalk effects are common. This handset has no provision for operating current TV sets etc., as Philips has arranged.

The rear panel sports a mains on-off switch, which is normally left on permanently, and four sockets. Sensibly, the satellite aerial socket is a Belling-Lee coaxial type, through which the 20V supply for the head-end electronics passes. There's a terrestrial aerial loop-through, with some gain provided to overcome the connection and routing losses. BSB's programmes are added to this en route, encoded to the PAL-I standard and modulated on to a ch. 37 carrier. The latter can be varied over the range of chs. 31-39. It usually has to be to avoid patterning due to the presence of the VCR, Astra box and any other local signal sources that jostle for a clear channel in which to spread their double-sideband wings in this u.h.f. window. A simple switched test pattern is provided, VCR style, to facilitate initial TV tuning. There's also a phono socket (CASS/ACM) for interfacing with a conditional access subsystem.

The baseband outputs leave via a single scart socket which provides the following: stereo sound; composite video; RGB video plus sync; and function switching voltages (at pins 8 and 16). When connected to a suitably equipped TV set the receiver can switch it to RGB operation automatically for best possible picture reproduction. It's a great pity that more comprehensive output facilities are not provided, but more on that later. This dearth of connection ports is shared by the other three first-generation BSB receiver designs, as are the standard BSB features and facilities – on-screen field strength indication, menu-led interactive remote control, scart-switch disable facility, auto/manual screen panning, wide-screen capability, digital stereo sound, on-screen programme and running-time indication and, for the engineer, on-screen readout of diagnostic data.

Performance

To use the PAL output, in r.f. or composite video form, is to throw away all the advantages of the new transmission system, stereo sound and all, and reduce the performance to that we get from the signal sources we've always had. When the accompanying TV set is equipped with a fully-connected scart socket the tremendous advantages of D-MAC become immediately apparent. Likewise the stereo sound can be breathtaking when fed through good amplifiers and loudspeakers – preferably not those fitted in a stereo TV set, since the spacing, acoustics and response of these seldom do justice to the rest of the system.

My appraisal therefore consisted of checking that the r.f. and baseband signals were present and correctly proportioned, then hastily switching to RGB operation with a large-screen TV set and an audio hook-up to a credible hi-fi system designed for CD operation. The results obtained depend to a large extent on the source of the material being used by BSB. With studio presentations, modern films and suchlike the results are superb, with the sound quality indistinguishable between CD and Nicam sources and pictures better than any seen before in a domestic context.

Particularly striking is the complete absence of spurious picture effects such as noise, sparklies, cross-colour, chroma bleed and dot/herringbone patterning. There's no doubt that MAC is a winner technologically, though there's a lot of truth in Ian Martin's comment (July page 682) that public acceptance of BSB depends less on its

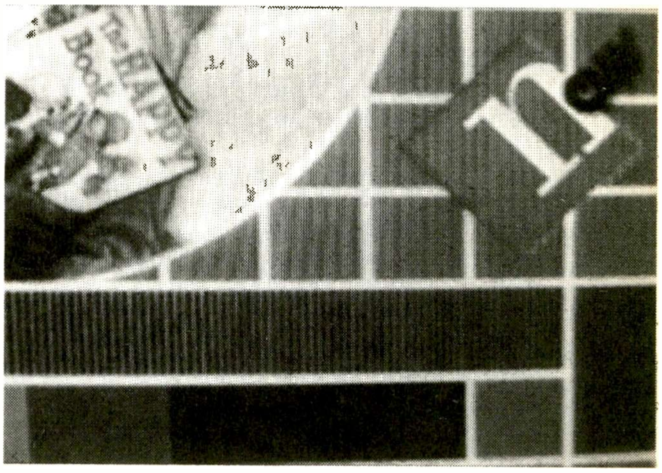


Fig. 1: Detail of the BSB test card, transmitted with MAC encoding and photographed direct off screen. The card has a happy resemblance to the "Carol and her teddy" BBC test card F, with a real photograph in the centre circle. It's ideal for subjective appraisal by engineers and lay people alike.

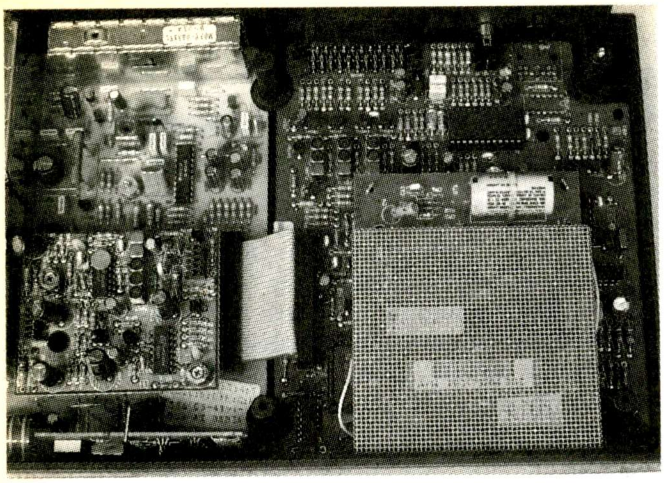


Fig. 2: Inside the Tatung TRX2801. The board with the screening grille is the access control module.

technology than its programming. As with CD audio gear, the designer's aim is to make the equipment as transparent as possible to the signals that pass through it. The sound and vision performance of the TRX2801 are in my opinion at least as good as that of the competitive receivers, all of which I've now had an opportunity to see. Fig. 1 shows the picture quality of a critical part of the test pattern transmitted via MAC encoding and displayed via the Tatung box's RGB output.

The on-screen field-strength indicator has two components, an analogue-style bar graph and a three-figure digital readout which relates to the data decoder's error rate. At first this looked like an excellent dish alignment aid, but I soon found that the bar hits the right-hand stop too readily, with the noise reading 000, staying like this over a small range of the aerial's pointing angle. To overcome this problem it's necessary to obscure the aerial's surface partially or to use a conventional field-strength meter. In this way you can maximise the safety margin to take into account bad weather and deterioration of the connections etc.

Sockets

One of the biggest frustrations in trying to achieve the full potential of the receiver is in attempting to hook it up to ancillary equipment, especially hi-fi VCRs and the AUX input of a home music system. In contrast with the bristling rear panels of today's better TV sets, VCRs and audio units, we here have a single scart socket to suggest that a stereo TV set is the ultimate in the AV world! A scart (ideally a twin-scart) equipped VCR can be used as a sort of switching centre, or peculiar trunk-and-branch scart leads can be devised and cobbled together.

The lack of an S-output socket is a serious omission for users with S-VHS VCRs. A "freelance" manufacturer has available an RGB-to-S converter, but this is a clumsy and expensive solution to a problem that shouldn't have arisen.

Inside the TRX2801

The internal circuitry is well spaced out. It's on two main PCBs, each of which sports a daughter board or two. Most of the analogue circuitry, including the power supply, tuner/i.f. section, r.f. modulator and PAL encoder, is mounted on a conventional SRBP panel. The switch-mode power supply has a tiny eight-pin control chip which drives a MOS power transistor whose load is a small ferrite transformer. The circuit is simple and runs cool. I found that there were no signs of scorching or colour fading on the components or panel after many hundreds of hours of running time. Stability is helped by the fact that the receiver is left on permanently. This also assists reliability.

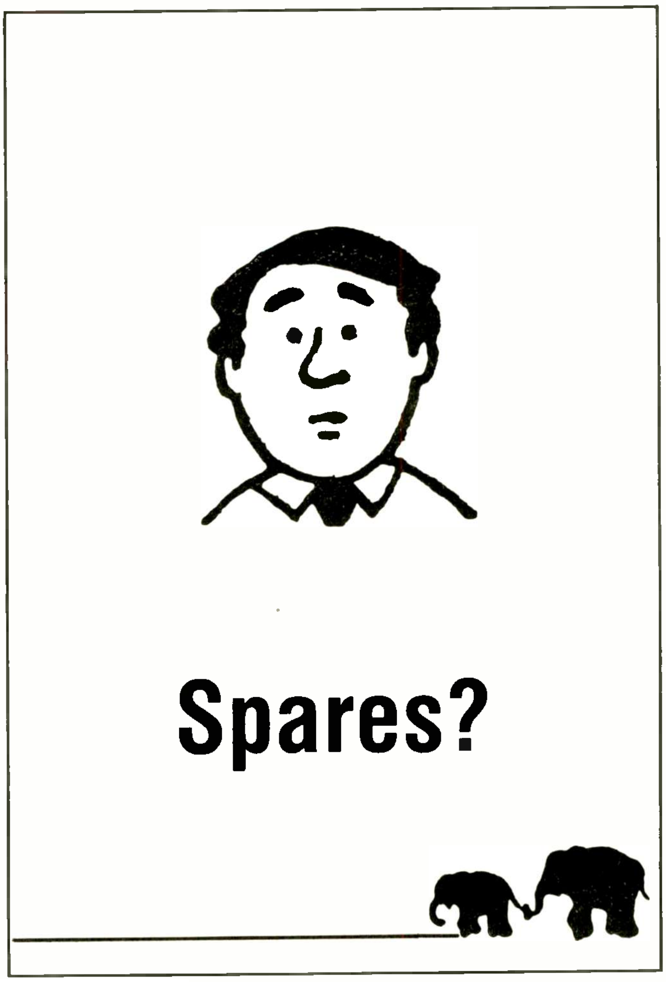
All the clever bits, including the digital processing and MAC decoding, are on a double-sided fibreglass PCB. The six LSI chips involved are fitted in sockets – hopefully reliable ones! Mounted on this panel, in daughter-board form, is the BSB ACM (access control module). This is not engineer serviceable and is thus an exchange unit.

The whole thing looks engineer friendly for servicing. A lot of the preset adjustments are in software rather than potentiometer form. There's little information as yet on the operation of the MAC decoder, and I'm sure that BSB won't let us into the secrets of the ACM.

In Conclusion

The present economic climate is of no help to those involved in satellite TV: broadcasters, setmakers and dealers alike are dismayed by the situation. When the initial demand has been met it will be interesting to see how sales develop. For the immediate future it looks as though Joe Public will be in a buyers' market. Since the overall performance, features and specifications of the present generation of BSB receivers are the same, Tatung's suggested price of £390-£400 may result in buyer's selecting the slightly less expensive Ferguson and Philips models.

Only time will tell on what the reliability, spares



availability and modifications will be with each model: no doubt *Television* contributors will keep us posted on this.

Meanwhile I'm impressed by the Tatung receiver. Congratulations on their achievements are due to all those involved in its very rapid design and engineering for production aided, I imagine, by gallons of midnight oil.

TEST CASE

334

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

The voice on the other end of the phone demanded to know how much it would cost to fit new heads to a Ferguson VCR. That's a difficult one to answer, especially when the model number is not known! Our prospective customer trotted back to his machine to have a look. When he got back he announced that it was an FV14T, which is quite a recent model – in terms of head life anyway. Was he sure that the heads were faulty? Who had made the diagnosis? *He* knew, he said. It emerged that he was an avid reader of several punter video magazines, and that long perusal of their contents had enabled him to identify both the cause of the trouble and its cure. There were white spots and streaks all over the playback picture. This meant that the video heads were faulty, didn't it? Did we have them in stock? They were hi-fi ones. Did we know that?

He was persuaded to let us check the machine before rushing into an expensive head drum assembly replacement. Twenty minutes later he arrived with the machine, also half a dozen copies of consumer video magazines with various sections highlighted in yellow marker pen. He wanted to stay with the machine while the service was done, but was talked out of that. Muttering about drop-outs, tip projection and decibels he drove away.

Sure enough when it was tested on the bench the machine gave us pictures that were overlaid with white spots and comet-tailed blips, but they were quite unlike the streaking and drop-out effects that are produced by a worn or faulty head. We found that the fault symptom was present with both the self-recorded tape that came inside the machine and a workshop test tape. The interference looked very much like that caused by static build-up and discharge on the upper drum assembly. So the first check was on the drum's earthing system – a spring-loaded brush bearing on top of the drum shaft. There was good contact here. Indeed when the brush bearing was lifted from the shaft there was no change in the symptoms.

A recording of a test pattern was then made and, as a check, was played back on another machine. The picture reproduction was fine, completely clear of spots and streaks. So the trouble in the Ferguson machine was confined to playback, when the tiny off-tape video signal is most vulnerable to noise and interference. Could the customer be right after all? A check was made on the off-tape r.f. signal level at test point TP5 on the preamplifier PCB. It was correct at 600mV peak-to-peak. Horrible thoughts of possible drum assembly faults, upper or lower, occurred to the technician who went off to see whether he could find a Ferguson or JVC machine with a similar head drum so that he could carry out a substitution test. It was probably just as well that he didn't find one: with the effort that would have been involved in swapping heads, swapping them back, soldering and setting up, hi-fi and all, it wouldn't have been a good move. Especially as the head drum was perfectly o.k., as we later discovered.

In his search for another machine our man had enlisted the help of other technicians. So it was that three men gathered around the recalictrant Ferguson VCR to see the fault symptoms for themselves. Now for some action. The head drum shaft was earthed via a clip-lead: no change. The drum motor's 12V supply was decoupled with a large capacitor: no change. Then someone pressed the pause key. Lo and behold, the spots disappeared! The tape transport system was started and stopped several times using the pause control. All the still pictures, though sometimes marred by mistracking noise, were free of interference spots. The culprit was found soon afterwards. What was it? See next month for the answer and another test case feature.

ANSWER TO TEST CASE 333
– page 859 last month –

TechnoCrat's Tatung television set last month had a shocking grey-scale. Initially the picture tube was suspected of having a strange green performance. It was not easy to prove this however as there wasn't a suitable base connector with the tube tester. In the event there was no need to make this test, since interchanging the feeds to the red and green cathodes transferred the fault to the red gun. Thus the green output stage was suspect.

The RGB output stages in the Tatung 170 chassis are unpretentious class A affairs. Each has a single BF422 transistor with a resistive collector load and capacitive response peaking in the emitter circuit. The collector loads consist of three 47kΩ, ½W resistors connected in parallel to give 15·65kΩ. The ones in the green output stage are R212/3/4: one of them had gone open-circuit, raising the value of the collector load to 23·5kΩ. As a result the voltage at the green cathode was reduced and the amplifier's linearity was upset. Hence the excessive green drive to the tube at low collector voltages, which correspond with picture highlights. After fitting a replacement resistor and resetting the background controls we found that the tube provided very good tracking performance.

This tube drive swap technique is a good and useful method of diagnosis, particularly when the fault is intermittent.

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The Changing Scene

Les Lawry-Johns

I'm sharing the shop at present with S.K. Lakha, who tends to show me up. Take the newsagent's video for instance. I'd spent some time looking at it and got nowhere. Then be brought it in to S.K. who fixed it in minutes. How was I to know that a lamp shuts off the juice to the selectors when it goes open-circuit? Sorry I missed out on that one. I'd better read the magazine more thoroughly, because it was mentioned some time ago in a series of articles in this book of learning.

I also had more trouble with that CVC5 I wrote about a couple of months ago. It started to play up again, so I drove down to see it. The owner told me that it was o.k. for a while then the colours changed on the left-hand side. I stayed and watched it for some time. Then on some scenes the picture became green on the left-hand side, reverting to normal towards the centre. This suggested a fault somewhere in the bistable circuit. After fiddling around for some time I discovered that D40, which links the ident signal to the bistable, was faulty. Should have remembered that. But I think the owner will soon buy a new set. It is, after all, just a little on the old side.

A lady phoned up the other morning to say that all she had was a white line across the screen. She said she'd bought the set from me some years ago and that it was a Philips one. So I thought it was a G11, packed my bags with the Philips stuff – chips and so on – and ventured off to her house. When I got there a Fidelity portable looked at me. As it was a Mk.2 version of the ZX3000 I didn't suspect the line output transformer of causing the trouble. But it was a question of carting it off down to the shop, where L.K. was operating. He was working on a video, but wasn't in a hurry. I plonked the Fidelity on the bench and removed the rear cover. "What's wrong?" he asked. "Field collapse" I replied.

"Let me do it" he said. So I let him snoop around on the main panel, checking resistors etc. Then I thought I'd better do something. Like change the field output chip. I looked for one everywhere but had to go down to Geoff in Sun Lane for one. When I got back S.K. was still looking at the set. We fitted the new chip and of course the white line was still present. Back to checking voltages etc. These proved to be more or less correct, so I felt that it was time to change the timebase generator chip. This involved another visit to Geoff – it's a good thing he keeps his stocks high. When this was fitted we had a full raster and I thought that the job was over.

Connecting the aerial lead produced clear sound but no sign of a picture. My defective memory tried to tell me something, but I didn't want to listen. I put my finger about an inch from the line output transformer and a spark leapt out at it. S.K. looked horrified, but I was o.k. "I've been hearing noises coming from that thing for some time" he said. I thought surely the newer type of transformer, with the integral first anode and focus controls, can't do the same thing as the earlier type, but after some time spent looking for picture content there was a crack and the screen display reverted to the white line. It then became clear. The old girl's not going to fork out for a new line output transformer on top of everything else I thought. I told her the sad story and left her to think about it. We've not heard since so she's probably decided to buy a new set. Oh well . . .

The point is that these Fidelity sets do tend to suffer from this sort of thing. It starts when the line output transformer sparks over internally. This usually knocks out the video chip and/or the timebase generator chip, depending on the model. So before you go ahead and start to replace the chips, change the line output transformer. With the earlier version this involves altering the focus and first anode supply circuits. All this means that it's wise to get the customer's agreement before you take on the repair.

A G8 that came in later left us in the same position. It seemed to be dead but there was plenty of h.t. It just didn't get to the line output stage because the h.t. fuse was open-circuit. There was no indication of a short-circuit in the line output stage so I fitted a new fuse, crossed my fingers and switched on. A picture appeared but the reds and greens were a bit out. Some time was spent getting this right and I was just admiring the picture when the set went off without warning. More fuses merely confirmed that there was trouble in the line output stage. The customer was told that the repair was likely to be expensive and is still thinking about it – or more likely he's replaced the set. At least I got a fiver for my trouble.

That's all for now. Love from H.B. and the animals, including that bad tempered bird! Finally I'd like to send greetings to my daughter Lavinia who lives with her family in Devon, and to Johnny Logan up north. Lavinia writes for a knitting magazine, producing complicated patterns that are far too involved for us TV people to be able to follow.

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1-123-032-11	Capacitor .22mF 400V (1-123-872-00)	0.77
1-129-952-11	Film capacitor 0.18mF 1.5kV	1.51
1-404-190-00	SW filter KV-2022UB	0.60
1-454-293-11	SLC6 solenoid	5.48
1-463-081-00	Tuner KV1812UB	16.34
1-463-296-00	Booster antenna C7/C5	18.93
1-464-188-00	SLC6 RF modulator	46.12
1-502-484-11	Speaker KV1810	4.19
1-502-829-00	Speaker KV2020	10.92
1-508-958-00	Contact RM440P	0.12
1-515-416-00	SLC7 relay	3.54
1-515-418-00	Relay (1-515-416-00)	3.27
1-515-547-11	Relay TC K55	3.47
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1-518-115-XX	Pilot lamp	0.81
1-518-116-00	Pilot lamp 360mA 11V	0.81
1-518-169-XX	Pilot lamp 40mA 4.5V	0.81
1-518-263-00	Pilot lamp 130mA 23V	0.63
1-518-323-00	Pilot lamp 13V HMK11	0.53
1-518-409-21	Pilot lamp 40mA 8V	0.80
1-519-174-00	LED display C7	8.46
1-536-683-11	Terminal antenna (1-536-683-00)	7.90
1-543-145-00	Take up sensor C7	1.17
1-551-513-11	Coax cable SL8000 (1-551-513-00)	5.28
1-552-438-00	Push switch SL8000UB	0.48
1-552-834-00	Slide switch SL8000	0.72
1-552-836-00	Slide switch rec/playback	1.17
1-554-820-11	Power switch	3.35
2-284-610-01	Orange ear pad MDR-4L1S	0.27
2-284-610-11	Black ear pad MDR-4L1S	0.27
3-309-418-00	Stop/eject button WM-4	0.60
3-472-332-00	Take up belt	0.60
3-536-447-01	Capstan belt TC-92 (3-536-447-00)	0.56
3-542-458-00	Capstan belt	0.64
3-543-978-00	Flat belt TC186SD	0.98
3-558-706-00	Capstan belt TC general (3-558-751-00)	0.64
3-573-122-00	Belt HMK3000 (4-913-325-01)	0.41
3-578-103-00	Screw cassette lid WM2	0.16
3-578-104-00	Coil spring WM2	0.16
3-578-115-00	Battery lid WM2	0.81
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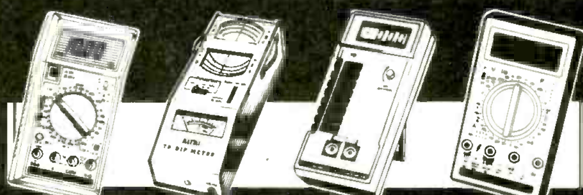

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BC327-25	£0.07	BUX84	£0.60
BC328	£0.07	TIP29	£0.30
BC337	£0.07	TIP31	£0.30
BC547A	£0.07	TIP32	£0.30
BC548	£0.07	TIP41	£0.27
BC549	£0.07	TIP42	£0.25
BC559B	£0.07	TIP42C	£0.40
BD137	£0.30	TIP112	£0.45
BD237	£0.22	2SA1102	£1.90
BD238	£0.22	2SB1016	£1.50
BD243C	£0.30	2SC1413A	£2.50
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BD9	2	6V 1A mains transformers upright mounting with fixing clamps.
BD11	1	6½in speaker cabinet ideal for extensions, takes our speaker. Ref BD137.
BD13	12	30 watt reed switches, it's surprising what you can make with these – burglar alarms, secret switches, relay, etc., etc.
BD22	2	25watt loudspeaker two unit crossovers.
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 operates a microswitch.
BD42	5	13A rocker switch three tags so on/off, or change over with centre off.
BD45	1	24hr time switch, ex-Electricity Board, automatically adjust for lengthening and shortening day, original cost £40 each.
BD49	5	Neon valves, with series resistor, these make good night lights.
BD56	1	Mini selector, one use is for an electric jigsaw puzzle, we give circuit diagram for this. One pulse into motor, moves switch through one pole.
BD67	1	Suck or blow operated pressure switch, or it can be operated by any low pressure variation such as water level in water tanks.
BD103A	1	6V 750mA power supply, nicely cased with mains input and 6V 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 pcb boards etc. Normal cost about 80p each.
BD132	2	Plastic boxes approx 3in 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	Microphones inserts – magnetic 400 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 sockets – 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 make a low cost disco panel.
BD199	1	Mains solenoid, very powerful, has 1in 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 soiled but OK.
BD252	1	Panostat, controls output of boiling ring from simmer up boil.
BD259	50	Leads with push-on ¼in 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.
BD305	1	Tubular dynamic mic with optional table rest.
BD653	2	Miniature driver transformers. Ref. LT44. 20k to 1k centre tapped.
BD548	2	3.5V relays each with 2 pairs changeover contacts.
BD667	2	4.7 µf non-polarised block capacitors, pcb mounting.

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

12-220V INVERTER KIT. This kit will convert 12V DC to 220V AC. It will supply up to 130 Watts with a large transformer. As supplied it will handle about 15 Watts. Heatsink required. Price is £12.00. Ref. 12P17.

PERSONAL STEREOS. Again customer returns but complete and with stereo headphones a bargain at only £3.00 each. Our ref. 3P83.

MAINS OPERATED MICROWAVE CONTROL PANEL with touch switches. This unit has a 4 digit display with a built in clock & 2 relay outputs – one for power & 1 for pulsed power level. Could be used for all sorts of timer control applications. Only £6.00. Our ref. **6P18**.

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. Our price only £3. Our ref 3P72. Or 2 for £5. Our ref 5P152.

STABILIZED POWER SUPPLY KIT 2-25V 2A. A kit for a bench or lab power supply containing PCB, transformer, heatsink and all other components. Short circuit protected. Case required. Priced at £20.00. Ref. 20P25.

GEIGER COUNTER KIT. Complete with tube, PCB and all components. 9V operation. Only £39.00. Ref. 39P1.

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.

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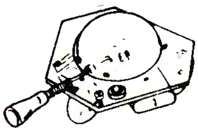
REAL POWER AMPLIFIER for your car, it has 150 watts output. Frequency response 20hz to 20Khz and signal to noise ratio, better than 60 d/b. Has built in short circuit protection and adjustable input level to suit your existing car stereo, so needs no pre-amp. Works into speakers. Ref. 30P7 described below. A real bargain at only £58.00. 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. Ideal to work with the amplifier described above. Price per pair £30.00. Order ref: 30P7.

VIDEO TAPES. These are three hour tapes of superior quality, made under licence from the famous JVC Company. Offered at only £3 each. Our ref: 3P63. Or 5 for £11. Our ref: 11P3. Or for the really big user 10 for £20. Our ref: 20P20.



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 £10. Our ref 10P81.

12" HIGH RESOLUTION MONITOR. Amber 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: £22.00. Order ref: 22P2.

MICROWAVE TURNTABLE MOTOR. Complete with weight sensing electronics that would have varied the cooking time. Ideal for window displays etc. Only £5.00. Ref: 5P185.

MAINS FANS. Snail type construction approx 5"×4" mounted on a metal plate for easy fixing. New. £5.00 each. Ref: 5P166.

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PANEL METERS. 270 deg movement. New. £3.00 each. Ref: 3P89.

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COMPOSITE VIDEO KITS. These convert composite video into separate H. sync, V. sync and video. Price £8.00. Our ref: 8P39.

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. 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 £60.00, reference 60P2. Both are brand new.

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. Our ref 20P22.

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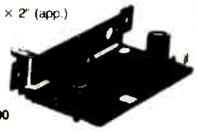
ORGAN MASTER. Is a three octave musical keyboard. It is beautifully made, has full size (piano size) keys, has gold plated contacts and is complete with ribbon cable and edge connector. Can be used with many computers, request information sheet. Brand new, only £15. Our ref 15P15.

1990 BULL ELECTRICAL CATALOGUE packed with bargains. Easy to use. Please request with your next order or send stamped A5 size envelope.

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. The amplifier has three transistors and we estimate the output to be 2W 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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20WATT 4OOHM 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.

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10 MEMORY PUSHBUTTON TELEPHONES. These are customer returns and 'sold as seen'. They are complete and may need slight attention. Price £6.00. Ref 6P16 or 2 for £10.00. Ref: 10P77. BT approved.

25 WATT STEREO AMPLIFIER IC STK043

with the addition of a handful of components you can build a 25 watt stereo amplifier. Supplied with circuit diagram. £4.00. Ref 4P69.

SPECTRUM SOUND BOX. Add sound to your Spectrum with this device. Just plug in. Complete with speaker, volume control and nicely boxed. A snip at only £4.00. Our ref. 4P52.

BBC JOYSTICK INTERFACE. Converts a BBC joystick port to an Atari type port. Price £2.00. Our ref: 2P261.

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SOLDERING IRON STAND. Price £3.00. Our ref: 3P66.

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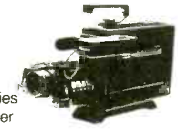

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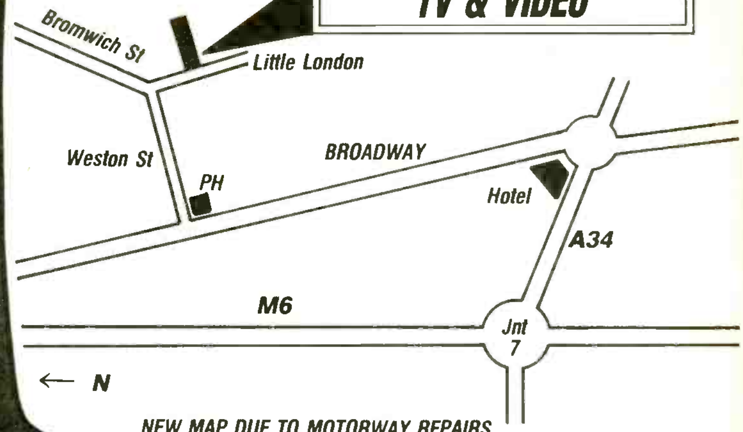

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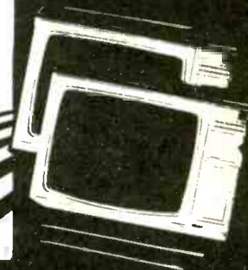

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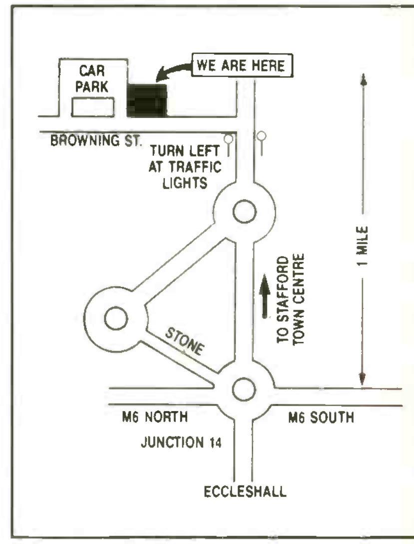

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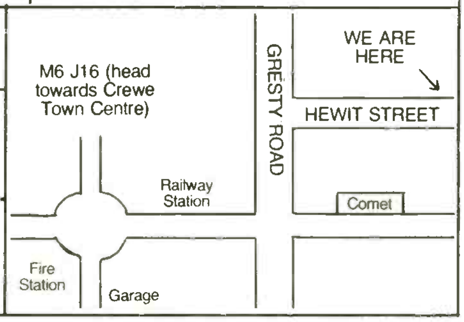

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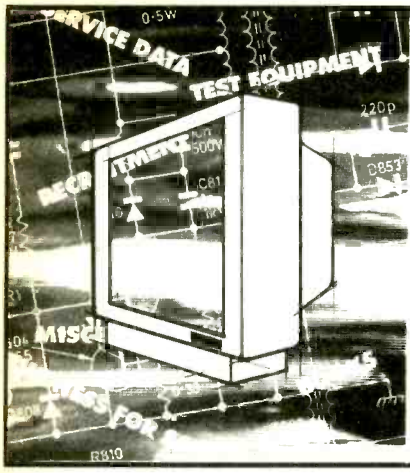

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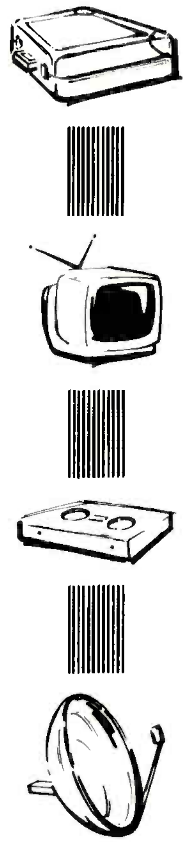

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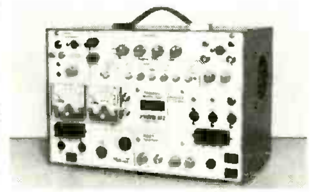

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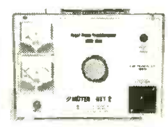

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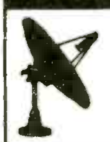

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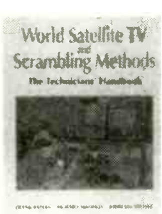

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BC263b	20p
BC294	30p
BC298	10p
BC300	30p
BC301	30p
BC303	30p
BC307	7p
BC308	7p
BC309	10p
BC327	10p
BC328	10p
BC328/338 pair	15p
BC337	10p
BC338	10p
BC347	10p
BC349b	10p
BC350	20p
BC365	10p

BC368	10p
BC369	10p
BC384	10p
BC394	10p
BC413	10p
BC414	10p
BC416	10p
BC440	30p
BC454	10p
BC455	10p
BC456	10p
BC460	25p
BC462	10p
BC463	10p
BC478	10p
BC527	10p
BC532	10p
BC546	10p
BC547	10p
BC548	10p
BC556	10p
BC557	10p
BC558	10p
BC559	10p
BC635	10p
BC636	10p
BCX31	25p
BCX32	25p
BD116	25p
BD124	30p
BD124 (metal)	30p
BD130Y	25p
BD131	30p
BD132/238	30p
BD135	25p
BD136	30p
BD138	30p
BD140	30p
BD176	25p
BD182	£1.00
BD183	70p
BD202	30p
BD204	30p
BD207	60p
BD221	20p
BD222	30p
BD228	30p
BD226	20p
BD233	30p
BD234	25p
BD235	30p
BD238	30p
BD239	15p
BD240	50p
BD243c	30p
BD244	50p
BD250a	30p
BD252	20p
BD253B	50p
BD331	20p
BD373b	20p
BD416	25p
BD433	25p
BD437	25p
BD438	30p
BD139	30p
BD439	50p
BD544D	40p
BD650	50p
BD678	30p
BD681	30p
BD682	30p
BD507	50p
BD508	30p
BD509	30p
BD510	30p
BD517	30p
BD519	30p
BD534	30p
BD535	30p
BD544D	30p
BD562	30p
BD610	40p

BD646	50p
BD676A	30p
BD807	20p
BD826	50p
BD933	30p
BD939	30p
BD948	30p
BDT31A	50p
BDX75	20p
BDV64B	50p
BDU65	50p
BF761	30p
BF769	30p
BF788	20p
BF819A	30p
BF858	30p
BF869	30p
BF871	30p
BFR52	7p
BFR81	15p
BFS60	10p
BFT42	20p
BFT57	20p
BFW11	30p
BFX85 100V. 1amp	30p
BSD215	50p
MR1366	20p
AN6350	£2.00
BRC-M-200	40p
BRC-M-300	50p
BRC 1093	£1.00
BRC 3064	£1.00
BTT822	£1.00
BTT6016	£1.20
BTT6018/ML237B	£1.50
BTT6218	£1.50
BTT8124	£1.00
BTT8224	£1.00
BUP22A	£1.00
CA270AE	50p
CA270CW	50p
CA270CE	50p
CA920AE	£1.00
CA1310	50p
CA3046	50p
CA3065Q	50p
CA3094AE	50p
CA3123	40p
CA3146	£1.00
CA3189	40p
CBF16848	50p
CD4510	30p
CD4555BE	30p
DM7492	50p
HA1124A	40p
HA1196	40p
HA1370	£2.00
HA1377	£3.00
HA11223	40p
HA11423	£1.00
HA11440	50p
HA11484	£3.00
HA11485 Ant	£1.00
HA17458	50p
HEF4001	10p
HEF4518B	25p
HBF4011AF	10p
HEF4053B	30p
HEF4066BP	20p
HEF4528	20p
HD3890C	£3.00
K5731D 1001012	£1.00
LA3220	50p
LA4102	£1.00
LA4261	£1.00
LA7830	£2.00
LA7831	£2.00
LM1111N	£1.00
LM1017N	25p
LM8361	£3.00
PCF8571P	£5.00
M913	£2.00
M1024=SAA	£2.00
M1025=SAA	£2.00
M5840A-84RS	£3.00
MC476p	£1.00
MC1307	75p
MC1312	
MC1330 GN76530	£1.00
MC1352	£1.00
MC1358	£1.00
MC1496	50p
MC14002	15p
MC14013	25p
MC14016	25p
MC14066	30p
MC14514	50p
MC1748	80p
MEM4956	£1.00
ML231	£2.50
ETT6016	£2.00
ML232	£1.00
ML236E	£1.00
ML237B	£1.00
ML238B	£4.00
ML239	£2.00

Thyristors

Philips Kits OT121	50p
IR106A	30p
BT151/500	20p
BT106 Plastic	30p
BT106 Metal	£1.20
BT119	£1.00
BT120	£1.00
BRC4443	75p
G11 Thyristor	60p
Decca 80-100	60p
2N4444	£1.00
MCR72-6	25p
OT112	£1.00
TF320M	£1.00
HC8441	£2.00
17052	£2.00
17088H	£2.00
17089R	£2.00
17053R	£2.00
5P2M	50p
RCA Line Thyristor	
CC1240H	£2.00
CC1240R	£2.00

Thermistors

PTHBG180M	75p
G8 Degausing	35p
Philip type VA1104	70p
ITTP7266312	15p
PT1451 AOR	15p
PT37P Fits Pye & PT34	20p
Degausing Thermistor (fits most sets)	20p
POS 109 Philips	50p
POS 016 Philips	50p

Thorn

ML926	£1.00
MAB8400B-C	£2.00
MAB8440 P-D070	£2.00
MAB8441 PT001	£3.00
MAB8420PC035	£2.00
MAB8422P-Q005	£2.00
MAB8440P	£2.00
MAB8400XX	£3.00
M708LB1	£2.00
MM5387	£1.00
MM5611	£1.00
MM5840	£3.00
PCD8571P	£3.00
K35 Philips Receiver IC	
MA1250 BJC	£3.00
M491BB1	£3.00
M5840A-84	£5.00
M58401-84	£5.00
MM5290N-4	75p
MM53108N	£4.00
MN1250BJC	£2.00
MR1366	20p
N64100	£1.00
NE555P	60p
NE555	60p
NE556	50p
NE646	50p
HD38980C	£3.00
IL-1	20p
OPT600	20p
OPT601	20p
PH2369	10p
PCD8571P	50p
PCD8572P	£2.00
SAA611	£1.00
SAA661	£1.75
SAA1021	£4.00
SAA1024	£2.50
SAA1073	£3.00
SAA1074	£3.00
SAA1075	£3.00
SAA1124	£2.00
SAA1130	£2.50
SAA1174	£3.00
SAA1176	£2.00
SAA1250	£3.00
SAA1251	£4.00
SAA1272	£3.00
SAA1274	£3.00
SAA1276	£3.00
SAA1292	£10.00
SAA1293	£3.00
SAA3027P	£4.00
SAA5000A	£1.50
SAB3013	£2.00
SAB3037	£2.00
SAB3205	£3.00
SAB3210	£2.00
SAB4209	£2.00
TBO0124	£1.00
SAA3008P	£3.00
SAA5000A	£2.00
SAA5010	£2.20
SAA5012A	£5.00
SAA5020	£3.50
SAA5025D	£3.00
SAA5030	£4.50
SAA5040	£2.00
SAA5040A	£3.00
SAA5042A	£3.00
SAA5043	£4.00
SAA5050	£4.50
SAA5051	£2.00
SAA5052	£2.00
SAA5053	£2.00
SAA5240	£4.00
SAA5241 P/A TEX IC	£5.00
SAF1032p	£2.50
SAF1039	£2.00
SAS570T	75p
SAS660	£1.00
SAS670	£1.00
SAS580	75p
SAS590	75p
SAS3210	£2.00
SL437F	£4.00
SL471	50p
SL480	£1.00
SL901B	£4.50
SL971B	£3.00
SL918	£4.50
SL1430	£1.00
STK4793	£3.00
STK5471	£3.00
STR58041	£5.00
TA7122	£1.15
TAA320A	50p
TAA470	£1.50
TAA570	75p
TAA611B	£1.00
TAA621	£2.00
TA7108P	£1.00
TA7117	50p
TA7120P	50p
TA7315AP	50p
TA7137P	50p
TA7193AP	£3.00
TA7240AP	£3.00
TA7265	£3.00
TA7609P	50p
TA7227P	£1.00
TA7265AP	£3.00
TA7608AP	£3.75
TA7680AP	£3.00
TA7750P	30p
TBA120A	40p
TBA120AS	50p
TBA120SA	50p
TBA120B	40p
TBA120SB	40p
TBA120T	50p
TBA120SQ	£1.00
TBA120U	75p
TBA120Q	30p
TBA120C	40p
TBA1440	£1.00
TBA1441	£2.00
TBA231	75p
TBA395Q	50p
TBA396Q	£1.00
TBA396	75p
TBA440P	£1.00
TBA1440C	£1.00
TBA480Q	£1.00
TBA520	£2.00
TBA530	£2.00
TBA540	£1.00
TBA560CQ	£1.00
TBA570	£1.50

TV Crystals

4MHz	
4.433-619	
6MHz	
8.867238	
11.059.000	
Large or small	50p each
Antistatic Isolators	
Disc Type Black	10p

Filters

CSA 3.97M		15p
6MEG	CDA	25p
6MHz	SFE	12p
SFE 5.5MHz		20p
SFD460B		15p
CSB455A		15p

TBA625	50p
TBA651	£2.00
TBA673	£1.00
TBA750Q	£1.50
TBA780	£1.50
TBA800	50p
TBA810AP	60p
TBA810S	60p
TBA820	60p
TBA820M	25p
TBA920	£1.50
TBA920Q	£1.50
TBA990Q	£1.00
TMS1000NL	£2.00
TMS1943 N2L (clockchip)	£1.00
TMS9980	£4.00
TMS9901	£1.00
TMS2708JG45	45p
TMS2716JL	£1.00
TMS3529	£1.00
TMS3720ANS	£3.00
TMS4014	70p
TX-012	£1.00
TMS9902	£1.20
ULN2004P	£1.50
ULN2216	75p
UPC566H	£1.00
UPC585C	£1.00
UPC1009C	£2.00
UPC1031H	£2.00
UPC1353C	£1.00
UPC1363C	£2.75
UPC1364C	£2.00
UPC1365C	£2.00
UPC1366C	£1.00
UPC1378H	£2.00
UPC1514C	£3.00
UPC2002	35p
UPD1943G	£2.00
UPD8049HC	£2
SN29848	50p
SN29770BN	£2.00
SN29771BN	£2.00
SN29772BN	£2.00
SN7402N	£1
SN7472N	£1
SN74107	£1.00
SN74167	70p
SN7472N	20p
SN75108AN	£1.00
SN76001	£1.00
SN76013ND	£2.00
SN76018	£1.00
SN76110N	£1
SN76115AN	50p
SN76131	50p
SN76141N	£1.00
SN76226	£1.00
SN76227N	£1.00p
SN76228N	£1.00
SN76270	£1.00
SN76532N	£1.00
SN76545N	£3.00
SN76546	£3.00
SN76550	30p
SN76552	30p
SN76570	£1.00
SN76620	50p
SN76660N	40p
SN76620AN	50p
SN76666	£1.00
SN76705N	£1.00
SN76707N	75p
SN76708AN	75p
SN76720	£1.00
SN76709N	£2.00
UA783P3C	40p
BT100A/02	40p
BT138/10A	70p
BT146	30p
TBA540Q	£1.50
TCA270	£1.00
TCA270Q	£1.00
TCA270S	£1.00
TCA270SQ	£1.00
TCA740	£1.00
TCA800	£1.50
TCA830	£1.00
TCA940	£1.00
TCEP100	£1.00
TCE120CQ	£1.00
TCE520	30p
TD6306P	£3.00
TDA440Q	50p
TDA1003A	£1.00
TDA1010	£1.00
TDA1013	£1.00
TDA1012	£1.00
TDA1013A	£1.00
TDA1060A	£1.50
TDA1035T	£1.00
TDA1035SB	£1.00
TDA1072	£1
TDA1150	50p
TDA1151	30p
TDA1154	50p
TDA1170S	£1.00
TDA1180	£2.00
TDA1190	£1.00
TDA1200	75p
TDA1270	£1.50
TDA1327A	69p
TDA1365	£3.00
TDA1512	£2.00
TDA1540P	£3.00
TDA1670A	£2.00
TDA1908A	£1.00
TDA2002	£1.00
TDA2003	25p
TDA2004	£2.00
TDA2008	£2.00
TDA2010	£1.00
TDA2020	£1.00
TDA2030	£2.00
TDA2140	£3.50
TDA2160	£1.00
TDA2320	50p
TDA2545A	£1.00
TDA2600	£3.00
TDA2640	£2.00
TDA2522	£5.00
TDA2530	£1.50
TDA2532	£1.00
TDA2540	80p
TDA2541	£1.00
TDA2542	£1.00
TDA2545	£2.00
TDA2546	£2.00
TDA2556	£1.00
TDA2560	75p

TDA3565	£3.00
TDA2575A	£1.00
TDA2577A	£2.00
TDA2578A	£2.00
TDA2579A	£2.00
TDA2581	£2.00
TDA2591	£1.00
TDA2593	£3.00
TDA2560	50p
TDA2556	£1.50
TDA2600	£5.75
TDA2611A	£1.00
TDA2611AQ	£1.00
TDA3651A	£1.00
TDA3652	£2.50
TDA2653	£4.00
TDA2640	£2.00
TDA2680	£1.00
TDA2690	£1.00
TDA2593	£1.00
TDA3047	£1.00
TDA3048	£3.00
TDA3083	£2.00
TDA3190	£1.00
TDA3300B	£5.00
TDA3301B	£4.00
TDA3505	£3.00
TDA3506	£3.00
TDA3560	£4.00
TDA3561A	£3.00
TDA3562A	£3.00
TDA3566	£3.50
TDA3564	£4.00
TDA3565	£3.00
TDA3571A	£2.75
TDA3581	£3.00
TDA3590	£3.00
TDA3591	£1.00
TDA3592A	£3.00
TDA3650	£3.50
TDA3651	£3.00
TDA3651AQ	£3.50
TDA3652	£3.50
TDA3653AQ	£2.00
TDA3653	£3.00
TDA3654	£2.00
TDA3654Q	£2.00
TDA3710	£3.50
TDA3800	£4.00
TDA3180	£2.00
TDA4260	50p
TDA4501	£3.00
TDA4505N4	£3.00
TDA4420	£2.00
TDA4600/2D Dil	£1.00
TDA4600-2 Flat	£3.00
TDA4601	£2.00
TDA8190	£3.00
TDA9403	£3.00
TDA9503	£3.00
TDB2033	£1.00
TDD1610S	50p
TD6306P	£2.00
TDA1060	£3.00
TEA1009	50p
TEA1039	£2.00
TEA1060	£2.00
TEA2017	£2.00
TEA5114	£1.00
TDA3300B	£6.00
SN74LS 125AN	30p
SN74LS 248	50p
SIL4516	50p
SN16861NG	50p
SN16862AN	£1.00
SN16964AN	50p
SN29764AN	£1.00
UA721	40p
UA7300	40p
MPS43A	25p
MJ13005	30p
MJE51T	25p
MJE340	28p
MJE660	25p
MJE661	25p
MJE3055	£1.00
MJE2801	30p
MJE2955	50p
MJE13005	50p
Sanikron Diode	30p

Transistors

A1222	25p	BF181	20p
A1223	25p	BF182	20p
AC106	25p	BF184	20p
AC121	25p	BF194	10p
AC124	25p	BF195	10p
AC128	25p	BF196	10p
AC137	25p	BF197	12p
AC151	25p	BF198	10p
AC131	25p	BF199	10p
AC138	25p	BF200	20p
AC152	25p	BF222	10p
AC153K	25p	BF224	15p
AC142K	25p	BF238	20p
AC169	25p	BF240	16p
AC176	25p	BF244	40p
AC178K	25p	BF245b	20p
AC179	25p	BF255	20p
AC186	25p	BF256	20p
AC188	25p	BF257	20p
ACY21	25p	BF258	25p
AD143	50p	BF262	15p
AD149	50p	BF263p	25p
AD161/162 pair	40p	BF264	15p
		BF271	10p
		BF273	10p
AF17A	25p	BF274	10p
AF139	25p	BF324	25p
AF181	£1.00	BF337	50p
AF239	25p	BF355	30p
AF367	25p	BF362	20p
AL102	£1.75	BF363	15p
AU110	£1.50	BF367	15p
BLY49	50p	BF391	15p
BF115	20p	BF394	10p
BF121	20p	BF419	30p
BF127	20p	BF422	15p
BF137	20p	BF423	15p
BF157	20p	BF448	30p
BF160	20p	BF470	30p
BF161	20p	BF471	30p
BF164	60p	BF597T	10p
BF179	30p	BF694	10p
BF180	20p		

Thorn Transformers

DT2076/78	£10.00
90D3-035403	£10.00
90D4-106403	£1.00
90D3-038-001	£5.00
OT204130	£3.00

I.C.s

MA721PC	£1.00	UPD114LC-2	£1.00
M50430-8505P	£1.00	MN1250BJC	£1.00
TD6359P	£1.00	M50441-5505P	£1.00
M58657P	£1.00	M491BB1	£2.00
PCD8572	£1.00	HA51338S	£1.00
HD74HC86P	£1.00		