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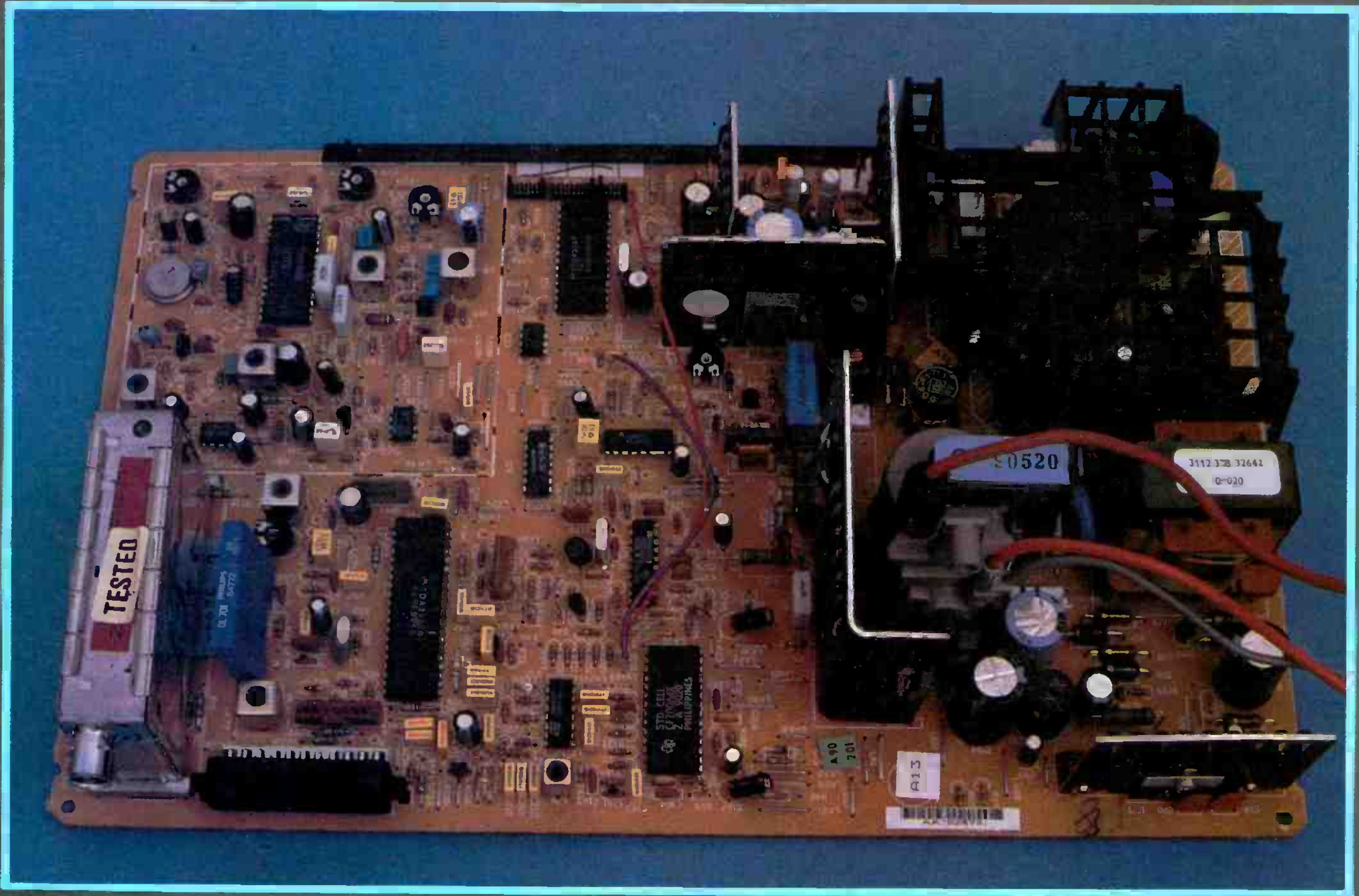

Inside the Ferguson TX98 Chassis

Satellite TV Band Scanner Unit

Features of the Sharp VCD-805 VCR

VCR Clinic • TV Fault Finding

Servicing Microwave Ovens

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TELEVISION

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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.

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We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television*, but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them.

this month

OUR NEXT ISSUE DATED DECEMBER WILL BE PUBLISHED ON NOVEMBER 21

AA119	9p
AAY32	9p
AC107	40p
AC125	25p
AC126	25p
AC127	21p
AC128	21p
AC128K	28p
AC141K	30p
AC142K	30p
AC176	22p
AC176K	28p
AC187	21p
AC187K	28p
AC188	21p
AC188K	28p
ACY18	48p
ACY19	48p
AD142	100p
AD149	60p
AD161	35p
AD162	35p
AF124	50p
AF125	50p
AF126	50p
AF127	50p
AF139	30p
AF239	30p
AF379	45p
ASZ15	100p
ASZ17	100p
BA145	10p
BA148	10p
BA154	6p
BA157	12p
BA526	188p
BB105B	18p
BB205B	24p
BC107	8p
BC108	8p
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BC109C	10p
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BC640	20p
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BDW24	56p
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BDW94	50p
BDY20	100p
BDY92	100p
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BF185	20p
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VN.10KM	60p
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2N.698	40p
2N.706	22p
2N.708	22p
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2N.930	18p
2N.1131	28p
2N.1132	28p
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2N.1711	24p
2N.1893	30p
2N.2102	50p
2N.2218A	24p
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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	38p
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
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IN.5403	11p
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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	160p
2.5	200p
3.276	118p
3.5795	95p
4.0	110p
4.194	130p
4.43	95p
4.9152	150p
5.0	130p
6.0	115p
8.0	125p
8.867	125p
10.0	140p
11.0	250p
12.0	120p
14.0	125p
14.756	200p
15.0	160p
16.0	130p
18.0	130p
18.432	130p
24.0	250p
48.0	160p
VOLTAGE REGULATORS	
7805	35p
7806	35p
7808	35p
7812	35p
7815	35p
7818	35p
7824	35p
7905	35p
7906	40p
7908	40p
7912	40p
7915	40p
7918	40p
7924	40p
78L05	28p
78L08	28p
78L12	28p
78L15	28p
78L18	28p
78L24	28p
79L05	40p
79L08	40p
79L12	40p
79L15	40p
7818KC	100p
7824KC	100p
LM309K	100p
LM317K	220p
LM317T	180p
LM323K	420p
LM723	40p
78HGKC	570p
78HO5KC	800p
78H12KC	700p
78GU1C	190p
79GU1C	215p
79HGKC	800p
VALVES	
DAF96	60p
DF96	50p
DL92	60p
DY86	50p
DY87	60p
DY802	75p
EABC80	60p
EB91	44p
EBF80	45p
EBF89	50p
ECC82	80p
ECC83	100p
ECC84	70p
ECC85	80p
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ECH84	70p
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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	100p
PY88	100p
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
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AN-272	480p
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AN-301	330p
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AN-316	350p
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AN-360	100p
AN-362	140p
AN-366	150p
AN-610	160p
AN-612	160p
AN-5151	600p
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AN-7145	195p
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AY3-1015	290p
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AY3-8912	400p
BA-301	65p
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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
BA-658	380p
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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	300p
TDA-8190	280p
TDA-8440	380p
TDA-9403	250p
TDA-9503	200p
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	48p
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-1018	170p
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UPC-1023	60p
UPC-1025	230p
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UPC-1028	90p
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UPC-1032	60p
UPC-1158H2	70p
UPC-1167CL	170p
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UPC-1187	150p
UPC-1188H	400p
UPC-1197	140p
UPC-1200	325p
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UPC-1373	85p
UPC-1378	210p
UPC-1382	110p
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UPC-1403CA	750p
UPC-1420CA	500p
UPC-1458	100p
UPC-1470	200p
UPC-1504C	400p
UPC-1505C	400p
UPC-1517CA	400p
UPC-1525C	400p
UPC-1536C	550p
UPC-1571C	300p
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ZN-425	320p
ZN-426	260p
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ZN-428	425p
ZN-429	215p
ZN-435	340p
ZN-448	510p
ZN-459	190p
ZN-1034	170p
ZN-1040	640p
ZNA-134H	2150p
ZNA-234E	920p

JAPANESE TRANSISTORS

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2SA-509	120p
2SA-550	150p
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2SA-608	15p
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2SD-864	200p
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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
2SD-1328	60p
2SD-1347	70p
2SD-1348	85p
2SD-1350	150p
2SD-1376	125p
2SD-1379	100p
2SD-1380	100p
2SD-1383	100p
2SD-1390	350p
2SD-1391	450p
2SD-1392	150p
2SD-1395	150p
2SD-1396	240p
2SD-1397	220p
2SD-1398	130p
2SD-1399	300p
2SD-1400	280p
2SD-1402	280p
2SD-1406	120p
2SD-1407	160p
2SD-1409	190p
2SD-1415	190p
2SD-1425	430p
2SD-1426	350p
2SD-1427	380p
2SD-1428	360p
2SD-1429	410p
2SD-1430	280p
2SD-1431	400p
2SD-1432	600p
2SD-1433	750p
2SD-1438	140p
2SD-1439	320p
2SD-1441	380p
2SD-1448	140p
2SD-1450	60p
2SD-1451	260p
2SD-1453	140p
2SD-1455	320p
2SD-1457	220p
2SD-1459	120p
2SD-1468	60p
2SD-1496	450p
2SD-1497	450p
2SD-1505	120p
2SD-1554	500p
2SD-1555	450p
2SD-1576	450p
2SD-1577	480p
2SD-1579	120p
2SD-1591	310p
2SD-1595	160p
2SD-1604	200p

2SD-1608	210p	2SD-1941	500p
2SD-1609	100p	2SD-1984	150p
2SD-1632	500p	2SJ-49	425p
2SD-1649	260p	2SJ-50	425p
2SD-1651	270p	2SJ-77	350p
2SD-1663	450p	2SK-19	45p
2SD-1666	120p	2SK-49	50p
2SD-1667	120p	2SK-55	100p
2SD-1668	120p	2SK-68	100p
2SD-1677	300p	2SK-134	415p
2SD-1739	450p	2SK-135	415p
2SD-1783	100p	2SK-147	160p
2SD-1815	100p	2SK-192	45p
2SD-1825	120p	2SK-195	150p
2SD-1843	100p	2SK-197	140p
2SD-1846	350p	2SK-312	750p
2SD-1884	300p	2SK-323	130p
2SD-1910	280p	3SK-88	70p

BRIDGE RECTIFIERS

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

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UHF TUNERS

U322LO	600p
U341	500p
U342	500p

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VIDEO LAMPS

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

CASSETTE DC MOTORS

6V	240p
9V	240p
12V CW	240p
12V CCW	240p
13.2V CW	290p
13.2V CCW	290p

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CASSETTE TAPE HEADS

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

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

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VIDEO HEADS

AKAI

VS-109/201/202/301/303	£24.00

AMSTRAD

VCR 4500/5200/9000	£13.00
VCR 7000	£17.50
VCR 6000/6100	£21.00
TVR2/TVR3/VCR4600/VCR4600 MKII/VCR4700	£15.00

FUNAI

E11/VIP1000/VP1400/VCR4000	£20.00

FISHER

FVHP510/520/530/615/622/710/715/720/721/722/910	£14.25
VBS7100/VBS7500/VBS9900	£29.00
VBS7000/VBS9000	£29.00
FVHP975	£32.00

GOLDSTAR

8000 3HSSDB	£21.00
GVH51/GVH1221/VCP4000/VCP4100/VCP4200	£21.00

HINARI

VXL2/VXL3/VXL4/VXL20/VXL25	£19.00
VXL5/V20H	£22.00
VXL6	£24.00
VXL8/VXL9/VXL10/VXL11	£21.00
VTV100/VTV200	£24.00

HITACHI

VT11/VT14/VT33	£15.00
VT7/VT17/VT19	£35.50
VT35/VT38/VT39	£35.50
VT120/VT220/VT225	£29.00
VT3000	£14.00
VT5000/VT5500	£19.00
VT6500/VT7000/VT8000/VT8300/VT8500/VT8700/VT9300/VT9500/VT9700	£15.00
VT8/VT56	£41.00
VT65	£40.00
VT130/VT138/VT250/VT255	£29.50
VT61E/VT62E/VT63/VT64	£25.00

ITT

VR3605/VR3905	£8.80
VR3833/VR3906/VR3913/VR3914/VR3935/VR3943/VR3954/VR3963/VR3975/VR3985/VR3986	£8.80

JVC & FERGUSON

JVC/AKAI/FERGUSON 3HSS (FOR ALL MODELS)	£7.00

JVC 3HSS

HR3300/HR3320/HR3330/HR3350/HR3360/HR3750/HR3860/HR4100/HR7200/HR7300/HR7350/HRD220	£7.00

FERGUSON 3HSS

3290/8903/8940/3V00/3V06/3V22/3V29/3V30	£7.00

JVC 3HSSL PIN

HR2200/HR3660/HR7600/HR7610/HR7650/HR7700/HRD110/HRD111/HRD120/HRD121/HRD225	£7.00

FERGUSON 3HSSL PIN

8904/8924/8941/8943/8944/3V16/3V23/3V24/3V31/3V35/3V36/3V38/3V29/3V49	£7.00

JVC 3HSSVA

HRD140/HRD141/HRD143/HRD150/HRD157/HRD158/HRD160/HRD455/HRS10/HRS100	£17.50

FERGUSON

8945/8947/8948/3V42/3V44/3V45/3V46/3V47/3V52/3V54/3V55/3V56/3V57	£17.50
8950/8951/3V64/FV10/FV11	£21.00
3V48	£24.50
3V43/3V53	£38.50

JVC

HRD170	£21.00
HRD565	£24.50
HRD725/HRD755	£38.50

JVC & FERGUSON

3V32/8942/HR7655	£24.50
HRD180/3V59	£30.50
HRD370/3V58	£31.00
HRD250	£30.00

LOGIK

VR960	£22.00

MATSUI

VX500E/VX600A/VX800A/VX810A/VX880A/VX770B/VX773B	£19.00
VCRL3/VX730	£20.50
VX735/VX755	£20.50
VX735A/VX755A/VX765/VX850	£20.50

GRANDATA LTD
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VIDEO HEADS — Cont.

MITSUBISHI

HS304/HS310/HS320/HS700	£26.00
HS306/HS710	£28.00
HS303	£22.00
HS301	£80.00

NATIONAL PANASONIC 4HSS-3HSSN

NV3000/NV300/NV7200/NV333/NV7500/NV7800/NV7850/NV322/NV332/NV340/NV390/NV2000/NV2010/NV7000/NV8170/NV8200/NV8400/NV8600/NV8610/NV8620	£7.00

NATIONAL

NV777/NV330	£20.50
NV430/NV460	£18.00
NV730/NV770	£20.00
NV366	£23.00
NV180	£33.50
NV370/NV380	£10.00
NV788	£43.50
NV810	£42.00
NV850	£50.00
NV870	£50.00
NVG15	£41.50
NVG30	£25.00
NVG33/NVG45/NVG46	£41.00
NVG40/NVG130	£28.00
NVG400	£42.00
NVG10/NVG11/NVG12/NVG14/NVG16/NVG120EM	£18.00
NVG18	£41.25
NVG20/NVG21/NVG22/NVG25/NVG28	£38.00
NVG50	£36.00
NVG730B	£41.00
NVH70	£50.00
NVH65/NVD80	£50.00
NVG7/NVG9	£21.00
CAM CORDER VEH 0366	£60.00
CAM CORDER VEH 0292	£52.00

N.E.C.

N9011/N9012/N9013E/N9014E/N9014G/N9015/N9016/N901A	£22.00
N911A/N915A/N916A/917	£34.00

ORION

VH3/VH555/VH600/VH700/VH844/VH900/VH1000	£17.50

PHILIPS

VR6460/VR6520/VR6920/64VR60	£10.00
VR6711 4 HEAD	£41.00
6920	£62.00

SAISHO

VR100/VR605/VR705/VR805/VR905/VR1000/VR1200/VR1600	£19.50
VR3300X/VR3600X/VR3650/VR3800	£21.25
VR3200	£21.25
VR3300/VR3600	£21.25

SAMSUNG

SVX301/VB900/VB910/VVT510/VT320/VT5600/VX510/VX511/VX520/VX616/VX626/VX627/VX717	£22.00
6900/370097	£27.00

SANYO

VTC5000/VTC5400/VTC600/VTC6500/VTCM10/VTCM11/VTCM20/VTCM21/VTCM25	£22.00
VTC5100/VTC5150/VTC5300	£25.00
VTC5350/VTC5370/VTCNX10/VTCNX15/VTCNX20/VTCNX30/VTC5500	£25.00
VTC9100/VTC9300/VTC9455/VTC9500	£28.80
VTC9350/VTC9355	£28.80
VTC5500	£30.50
VHR1110/VHR1150/VHR1300/VHR1700/VHR2300	£20.00
VHR3200/VHR3270/VHR3100/VHR3150/VHR3400 (FVH-P15)	£22.50
VHR1200	£22.00
VHR1500/VHR2500	£33.00

SHARP

VC300/VC381/VC383/VC386/VC387/VC388/VC482/VC483/VC486/VC3300/VC8381/VC9100/VC9300/VC9500/VC9700	£14.50
VC582/VC583/VC651/VC681/VC750/VC780/VC781	£14.50
VC600/VC6300/VC7300/VC7700/VC7750/VC8300	£35.00

SONY

DSR-35R (FOR C20/C30/C40/SLF1UB/SLF1E) 2 PIN	£15.00
DSR-43R (FOR SLC7 RANGE/SL5000/SL5100/SL3000) 1 PIN	£13.00

TOSHIBA

V21/V31/V33/V50/V51/V53/V9600	£17.00
V55/V57	£9.00
V71/V73/V74/V75/V81/V82/V83/V84/V85/V86/V87	£18.25
V93	£23.00
V5470/V5480	£18.00

TRIUMPH

VR9501/VR9511/VR9592	£22.25

VCR PINCHROLLERS

AKAI

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

AMSTRAD

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

FERGUSON

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

FISHER

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

HITACHI

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

ITT

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

JVC

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

MITSUBISHI

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

NATIONAL

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

PHILIPS

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

SANYO

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

SHARP

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

SONY

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

VCR BELT KITS

AKAI

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

AMSTRAD

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

FERGUSON

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

FISHER

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

GEC

4005	150p

HITACHI

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

ITT

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

JVC

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

MITSUBISHI

HS-200	200p

NATIONAL

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

PHILIPS

VR-6460	170p

SANYO

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

SHARP

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

SONY

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

TOSHIBA

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

MOD KIT TAPE CREASING
AMSTRAD
VCR450, 4600, 4700 — 620p

CASSETTE HOUSING

FERGUSON

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

JVC

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

VIDEO MOTORS

AMSTRAD

VCR-7000 REEL MOTOR	1700p

FERGUSON & JVC

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

NATIONAL

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

SANYO

REEL MOTOR 4-529V-10800	630p

SHARP

REEL MOTOR RMTOV 1008 GEZZ	1350p

SONY

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

VIDEO LAMPS

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

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STR 5214	650p
STR 5314	650p
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STR 20013	550p
STR 30110	330p
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4000B SERIES CMOS IC's

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

74 SERIES

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

74HC SERIES HIGH SPEED CMOS

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

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

74LS00	12p
74LS01	12p
74LS02	12p
74LS03	12p
74LS04	12p
74LS05	12p
74LS08	12p
74LS09	14p
74LS10	12p
74LS11	12p
74LS12	12p
74LS13	20p
74LS14	24p
74LS15	14p
74LS20	14p
74LS21	14p
74LS22	14p
74LS24	35p
74LS26	14p
74LS27	14p
74LS28	14p
74LS30	14p
74LS32	15p
74LS33	15p
74LS31	15p
74LS38	15p
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74LS114	28p
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74LS132	30p
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74LS145	65p
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74LS148	75p
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74LS162	38p
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74LS166	55p
74LS168	60p
74LS169	55p
74LS170	68p
74LS174	30p
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74LS247	40p
74LS248	40p
74LS249	70p
74LS251	24p
74LS253	36p
74LS256	52p
74LS257	32p
74LS258	35p
74LS259	50p
74LS260	30p
74LS266	22p
74LS273	44p
74LS279	33p
74LS280	88p
74LS283	51p
74LS290	26p
74LS293	26p
74LS365	26p
74LS366	31p
74LS367	28p
74LS368	30p
74LS373	45p
74LS374	45p
74LS375	46p
74LS390	42p
74LS393	37p
74LS399	68p
74LS629	95p
74LS641	88p
74LS642	105p
74LS644	105p
74LS645	105p
74LS670	62p
74LS674	310p
74LS687	250p

COMPUTER IC'S

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

OPTO COUPLERS

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

LED DISPLAYS

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

SOLDERING IRON

ANTEX XS25W 240V Soldering Iron 240Vac	650p
Spare Element for XS25W 240V	340p
ANTEX C15W 240V Soldering Iron 240Vcm	650p
Spare Element for C15W 240V	340p

DESOLDERING PUMP

Desolder Pump	350p
Spare Nozzle	60p
SOLDER MOP	65p

SOLDER

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

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Soldering Stand	260p
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5¼ inch DSDD (10 in box) Branded Name	£6.00
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★ SERVICE KIT ★
★ ★ ★ ★ ★ ★ ★ ★ ★ ★

Each Kit Contains
Belts Set, Pinch Roller, Tension Band & Idler Tyre

NATIONAL NV300/NV340	580p
NATIONAL NV7000/NV7200	550p
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FERGUSON 3V35-36, 38-39	550p
FERGUSON 3V29/30	625p
JVC HRD110/111/120/225	550p
JVC HR7200	625p
HITACHI VT11/VT33	625p

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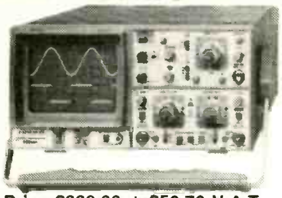
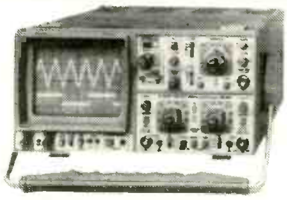
HM203-7 20MHz STANDARD



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

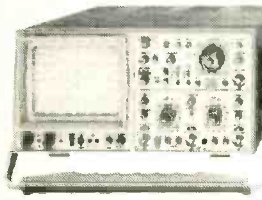


SPECIFICATION
* 2 Channels
* Bandwidth: DC-60MHz
* Sens: Ch1., Ch2., 1mV/cm
* Timebase: 2.5s-5ns/cm
* Triggering: DC-80MHz
* Active TV-Sync-Separator
* After delay trigger
* Sweep delay * Delay line
* Trigger LED indicator
* Calibrator: 1KHz & 1MHz Sq. Wave
* Component tester
* Plus many more superb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

Price £610.00 + £91.50 V.A.T. **FREE Securicor Delivery**

HM1005 100MHz UNIVERSAL

3 CHANNELS-UP TO 6 TRACES

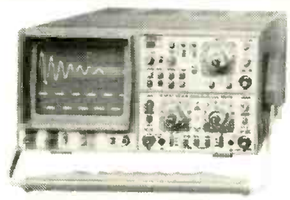


SPECIFICATION
* 3 Channels
* Bandwidth: DC-100MHz
* Sens: Ch1., Ch2., Ch3., 1mV/cm
* Timebase A: 2.5s-5ns/cm
* Timebase B: 0.2s-5ns/cm
* Triggering: DC-130MHz
* After delay trigger * Delay line
* Trigger LED indicator
* Overescan LED indicator
* Active TV-Sync-Separator
* Calibrator: 1KHz & 1MHz Sq.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

Price £792.00 + £118.50 V.A.T. **FREE Securicor Delivery**

HM205-3 20MHz DIGITAL STORAGE

SPECIFICATION
* Digital Storage
* Analogue real time (Same as 203-6)
* Bandwidth: DC-20MHz
* 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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B.K.'s CRT TESTER-REJUVENATOR

Tests and rejuvenates blue, green & red guns separately. Fitted with delta and P.I.L. sockets. Compact size 120×65×60 mm. Supply 240V AC

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Revolutionary L.O.P.T. tester. Operates in dynamic mode which actually tests the L.O.P.T. under high voltage conditions without de-soldering or removal.
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THANDAR SC110A PORTABLE OSCILLOSCOPE

* Only 2¼" thick
* Fits in a brief case
* Sens. 10mV
* Bandwidth 10MHz
* Full trig. fac. inc. TV frame etc.
* Battery or mains adaptor
* Size 255mm x 148mm x 50mm

ACCESSORIES
Carry Case £6.25 + £0.93 V.A.T.
Probe £7.50 + £1.30 V.A.T.
Mains Adaptor £7.30 + £1.09 V.A.T.

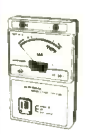
Price £249.00 + £37.35 V.A.T.

DIGITAL LCR METER

* LCD Display
* 18 Ranges
* Inductance 1μH – 2H
* Capacitance 1pf – 200μf
* Resistance 1 ohm – 20Mohm
* High acuracy

Price £95.00 + £14.25 V.A.T.

INSULATION TESTER 500V



* Electronic battery operated
* Measuring Voltage 500V DC
* Measuring Range 0-100Mohm
* Centre scale 2Mohm

Price £65.00 + £9.75 V.A.T.

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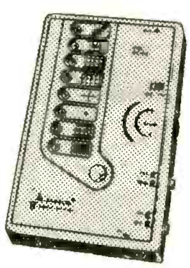

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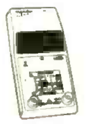

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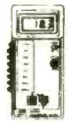

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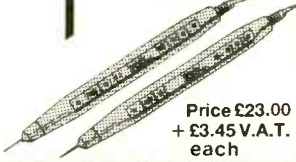

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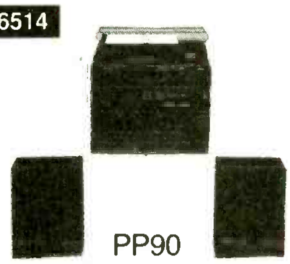

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TELEVISION

Viewing Habits

The British have long been a nation of TV addicts. Is this about the change? It seems hardly likely that there would be any significant change in such an established pattern of behaviour in the short term. Nevertheless some researchers claim to have detected a change. As so often with these things, it depends on whose figures you look at. According to *Cultural Trends 1990*, published by the independent Policy Studies Institute, the average time per person spent viewing the four terrestrial channels fell each year from 1985 to 1989 and is down by seven per cent over the period. The Institute comments that British viewing has declined despite having more channels to watch. Transmission hours for the terrestrial channels have increased by 29 per cent since 1984-5, mainly as a result of more daytime TV and broadcasting into the early morning hours. According to Steven Barnett, director of the Media Futures Group at the Henley Centre for Forecasting, viewing reached a peak of 26 hours a week on average in 1985, then fell steadily to 24 hours 44 minutes in 1989, a drop of nearly five per cent. The Group claims that the decline continued into the first half of the current year, with the exception of June when the World Cup affected viewing time. Looking farther back, the group points out that average viewing time increased from about 13 hours a week in 1960 to the peak reached in 1985. Over at the BBC Peter Menneer, head of broadcasting research, comes up with some more precise figures. These suggest that the average weekly viewing time for the terrestrial TV channels in 1989 was 24 hours and 44 minutes. To this must be added 37 minutes for satellite TV and an estimated 68 minutes for time-shifted viewing using a VCR, giving a total of 25 hours, 53 minutes. According to the BBC this compares with 25 hours, 54 minutes in 1986. The BBC is to introduce an improved audience measurement system next year to assess VCR usage, i.e. whether rented videos or recorded programmes are being watched, and the extent of satellite TV viewing. For the present the BBC's research suggests that total viewing time is static, varying within the total as further options for viewers are added.

A total viewing time of around 26 hours a week has always been a bit of a surprise to this observer. Over a seventh of the total hours available! Take off the hours for sleeping, eating and other essential activities, then working and travelling time, and it gets to look as though viewers' eyes seldom stray from the box. Then again these are average figures. There are many who seldom watch, so that the viewing time of those who do is proportionally greater. There's a difference however between viewing and having the TV set switched on, and one suspects that these research figures tend to relate to the latter rather than the former.

It's interesting that the slight decline in viewing hours detected by some researchers occurred during a period of increasing affluence for most people. This suggests that when people have more to spend they go out more and thus spend less time in front of the box. What small amount of research I've been able to do suggests that people get plain fed up with TV after a time! These factors tend to suggest that though average viewing time is extensive commitment to the box is not so firm. Do people watch more when financially strapped? This would appear to be the case from some of the research quoted above. The Henley Centre for example points out that watching TV costs around 6p per hour compared to 30p an hour for gardening and listening to hi-fi, £1·60 an hour for social drinking and £4·50 for eating out. It further found that the more affluent social groups spent just under 18 hours a week watching TV in 1988 whilst the least well off spent almost 32 hours. Age is another significant factor. According to Henley those over 65 spent more than twice the amount of time watching TV as those in the 16-24 age group.

If there has indeed been a decline in viewing, satellite TV has come at a difficult time. Could it perhaps be adding to the trend away from viewing, i.e. could more TV mean less watching? Steven Barnett presents some reasons to suggest that this could be the case. He points out that the "conventional wisdom" says that TV viewing in the UK was held back by lack of choice: increase the supply and people will watch more. Some evidence he presents suggests that the opposite is the case however, that channel proliferation breaks viewing habits. The sudden availability of "a surge" of unfamiliar programmes overwhelms the viewer who "resorts to avoidance". The effect of the advent of Channel 4 in 1982 is quoted as confirmation of this view: the 2,000 hours a year of programmes that were added by Channel 4 led to an average fall in total viewing of ten minutes a week in 1983. Viewing in homes with satellite TV on the other hand has been found to be higher than average, though not as high as some had expected. But it has to be said that the signs here are hard to read: the novelty factor and socio-economic considerations make it difficult to form definite conclusions at the present time.

In short, though there does appear to have been a decline in viewing it has so far been too small to be of any significance. It could easily vary one way or the other as a result of the various factors mentioned above. But it does mean that the additional providers of programmes are going to have a hard time obtaining market share. The satellite broadcasters have tackled this by buying up film rights, though the films are in practice usually available in cassette form first. The prospects for Channel 5 look decidedly dim at present.

COVER PHOTO

This month's cover photograph shows the Ferguson TX98 chassis. See article on pages 26-9.

Letters

THAT VCR SMPS – A REPLY

G.R. Darby was very kind (letter, September) about my article on the switch-mode power supply used in the Ferguson FV30, but I feel that some sort of reply is needed to the points he raised. He's right in saying that although a SMPS is more efficient the overall saving is in reality very small. There's a school of thought however that considers electronics to be cheaper in comparison with large lumps of iron surrounded by many metres of copper wire, though I must confess my ignorance of the costs in this respect. Certainly when a chopper power supply goes wrong it's as expensive to restore to normal working as it would be to buy a new mains transformer! Even the Ferguson FV33H, which is a JVC-built machine, has a SMPS. A recent look as the new FV40 range however reveals a welcome return to a mains transformer, bridge rectifier and static regulator. Maybe my crystal ball is in need of attention. . .

I've investigated the safety aspect of the power supplies used in the FV30, FV31 and FV32 quite extensively and cannot find any reason for anxiety about leaving them switched on – in fact they could be slightly safer than a transformer-fed supply. Should an electrical overload cause a mains transformer to heat up its mass can store an amazing amount of heat, and it takes a long time to cool down.

Next to the question of satellite TV reception at v.h.f. Experience with the Pace receiver used by Alba, Bush and Ferguson shows that the phase-locked loop f.m. demodulator operates at around 480MHz. Radiation from it can be picked up by a u.h.f. set tuned to ch. 22. Could it be that other makes of satellite TV receiver use PLL demodulators that operate at lower frequencies, say in the v.h.f. range?

Finally the correspondence about shoddy sets. It seems to me that if the Great British public was willing to pay a fair price for its sets instead of continually forcing prices down by favouring the lowest-priced ones manufacturers could afford to build decent sets. The race to add extra new features that no one uses twice is crazy. One day I'm going to build a set with rotary knob controls, a Yaxley switch to select the channels and a wooden cabinet with a decent speaker – also a stand that doesn't take 45 minutes and three broken fingers to put together, only to look like a Salvador Dali nightmare when it's complete!

J. LeJeune,
Ravenshead, Nottingham.

SONY WIREWOUNDS AND SWITCHES

There was mention of the wirewound resistors in the KV2090/2/6 series of TV sets in your August and September issues. As Nick Beer stated, we do recommend that the wirewound resistors on board B are routinely resoldered using high melting point solder. This should be done as a precautionary measure whenever one of these sets is received for service. Nick Beer is also correct in saying that this procedure was incorporated into the power switch recall modification, but in addition we issued a service bulletin in September 1987 concerning the stand-off resistors. Sony Consumer Products Service operates in conjunction with its trade account holders, so those without accounts will obviously not have received this resistor service information.

The service information relating to these resistors is as follows. In all models the resistors concerned have the same circuit reference numbers which are R601, R621, R622, R637 and R640. High-temperature solder must be used. Employ a high-wattage iron to ensure that the solder melts completely, otherwise dry-joints may be formed. The centre pins of each resistor must be thoroughly desoldered before resoldering.

On the subject of the switch modification programme, if you know of or receive any TV sets in the list below that have not had their switches changed to the ALPS type contact the Sony Special Operations Department at Thatcham, on 0635 69500. On receipt of the set's model and serial number, the customer's name and address and your Sony account number a switch kit will be sent to you together with a special warranty claim form. Note that this applies only to Sony account holders. The switch parts kits are not available via the usual ordering system and are not available to non-account holders. Under no circumstances should a non-ALPS switch be fitted to any of the listed models or a model where an ALPS switch was fitted originally as this could compromise the safety of the set. Here's the switch modification models list:

KV2090UB	KV21XRL	KV27XRU
KV2092UB	KV2215UB	KV27XRTU
KV2092EI	KV2215EI	KV2752UB*
KV2096UB	KV2217UB	KV2756UB*
KV21XRU	KV2252UB*	KV2762UB*
KV21XRTU	KV2256UB*	KV2766UB*

*RX models only: they can be identified by the RX sticker on the rear cover and a seven-digit serial number.

D. Meyer, Technical Support Manager,
Sony Consumer Products Company UK,
Thatcham, Newbury, Berks RG13 4LZ.

RECORDING SECAM

In his TX9 SECAM modification article (August) Richard Edeson mentioned video recording. Very few VCRs will record SECAM properly without modification. With the colour/auto switch in the colour position they will record SECAM but, as Richard Edeson noted, there will be red and blue flashes all over the picture. All VHS machines are designed to be able to record SECAM with simple modification however. Machines sold in Germany, the Middle East and sometimes in the rest of Europe have this modification as standard. It consists of disabling the colour killer, introducing bell and anti-bell filters, stopping the chroma phase rotation on record and playback and switching out the two-line delay on playback. This is all achieved by taking a line high or low depending on the machine and connecting switching diodes or transistors between this line and the relevant circuits. An external switch can be used to take the line high/low, but there's usually an automatic SECAM detector.

The SECAM detector works by gating out the line-rate ident signal, using burst gate pulses, and applying it to a ceramic filter that resonates at close to one of the SECAM carriers (4.25MHz or 4.41MHz). On early JVC machines a 4.5MHz US sound ceramic filter was used. When a SECAM signal is present this filter resonates on every other line. An envelope detector is used to apply this filter's output to a 7.8kHz tuned circuit whose output is rectified, filtered and amplified to form the signal on the "SECAM high" line. In modern machines this is all done in a chip, but early machines (JVC HR3300 etc.) used discrete components.

To modify a UK machine all that's usually necessary is to solder the components required into the vacant holes in the board. If you can't get the SECAM detector chip, fit a manual switch and perhaps an LED to remind you to switch back to PAL afterwards – otherwise you'll have non-standard PAL recordings. The difference between a modified and a non-modified machine makes it well worth the effort. Details can usually be found in a service manual by comparing the differences between UK and German models. Not Ferguson manuals however – it's necessary to use the JVC equivalent. I've found that some Fisher, Blaupunkt, Olympus and NordMende UK machines already have the SECAM circuitry. The Akai VS2 has a third (SECAM) position which is mechanically stopped on its colour/auto switch: removing the stop works well.

Also note that this is not the VHS SECAM standard. It's provided for the convenience of people who live in dual-standard areas and is now usually called MESECAM (Mid-Europe SECAM or Middle East SECAM). Machines specifically intended for SECAM use are completely different and their tapes will play only in monochrome on modified PAL machines using the MESECAM system and vice versa.

Several Betamax machines I've tried will record SECAM only in monochrome. An exception is the Sony SLC7, which produces the red and blue flashing problem. Unfortunately Beta manuals don't give details of German versions that do have SECAM circuitry.

Gareth Foster,
Whitton, Middx.

VINTAGE RADIO

I have been following the recent correspondence relating to the Bush DAC90A with great interest since this set, its predecessor the DAC90 and associated models such as the DAC10 are great favourites in the vintage radio world. True enthusiasts do of course try to keep their sets as close as possible to the original, which is the main reason why I've disagreed in the past with Dave Porter – bless his little cotton socks – over his suggestion that the UL84 should be used in place of the UL41, especially as the Mazda 10P13 is virtually a plug-in replacement calling for only minor component value changes. This makes it easy to return to the correct valve when one comes to hand. This subject was included in an in-depth study of the DAC90 and the DAC90A in issue 22 of *The Radiophile*, which is available as a back number for £1·95 (UK and Eire) including postage – overseas £2·75 by surface mail. We can also supply copies of the full service manual for £5 plus postage or just the circuit for £1 including postage, also 10P13 valves.

I must take issue with Geoff Davies over changing so many components as a matter of course. It takes only minutes to check the few capacitors in the DAC90 likely, but not at all certain, to be the cause of trouble. It's surely more satisfying to discover any that are faulty than to scrap them all, good or bad. The usual certain candidate for replacement is the coupling capacitor between the anode of the UBC41 and the grid of the UL41, while the capacitor across the mains input is best left out altogether unless modulation hum is apparent. The various

next month in TELEVISION

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● SERVICING THE MITSUBISHI CT2227
John Coombes reports on the faults you could encounter with this popular 22in. colour TV set.

● EQUIPMENT REVIEW: SIGNAL GENERATOR FOR S-VHS EQUIPMENT
Running a specialised service department, which is essential for some of today's more complex consumer electronics equipment, naturally calls for specialised test equipment. It can be expensive, so great care is required over its selection. Steve Beeching found that he needed a signal generator for dealing with S-VHS equipment. The answer was the Leader 430P, which provides sweep and multiburst signals and colour patterns.

● INTERCONNECTING VIDEO EQUIPMENT
Mutual interaction has always been a problem when various signal sources are connected to a TV set acting as a monitor. The problem has become even worse now that two satellite TV receivers are in many homes connected to the main TV set. James Slater of the IBA reports on the problem and preferred methods of interconnection.

● LATEST CD FORMATS
The basic CD formats were described in our April issue. R and D work continues apace however, particularly on recordable/erasable discs. George Cole reports on the latest developments.

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decoupling capacitors, h.t. and a.g.c., are best checked by disconnecting their earthy ends and using a meter to check how much current flows through them. You may be surprised how well some of them have lasted! Likewise I can see no reason to replace high-value, or indeed any, resistors unless they can be proved to have gone well off value. My experience of servicing these sets goes back to the late Forties, and I agree with Geoff that they have proved to be very durable – so why not leave well alone?! This goes for the valves as well! Neither should it be necessary to modify the smoothing if the existing capacitors are in good order. The most common cause of obtrusive hum in the DAC90A is an internal short in the UL41. By the way the UL46 is also a pentode and is virtually identical apart from the fact that its construction was refined to give it anti-microphonic qualities so that it could be used as a video amplifier in 405-line TV receivers. Certain Philips sets used two UL41s (field and sound output) and a UL46 in the video stage, and were therefore a useful source of spares for the DAC90A!

I hate to keep having to cross swords with Geoff, but in forty odd years of servicing I can't ever remember having come across a case of an output transformer going primary-to-secondary short-circuit. By definition the insulation between the windings has to be good since the primary carries h.t. and in many sets one side of the secondary is connected to chassis. Honestly, there's no reason to start worrying about checking the insulation! While it's laudible to consider the possibility of the loudspeaker grill becoming live, the number of accidents caused by radio sets is negligible. The only advisable precaution to take against shocks from a.c./d.c. or other mains-connected chassis receivers is to make sure that the mains lead is wired correctly into the power plug – by checking that there is zero or a very small resistance between the neutral pin and chassis and a fairly high resistance between the live pin and chassis. In the DAC90/90A the situation is complicated by the mains supply entering the set via a two-pin male/female connector. The answer here is to mark the connector clearly as to the correct fitting and to warn the customer not to alter it. There must have been millions of a.c./d.c. radio sets in use around 1950, just before TV took off, and I can assure Geoff that customers were not dying like flies from electric shocks. In fact the one accident that I can remember was so unusual and so well reported in the trade press that no engineer could have been unaware of its cause – a very bad bit of work on the part of an unskilled dabbler who had used too long a screw to secure a chassis and thus rendered exposed metalwork live. Obviously this same individual hadn't checked the mains polarity when installing the set.

Could I just remind vintage radio enthusiasts that *The Radiophile* is written especially for them (of course you can Chas! It's a damn good read – *Ed*.). It costs just £10 for six issues (UK and Eire), £15 overseas by surface mail.

Chas E. Miller, Editor, The Radiophile,
Larkhill, Newport Road, Woodseaves, Staffs ST20 0NP.
Telephone 0785 74 696.

HELP WANTED

Some time ago the local Radio and Television Servicing City and Guilds Course here closed down. No comparable Technical College course is currently available. To help several youngsters who wish to enter this field we've obtained suitable premises and a supply of television and radio sets etc., also help from a long-retired ex-TV engineer. Unfortunately we lack technical information – circuit diagrams, textbooks etc., also circuits for test equipment which we need. If any readers have *Television* magazines from 1970 onwards or other information they no longer require it would be of great help to us. Manufacturers seem to be unable to help and without such material the scheme is doomed to failure. Without help these youngsters can look forward only to life on the dole.

Leslie Howard, 30 Dylwyn Street,
Llanelli, Dyfed, South Wales.

Can anyone supply a u.h.f tuner for a Schneider Model STV1500 (CM114RC chassis)? The tuner type is ET-31, part no. 55-10702-6.

D.R. Webster, 44 Mossmill Park, Mosstodloch,
Fochabers, Grampian IV32 7JY.
Telephone 0343 820 924.

Does anyone have or know where I can obtain a line output transformer for an ITT portable fitted with the CVC40 chassis?

K.C.H. Cattell, 119 Dormington Road,
Kingstanding, Birmingham B44 9LE.

Would anyone in this area be willing to provide hands-on training to a pleasant chap with TV/video certificates, in exchange for voluntary labour?

Paul J. Stephenson, 38 Harwood Drive,
Waterthorpe, Sheffield S19 6LD.

Can anyone supply me with the circuit diagram for the Ferguson satellite TV module type SM01? All expenses paid. A photocopy would do.

Keith Parker, 20 Herbert Road,
London N11 2QN.
Telephone 081 889 3779.

Can anyone supply a circuit diagram or service sheet for the Akai VT110 portable VCR – a photocopy would do? Due to the age of the recorder (1976) Rank Audio Visual, the agent, is unable to help. Also does anyone have any spares?

S. Carter, 26 Rawlings Road,
Smethwick, Warley, West Midlands B67 5AA.

Can anyone supply a service manual or circuit diagram for the Heathkit IO-103 oscilloscope? I need to replace some burnt resistors.

C. Hall, 7 Jubilee Road,
Threemilestone, Truro, Cornwall TR3 6BS.

Does anyone know where we can get an M51354AP chip? It's the vision demodulator chip used in a colour TV, Model NE14KQ. We would also like to beg or borrow a user instruction book for the Ferguson 3V31 VCR. This is no longer available.

G.B. Electronics, 171 Leicester Causeway,
Coventry CV1 4HG.
Telephone 0203 525 769.

Does anyone have or know a source of the AN239 vision/sound demodulator chip used in the National Model TC361GM? Alternatively does anyone have a surplus i.f. board, with or without the tuner?

D.J. Hawley, 3 Ashfield Court,
113 The Grove, London W5 3SN.
Telephone 081 567 3672.

Satellite Band Scanner Unit

Denis Mott

Once satellite TV became popular with a large section of the public a proliferation of signal-strength meters to help installers to align the dishes correctly came on the market. After trying one of these meters I came to the conclusion that there must be a better way of seeing what was going on up there. Thus Sat Scan 1 was born. It consisted of an Hitachi tunable i.f. block plus the cribbed video amplifier circuit from a commercial satellite TV receiver. A sawtooth waveform was fed to the tuning line and to the X sweep of an oscilloscope. The video output was fed to the scope's Y input. I tried this scanner with a 1.2m dish equipped with a polar mount to see whether it would assist installers in their work. My conclusions were: (1) that the scope's display wasn't bright enough for outdoor operation, and (2) that two separate units, the scope and scanner, were too many to be carried around on a rooftop. Thus Sat Scan 2, described in this article, was born.

I already had a 5in. TV monitor covering Bands I and III and the u.h.f. channels, with a built-in signal-strength meter. It could also provide a swept spectrum for display on an oscilloscope. The obvious thing to do was to combine the satellite receiver into the monitor and modify the c.r.t. drive to provide a scan display.

The features I considered to be necessary are: (1) normal video and sound operation; (2) spectrum analysis with the c.r.t. doubling as the display; (3) a signal strength meter – relative not calibrated; (4) manual and swept tuning; (5) an LNB polarity switch; (6) variable gain; and (7), included though not essential, a Band I/III/u.h.f. tuner. This article describes how these requirements were met. I don't intend to provide constructional details or a PCB layout as anyone attempting to build a scanner of this type should be able to work out his own way of building the unit or modifying an existing piece of equipment. In this article we'll consider the circuitry required and the way in which various items were integrated to form the unit.

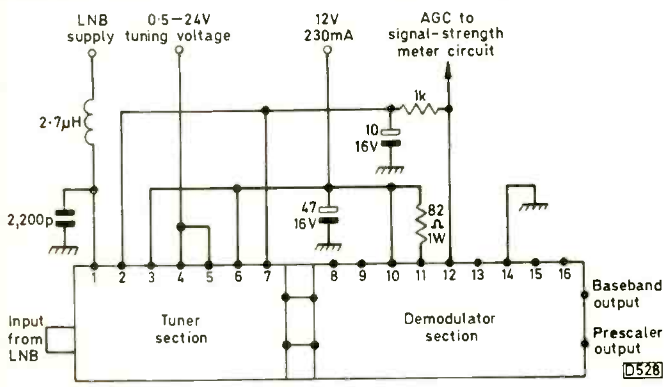


Fig. 1: Connections to the Hitachi BSF561B satellite TV tuner module.

Tuner/IF/Video Sections

The tunable i.f. block I used is an Hitachi type BSF561B, which carries out all down-conversions from 950-1,750MHz to video. It's varicap tuned, has a.g.c., and provides the LNB with its supply and polarity switching voltages. Fig. 1 shows the connections. Modules with similar features are produced by manufacturers such as Alps, Mitsubishi and Astec.

The LNB's i.f. output is fed directly to the F connector on the Hitachi module, which provides a video output with a bandwidth of about 10MHz. The following video amplifier, see Fig. 2, provides amplification, low-pass filtering and dispersal signal removal. It's a straightforward circuit employing eleven transistors of common types. Tr1-Tr7 provide amplification and, in conjunction with the coils, filtering. Tr8-Tr10 and D1 remove the energy dispersal signal. Tr11 is simply an output buffer.

Scan Sweep Generator

The original Sat Scan 1 used an independent 30V sawtooth oscillator that ran at 75Hz. As this version uses the c.r.t. to display the spectrum the sweep voltage must be synchronised with the field scanning. The TV chassis I used is a Network 1202H1. Its field output stage produces a 1V peak-to-peak field scan waveform – see Fig. 3(a). Our requirement however is 2V peak-to-peak, with the bottom of the waveform

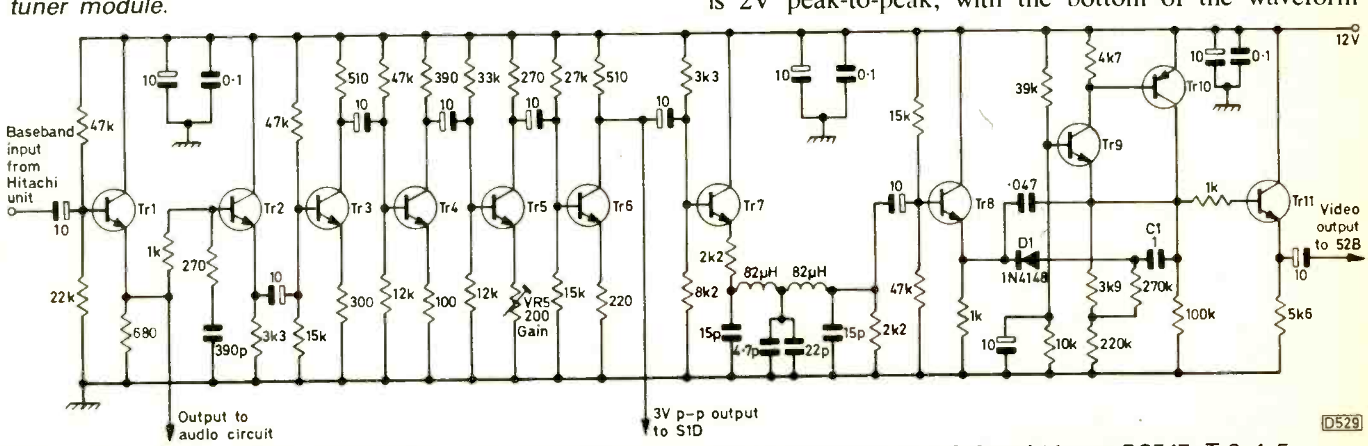


Fig. 2: The video amplifier circuit which was adopted from a commercial unit. Tr1, 2, 7, 8, 9 and 11 type BC547; Tr3, 4, 5, and 6 type ZTX314 or BSX20; Tr10 type BC557. All resistors 5% 0·25W. All capacitors 25V working. Coupling capacitors tantalum bead type, decouplers tubular, C1 polyester, filter capacitors ceramic.

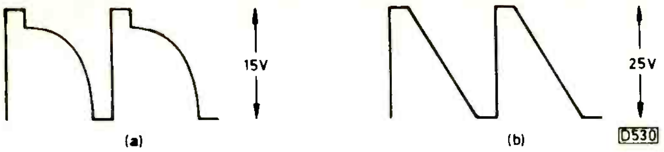


Fig. 3: Sawtooth waveforms, see text.

at 0V d.c. and without a.c. coupling. So half an LM393 operational amplifier chip was arranged to provide a gain of just less than two without inversion. The circuit is included in Fig. 4, which shows the overall arrangement of Sat Scan 2. By using carefully selected components the waveform shown in Fig. 3(b) was obtained. R1 sets the gain while R2, C1 and C2 provide filtering. The output is taken to the tuning line via switch S1C which gives manual/swept tuning selection.

Display System

Several modifications are necessary to enable the basic TV chassis to be used either as a normal TV set or as a scan display. Fig. 5 shows a simplified block diagram of the chassis and the points where connections must be made. The detected terrestrial TV signal must be taken to a selector switch (S2B) then returned to the video preamplifier, buffer or whatever in the set.

In the terrestrial TV mode the video signal is simply looped through via S2B and S1B, as shown in Fig. 4. For normal satellite TV reception the 1V peak-peak video output from the video amplifier passes to the main PCB via S2B and S1B while the audio output is switched to the main PCB via S2A.

The arrangement used in the scan mode is rather different. A 3V peak-peak unfiltered output from the video amplifier is fed via S1D and a 1µF coupling capacitor to the non-inverting input of the other half of the LM393 operational amplifier chip. This operational amplifier is used as a voltage comparator. The d.c. levels at the two inputs are set by VR1 and VR2. A 2V peak-peak line-frequency sawtooth is fed to the inverting input via a 47nF coupling capacitor. With the main chassis used here the line-frequency sawtooth was obtained from pin 11 of the sync/timebase generator chip IC601.

If a steady voltage is fed to the amplifier's non-inverting input and a sawtooth is fed to its inverting input the output will remain high until the ramp input voltage exceeds the other input. The output will then go low. Since the ramp is at line rate a bright-up line will be seen until the ramp voltage exceeds the video input voltage, the length of the bright-up depending on the amplitude of the video signal. The vertical position of the bright-up line depends on the point where the signal is along the tuning sweep sawtooth. The top of the display represents 1,750MHz and the bottom 950MHz. Presets VR1 and VR2 are adjusted so that with a known signal, e.g. one from Astra, and the video gain control set at approximately midway the line bright-up covers approximately 75 per cent of the screen's width.

There's one difficulty with this arrangement. The signal fed to the set's video amplifier also drives the sync separator. As the scan-mode signal has no

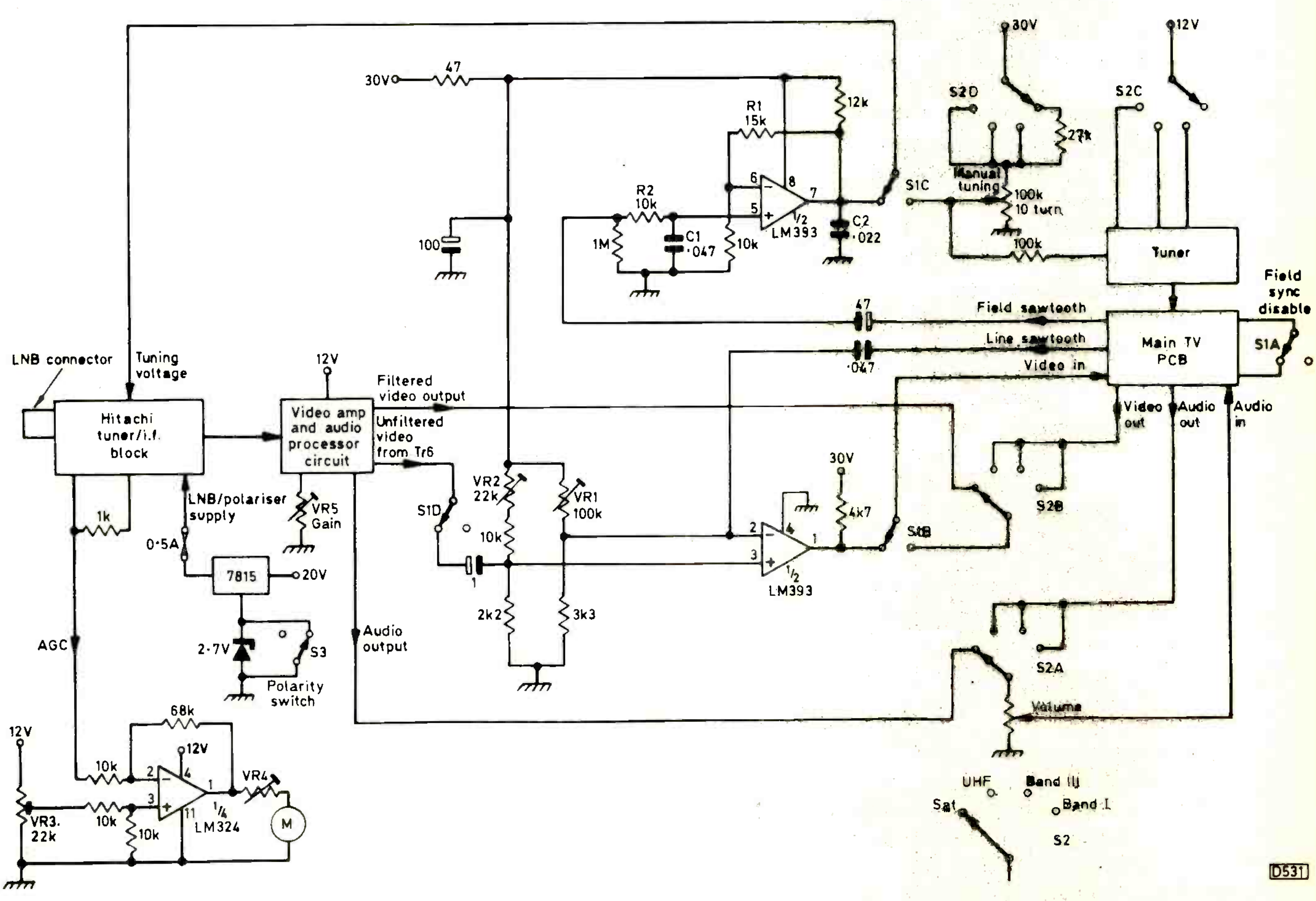


Fig. 4: The main frame circuits and the interconnections between the various items that comprise Sat Scan 2. S1 is a 4-pole 2-way switch, S2 a 4-pole 4-way switch and S3 a 1-pole single-throw switch.

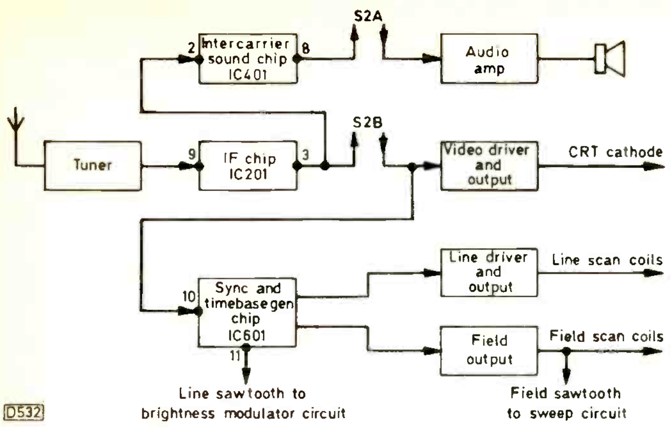


Fig. 5: Simplified block diagram of the TV chassis used, showing the interconnections required.

defined sync pulses the operation of the field oscillator becomes erratic. This means that the tuning sweep will also be erratic. A way out of this is to disable the field sync in the scan mode and let the field oscillator run free. This tends to result in a slight display wobble. Bringing the field hold control out to the front panel enables you to stablise the display. In the normal TV mode the sync pulse feed is restored and slight adjustment of the field hold control will stop the picture rolling.

Signal Strength Meter

The a.g.c. output from the Hitachi tunable i.f. block is directly proportional to the input from the LNB. This a.g.c. voltage is accessible but it swings from 3V with no signal to 1.7V with a large signal. The problem is how to offset the no-signal standing voltage and ensure that the moving-coil signal-strength meter produces the required movement as the signal level is increased. Once more the use of an operational amplifier provides a solution, this time one section of an LM324 quad operational amplifier chip. It's connected as a differential input amplifier with unbalanced gain. The non-inverting input is fed with a preset voltage tapped from VR3 to back-off the standing no-signal a.g.c. voltage. The inverting input is fed with the a.g.c. voltage: as the input falls, the output voltage will rise. VR4 controls the meter's f.s.d. Its value depends on the meter used.

The signal-strength meter cannot work in the scan mode but operates very well as a relative indicator with manual tuning. A minor fault with this circuit is a small positive offset on the meter under no-signal conditions. This doesn't detract from the feature's usefulness however.

Audio Circuit

An audio processor – see Fig. 6 – was built on the same board as the video amplifier. I can claim no originality for this circuit since it was borrowed from a commercial design. It works on the PLL principle, with tuning by means of variable d.c. voltage. As I wasn't bothered about other sound channels the tuning was preset. If tuning is required a control could be taken out to the front panel.

Power Requirements

One major problem with the use of a TV chassis as a scan display device is the power requirements. In this case there is the additional problem of supplying power to the Sat Scanner. As a result the final instrument is not light – it weighs in at 12lb (5.5kg). If the instrument is to be used outside, the mains input should be supplied via an isolation transformer or come from an ELCB protected supply. The power requirements are 12V a.c. at 1.5A for the display, and 30V and 20V d.c. for the scanner.

With a Marconi LNB polarity selection is achieved by feeding either 18V or 15V up the coaxial cable. To obtain these two voltages a fixed 15V regulator is used with a 2.7V zener diode in series to earth. The zener diode is shorted out for 15V. With other types of LNB the unit should be used in the 15V mode, but polarity switching will not take place. I didn't bother with additional circuitry to cater for alternative polarisers as the majority of LNBs encountered are of the Marconi type. Additional outputs for other polarisers could be added if required.

In Conclusion

Sat Scan 2 has been used on the rooftops any number of times. It makes child's play of finding Astra or any of the other observable satellites. I've tried my 80cm dish and Marconi LNB with various low-power birds. Although some sparklies are visible alignment is simplicity itself: use the scan mode to find the bird then the signal-strength meter to tweek for maximum smoke!

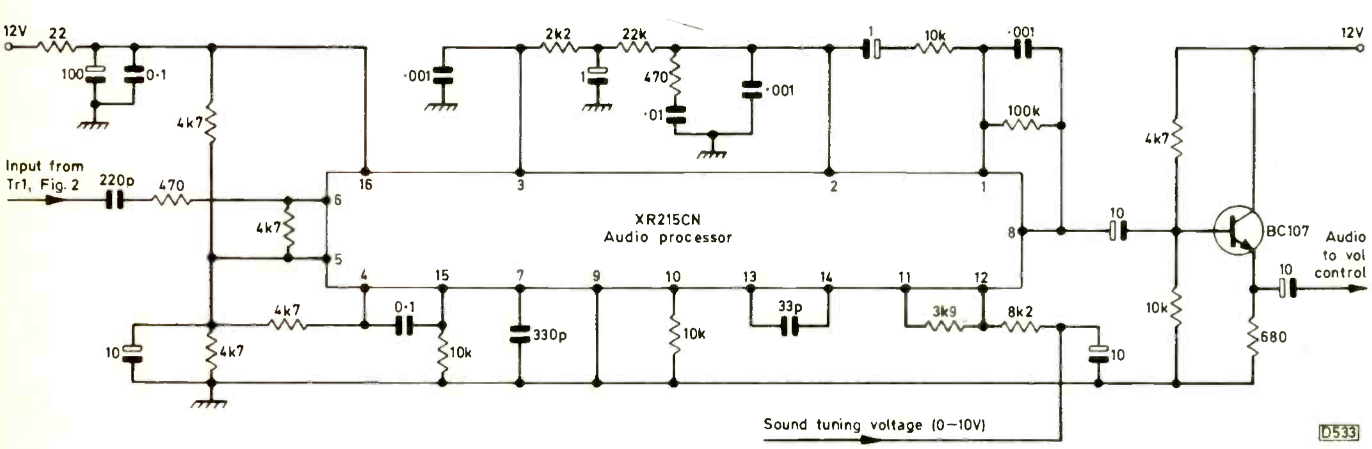


Fig. 6: The sound circuit. Agents for the chip are Microlog Ltd., The Cornerstone, The Broadway, Woking, Surrey.

Teletopics

MATSUSHITA'S SOFTWARE MOVE

Matsushita Electric Industrial, better known to the trade and public through its Panasonic and Technics brand names, has held talks with Music Corporation of America (MCA) over a possible takeover offer. MCA owns Universal Pictures, which has a library of some 3,000 film titles including ET, Jaws and Back to the Future and is a leading TV producer. MCA owns a variety of other US entertainment assets including major record labels. It's considered that Matsushita would have to pay some $7bn (£3·7bn) to buy out the existing shareholders. As Matsushita is reputed to have a cash pile of about £5bn however this should be no great problem. Matsushita would be following the example set by Sony, which bought Columbia Pictures for $3·4bn last year and paid $2·5bn for CBS records in 1988. Apart from general corporate expansion, the great advantage to a video/audio manufacturer of owning software houses is that it ensures the availability of programme material for any video/audio systems developed by the manufacturer in the future.

KODAK'S PHOTO CD SYSTEM

Kodak has announced a photographic system called Photo CD that will enable conventionally shot still photographs to be stored on compact discs. It's been developed in conjunction with Philips, using the latter's CD-I system technology. Consumers will be able to have up to a hundred photographs transferred on to a gold-coloured CD which can be played on CD-I players, CD-ROM-XA (compact disc read only memory extended archi tecture) systems and new Photo CD players (which will also be able to play standard audio CDs). Viewers will display their photographs on the domestic TV set. Photo CD discs are expected to cost around £10 each, with the players selling for about £300. Exposed 35mm film would be processed in the normal manner, then scanned, digitised and recorded. A disc could be taken back to the processors for extra films to be recorded until the disc is full. The negatives would remain available for prints. Kodak intends to license the system to other manufacturers with a view to establishing a world wide standard system. Photo CD is expected to be launched in Japan and the USA next year and in Europe the following year.

SATELLITE TV

The UK public appeared to lose interest in satellite TV in August. Only some 31,000 new installations seem to have been carried out, including both Astra and BSB. Maybe it was something to do with the fine weather, or maybe the credit squeeze is responsible. In its first four months of operation about 70,000 BSB receivers were installed. BSB hopes to be available in a million homes by Christmas, including those served by cable. Sky is considering adding an arts channel to its services, to be financed by corporate sponsorship. It could be made available when Astra 1B comes into operation early next year – the present plan is to make three of 1B's sixteen transponders available for English-language channels.

Eutelsat II F1, the first of the new series of medium-power Eutelsat craft, has been successfully placed in orbit at 13°E and is now undergoing tests. In the optimum service area the Superbeam e.i.r.p. is 52dBW while the widebeam has an e.i.r.p. of 45dBW.

BROADCASTING NEWS

An alternative way of organising the proposed Channel 5 service has been suggested by the IBA. Up to now the idea has been to have a single network covering about 70 per cent of the population using 25 transmitters. The alternative would enable local television to be provided in as many as 35 cities and towns. It would require 63 transmitters, provide a coverage of about 60 per cent of the population and delay the start of the service by eighteen months.

Proposals for implementing an improved PAL specification were presented at the International Broadcasting Convention held at Brighton in September. Improvements could include a 16 : 9 aspect ratio. A demonstration is to be held at next year's Berlin Radio Show but it's expected to be at least five years before transmissions could start in Germany.

The Independent Television Commission has decided that the Channel 3 (ITV) franchises to be advertised next January will be for the same areas and times as the present contracts – as now there will be fourteen areas.

Nicam sound has come to Cumbria. The Caldbeck transmitter and its dependent relays (excluding Kendal and its relays where further modifications are required) are now providing the service.

NEW FERGUSON CHASSIS

A new TV chassis, type IKC2 (International Kit Chassis Mark 2), has been announced by Ferguson. The first model to use it will be the 41P3. Like the ICC5 it's a core chassis with provision for plug-in modules to cater for various model specifications. The switch-mode power supply is similar to that in the ICC5 and it also uses the common field/line output transformer arrangement. Of particular interest is a new chip, type TBA8659CN, that acts as a colour decoder with PAL/SECAM/NTSC switching and incorporates the sync and timebase generator circuits. The i.f. chip is mounted on a separate subpanel. We shall be returning to this chassis in a later issue.

PYE RELAUNCH

Philips has relaunched the Pye brand and is to pursue a two-brand strategy in the UK with the Philips brand used for upmarket video/audio products and the Pye brand aimed at the volume sector. Senior Philips Consumer Electronics management will control overall sales and marketing policy and there will be a single sales force. Pye is to be given "a more modern, up-dated look". The new Pye range includes a 21in. model with teletext and an integrated Astra receiver at a suggested price of £550.

CHIPPERY

A new Texas Instruments chip, type CF70088, integrates the DQPSK demodulation and demultiplexing operations in a Nicam decoder. Previously two separate chips had been required. It doesn't incorporate the DA converters. Toshiba is understood to be working on a chip that will incorporate the whole Nicam decoder.

SGS-Thomson has announced a three-chip set for PAL TV receivers – the TDA8212 i.f. section, TDA8214 sync/timebase generator chip and the TDA8216 PAL decoder and video processor. The aim has been simplified design with a 30 per cent reduction in the number of peripheral components required.

Motorola has developed the 68340 microcomputer chip as a central control device for use in CD-I (compact disc interactive) players.

INTERESTED IN BBC NOSTALGIA?

The various articles by Keith Hamer and Garry Smith on test cards and tuning signals published in this magazine over the years have always attracted a lot of interest. The duo have now decided to start their own quarterly *TV Graphics Review*. Each issue of the A5-size magazine will feature graphics of every description and have around twenty pages. For further details write to Keith Hamer at 7 Epping Close, Derby DE3 4HR (telephone 0332 513 399). Keith would particularly like to hear from anyone who has available photographs or tapes containing suitable material.

TV/VIDEO EQUIPMENT NEWS

Panasonic has announced the first TV set, Model TW-25W2A, fitted with the new Alpha-3 chassis. It's a 59cm model with an integrated Astra receiver. There's 88-channel tuning with seven audio presets, two for stereo – audio mode 7 is programmable. The chassis incorporates a newly developed noise-reduction circuit and a black-level expansion circuit that automatically adjusts the contrast. The TW-25W2A has a Nicam decoder, Fastext, on-screen graphics, a stereo amplifier providing 20W per channel, twin scart sockets for composite video and Y/C signals and a further scart socket for a Sky decoder. The suggested price, including a 60cm dish, is £1,099.

Sony has launched two satellite systems, Models SAT03/60 and SAT03/80, the last two digits indicating the dish size (cm). There's also a new Hi-8 camcorder, Model CCD-V700E, which has a 440,000-pixel image sensor and hi-fi stereo sound.

Philips is about to release a new camcorder, Model VKR9550, that acts as both a movie and a stills camera. It has a 700,000-pixel image sensor and uses the S-VHS system. In the still mode the camcoder records sequentially scanned pictures at a rate of 25 per second, thus avoiding a blurred image. In the movie mode the recording is conventional, with 50 interlaced fields a second.

Ferguson has launched a Fastext adaptor, Model VA354, which is compatible with its FV37H, FV43H, FV46T and FV47S VCRs. The FV45X has the adaptor supplied as standard. With the VA354 plugged into a recorder's scart socket and an eight-pin plug the VCR has a Fastext facility with teletext timer programming. An 8mm camcorder, Model F801, is being added to the Ferguson range of camcorders. It's ultra-compact, weighing 980g inclusive. The suggested price is £850.

NEW WIZARD CATALOGUE

The new Wizard 1990-91 trade catalogue is available free of charge to trade customers from Wizard Distributors, Empress Street Works, Empress Street, Manchester M16 9EN (telephone 061 872 5438). It contains details of a wide range of spares and accessories, including some important illustrations, and a section on Schneider for which Wizard is the official distributor of audio/video spares.

Any 250v or so 0.047's?

VCR Clinic

Reports from Philip Blundell, AMIEIE, Eugene Trundle, Alfred Damp, Ed Rowland, John C. Priest, Jim Littler, Jeff Herbert, S. Da Costa, Ian Bowden, Mick Dutton and Nick Beer.

Philips DMP Series Deck

On going from rewind search to playback the take-up spool would sometimes cease to rotate and the machine would then stop. When play is selected the brake magnet normally holds the brakes off, but sometimes the magnet let go and the fault would occur. The cause of the problem was a dry-joint on the brake electromagnet. **P.B.**

Philips VR6290

If you tried to go to stop after this machine had been playing for a few hours it would get stuck in pause and couldn't be restarted, stopped or put into standby. Scope checks around the keyboard processor chip showed that the SDA2 and SCL2 signals changed from blocks of data to continuous signals. Replacing the keyboard module as an initial check made no difference. The SDA2 and SCL2 lines communicate with the tuner, so a new one was fitted. This cured the problem. It seemed an unlikely cause, but fitting the suspect tuner in a working machine took the fault with it. **P.B.**

Philips VR6182

If you have to order a capstan flywheel for later Philips models check whether the tacho head is adjustable from the top of the machine. If so a modified flywheel is needed, part number 4822 535 92909. **P.B.**

Philips VR6760

This machine had the usual jammed rack. So the deck was stripped down and the rack, pinch roller and coupling were replaced. After giving the mechanism a dummy run using a 9V battery we tried the machine out for the first time for real. This showed that the power supply was dead, the cause being the BD436 transistor 7001 which was open-circuit. After replacing this we made another attempt. This time the deck initialised but a burning smell came from the 5V section of the power supply. Someone had replaced the BYV10-20 with a 10V zener diode. As there is normally a 14V squarewave across this diode it was working rather hard. Everything was o.k. when the correct diode had been fitted. **P.B.**

JVC HRD170

If you encounter one of these machines with a channel change fault, be wary! We've now had two in which the channel could not be changed using either the front-panel keys or the remote control unit. Since neither the tuning nor the channel digit display changes you might reasonably suspect the clock/display/key-decoder microcomputer chip on the front panel. Not a bit of it! With both the machines we had in the bug responsible was IC2 on the tuner/i.f. panel. It's type M50440-391SP. **E.T.**

Ferguson 3V41

This camcorder came in with the fault report "no eject". In fact no other function worked: the stop LED would blink then the unit would shut down. On inspection we found that the mode control motor didn't move. Power was being supplied to the motor, which was drawing a heavy current. The problem was that the loading bracket assembly's worm gear was sticking. Normal operation was restored by removing the worm gear and the grease applied to the spindle (similar to the problems you get with the 3V44 etc.), cleaning and applying new grease. **A.D.**

Amstrad VCR4500

The symptoms with this machine were no clock display and no functions, with the function and pause LEDs permanently lit. Voltage checks around the power supply revealed that the A/T 12V rail at pin 1 (red lead) of plug CL4 was low, the reading being 2.8V. Further investigation brought us to R661 (4.7Ω) which was open-circuit. Fitting a replacement cleared up the trouble. **E.R.**

JVC HRD170

This machine had been to another dealer with the now familiar "intermittent function" fault. In return for a large sum of money a new set of carriage end-sensors had been fitted. This had failed to cure the trouble of course and the machine's owner, being unable to obtain either satisfaction or a refund, brought the machine to us. As usual we found that the small earthing screw on the motor subpanel was loose.

After putting this right we connected the machine to the mains supply and switched on. It immediately went into the fast-forward mode. When a cassette was loaded the machine acted normally. We noticed however that when the tape was ejected the loading motor at the side of the carriage continued to run for a further five seconds. Also the machine went into fast forward every time it was disconnected then reconnected to the mains supply. A quick look at the end sensors showed that the two-pin plug on the left-hand sensor had been left off. Refitting this restored normal operation. **E.R.**

Amstrad VCR6000

The call-out note said "intermittent poor picture and the sound grunts". On playing back a tape in the SP mode it was obvious that the machine was switching randomly between SP and LP. So the tape path was examined and the audio/control head was cleaned and its alignment checked. This didn't clear the fault but I next found that putting the machine into the forward search mode then reverting to play would clear it. After doing this the machine would play normally for several minutes or until stop was pressed. On next pressing play the fault would again be present. I checked the A/C head connections and followed the path back to plug and socket CN-E on the servo board. As this area of the board seemed to be sensitive to pressure some time was spent looking for dry-joints, checking the coupling electrolytics C417 and C419 and bypassing CN-E by wiring a lead direct to the board. As none of this produced a solution the machine was taken back to the workshop.

With the machine on the bench I used a scope to check the CTL pulses from the A/C head right through to pin 25 of IC402. Everything was o.k. The waveforms at TP401 and TP402 were next checked. RF SW (f) at TP401 was o.k. but the CTL pulses (g) at TP402, although of correct amplitude and in the correct phase relationship with RF SW (f), were accompanied by an awful lot of noise on the base line. Checks on the peripheral components in this area (CTL-Amp) of the chip failed to reveal anything amiss so a new 14DN363 servo chip (IC402) was obtained and fitted. Result, a nice clean waveform at TP402 and fault-free performance.

The apparent dry-joint or board sensitivity to pressure had been a red herring, the cause of this being hand-capacitance effects. In fact it was possible to trigger the machine into and out of the fault condition by applying a finger tip or the end of a screwdriver to the can of C419. The resulting massive squarewave that showed momentarily at TP402 booted the LP/SP switching into the opposite mode in the same way that selecting forward search would also clear the fault for short periods.

J.C.P.

Samsung VI611

I came across this machine in a friend's shop. It played all right but wouldn't record off air. The E-E display consisted of a blank raster with a murky bar near the top and the tuning was not precise. I suggested scoping the video detector's output but the scope was broken. So I injected a 39.5MHz signal from a signal generator into the i.f. amplifier. This showed that the i.f. section was all right. The next step was to decouple the various feeds to the tuner. First the a.g.c., then the a.f.c. and finally, using a 22μF capacitor, the tuning voltage at pin 2. This last action restored the picture and sound. When the voltage was traced back to source I found that C4 (47μF, 100V) in the 52V part of the power supply was open-circuit. **J.L.**

Panasonic NV-L20

This machine was dead: after an initial burst at switch-on there was no output from the switch-mode power supply. Diode D1103 on the primary side of the chopper transformer was leaky. **J.H.**

Logic VR950

Playback of prerecorded tapes was normal but as there were no recorded control pulses servo lock was lost with the machine's own recordings. We found that the inverter transistor Q0214 on the main panel PC6 was faulty. **J.H.**

Panasonic NV333

After running for just a split second in the rewind or fast forward mode this machine would stop. Playback was o.k. We thought that the fault was a mechanical one but eventually found that D1003 in the power supply was open-circuit, reducing the relevant voltage to about half. We were surprised by this: since playback was perfect one would have thought that the power supply was o.k. **S.DaC.**

Panasonic NV780/480/850

The problem was no capstan motor rotation. An external 5V supply showed that the motor was all right and we then found that the 5V capstan pulse was missing at pin 38 of the syscon chip IC6001. Replacing this chip failed to resolve the problem which, after much frustration and head-scratching, turned out to be due to the MN1455BVL chip IC7501 on the timer panel. **S.DaC.**

Ferguson FV20

The reported fault was no colour. We found that the machine played back prerecorded tapes all right but it wouldn't record any chroma. As a first step we scoped the down-converted chroma output at pin 5 of IC201. There was only a very small signal here, about 10mV peak-to-peak. This signal is fed to an emitter-follower buffer stage via a low-pass filter, LPF202, so the input to the filter was disconnected to see if the problem was due to excess loading. There was no change in the signal level. All the inputs to the chip were then checked and found to be correct, suggesting that the chip itself was defective. As we had another FV20 in the workshop we borrowed its main converter chip. Still no improvement. After spending some time going round in circles we decided to replace the low-pass filter with the one in the second machine. To our relief a healthy 900mV peak-to-peak chroma signal then appeared at IC201's output pin.

I.B.

Hinari VXL8

This machine's problem was that the capstan wouldn't run. We'd no service information but we had a bit of luck: when we touched the ribbon cable to the capstan PCB the motor started to work. There was no further trouble after stripping this back and resoldering it. **M.D.**

Tatung VRH8490

The main complaint was no play. In addition the sound had been slurred for some time. When a tape was inserted it threaded all right but when play was selected there was a squealing noise and the machine shut down. The cause of the problem was that the pinch roller had seized solid on the shaft. Freeing is enabled the machine to play but we had to fit a replacement to cure the wow on sound. **M.D.**

Panasonic NV-G40

This machine uses the later version of the G mechanism, which is much more reliable. It would refuse to keep a tape in however. The machine would load the tape then begin to lace it but the mechanism didn't click and engage half way through to allow lacing to be completed. An additional point is that the fault was intermittent. Experience of the earlier version suggested that the relay was probably faulty. Sure enough a replacement restored normal operation. The replacements now supplied are like those used in the subsequent L model number machines. **N.B.**

Panasonic NV-L20/L25/L28

This range of machines uses a very slightly improved and modified version of the G deck. Noisy rewind was the complaint with an L20B that came in recently. On test it wasn't noticeably noisy but a slight knocking was just discernible. As it causes the problem in the earlier versions I first replaced the main pulley (VXP0917). This time however the cause was the intermediate gear (VDG0546) which transfers the drive from the centre pulley unit. **N.B.**

Inside the Ferguson TX98 Chassis

J. LeJeune

Having reached the ton with its TX100 chassis Ferguson then went into reverse, producing the TX99 then the TX98. There were no backwards design steps however. The TX98 is quite obviously a UK design: it looks and feels like a Ferguson. It was possibly the first TV chassis to incorporate Fastext in a single chip on the main PCB, along with remote control, on-screen graphics and scart facilities. The chassis does not have stereo sound capability though. But there's full remote control offering armchair tuning of 49 programmes, a snooze facility that puts the receiver into standby after half an hour, quick recall of the last programme selected, auto-switching to standby after ten minutes with no signals present, and automatic line timebase time-constant compensation on all programme selectors through signal recognition.

The 8.5 by 13 inch chassis is nicely laid out – see our front cover photograph. Components and links are marked on the top side but not on the copper side. There are two smaller PCBs, one for the c.r.t. base, with the RGB output stages on it, and the other for the front panel controls and LED displays.

Block Diagram

Much of the circuitry will be familiar to those who handle Ferguson sets. Basic items such as the power supply, the line and field output stages, the TDA4505 signals processor (i.f. strip plus sync circuits and the timebase generators) and the TDA3301B colour decoder are the same as those in the TX99 chassis, which was described in the August 1988 issue of *Television*. Fig. 1 shows a block diagram of the TX98. The shunt-mode chopper power supply uses a TDA4600-2 control chip and a TIPL761A chopper transistor, and provides mains isolation. Its start-up thyristor circuit is straight out of the TX100. The field output stage is also familiar, coming from the TX90 via the TX99. The line driver and output stages also come from the TX99: they are simple and economical and have proved to be very reliable.

Control System

There have been two models fitted with the TX98 chassis to date, the 36K3 and the 51P7. I had the larger screen model for review and found that it contained another old friend, the SC4 tuner. As in the TX99, this is followed by a single-transistor i.f. preamplifier stage, a SAW filter and then the TDA4505 chip. The differences from the TX99 in this area relate to the tuning system. In this version of the SC4 the local oscillator signal is available at pin 8, which in previous versions was a 12V input. The output at pin 8 is coupled to an SP4633 prescaler chip IC19 whose division ratio is 64. Fig. 2 provides a simplified block diagram of the frequency-

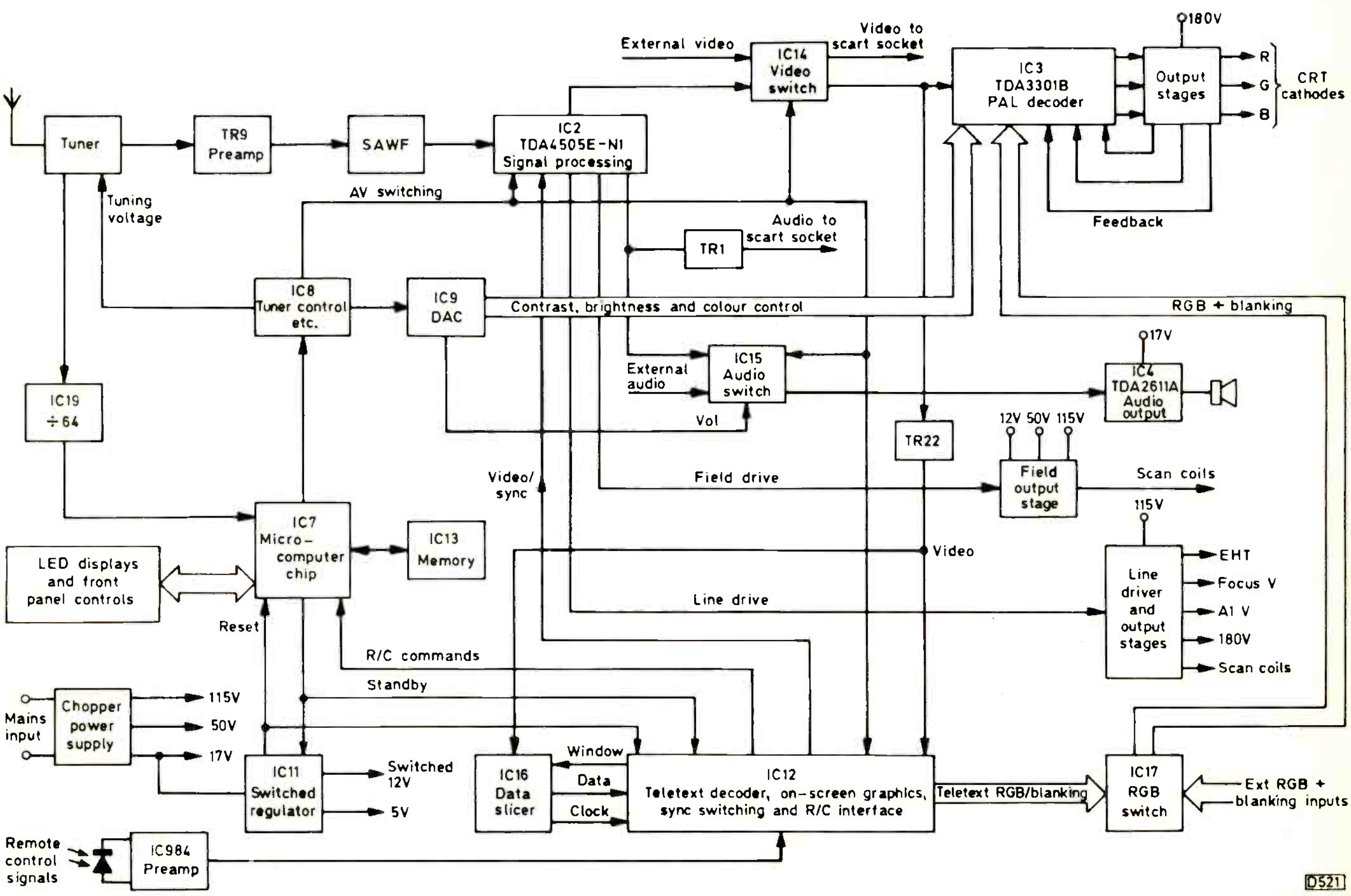


Fig. 1: Block diagram of the Ferguson TX98 chassis.

synthesis tuning system. The output from the prescaler chip enters the 6805T2 microcomputer chip IC7 at pin 11. Commands from the remote control system arrive at pin 2. The programme tuning data, along with normalised analogue control settings, are stored in the SDA2516 non-volatile memory chip IC13. On receipt of a channel change command the relevant data from the memory enters IC7 at pin 25. A phase-locked loop within IC7 produces a control voltage at pin 7. This is fed to the UAA2001 tuner control chip IC8 which produces the tuning voltage at pin 2. After filtering to control the rate-of-change this voltage is applied to pin 5 of the tuner. The tuning voltage supply is obtained from the 115V h.t. line and is stabilised by the 33V zener diode D33.

IC8 also forms part of the analogue control system – for volume, brightness, contrast and colour saturation control. It receives data from IC7 at pin 14 and supplies a data output at pin 4 which is connected to pin 1 of the MC144111 digital-to-analogue converter chip IC9.

The TDA4505 Chip

The TDA4505 chip IC2 provides composite video, audio, field and line drive and tuner a.g.c. outputs. It incorporates an a.f.c. circuit but this feature is left unused as the receiver has a frequency-synthesised tuning system. Its a.g.c. output is inverted by TR10 for application to the tuner. The a.g.c. crossover point is set by RV1, which is normally adjusted for 3.5V at pin 1. It's important that the a.g.c. voltage at pin 2 of the SC4 tuner does not exceed 3.5V – if it does the video will be noisy. The tuner's a.g.c. voltage should lie in the range 2.5-3V, set by RV1.

The composite video plus 6MHz sound output appears at pin 17 of the TDA4505 chip. You can expect 1.75-2V peak-to-peak video at this pin, sitting on a d.c. level of 2.25V. The 6MHz intercarrier sound is filtered out and re-enters IC2 at pin 15, the audio output appearing at pin 12. Its level is fixed by a 3.3kΩ resistor connected to pin 11 since volume control is carried out in the following switching chip IC15.

Signal Switching

The audio and video switching system is shown in Fig. 3 (there's separate switching for the teletext/external RGB signals). Two chips are used for the switching, a TDA5850 (IC14) for the video signals and a TDA8196 (IC15) for the audio signals. They are controlled by the AV output from pin 5 of the tuner control chip IC8.

IC14 receives off-air video at pin 8 and video from pin 20 of the scart socket at pin 4. Its output at pin 5 is filtered to separate the luminance and chrominance signals which are then fed to the TDA3301B colour decoder chip. The output at pin 5 is also fed via emitter-follower TR22 to the teletext decoder/on-screen graphics generator circuitry. Pin 2 provides an output that's taken to pin 19 of the scart socket. The switching control input is at pin 3, which is connected to the AV line via the inverter TR13.

The arrangements around IC15 in the audio channel are somewhat different. Off-air audio enters this chip at pin 2. This feed is also taken to the emitter-follower TR1 whose output is connected to pins 1 and 3 of the scart socket. The audio inputs at pins 2 and 6 of the scart socket are summed and fed to pin 4 of IC15, which receives a d.c. volume control potential from the DA

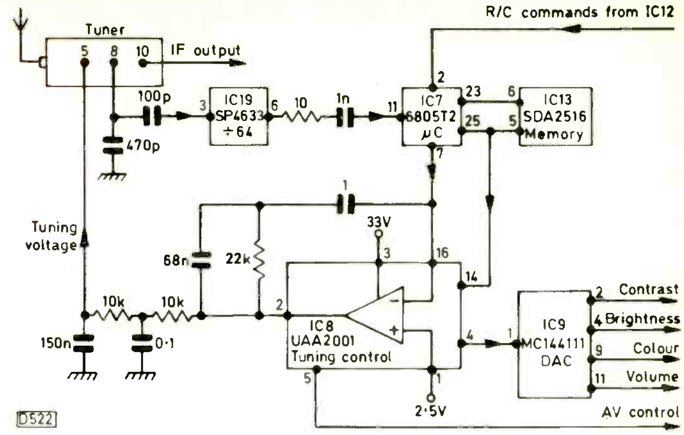


Fig. 2: The tuning and analogue control system.

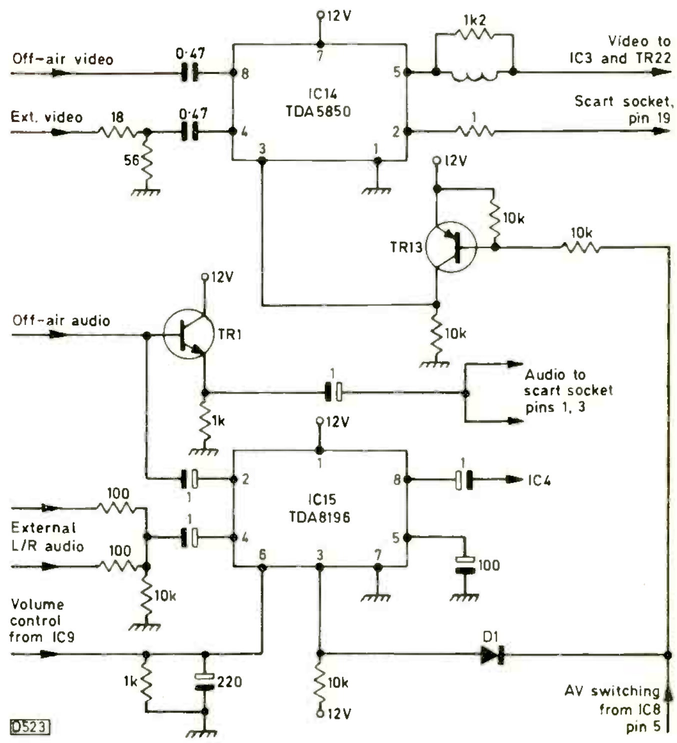


Fig. 3: The video and audio signal switching arrangement.

converter chip IC9 at pin 6. The output to the TDA2611A audio chip IC4 is at pin 8.

When AV is selected the control line takes pin 19 of the TDA4505 chip IC2 low. This input acts on the a.g.c. circuit, muting the i.f. strip so that the off-air sync pulses are deleted. The composite video input is fed via TR22 to a switch in the teletext chip IC12, emerging at pin 2 of this chip from which it's fed back to the sync separator in the TDA4505 chip at pin 25. In the RGB mode the switch in IC12 selects pulses generated within this chip for feeding back to IC2 to synchronise the timebase generators.

The Colour Decoder Chip

A Motorola TDA3301B chip (IC3) is used as the PAL decoder. This chip also provides auto grey-scale tracking, beam limiting and switching between off-air and teletext/external RGB inputs. The component count in this area is low and the arrangement deceptively simple – a remarkable amount of cunning went into the design of this 40-pin chip. The luminance delay line DL14 is a TDK SEL4680: it resembles a thick-film circuit.

There are separate feedback paths from the RGB output stages to IC3 for grey-scale tracking. The chip generates dark-level pulses which are inserted during the field flyback period to enable the "black current" at each gun to be sampled. A switched sampling system within the chip compares the feedback samples with an internal reference. The error voltages produced are stored as clamp voltages on the 10nF capacitors connected to pins 15, 18 and 21. This system operates at only the low-light drive level of course. RV21 and RV23 on the c.r.t. base panel enable the gain of the green and red output stages respectively to be adjusted for correct highlights. Following current practice, the gain of the blue channel is fixed at close to maximum. Black level is set by selecting aux with no input and using the brightness control on the remote control unit to set the highest of the c.r.t.'s cathode voltages at 160V. This should be the "normal" setting.

RGB Output Stages

Fig. 4 shows the red output stage. TR25 is a class A amplifier driving the two emitter-followers TR29 and TR26. Under normal drive conditions TR25 forward biases the base of TR26 via D204, the c.r.t.'s red cathode current flowing via R65, R63 (these two resistors are on the main panel), R212, TR26 and the flashover protection resistor R225. The voltage developed across R65 is thus proportional to the cathode current and is used as the feedback. With a sudden transition to black TR25 is cut off and the c.r.t.'s cathode capacitance is discharged via TR29 and D203.

TR20, TR30 and their associated components are common to all three RGB channels. TR20 is a constant-current source, providing a stable bias for the RGB amplifiers. When the set is first switched on TR30 is cut off and D209 is forward biased by the 12V supply. The current drawn through R65 and R63 develops sufficient voltage to bring the beam limiter system in IC3 into operation, overriding the auto grey-scale circuitry. The conduction of TR30 is controlled by the delay circuit R223/R227/C212. At switch on C212 charges via R223. Once TR30's base voltage rises sufficiently it switches on, reverse biasing D209. D210 provides a discharge path for C212 at switch off. The circuit is included to avoid the viewer seeing a peak-white auto grey-scale line during the heater warm-up period.

Beam Limiting

In addition to providing a sample "black current" feedback voltage R65 also enables the TDA3301B chip to provide beam limiting. When the chip senses that the current in any of the three beams has reached the maximum allowable value the beam limiter system within the chip reduces the drive via the contrast control arrangement. The maximum beam current is set at 3mA by the value of R57.

There's a further beam limiter circuit associated with the e.h.t. system, see Fig. 5. It's a conventional circuit based on a diode that cuts off when the total beam current reaches a certain value. The diode concerned, D27, is forward biased from the 115V h.t. line via R127 and R128. In normal operation the beam current flows via this diode. Should the current reach the excess level the voltage at the junction of R128 and D27 will swing negatively, cutting the diode off. The beam current path is now via R127/8. The negative-going voltage switches on the

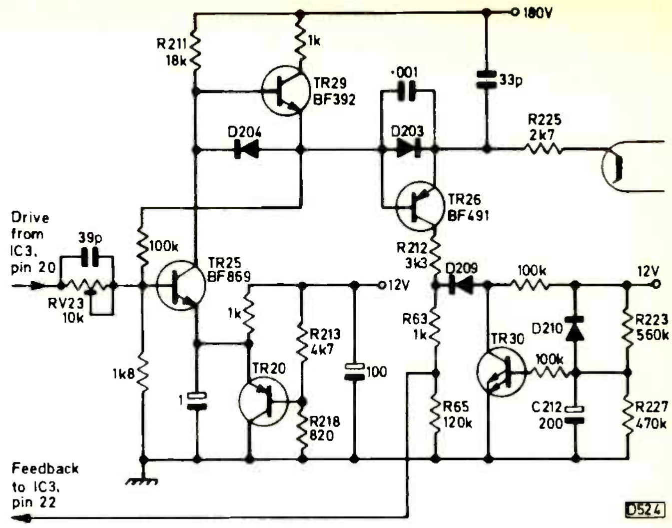


Fig. 4: The red video output stage circuit. The circuitry around stabiliser transistor TR20 and the delay-on transistor TR30 is common to all three RGB output stages.

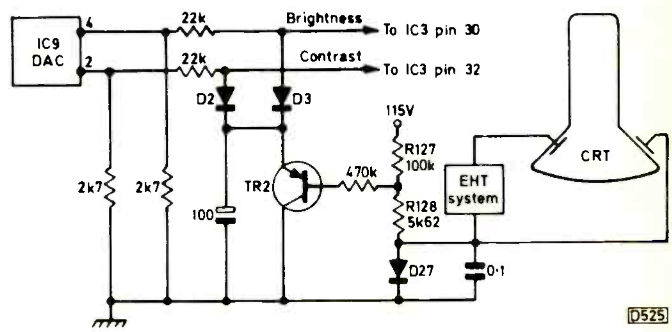


Fig. 5: The static beam limiter circuit.

emitter-follower TR2 so that diodes D2 and D3 also conduct, pulling down the contrast and brightness control voltages to provide static limitation of beam current.

This double-barrelled beam-limiting arrangement is popular in current designs, affording improved c.r.t. protection against excessive dissipation. Along with the stabilised heater voltage this technique helps prolong c.r.t. life, though there's a little sacrifice in terms of picture "punch". It's nowadays commonplace and is preferred to the "leap out and stun you" pictures of the early and mid-eighties.

Alternative CRT Base Panels

There are two c.r.t. base panels, types PC1311-001 and PC1318-002. The only difference between them appears to be the value of the c.r.t. heater dropper resistor R222 which is 3.3Ω on the former panel and 6.8Ω on the latter.

Standby Switching

A simple arrangement is used to give standby operation. The 5V and 12V l.t. supplies are derived from the TBA8138 regulator chip IC11, see Fig. 6. In the standby mode a low from the microcomputer chip is applied to pin 4 of IC11, switching off its 12V output. Since the TDA4505 chip receives its supply from the 12V rail the i.f. system and the timebase generators are cut off. In this condition the chopper circuit continues to operate in a low-power, high-frequency mode, as in the TX99. The maintained 5V supply keeps the microcomputer chip and the remote control system in operation. Otherwise the power supply and the timebase output stages remain as in the TX99.

Remote Control

Signals from the infra-red remote-control handset are detected by a photodiode and then amplified by an SL486 chip, IC984. These components are on the front control panel. The output from IC984 is fed via a remote-control interface circuit in the teletext chip IC12 to the microcomputer chip IC7 where the commands are decoded and routed in the appropriate directions. IC7 also drives the LED displays. The control system consists of IC7, the memory chip IC13, the tuner control chip IC8 and the DA converter chip IC9. Decoded data travels from IC7 to the DAC chip via IC8 which inverts it. IC7's 4MHz clock crystal is connected between pins 4 and 5: the clock signal is also used by IC8 and IC9.

Reset for the microcomputer chip is derived from pin 6 of the 5/12V regulator chip IC11. At power-up this pin goes low for 200msec. During normal operation it sits at 5V while in standby the voltage drops to 4.5V. The reset function selects programme 1 and normalises the user controls.

The reason for passing the remote control data to IC7 via the teletext and graphics processor chip IC12 is that this i.c. checks for text commands. These are not passed on, being diverted to the text/graphics system in the chip. The other commands are passed to IC7.

Teletext

Though the set is described as having a single-chip teletext decoder, the Texas CF70064 teletext decoder chip IC12 works in conjunction with the CF72303 data slicer chip IC16. Video from the switching chip IC14 reaches IC16 via the buffer transistor TR22. Thus teletext signals coming via the scart socket can be decoded. This is useful where a satellite TV receiver is connected to the scart socket. The data slicer chip generates clock, data and sync signals. It has a crystal oscillator that runs at 55.5MHz, eight times the teletext clock frequency: the crystal is connected between pins 11 and 12 – you should see 6V peak-to-peak at pin 12.

The inclusion of nearly all the teletext decoding and display generation circuitry within the 28-pin CF70064 chip is a considerable achievement. This is not a fully-implemented Fastext system however. The coloured buttons do not give instant access to the desired page but, in this version, give one-button selection of the page number. After that the decoder looks for the page in the normal way.

IC12 also provides on-screen graphics which are called up whenever a remote-control command that necessitates their appearance is received. This is organised by the chip's internal logic and is one reason for routing the remote-control commands via this chip. The system timing oscillator runs at 22MHz. It's controlled by the BB531 varicap diode D41 linked to pin 26 – the control voltage comes from pin 28.

RGB Source Switching

The TEA5114A chip IC17, see Fig. 7, provides switching between the RGB and fast blanking signals from the teletext chip and those from the scart socket. Pin 8 (source switching) of the scart socket is not

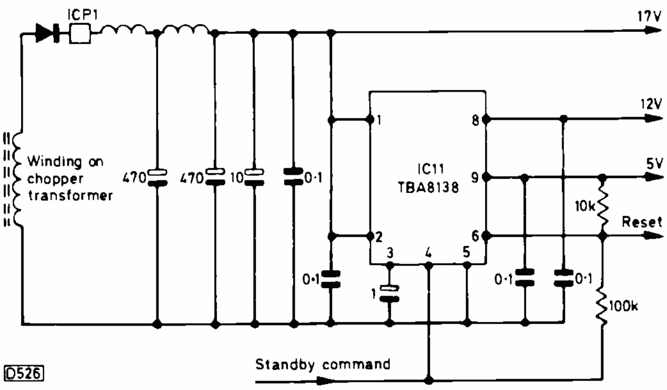


Fig. 6: The l.t. regulator circuit also provides standby switching. In early production a subpanel with separate 5V and 12V regulators was fitted in place of IC11.

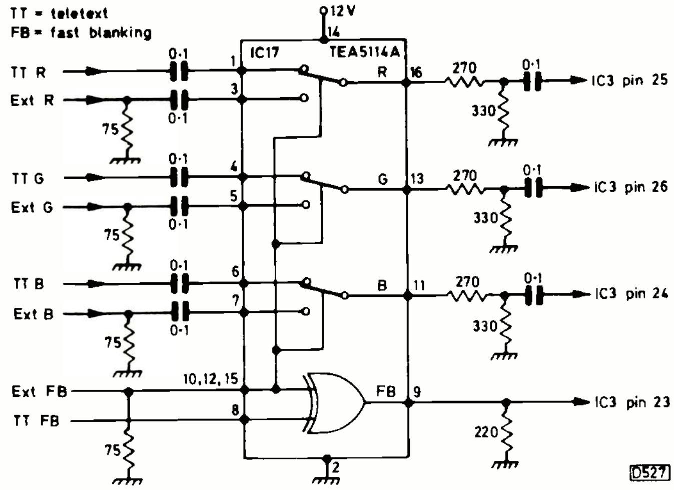


Fig. 7: The RGB source switching chip IC17.

connected. An exclusive-or gate in IC17 selects the fast blanking from either source automatically.

Summary

The TX98 chassis should earn for itself a place in engineers' hearts for its straightforward design, ease of servicing and performance. Much has been crammed into the chassis, yet the layout is uncluttered. The receiver works well with mediocre signals, is light on mains power – it could well work with a battery adaptor if one is ever made available – and offers all the features of an expensive model at a moderate price. As the nine in its chassis number suggests it's designed to drive 90° tubes.

The set should not present any serious challenges to the service engineer. Remember that the sync pulses and the remote control commands pass via the CF70064 teletext chip, points that could lead to confusion. Failure of the BY500-800 h.t. rectifier D17 can cause damage to the following components: the chopper transistor TR3, its TDA4600-2 control chip IC6, the mains bridge rectifier diodes D6-9 and the degausing thermistor Z2 which also acts as the surge limiter. With any faults in this area use only direct Ferguson replacements. There have been one or two minor modifications. R35 has been changed from 1kΩ to 560Ω to overcome loss of colour with high beam current; C74 has been changed from 22nF to 15nF to improve the h.f. response with the smaller-screen model; C40 has been deleted with main board PC1410-006 (Model 36K3) to correct a small h.f. video lift because this model doesn't have scart facilities.

Long-distance Television

Roger Bunney

There was a marked fall in Sporadic E reception during August, with perhaps just two excellent days. Few exotic signals have been seen so far this year, though Simon Hamer in Powys received a system M signal, obviously from North America, on ch. A2 at 1920 BST on the 2nd of August. There's been a lack of signals from Arabic stations, and a look at the reception pattern shows a heavy bias towards signals from Spain/Italy and to a lesser extent from Scandinavia, i.e. a North/South line seems to be favourite at present.

The log for UK SpE reception is as follows:

4/8/90 RTP (Portugal) chs. E2, 3; TVE (Spain) E2, 3; RAI (Italy) IA, B; C+ (Canal Plus, France) L2, 3; +PTT (Switzerland) E2; YLE (Finland) E3; SVT (Sweden) E2, 3, 4; NRK (Norway) E2, 3, 4.
5/8/90 RAI IA, B; TVE E2, 3, 4; +PTT E2, 3; C+ L2, 3; ARD (West Germany) E2, 3; NRK E2.
6/8/90 TVE E3, 4; RAI IA; RTP E2, 3; TVE-2 E2; EPT (Greece) E3; Iran E2.
7/8/90 TVE E2, 3, 4; +PTT E2, 3, 4.
8/8/90 TVE E2, 3, 4; RAI IA; RTP E3; TVP (Poland) R1.
9/8/90 JRT (Yugoslavia) E3, 4; RAI IA, B; RTSH (Albania) IC; TSS (USSR) R1, 2, 3; TVP R1, 2; CST (Czechoslovakia) R1, 2; ARD E2, 3, 4; +PTT E2; ORF (Austria) E2a, 4; C+ L2, 3, 4; RTP E2, 3; TVE E2, 3, 4; TVE-2 E2. An unidentified ch. IA private station was also received.
10/8/90 TVE E2; RTP E3; JRT E4; RAI IA; TSS R1, 2; CST R1, 2; MTV (Hungary) R1, 2; TVP R1.
11/8/90 RAI IA, B; NOS (Holland) E4; TVE E2, 3, 4; C+ L3.
12/8/90 SVT E2, 3, 4; NRK E2, 3; RUV (Iceland) E4; TSS R1, 2, 3; RAI IA, B; TVE E2, 3, 4; C+ L3; JRT E3.
13/8/90 NRK E3; C+ L3.
14/8/90 RAI IA; TVE E2, 3, 4; RTP E3; C+ L4; TSS R2.
15/8/90 TVE E2, 3, 4.
16/8/90 RAI IA, B.
21/8/90 TVP R2; DR (Denmark) E3; NRK E2, 3, 4; SVT E2, 3, 4; RUV E4.
23/8/90 RAI IA, B; JRT E3; TVE E2, 3, 4; C+ L2, 3, 4; CST R1, 2; +PTT E2; RTP E2, 3.
24/8/90 MTV R1; TVP R1, 2, 3; TSS R1, 2, 3; CST R1; RTSH IC; ARD E2; RAI IA, B; ORF E2a 4; +PTT E2, 3, 4; TVE E2, 3, 4; TVE-2 E2; RTP E2, 3; JTV (Jordan) E3.
25/8/90 TVE E2.
27/8/90 SVT E2, 3; RAI IA, B.
28/8/90 +PTT E3; ARD E2; TVE E2.
29/8/90 TVP R1; CST R1; TSS R1; TVE E3.
30/8/90 RAI IA, B; C+ L2; JRT E4; TVP R2.
31/8/90 RAI IA, B; TVE E3; TVP R2; CST R2.

By normal English Summer standards the weather in the UK has been good. As a result tropospheric reception was noted on certain days. On the 4th signals from RTE (Eire) in Band III and at u.h.f. were received in the south west, also similar signals from TVE. There was a lift during the 9-11th with signals from France and the Benelux countries received over much of the UK in Band III and at u.h.f. Signals from TVE in the same bands were received on the 10-11th in the south west. A final tropospheric opening on the 25/26th produced the usual signals in the south east.

There was an excellent auroral event on the 16th, with Band I signals noted in the UK from Finland, the USSR and from other, unidentified sources. A repeat occurred on the 20th, but this time reception was mainly in Scotland. NRK (Norway) was identified. Further auroral activity on the 22nd produced unidentified Scandinavian signals in Band I and RTE signals in ch. B and also in Band III.

Tim Anderson has seen a new Italian private station on ch. IA with the identifications "Ale Italia" and "Canal Otto Video". K. Fellingham of Copnor, The Street, Lawshall, Bury St. Edmonds, Suffolk IP29 4QT would like to hear from any nearby DXers. Roger Fussel in Cornwall has obtained several Rank mono TV chassis that he intends to convert to DX use. He would like to hear from anyone with experience of Rank sets. His address is 55 Peacock Avenue, Torpoint, Cornwall.

The present Solar Cycle is now thought to have passed its peak. The fact that the solar spots are drifting towards the solar equator is thought to confirm this. The peak of the Perseids meteor shower occurred at 1130 GMT on August 13th. Apart from some excellent reflections from Scandinavia the shower didn't produce much activity.

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

News Items

UK: During the coming autumn the BBC is to allow RTE programmes to be transmitted in scrambled form as a pay-TV service during the BBC-TV network downtime, most likely on BBC-2 channels. A modified form of Discret encryption similar to that used for the British Medical TV transmissions will be used. Initially the broadcasts will take place during one night a week. The programmes will be sponsored. Pulses to start a VCR will be included in the encryption so that the programmes can be recorded and watched next day.

Germany: The East German DDR-TV service will join the West German network on October 14th. DDR is currently equipped mainly for SECAM transmissions and a change to PAL is expected. The Rostok region service will join NDR. A third network is to be installed in the Dresden (Sachsen) region, to be part operational by the end of the year. The first transmitters in this network, all operating with PAL, will be Dresden ch. E59, Lobau ch. E56 and Cottbus ch. E57. DFF-1 and DFF-2 in this region are likely to become ARD-1 and ZDF, with the third network transmitting a mixture of West German and DFF material.

Lebanon: Dalibor Frkovic (Yugoslavia) reports that a service called "The Action Channel" is in operation on ch. E3. It uses a logo (earlier thought to be used by an Egyptian service) with three overlapping pyramids. Programmes start at 1230 CET with an identification slide and the Lebanese flag. The transmitter is thought to be co-sited with the "Middle East TV" operation, either in the Lebanon or Cyprus – some of the programmes carry a "recorded by satellite" logo.

Jordan: The Suwaileh (Amman) ch. E3 transmitter now uses two audio subcarriers.

50MHz Amateur Radio: Belgian 50MHz operators are now allowed to operate with both vertical and horizontal polarisation. Swiss amateurs have been heard using the 50MHz band during TV hours, though the agreed times are 2300-0400 till late September then 0000-0500 from October to March. Transmissions during these hours are permitted only when TV and other transmitters near the borders are off-air.

Equipment: The recently introduced Sony GVM1300 13in. multi-scan monitor will detect the parameters of incoming signals and lock to them automatically. The line timebase runs from 15-36kHz and the field timebase from 50-100Hz. Resolution is 600 lines. The US price is quoted as $1,495. European availablity has not so far been announced.

Satellite TV

Kopernikus-2 at 28.5°E began tests on August 10th. The frequencies used initially were 12.52GHz, 12.59GHz and 12.69GHz. Various programme feeds are being carried, plus occasional corporate videoconferencing.

On Astra, Filmnet is carrying out teletext tests on pages 800 plus during weekday daytime periods. The Japanese-language service JS-TV that uses the Lifestyle transponder is said to be achieving high viewing figures. Astra 1C may be operational in 1994, with the possibility of HD-TV transmissions. Sky has indicated that at present it does not envisage HD-TV services in the foreseeable future. A new service "TV Belgrade" should be available across Europe from November 1st.

Ian Waller (Lincoln) tried using his BSB receiver system recently with signals from SF Succe at 27.5°W. He successfully locked video but there was no sound.

The main Jodrell Bank dish has been painted white to reduce surface expansion/contraction which is distorting its 250ft wide surface. Apparently surface movement has been reduced and performance improved. If anyone has some high-gain white paint I could use it!

Motorola has planned a new world-wide communications network that uses low orbiting satellites (at 413 miles above the Earth) operating in the 1-2GHz band. Known as the Iridium Project, it's intended mainly for mobile communications. Two demonstration craft could be in orbit by 1992. Financial backers are being sought.

Signals from a BAE Starbird SNG vehicle in Amman have been seen via Eutelsat at 7°E. Israel has used the old RTL transponder on Eutelsat-1 F4 at 13°E for outgoing feeds used by CCN/CBS.

A new satellite has been noted here at about 16°W, with data downlinking via an 11.4GHz transponder using circular polarisation. No video so far. I've no idea what it is – it's not a Gorizont sidelobe.

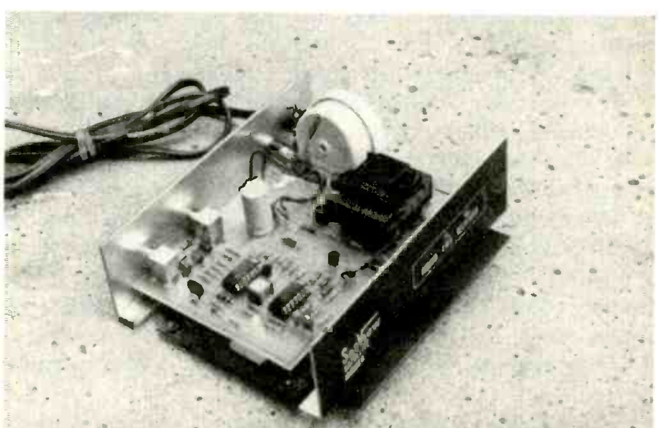
The Sat Minder

From time to time one hears of satellite receiving equipment being stolen. A colleague of mine had his 1.8m spun dish, stand and electronics stolen from a back garden even though the thieves had to scale a 6ft fence. To help with this problem a Bedfordshire company has produced an alarm to protect both internal and external equipment against theft or tampering.

Its small black metal case (5¼ × 6 × 2in.) contains a mains-powered circuit that uses two chips and three transistors mounted on a single-sided PTFE PCB, with input/output connections via chassis-mounted F sockets. The unit is connected in series with the coaxial feeder between the dish and the input socket on the receiver. Ideally the alarm should be fitted midway to be less noticeable. Once installed and activated by the reset switch at the back the unit will emit a very loud 120dBA noise, not unlike an internal fire alarm, if the LNB is disconnected or shorted. The alarm will also sound if the supply from the receiver to the LNB is removed. The unit has three LEDs, one for "armed", the others for "LNB" and "receiver". The "armed" LED lights when power is applied. The others light when the relevant piece of equipment is removed.

Thought has gone into the design, with a cool running mains transformer which is unusual nowadays. Construction is of a high standard. The alarm comes with a 4ft length of twin flex and a plugged F jumper.

I'd consider this to be an essential piece of equipment for anyone who has an expensive satellite receiver system. The cost is £35 plus post (UK) at £2.50, inclusive of VAT. For further details contact Electron Electronics at Unit 14-16, Singer Way, Woburn Road Industrial Estate, Kempston, Bedford MK42 7AE – telephone 0234 841 174.



Internal view of the SatView alarm.

Features of the Sharp VCD-805

Mick Dutton

Sharp's top of the range VCD-805H VCR has some very impressive features. These include digital picture effects such as nine-picture strobe, frame-by-frame advance, picture-in-picture, variable-speed strobe and a nine-channel picture search that enables the user to scan the broadcast band and sample the programmes available. The digital circuitry also provides a superb still-frame picture. Other features include a comprehensive on-screen display, a linear tape counter and index search. Picture quality is excellent in the normal and the trick modes. The machine follows normal Sharp design practice, with everything accessible and the panels laid out logically. Design is up to the minute all round, including a digital servo system.

The sophisticated on-screen display system provides the user with full timer-control information in an easy to understand form. In the absence of a signal it provides a blue screen with the Sharp logo, which doubles as the initial tuning signal.

A data bus links the system control and timer chips along with the servo and digital circuits. The tuning chip is also responsible for the key scan and processing of the remote control information.

The mechanics are new, but appear to be just as solidly built as in previous machines.

Video System

The digital section is contained in a metal can that's mounted above the other electronices. Fig. 1 shows a simplified block diagram. Incoming off-air, playback or external (from the scart socket) video is applied to selection switches and then follows two paths, called main and sub video. The main video signal is buffered and then passed via a switch and amplifier to the r.f. modulator and the scart socket's video output pin. This switch is used to select either the main or the digitally generated signal. It can switch between the two pictures or one picture can be inserted into the other one.

The sub-video path also starts with a buffer, after which the signal is separated into its luminance and chrominance components. A low-pass filter ensures that there are no luminance signal components above 3MHz, to avoid interference with the 10MHz sampling carried out in the following analogue-to-digital converter. The digitised luminance is then fed into two memory chips each of which stores a complete field. A 4.43MHz bandpass filter selects the chroma signals, B – Y and R – Y, which after demodulation are digitised and stored in a single memory chip.

A sync separator extracts the sync pulses which are passed, as write sync, to the memory control chip to lock its write clock. This chip contains most of the digital signal processing. It provides digital chrominance (R – Y and B – Y) and luminance outputs that pass to three separate DA converters. After filtering the analogue signals are fed to the encoder chip where sync from the main signal path is inserted so that both sets of signals are locked.

Let's consider briefly the way in which a digital picture for insertion in the main one is formed, see Fig. 2. Since they are extracted and reinserted later it's not necessary to digitise the sync signals. With a 51.2μsec length of line sampled at 10MHz there will be 512 samples per line. In the vertical direction the top 30 lines and the bottom 9.5 aren't sampled, leaving 273 lines that are digitised. After processing, an insertion signal box that's 17μsec wide and 90 lines high is obtained.

The AD converters are conventional. The luminance input is first clamped then fed to 64-bit comparators whose outputs pass to a 64-to-6 bit encoder. A data latch and buffer feeds the signal in serial form to the memories. The reference voltages for the comparators come from an integrated ladder network fed from internal reference sources, giving a 2.8V reference at the bottom of the ladder for black level and 3.5V at the top.

The chroma AD converter operates on similar principles but in this case the incoming R – Y and B – Y signals are multiplexed at 2.5MHz to provide alternate samples. Clamping is somewhat different since the reference position is mid-point, i.e. no chroma means the half-voltage level. Thus the chroma can swing between positive and negative values. This time the sampling rate is 5MHz, with the output to the memory again in serial form.

The three memory chips, two for luminance information and one for chroma, are identical. They are unusual in having separate inputs and outputs to enable them to be filled at the same time that they are being emptied. This gives perfect transitions between successive digital pictures. Each chip can store 320 lines × 270 columns, and a refresh circuit is built in to ensure that the material doesn't deteriorate with time. The heart of the digital circuitry is the memory control chip, a 100-pin monster. Amongst other things it generates all the timing pulses and the sync signals required.

There are two voltage-controlled oscillators, one for writing information into the memories and the other for reading it out. The write clock is synchronised to the sub-video input. It runs at 10MHz. The 5MHz chroma sampling pulses and 2.5MHz R – Y/B – Y multiplex pulses are derived from it.

The read clock also runs at 10MHz. It generates sync pulses and pulses for reading the information out of the memories, and is locked to the main video line sync pulses. As a result the digital video is synchronised with the main video source, giving noise-and jitter-free transitions.

In the digital pause mode the information coming from the video heads contains considerable noise. As this signal would be unsatisfactory for locking a VCO the VCO is switched off. The 10MHz crystal-controlled oscillator is then used instead.

The memory control chip combines the information from the two luminance stores to provide an output to the luminance DA converter. The chroma signals have to be demultiplexed then sent to separate DA converters. DA conversion is simple. The incoming serial data operates a series of swiches that place, in turn, the 5V supply across different combinations of an internal resistive ladder network. The outputs are buffered then fed through low-pass filters to remove any residual sampling frequency components. For the luminance signal the filtering cuts off signals above 3MHz. With the

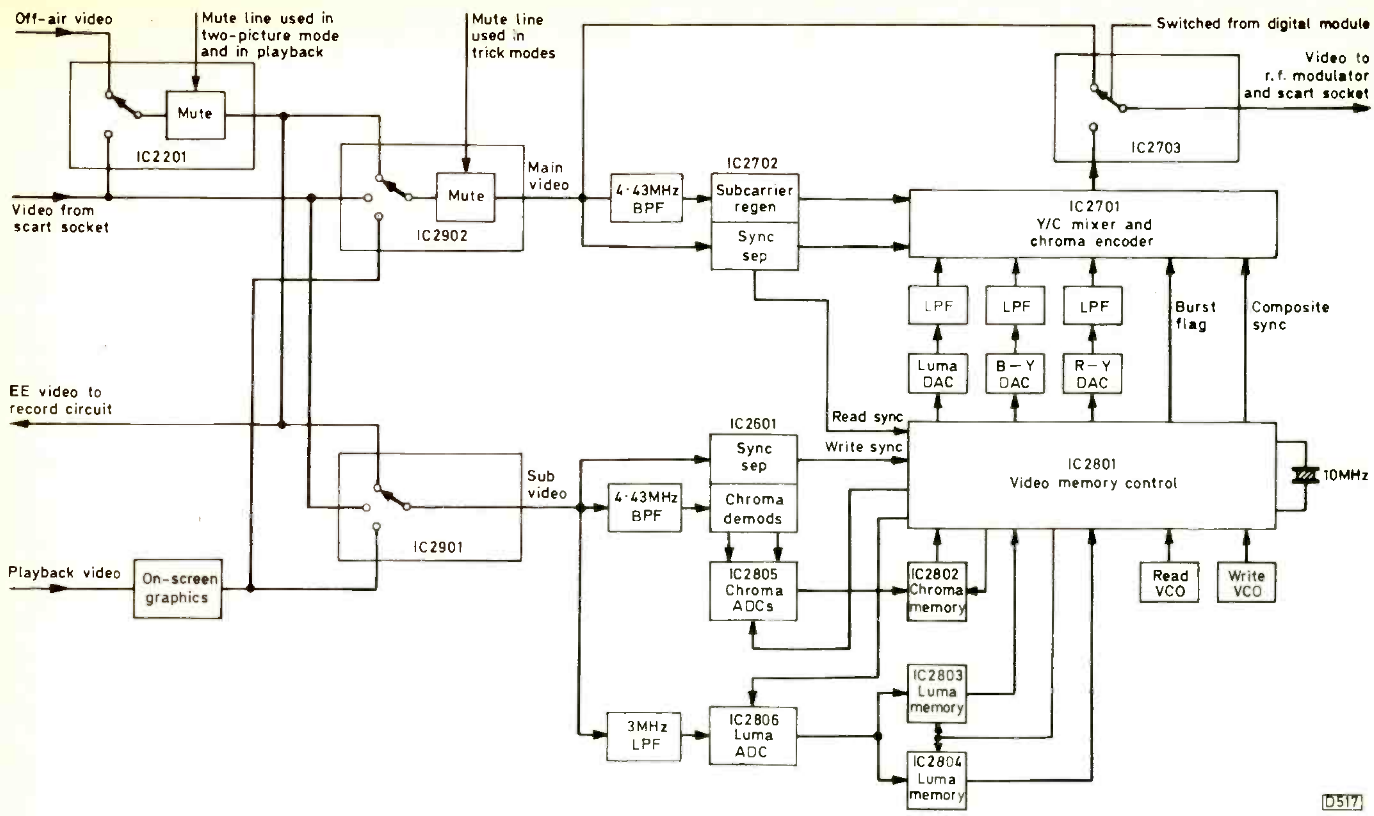


Fig. 1: Simplified block diagram of the digital video processing circuitry.

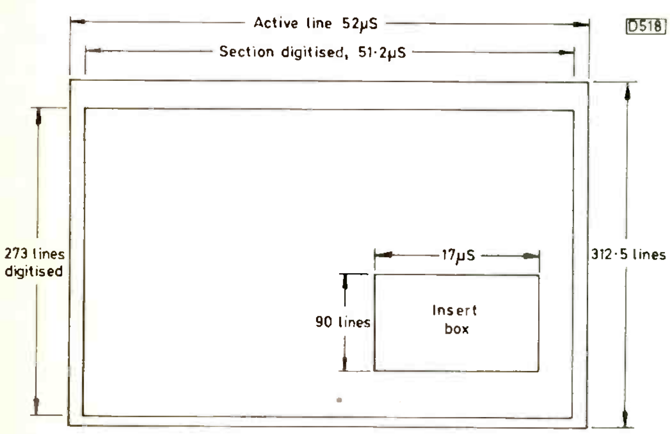


Fig. 2: Sampled area of the picture and the size of the insert box.

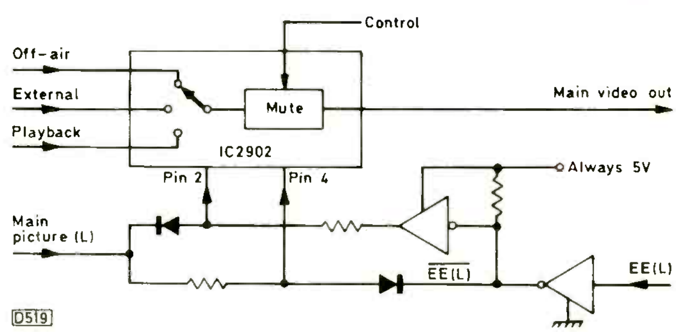


Fig. 3: Main picture selection switching.

Fig. 4: Symbols used to denote digital transistors. (a) NPN type with type number starting DTC. (b) PNP type with type number starting DTA.

chroma signals the cut-off is at 1MHz.

The three signals are finally fed to an encoder chip that produces a composite video output complete with reinserted sync and burst, along with the colour subcarrier.

Video Switching

As its name suggests, the main video provides the main picture. The sub video is digitised to provide effects and picture-in-picture. To reverse the presentation of the two pictures seen in the picture-in-picture mode all video sources have to be switched in both channels. This is done by electronic switches which are controlled by high and low signals on the playback-high and digital-on control lines. Fig. 3 shows the relevant circuitry and Table 1 the logic conditions. It's also necessary to switch the initial input to the machine from off-air to scart sourced, which is also done by the switching chip. Digital transistors – see Fig. 4 – control the switching. An interesting point here is that low is represented by a voltage of less than 0.5V while high is 1.8V or greater.

Servicing should be fairly straightforward, and if previous Sharp models are anything to go by the reliability should be high.

Table 1: Picture selection logic.

Mode	*EE (L)*	*EE (L)*	*Main pic*	*Pin 2*	*Pin 4*
EE or two-picture	L	H	L	L	L
Play or two-picture	H	L	L	L	L
Two-picture reverse (EE sub video)	L	H	H	L	H
Two-picture reverse (play sub video)	H	L	H	H	L

TV Fault Finding

Reports from Eugene Trundle, Nick Beer, Ed Rowland, Jim Littler, Ian Bowden, Stephen Leatherbarrow, Hugh MacMullen and Paul Hardy

Toshiba 222T5B

Teletext faults are rare and the one on this set was really nasty. The symptom was intermittent loss of the text display – sometimes to a blank screen, sometimes to garbled characters. There was no clock feed at pin 18 of the SAA5030 VIP chip, though there was activity at the 6.9MHz tuned circuit connected to pin 21. The culprit turned out to be the decoupling capacitor connected to pin 20 of the SAA5030 chip. It was leaky and "grumbling". Many text sets use this chip, so it's possible that this fault could occur with other sets. **E.T.**

Ferguson SRB1 (BSB Receiver)

As many of you will probably know, there was a batch of faulty ACM modules which cannot be authorised by BSB. They have codes E019 8. . . Apparently the problem was BSB's. The only solution is to return the receiver to the manufacturer for a replacement module to be fitted.

One of our customers had one of the faulty receivers. A replacement also had a problem. The picture disappeared, leaving a blank raster with only the BSB header at the top. After a while this also disappeared. Calling up the installation details showed that a scrambled signal was being received, and the ACM menu confirmed that the receiver was authorised. There was an input to the D-MAC decoder but the output was corrupt as the descrambler chip ID7 was faulty. It's a 68-pin, four-sided flat-pack device, type DMA2285, fitted in a holder. When replacing one of these chips the interesting thing to note is that pin 1 is half way along one side, denoted by the standard indentation pip. **N.B.**

Matsui 2180TT/Saisho FST212T

This set was dead. In these circumstances the first thing to check is the wirewound 5.6Ω resistor R502. You quite often find that it's open-circuit because the STR58041 chip IC501 has failed. This time the resistor was o.k., but we replaced the chip as we've known it to go open-circuit. There were still no results. Further checks with the meter revealed that R516 (1.5Ω) had failed. Replacing this restored normal operation. **E.R.**

Matsui/Saisho Regulators

When dealing with power supply faults in Matsui or Saisho sets that use an STR50103 or STR58401 regulator chip it's advisable to check that only one mica insulator has been fitted to the heatsink. We've had several cases where two insulators have been fitted in this position. In each case the chip either failed completely or intermittently due to the reduced efficiency of the heatsink action. **E.R.**

Network NWC1402R

The original fault with this set was no green in the picture. One of the transistors (Q507) on the c.r.t. base panel was open-circuit. Fitting a replacement restored the missing colour and the set was then left on soak. After about fifteen minutes a high-pitched whistle suddely developed. It took quite a lot of panel probing and flexing before we discovered that the noise was coming from T431. A liberal blob of Araldite applied to the windings provided a cure. **E.R.**

Sanyo CTP6132

C440 (4.7μF) proved to be the cause of field foldover at the top of the picture. If you encounter this problem with one of these sets it's also prudent to change C447 (10μF) as this component can also cause trouble. **E.R.**

Ferguson TX100 Chassis

The customer's complaint was that the sound sometimes disappeared completely, a sharp tap on the cabinet bringing it back. Checks showed that R95 (2.2Ω) was dry-jointed at one end – in fact it had never been soldered. It's surprising that the set had worked for several years without giving trouble. **E.R.**

Hitachi CPT2288DS

Mr. Kokolay is an old friend of ours. He'd bought this set in Germany and taken it to Spain where he works most of the time. When he brought it back to Blighty he found that it didn't work – the set was dead apart from the red on light. On investigation we found that there was no output from the switch-mode power supply because LL04 was open-circuit.It's a substantial coil with 24 s.w.g. wire and it's glued, so I didn't see why it should go open-circuit. I removed it by heating the glue with a soldering iron then took off two turns, cleaned and tinned the ends then soldered the coil back, finally glueing it down again. The set is designed for 225V mains operation but seems happy enough on 240V. I looked for one of those old Luxor or Kuba mains transformers for it but they've long since gone. **J.L.**

Saisho CT1400

The fault with this set was low sound – it was virtually non-existent. We found that R356 (10kΩ, 0.5W) was open-circuit. It was a simple fault but was time consuming with no circuit diagram. **J.L.**

Luxor 17L67 (L2 Chassis)

This set was dead, or to be more correct there was an overload. We soon found that the S2000AF line output transistor TB503 was short-circuit. Note the F in the type number. This indicates that it has an insulated rear side – the S2000A is uninsulated. The efficiency diode DB508 was also short-circuit. After fitting new components we switched the set on. A very loud arcing sound came from the c.r.t. base area and the 120V h.t. supply was low at around 60-70V. The arcing was from the focus lead to a chassis point. As it came from a section of the e.h.t. winding this suggested loss of regulation or some form of runaway, but the h.t. was low instead of high.

The set was quickly switched off, then on again with a scope connected to the line output transistor's collector. The line flyback pulses were over 2kV! No wonder the 1.3kV rated output transistor had failed. We disconnected the scan coils and the collector of the line output transistor then switched on to see whether the h.t. was this time correct. It was still low at around 65V. There was little left in the circuit apart from DB508 which had already been replaced and the flyback tuning capacitor CB507. The later turned out to be open-circuit. As a point of interest we found that the replacement was rated at 1.6kV instead of 1.5kV. **I.B.**

B and O 8902

When this set was first switched on there was a weak raster with snow. There was muted sound but the on-screen graphics were normal. After a few minutes or so a dim picture whose black level varied with the contrast control setting would appear. We soon found that the common supply feeding the regulators on the chroma drive PCB and the tuner/i.f. PCB was low at 12.5V instead of 18.5V. The cause was a cracked and leaking supply reservoir capacitor, C20 (220μF), on the power supply control PCB. **I.B.**

Ferguson TX10 Chassis (Teletext)

This teletext set had been serviced, including tube replacement. On test an apparent text fault occurred: all blue content was missing, but only in the text mode. As a replacement teletext panel was available this was fitted as a check but failed to provide a cure. A scope check then showed that the blue output from the teletext panel reached the TDA3560 colour decoder chip's data insertion pin. When this chip was replaced normal operation was restored. It's the first time that we've experienced this particular problem with a teletext set. **S.L.**

Network NWC1430

This colour portable couldn't be shifted from channel 1 by using the front panel up/down buttons. The μPD1937C chip IC1301 is responsible for this function so our checks centred around it. The supply was present, the external 455kHz oscillator connected to pins 10 and 11 was working correctly and there were normal d.c. level changes at pins 2 and 3 when up/down commands were given. Replacing the chip restored normal operation. **S.L.**

Alba CTV14RS

No sound with field collapse should direct attention to the appropriate supplies as these two stages very often share a common rail. In this particular case the 12V supply derived from the line output transformer was missing. The surge limiter resistor R425 (6.8Ω) was open-circuit because rectifier diode D410 was short-circuit. **S.L.**

ITT TB1250 (CVC824 Power Panel)

The customer's complaint was of colour loss. We found that the colour came and went, with bands of red/green changeover showing occasionally. I'm ashamed to admit that I went straight to the TDA3560 colour decoder chip and replaced it. This didn't do anything for the fault, so a closer look was called for. When the colour was turned off with the front control we saw that the picture had a curious flutter. This was accompanied by a slight pull now and again at the top of the screen. The penny then dropped and attention was turned to the TDA9503 chip IC711 which contains the line oscillator. We soon found that the 12V supply decoupler C721 (100μF, 16V) was faulty. It's of the PC mounting type and when it was removed one leg parted company. **S.L.**

Grundig C7400

This one led us a dance because it would go into standby about four times an evening. After very many hours of testing we eventually found that C642 (100μF, 10V) went open-circuit intermittently. It decouples the TDA4600 chip's reference voltage. **H.MacM.**

Sanyo CTP3101

This set had perfect chrominance but no luminance. Increasing the tube's bias voltage made it possible to see something. Eventually I found that Q342 in the blanking circuit was faulty. When in circuit this transistor produced no voltage reading at its collector and a positive reading at its base instead of -1V. It checked all right out of circuit however. **H.MacM.**

Philips K30 Chassis

Occasional failure to start was eventually traced to the electrolytic block C1460a/b going open-circuit. It acts as the reservoir/smoothing capacitance for the 140V h.t. line. **H.MacM.**

Philips K30 Chassis Ed II

This set came from another dealer with a note to say that the c.r.t. was suspect – there was no blue luminance. A check showed that the blue luminance output at pin 16 of the TDA3560 colour decoder chip was very low. The cause was traced to C3044 (22nF) which is connected to pin 18 – it was open-circuit. This capacitor appears to provide clamping in the blue channel within the chip. **H.MacM.**

Saisho CTR5

The problem with this small CTV/radio receiver was no sound on either radio or TV, though the picture was normal. I'd no circuit diagram but checks showed that there was no supply to the radio/audio section. Further checks revealed that the 7808 regulator mounted on the mains transformer under the radio section was open-circuit. This set is not at all easy to work on. The fault will be relevant to other brands that use the same chassis. **P.H.**

Solavox 20S09 (ITT CVC1175 Chassis)

This set was dead. Power was present but the power supply didn't work. The cause of this was that D658 was short-circuit. A BZX61C120 got the power supply to work but it took several minutes to stabilise. Replacing C716 (10μF, 350V) cured this. I suspect that D658 had failed because C716 was allowing spikes into the supply. In the event of the 115V h.t. line going high D658 is supposed to short and load the supply. **P.H.**

Practical Digital Logic

Part 2: The New Symbols

David Botto

In Part 1 last month we were mainly concerned with the basics of Boolean algebra in relation to digital circuitry. You'll also recall Pete's comment on the new logic symbols – why change the symbols and what was wrong with the old ones? The answer to this is that there's nothing wrong with the conventional symbols which should, strictly speaking, now be referred to as logic diagrams. They will continue to be used. In fact the tendency seems to be to use the old logic symbols to represent simple gates and inverters while, in the same circuit diagram, using the new logic symbols to represent the more complex digital devices. You will of course encounter some digital circuit diagrams that consist entirely of the new logic symbols. However the circuit is presented, it's obviously necessary to understand all these symbols.

Personally I like the shapes of the conventional symbols. As with an analogue watch with hands, you can see the situation at a glance. With the new logic symbols you have, at least to start with, to look hard and think about their meaning. The new symbols are a completely new way of representing logic circuitry – it's not just a case of changing the shapes of the symbols. They are used to reduce the tangle of interconnections that would otherwise be present in a circuit diagram and to give the engineer more information about the devices used in the circuit. To obtain this information with the old symbols you's normally have to consult the relevant data books. In addition there's a powerful aid known as dependency notation. This may appear to be difficult to grasp but is actually quite straightforward. We'll return to it later.

Qualifying Symbols

Before we consider the composite logic symbols themselves it's necessary to understand the meaning of the signs that accompany them. Fig. 1 shows the qualifying symbols that form an integral part of the new logic circuitry. Just to make things a little more interesting, you may find that some manufacturers use their own variations on these symbols!

Logic Gate Symbols

The new logic symbols consist of a block or blocks together with the appropriate qualifying symbols. A number of logic gates and circuits may be enclosed within the same logic symbol block. Normally all inputs feed in from the left, with the output signals taken from the right. Where this is not so the qualifying symbols shown at (39) and (40) in Fig. 1 are used.

Fig. 2 shows the new symbol for a gate with two inputs, A and B. The & sign indicates that it's an and gate while the little triangle on its side shows that the gate contains a buffer amplifier. The symbol placed near the output C tells us that the device has an open-collector npn output stage. The symbol on the outside of the box at C – see Fig. 1-36 – is an output polarity indicator showing that negative logic applies here, i.e. one is low. The complete diagram thus represents a nand gate. With positive logic (one high) the output polarity indicator shown in Fig. 1-35 would be used.

Fig. 3 shows the internal circuit of the nand gate represented in Fig. 2 – it's one section of an SN7439 quad nand gate. Notice that an external load or "pull-up" resistor is required – this is what's meant by an open-collector output.

Fig. 4 represents the complete SN7439 quad nand gate chip. Notice that the qualifying symbols are used in only the top block. This indicates that each of the three blocks below the top one is identical to it.

Common Outputs

Fig. 5(a) shows two or gates with inputs A, B, C and D driving an and gate, using conventional symbols. Fig. 5(b) shows the same circuit using the new logic symbols. The upper two blocks are identified in the top one as being or gates incorporating buffer amplifiers. The bottom block is identified by the double line as a common-output element, and is further identified as being an and gate. The common output block could have inputs other than those from the two or gates. The dotted lines show two possible additional inputs. These would make the common-output element block a four-input and gate.

Common Control Block

Fig. 6(a) shows, with conventional symbols, four exclusive-or gates. Input A is common to all four. The Boolean equation for an exclusive-or gate with inputs A and B and output C is

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

which is usually written as $A \oplus B$. Fig. 6(b) shows this circuit using the new method, with the top block representing a common input affecting all the blocks below. This shape is always used for a common control section, and it's important to remeber that the input to the common control block represents an input to each block below. The symbol = identifies the four gates as being exclusive-or devices.

Fig. 7(a) shows, with conventional symbols, the contents of an SN54LS366A chip. It has six inverting buffers plus an and gate with an inverter at each input, making it a nand gate. The buffers can't operate unless a binary one signal is present at point Z. Thus two binary zero signals are required at the inputs to the nand gate to enable the buffers. These buffers are referred to as tri-state devices: the output is either high or low or, if the buffer is not enabled, is in a high-impedance state with the logic level undefined.

Fig. 7(b) shows the arrangement using the new method. The control block is shown as including an and gate which, with inverters at its inputs, acts as a nand gate. The letters EN denote the enabling action of the control block. The little triangle on its side in the first block beneath the control block indicates a buffer amplifier while the upside-down triangle indicates that the amplifier has a tristate output. Outputs Y1-6 are shown as being inverted for logic one.

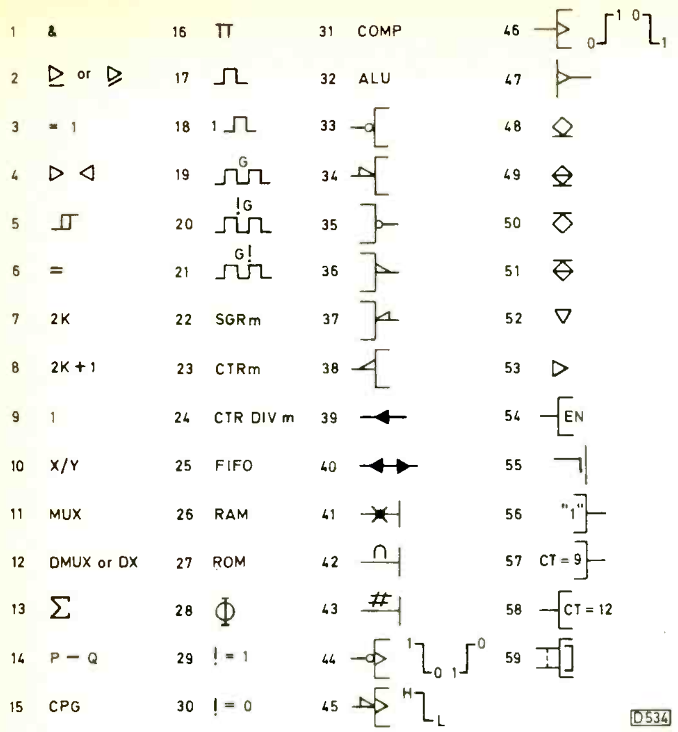
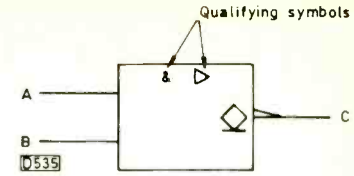
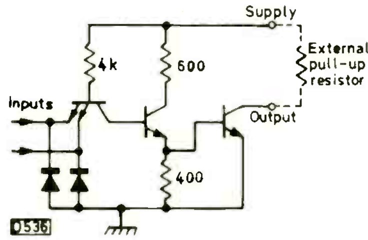


Fig. 1: Signs (qualifying symbols) used with the new logic circuit symbols. 1 And gate or function. 2 Or gate or function. 3 Exclusive-or gate. 4 Buffer or driver amplifier – arrow indicates direction of signal flow. 5 Schmitt trigger. 6 Logic identity – all inputs must stand at the same state. 7 Even number of signal inputs must be active. 8 Odd number of signal inputs must be active. 9 One input must be active. 10 Code Converter. 11 Multiplexer. 12 Demultiplexer. 13 Adder. 14 Subtractor. 15 Carry pulse generator. 16 Multiplier. 17 Retriggerable monostable. 18 One-shot (non-retriggerable monostable). 19 Astable multivibrator (waveform not always shown). 20 Synchronously starting astable multivibrator. 21 Astable – halts when pulse ends. 22 Shift register – m is number of stages. 23 Counter – m is number of stages. 24 Counter with cycle length. 25 First in/first out memory. 26 Random access read/write memory. 27 Read only memory. 28 Gray box. 29 Element powers up and sets to one. 30 Powers up and sets to zero. 31 Comparator. 32 Arithmetic logic unit. 33 Input inverter in chip. 34 Logic one low input (inverter in chip). 35 Output inverted. 36 Logic one low output. 37 Logic one low input with signal movement right to left. 38 Logic one low output with signal movement from right to left. 39 Signal flow right to left (no symbol means flow is left to right). 40 Signal flow in both directions. 41 Non-logic connection (usually labelled). 42 Analogue signal(s) entering digital circuit. 43 Input for digital signal on an analogue symbol. 44 Binary one produces temporary zero output, positive logic. Inverse with negative logic. 45 as 44, negative logic. 46 Binary zero produces temporary one output, positive logic, inverse with negative logic. 47 Zero in produces temporary one out at right. 48 NPN open-collector output. 49 NPN collector output with internal resistor. 50 NPN open-emitter output. 51 NPN emitter output with internal resistor. 52 Tristate output. 53 Buffer amplifier. 54 Enable input. Binary one enables all outputs. 55 No output until applied input logic signal ceases. 56 Fixed state output remains at one. 57 Output active only when register contains indicated number. 58 When input is active internal register will be as number indicated. 59 Input line grouping – two or more signals are required to implement a single logic input.

Fig. 2: Nand gate symbol with negative logic output.





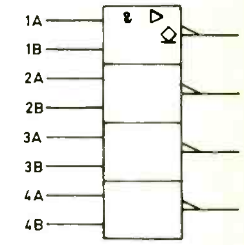


Fig. 3 (left): Internal circuit of the nand gate shown symbolically in Fig. 2.

Fig. 4 (right): Quad nand gate symbol (negative logic output).

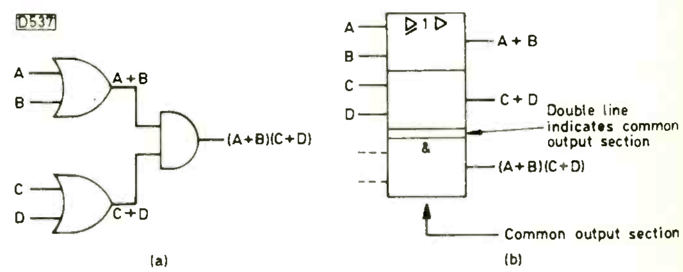


Fig. 5: Old and new symbols, two or gates feeding an and output gate.

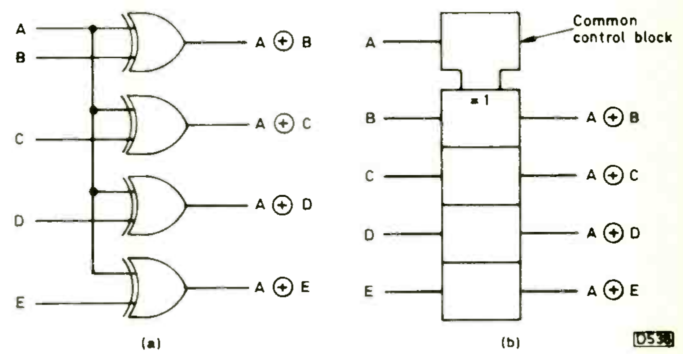


Fig. 6: Old and new symbols, showing a common control block.

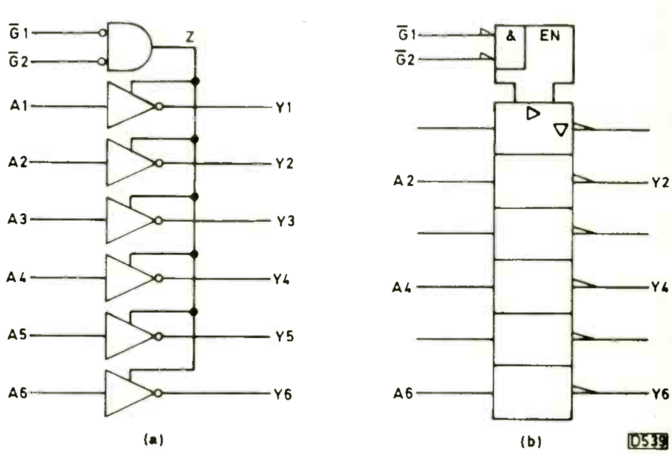


Fig. 7: Further example of old and new symbols.

Dependency Notation

Dependency notation, or in plain English representing logic functions by means of little signs and figures, is the thing that makes the new logic symbols completely different from the old system. At first sight these dependency notations may make the long-suffering TV/video engineer turn quite pale, but their use shows the relationship between a device's inputs and outputs without the need to show all the separate gates and their interconnections.

There are two simple rules to understanding dependency notation. First, the input or output that affects other inputs or outputs is labelled with a recognised letter symbol – see Table 1 – that shows the logic function, also an identification number. Secondly, each input or output that's affected by the labelled input or output is marked with the same identification number.

We'll consider and dependency first, signified by the letter G.

Fig. 8(a) shows part of an SN74LS257B selector/multiplexer chip drawn using conventional symbols. A multiplexer circuit is used to select one from a number of inputs and route it to a single output. For and gate 1 to produce a binary one signal at point L there must be a binary one at input 1A and a binary zero at input $\overline{AB}$. For and gate 2 to produce a binary one at M there must be a binary one at 1B and at $\overline{AB}$. Outputs L and M are fed to an or gate which is of a type that has to be enabled by a binary one at Z (zero at input $\overline{Z}$). So provided a binary one is present at points Z and either L or M a binary one will be present at output 1Y.

Let's now look at this in the new system, see Fig. 8(b). Input signal $\overline{AB}$ is shown connected to a control block input labelled G1. This indicates that it's anded with inputs 1A and 1B to the block below, labelled $\overline{1}$ and 1 respectively. The letters MUX indicate that the block is a multiplexer, the two triangle symbols indicating that the block contains a buffer and a tristate device (the enabled or gate). The blocks below, shown in dashed outline, contain identical circuitry to the one above and all are subject to the common control block at the top. For simplicity the inputs and outputs of the lower block have been omitted.

A point to note in all this is that while the conventional way of drawing a circuit tells us exactly how the circuit works the new system tells us what a device does without showing the circuitry within.

Fig. 9(a) shows an or gate whose output feeds one input of an and gate. The Boolean equations for the conditions at points Y and Z are A + B and (A + B)C respectively. The same circuit can, as part of a complex symbol, be represented as shown in Fig. 9(b). Two inputs labelled with the same letter indicate the inputs to a gate: since the letter used is G this indicates that the gate's output is fed to an and gate whose other input C is also labelled 1.

Or dependency is signified by the letter V. Fig. 10(a) shows an or gate with a signal from point A fed to one input while a signal from elsewhere in the device is fed to its other input. Using dependency notation we can

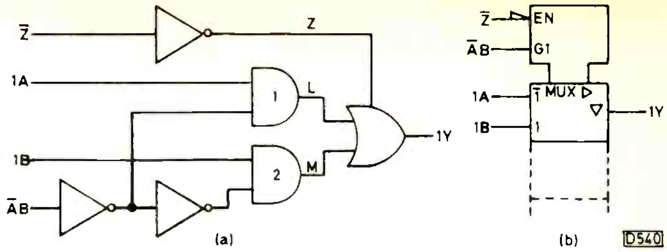
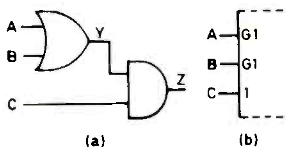


Fig 8: Comparison of old and new symbols with the latter illustrating dependency notation.



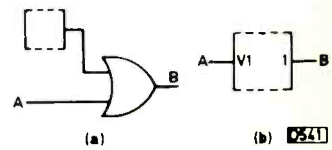
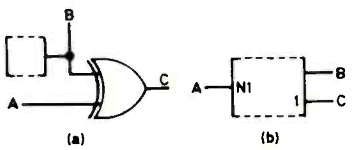


Fig. 9 (left): And gate dependency.
Fig. 10 (right): Or gate dependency.



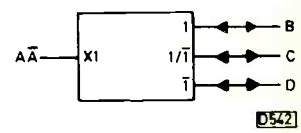


Fig. 11 (left): Negate (exclusive-or) dependency.
Fig. 12 (right): Example of transmission (X) dependency.

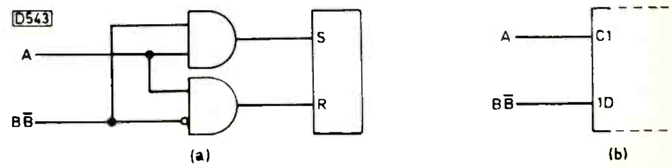
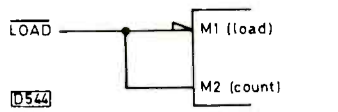


Fig. 13: Control dependency, (a) old and (b) new system.



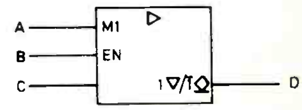
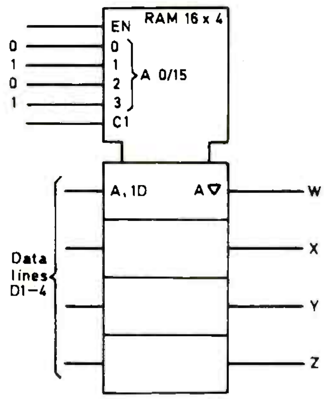


Fig. 14 (left): Input mode dependency.
Fig. 15 (right): Output mode dependency.



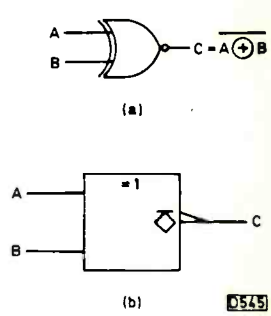


Fig. 16 (left): Address dependency with a 16 × 4 RAM.
Fig. 17 (right): Exclusive-or gate symbols.

draw the circuit as shown in Fig. 10(b).

The rule with negate (exclusive-or) dependency, letter N, is that every input or output bearing the same number stands in an exclusive-or relationship with the relevant N numbered input or output. This is illustrated in Fig. 11 where the external input to the exclusive-or gate is labelled N1 and the output 1.

The Z dependency symbol shows that the logic device contains internal logic connections between inputs and

Table 1: Dependency notation letter symbols.

Letter symbol	*Function*
G	And
V	Or
N	Negate (exclusive-or)
C	Control
EN	Enable
M	Mode
A	Address
R	Reset
S	Set
X	Transmit
Z	Interconnect

outputs bearing the same number, also internal inputs and outputs. A number such as Z1 is used with all the affected inputs and outputs labelled with the same number 1.

X indicates controlled two-way connections between various input and output ports. In Fig. 12, if $A\bar{A}$ is at binary one B is connected internally to C while if $A\bar{A}$ is at binary zero C is connected to D.

The control dependency denoted by C usually indicates enabling or disabling of the inputs to digital storage circuitry such as bistables. Fig. 13(a) shows a simple example. The circuit can work only when control signal A is at binary one. With inputs A and $B\bar{B}$ at one there will be a one at S (set) and a zero at R (reset). The circuit now stores a binary one. With $B\bar{B}$ at binary zero R will be at one and S at zero. This time the circuit stores zero. The symbol C1 in Fig. 13(b) indicates a common control point, with all inputs controlled by C standing at binary one when A is at one. When A stands at zero all inputs controlled by C1 will be at zero. With A at binary one $B\bar{B}$ must also be at one for the storage device to hold the binary one signal: this is indicated by the symbol 1D.

S, R and EN dependency should be easy enough to follow.

M dependency shows that the various inputs and outputs of a device depend on the mode in which it's operating. For example Fig. 14 shows one small section (an input) of a complex digital chip, the SN54LS690, a synchronous counter with output registers and multiplexed tristate counters. When the input shown is low the signal is inverted, appearing as a high at the point labelled M1. In this mode digital information is loaded into the device. When the input goes high M2 is high and M1 low. The chip now operates as a synchronous counter.

Fig. 15 shows how mode dependency can affect outputs. The symbol at the top of the rectangle indicates a buffer amplifier. With a binary one at input A the device has a tristate output. When A is zero the output becomes an nnp open-collector and the tristate symbol doesn't apply. For the buffer amplifier to work at all an enabling signal must be present at input B.

One use of the address dependency symbol A is shown in Fig. 16, which represents a 16 × 4 RAM chip. The common control block shows the four address lines bracketed together and labelled with an A. 0/15 represents the fact that there are 16 memory storage areas in the chip, each one of which contains a four-bit binary word. Inputs 0 to 3 receive four binary signal values. In the example shown input 0 (the least significant bit) is at zero, input 1 at one, input 2 at zero and input 3 (the most significant bit) at one. The memory location address selected is thus 0101. Any of sixteen locations (0/15) can be selected by using different combinations of binary digits on the address lines.

To write into a memory location input, line C1 (control 1) must be at binary one. The information appearing on the data input lines D1-4 will then be stored in the memory location selected. To read the contents of this location a binary one is applied to the EN input line and zero to C1. When this is done the binary values stored at the selected location appear on output lines W, X, Y and Z.

Gray Box Symbol

When the "gray box" sign shown in Fig. 1-28 appears at the top of a logic device symbol this indicates that some information about the chip is written in words in addition to coding and dependency notation. This is done only in the case of extremely complex logic circuitry. You'll agree that it's an improvement on the blank box outlines that often appear in some skimpy TV/VCR service manuals!

The Exclusive-nor Gate

Fig. 17 shows symbols for the exclusive-nor gate. It operates in the same manner as an exclusive-or gate but with inverted (complemented) output. The Boolean equation is

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

We can simplify this by using the rules of Boolean algebra given last month. First by DeMorgan's theorem we can change it to

$$(\overline{\bar{A}B})\ (\overline{A\bar{B}})$$

then by the law of distribution to

$$A\bar{A} + AB + \bar{A}\bar{B} + B\bar{B}.$$

By the law of complements

$$A\bar{A} = 0 \text{ and } B\bar{B} = 0$$

which leaves

$$AB + \bar{A}\bar{B}$$

or, by the law of commutation,

$$\bar{A}\bar{B} + AB$$

which is usually shown as

$$C = \overline{A \oplus B}.$$

Last Month's Problems

Now for the answers to the problems presented last month. When the four inputs to the gates that were shown in Fig. 20 are changed to A, B, C and D

$$E = (A + \bar{B})\ (\bar{C} + \bar{D}).$$

With the four inputs A, $\bar{B}$, C and $\bar{D}$

$$E = (\bar{A} + B)\ (\bar{C} + D).$$

Incidentally, as you may by now have realised given only a Boolean equation it's possible to draw the relevant circuit diagram. For example, if $Z = (A + B)(C + D)(E + F)$ it's obvious that the circuit consists of three or gates which feed their outputs into a three-input and gate.

If you want to take this subject further I'd recommend that you obtain a copy of the latest edition of the Texas Instruments' publication *The TTL Data Book Volume 1.* It contains over a thousand pages of information and shows a good range of the new logic symbols together with their conventional logic diagram counterparts, some of which are extremely complex. The book gives the Boolean expressions for a number of circuits. It's obtainable from RS Components (order from Electromail, PO Box 33, Corby, Northants NN17 9EL) or Texas Intruments Ltd., Manton Lane, Bedford MK41 7PA. The price is £14.95 plus £2.50 post and packing.

The aim of these two articles has been to provide readers with a reasonable knowledge of Boolean algebra and to serve as an introduction to the understanding of the new logic symbols. You'll find that a study of these important subjects will pay off in the months to come.

ECONOMIC DEVICES PO BOX 15, WOLVERHAMPTON, WV2 4AZ

15/80H	3.72
15/85R	3.72
17052	4.58
17053	5.61
17074	9.30
17089	3.45
17127	2.50
17376	1.58
1N4001	0.04
1N4002	0.06
1N4003	0.06
1N4004	0.05
1N4005	0.05
1N4006	0.08
1N4007	0.07
1N4148	0.03
1N4448	0.05
1N5401	0.11
1N5402	0.13
1N5403	0.18
1N5404	0.10
1N5408	0.16
1N914	0.04
1S555	0.18
1S44	0.10
1S921	0.10
2N2219A	0.29
2N3053	0.35
2N3054	0.99
2N3055	0.66
2N3442	1.16
2N3702	0.14
2N3703	0.18
2N3705	0.15
2N3706	0.14
2N3707	0.16
2N3711	0.11
2N3771	1.56
2N3772	1.55
2N3773	1.61
2N3819	0.40
2N3823	1.17
2N3904	0.50
2N3908	0.62
2N4101	1.33
2N4240	2.68
2N4444	1.66
2N5293	0.50
2N5294	0.50
2N5296	0.50
2N5297	0.50
2N5298	0.61
2N6109	1.58
2N6130	0.85
2N6133	1.25
2N6180	0.73
2N6292	1.60
2SA1006	1.50
2SA1011	0.99
2SA1015	0.20
2SA1012	0.80
2SA1020Y	0.99
2SA1027R	0.45
2SA473	0.75
2SA766S	4.95
2SC1173Y	1.25
2SC1474	1.25
2SC1509	1.35
2SA1095	3.00
2SA1103	6.00
2SA329	0.40
2SA489	1.17
2SA490	1.32
2SA493	2.25
2SA562	0.57
2SA564	0.62
2SA614	0.97
2SA628	0.37
2SA639S	1.75
2SA659	0.49
2SA673	1.50
2SA684	1.20
2SA697	0.80
2SA699	1.25
2SA715	0.95
2SA748	1.95
2SA817	0.18
2SA835	2.50
2SA836	0.89
2SA844	0.65
2SA872	0.99
2SA884	2.15
2SA937R	0.97
2SA940	2.23
2SA940-2	2.14
2SA950	0.72
2SA951	1.75
2SA966-Y	0.85
2SA999	0.75
2SB774	0.65
2SB185	1.13
2SB375	3.87
2SB400	0.40
2SB405	1.03
2SB511	0.99
2SB54	1.39
2SB546	0.56
2SB56	2.80
2SB618A	2.22
2SB631	2.00
2SB643	0.58
2SB669	3.67
2SB681	3.96
2SB695	1.98
2SB774	0.65
2SB819	1.13
2SC1096	1.16
2SC1104	3.98
2SC1106	4.54
2SC1114	3.25
2SC1116	4.95
2SC1124	1.26
2SC1129	1.65
2SC1131	0.64
2SC1158	3.33
2SC1162	0.55
2SC1172	2.22
2SC1195	6.09
2SC1213	0.89
2SC1226	1.46
2SC1293	0.90
2SC1306	1.98
2SC1317	0.50
2SC1364	0.49
2SC1383	1.20
2SC1391	2.45
2SC1398	0.41
2SC1413A	2.10
2SC1446	1.25
2SC1447	2.07
2SC1475	0.60
2SC1505	1.00
2SC1514	1.76
2SC1573Q	1.10
2SC1583	0.34
2SC1617	3.89

2SC1678	1.98
2SC1741	1.25
2SC1810	1.70
2SC1815	0.20
2SC1826	0.67
2SC1829	2.25
2SC1875	4.50
2SC1893	3.02
2SC1906	0.98
2SC1921	1.37
2SC1923	0.30
2SC1929	2.25
2SC1942	2.59
2SC1959	0.20
2SC1957	0.95
2SC1953	1.93
2SC1962	1.93
2SC1969	1.79
2SC1983	1.56
2SC1985	1.56
2SC2009	0.34
2SC2029	2.33
2SC2028	2.11
2SC2063	0.99
2SC2078	3.39
2SC2073	2.73
2SC2085-Q	1.65
2SC2091	1.30
2SC2141	2.44
2SC2166	0.87
2SC2216	0.69
2SC2233	1.20
2SC2236	1.69
2SC2278	1.14
2SC2314	0.87
2SC2335+Kit	7.00
2SC2551	1.26
2SC2565	4.10
2SC2570	0.46
2SC2577	1.34
2SC2578	6.75
2SC2671	0.91
2SC288A	1.85
2SC3153	6.50
2SC372	1.40
2SC373	1.16
2SC383	1.33
2SC388	1.27
2SC394V	0.81
2SC403C	0.60
2SC458	0.34
2SC495	0.92
2SC515A	1.85
2SC535	0.79
2SC536	0.06
2SC537	0.54
2SC605L	1.16
2SC620	1.46
2SC643A	1.54
2SC668	0.67
2SC681	4.40
2SC682	1.88
2SC684	1.65
2SC693	0.63
2SC710	1.15
2SC711A	0.50
2SC717	1.28
2SC734	1.43
2SC783	3.98
2SC790Y	1.85
2SC828	0.28
2SC867A	4.54
2SC876	0.96
2SC930	0.54
2SC935	4.13
2SC940	4.68
2SD1128	2.90
2SD1138	0.94
2SD1273	1.48
2SD1453	1.33
2SD152K	2.64
2SD198	3.87
2SD234	0.47
2SD235	0.60
2SD24	2.29
2SD257	1.98
2SD292	4.09
2SD313	2.92
2SD325D	2.26
2SD350	3.05
2SD353	7.50
2SD389	2.41
2SD401	1.40
2SD414	1.98
2SD471	2.13
2SD560	2.95
2SD600	2.98
2SD601R	0.65
2SD613	1.03
2SD636	0.40
2SD639-R	0.72
2SD655	0.98
2SD657	2.80
2SD661A	0.80
2SD731	2.11
2SD773	0.60
2SD811	7.63
2SD823	1.98
2SD837	1.48
2SD841	1.37
2SD856	0.89
2SD857Q	1.84
2SD882	1.15
2SD894	1.75
2SD898	2.19
2SK105H	2.15
7805-T022	0.63
7808	0.45
7812-T022	0.35
7815	0.64
7905	0.80
AD140	1.06
AD143	1.93
AD145	1.60
AD161	0.74
AD162	0.74
AF114	2.47
AF115	0.90
AF118	1.20
AF127	1.00
AF139	0.40
AF178	1.45
AF179	0.55
AF180	0.55
AF181	0.53
AF186	1.32
AF239	0.53
AF279	0.88
AN115	3.90
AN155	1.89
AN206	2.58
AN208	3.55
AN210	1.56
AN211	3.25

AN214Q	2.40
AN234	5.09
AN236	3.33
AN240P	0.99
AN241	1.71
AN245	5.48
AN253	1.80
AN260	3.85
AN272	7.92
AN295	7.63
AN301	2.45
AN302	3.09
AN305	8.88
AN315	2.46
AN316	4.95
AN318	7.16
AN320	5.47
AN321	2.25
AN322	7.62
AN337	5.37
AN340P	1.53
AN355	1.65
AN362	1.50
AN370	3.95
AN5111	3.43
AN5120N	4.50
AN5132	4.42
AN5250	4.40
AN5610	7.43
AN5612	2.20
AN5613	4.20
AN5630	3.95
AN5701N	1.66
AN6250	1.75
AN6300	4.40
AN6310	4.54
AN6340	5.62
AN6341	2.22
AN6363	16.00
AN6531	1.95
AN6551	0.50
AN6552	0.68
AN6610	1.15
AN7111	1.25
AN7115	2.52
AN7145	2.17
AN7146	9.90
AN7151	2.37
AN7156	3.37
AN7158	2.67
AN7218	0.80
AN7223	4.55
AU107	7.72
AU110	5.69
AU113	14.63
AY106	2.80
BA524	8.94
BA310	0.14
BA1310	1.50
BA1320	1.38
BA1322	3.95
BA1330	2.75
BA145	0.19
BA148	0.25
BA154	0.40
BA155	0.12
BA156	0.05
BA159	0.09
BA182	0.19
BA222	1.66
BA302	1.24
BA311	0.65
BA312	1.45
BA313	0.76
BA317	0.04
BA318	0.09
BA328	2.22
BA333	1.37
BA335	6.27
BA5102A	2.19
BA511	1.95
BA514	1.00
BA521	1.20
BA524	8.94
BA526	7.98
BA527	2.98
BA532	1.20
BA536	0.99
BA6209	1.06
BA656	1.51
BA7100	11.35
BA841A	28.98
BA843	3.96
BA854	5.76
BAV18	0.06
BAV19	0.24
BAV20	0.36
BAV21	0.12
BAW62	0.11
BAX12	0.49
BAX13	0.11
BAX16	0.08
BC107B	0.11
BC108B	0.15
BC109B	0.14
BC113	0.14
BC119	0.36
BC126	0.20
BC132	0.14
BC135	0.14
BC137	0.18
BC138	0.34
BC139	0.33
BC140	0.30
BC141	0.31
BC142	0.26
BC143	0.34
BC147	0.14
BC148B	0.13
BC148C	0.11
BC149B	0.13
BC153	0.14
BC154	0.14
BC159	0.16
BC160	0.40
BC161	0.28
BC168	0.36
BC169C	0.16
BC170	0.16
BC171	0.11
BC172B	0.27
BC173	0.17
BC174B	0.27
BC177	0.35
BC178	0.26
BC179	0.26
BC182	0.09
BC182LB	0.14
BC183LB	0.09
BC184	0.70
BC184LB	0.13
BC186	0.25
BC187	0.28
BC204	0.35

BC207	0.19
BC212B	0.26
BC213L	0.10
BC214	0.10
BC225	0.40
BC237	0.10
BC238	0.10
BC238B	0.08
BC239B	0.25
BC251A	0.31
BC294	0.50
BC300	0.38
BC301	0.34
BC302	0.53
BC303	0.48
BC307A	0.06
BC308A	0.11
BC309	0.17
BC317A	0.13
BC327	0.09
BC328	0.11
BC337	0.09
BC338	0.12
BC368	0.19
BC440	0.69
BC441	0.46
BC454	0.36
BC460	0.42
BC461	0.47
BC462	0.51
BC463	0.30
BC478	0.32
BC479	0.41
BC532	0.28
BC546	0.08
BC547	0.10
BC548	0.28
BC549	0.10
BC550	0.19
BC556	0.11
BC557	0.08
BC558	0.10
BC559	0.10
BC560C	0.14
BC635	0.34
BC636	0.20
BC637	0.24
BC639	0.15
BC640	0.24
BCX34	0.55
BD115	0.36
BD116	0.70
BD124	1.31
BD131	0.42
BD132	0.42
BD133	0.53
BD135	0.36
BD136	0.36
BD137	0.41
BD138	0.28
BD139	0.24
BD140	0.35
BD144	1.43
BD150	0.75
BD157	0.67
BD160	1.60
BD163	0.71
BD166	0.69
BD175	0.28
BD179	0.30
BD181	0.99
BD182	0.99
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BD184	1.21
BD187	0.80
BD189	0.65
BD190	0.55
BD201	0.41
BD202	0.60
BD203	0.46
BD204	0.41
BD207	1.73
BD208	1.23
BD222	0.52
BD225	0.46
BD228	0.63
BD229	1.05
BD232	0.49
BD234	0.42
BD237	0.36
BD238	0.28
BD239	0.45
BD240	0.57
BD241	0.39
BD242	0.37
BD243A	0.62
BD243C	0.50
BD244	0.42
BD244C	0.72
BD245C	0.83
BD246C	0.85
BD253	1.05
BD278A	0.70
BD317	1.20
BD318	2.72
BD375	0.42
BD380	0.66
BD410	0.49
BD433	0.44
BD434	0.45
BD435	0.49
BD436	0.74
BD437	0.45
BD438	0.52
BD441	0.59
BD442	0.50
BD509	1.64
BD510	0.75
BD519	0.78
BD529	0.75
BD530	0.73
BD533	0.67
BD534	0.52
BD535	0.38
BD536	0.50
BD537	0.50
BD538	0.67
BD544B	0.75
BD677	0.33
BD679	0.43
BD680	0.66
BD681	1.48
BD696	2.47
BD699	1.85
BD700	3.70
BD707	0.60
BD709	0.80
BD710	0.80
BD809	0.45
BD810	0.57
BD879	0.74
BD895	2.18
BD901	0.56
BD902	0.56
BDW83C	0.99
BDW84C	0.99
BDX32	1.65
BDX53A	0.46
BDX53B	3.35

BDX54B	0.33
BDX62A	2.09
BDX63A	1.96
BDY20	1.21
BDY81	1.18
BF115	0.29
BF117	0.66
BF118	0.67
BF121	0.25
BF123	0.13
BF127	0.13
BF137	0.29
BF153	0.58
BF154	0.26
BF157	0.33
BF158	0.18
BF159	0.18
BF160	0.31
BF167	0.38
BF173	0.34
BF177	0.55
BF178	0.40
BF179	0.36
BF180	0.36
BF181	0.32
BF182	0.34
BF183	0.39
BF184	0.43
BF185	0.39
BF194	0.14
BF195	0.14
BF196	0.17
BF197	0.24
BF198	0.17
BF199	0.17
BF200	0.37
BF218	0.36
BF224	0.17
BF237	0.65
BF240	0.19
BF241	0.17
BF245	0.50
BF245B	0.49
BF246A	2.52
BF255	0.20
BF256	0.15
BF257	0.34
BF258	0.33
BF259	0.34
BF262	0.57
BF263	0.57
BF271	0.34
BF273	0.20
BF274	0.34
BF324	0.23
BF336	0.33
BF337	0.31
BF338	0.34
BF355	0.45
BF362	0.60
BF363	0.50
BF371	0.50
BF391	0.25
BF417	0.84
BF418	1.87
BF422	0.15
BF423	0.33
BF450	0.35
BF451	0.11
BF457	0.41
BF458	0.49
BF459	0.26
BF460	1.63
BF469	0.33
BF470	0.26
BF471	0.25
BF472	0.33
BF479	0.61
BF480	0.89
BF491	0.50
BF506	0.43
BF532	0.24
BF596	0.18
BF597	0.27
BF694	0.22
BF757	0.34
BF759	0.28
BF761	0.43
BF762	0.34
BF869	0.49
BF870	0.30
BF959	0.42
BF960	0.59
BF970	0.39
BFR39	0.44
BFR61	0.92
BFR62	0.50
BFR79	0.29
BFR81	0.29
BFR86	1.08
BFR89	1.63
BFR90A	0.54
BFX29	0.34
BFX84	0.37
BFX85	0.31
BFX86	0.36
BFX87	0.55
BFX88	0.34
BFX89	0.44
BFY50	0.30
BFY51	0.33
BFY52	0.27
BFY79	0.49
BFY90	1.16
BLY49	2.20
BR100	0.23
BR101	0.78
BR103	0.79
BR303	1.20
BRC84	2.08
BRX44	0.60
BRX49	0.46
BRY39	0.65
BSS38	1.18
BSTBD140G	4.93
BSTC0246	5.99
BSTC0233	6.12
BSTCC0143	3.07
BSTD1043	2.85
BSV57B	3.91
BSW68	0.60
BSX19	0.34
BSX20	0.19
BSY52	0.50
BSY79	0.51
BT108	1.45
BT119	1.76
BT120	2.17
BT121	2.48
BT123	1.98
BT151 800R	0.85
BTT6018	2.42
BU106	2.48
BU108	1.50
BU109	2.25
BU110	5.69
BU125	2.48

BU126	1.10
BU137	6.53
BU205	1.15
BU206	1.27
BU207	1.65
BU208	1.12
BU208/02	2.35
BU208A	1.12
BU208D	1.43
BU209	1.75
BU226	2.56
BU326A	0.99
BU406	1.24
BU406D	1.24
BU407	0.54
BU412	5.29
BU426A	1.67
BU500	1.53
BU508A	1.50
BU536	1.55
BU608	1.95
BU705	2.50
BU806	0.98
BU807	1.40
BU826A	1.95
BUW84	0.66
BUX84	0.50
BUX85	0.69
BY126	0.13
BY127	0.13
BY133	0.15
BY164	0.64
BY176	0.93
BY179	1.42
BY182	1.05
BY187	0.77
BY189	1.76
BY198	1.62
BY207	0.17
BY208	1.86
BY210-400	0.18
BY210-600	0.31
BY210-800	0.19
BY223	1.25
BY224-600	2.60
BY226	0.15
BY227	0.20
BY228	0.60
BY229-1000	1.12
BY229-600	1.20
BY255	0.13
BY295-600	1.23
BY298	0.20
BY299	0.60
BY407	0.90
BY409	1.49
BY448	1.40
BY713	1.12
BYW56	0.29
BYX55-600	0.23
BYX71-600	0.85
BYX71-350	0.88
BYY56	1.48
BZY93C30	1.86
C106D	0.37
C106M	0.76
CA3046	1.55
CA3089	0.83
CA3090AQ	3.25
CA3094	1.72
CA3131EM	2.95
CD4001	0.24
CD4002	0.27
CD4008	1.35
CD4011	0.20
CD4012	0.24
CD4013	0.33
CD4016	0.25
CD4017	0.30
CD4020	0.75
CD4021	0.39
CD4023	0.28
CD4025	0.64
CD4028	0.84
CD4040B	0.45
CD4047	1.06
CD4049	0.24
CD4052	0.33
CD4066	0.23
CD4069	0.29
CD4070	0.25
CD4081	0.14
CD4093	0.40
CD4511	0.44
CD4528	0.52
CD4556	1.47
CR02AM-8	1.70
CV12E	4.19
CX095D	3.14
CX104	8.77
CX108	5.52
CX109	7.20
CX130	8.76
CX134	4.50
CX136	11.49
CX139	11.83
CX157	5.52
CX158	10.45
CX177	8.80
CX187	5.26
CX755	12.95
CX885A	6.85
E1222	0.40
E5024	0.28
E5386	0.25
GD243	1.95
GF758	0.84
HA11215	1.75
HA11211	2.53
HA11225	4.29
HA11229	3.46
HA11235	1.95
HA11124	5.25
HA1125	4.29
HA1137W	1.38
HA1138	3.75
HA11414	4.20
HA1156	1.16
HA1160	5.79
HA1166X	6.73
HA1167	6.60
HA11706	3.61
HA11705	8.00
HA11703	3.45
HA11701	3.57
HA11710	3.45
HA11713	2.90
HA11711	9.40
HA11715	9.99
HA11714	7.76
HA11716	13.10
HA11725	18.26
HA11725MP	16.00
HA117555P	6.23
HA11781	21.15
HA1180	5.15

HA1196	7.43
HA13001	1.73
HA1306	2.26
HA13402	7.06
HA13342	2.65
HA13365	4.02
HA1366WR	2.88
HA1367	2.75
HA1368R	1.95
HA1368	2.65
HA1370	3.71
HA1374	1.80
AA117	9
HA1377	1.95
HA1389R	2.05
HA1389	2.39
HA1392	2.22
HA1394	2.65
HA1397	2.75
HA1398	2.75
HA1406	2.07
HA1452	0.85
HD14538	2.07
HD38702-A2	7.95
HD38750A53	5.77
HD38750A-7	7.25
HD38800A50	14.09
HD44801A05	14.07
HISH1010	14.60
HISH1004	6.00
HISH1002	9.50
HM6231	12.24
HM6232	7.20
HM6251	5.69
HM7103	4.85
HM9032	4.00
HM9012	3.22
HM9015	3.24
HT4207	13.25
HT4208	20.65
KA2101	1.00
KC581C	7.75
KC582C	4.85
L200CV	1.69
LA1201	0.75
LA1210	1.56
LA1230	1.18
LA1320	2.87
LA1357N	3.06
LA1363	1.05
LA1364	3.02
LA1365J	1.45
LA1385	1.53
LA1387	3.18
LA3350	1.43
LA3361	1.60
LA3390	5.52
LA4032P	2.35
LA4100	1.25
LA4101	1.30
LA4102	0.75
LA4112	1.35
LA4125	2.25
LA4138	4.98
LA4140	0.70
LA4192	1.23
LA4220	1.25
LA4420	1.72
LA4422	1.00
LA4430	2.88
LA4440	2.55
LA4445	1.80
LA4460	1.50
LA4461	1.60
LA5112N	1.18
LA7020	13.86
LA7025	11.97
LA7027	10.92
LA7040	9.20
LA7042	3.90
LA7800	1.30
LA7801	3.21
LB1274	1.90
LC7800	9.20
LD3120	1.13
LD3150	2.75
LM1017N	1.81
LM1877	1.88
LM2808	5.94
LM2877	7.45
LM317CKC	1.08
LM324N	0.59
LM339N	0.43
LM340K	11.65
LM348N	2.15
LM380N	1.50
LM567CN	1.71
LM6402/011	10.23
LM6402A093	10.15
LM748	0.69
LM8360	3.87
LM8361	2.95
LR3419	9.37
LR3471	9.37
LU1141	7.27
LU52012	20.62
LU52011	14.95
LU03112	12.37
M193	6.83
M21C	1.32
M23C	1.98
M293	7.08
M51102L	2.77
M5115P	5.24
M51203L	3.15
M51231P	0.95
M5134-9341	4.13
M51353P	5.25
M51381P	5.98
M51393AP	4.50
M51394P	14.50
M5142P	6.85
M5144P	4.27
M51513L	2.55
M51515BL	2.75
M51517L	2.90
M5192	3.13
M5194AP	5.74
M5231L	1.58
M53274P	1.33
M54532P	1.45
M54544L	4.20
M58478P	6.75
M58485P	14.43
MA06	1.07
MA8001	0.82
MA8003	1.16
MB3705	1.98
MB3712	1.85
MB3713	1.69
MB3730	2.31
MC13002	2.99
MC1310P	1.95
MC1327P	1.33

MC1330P	1.98
MC1350P	0.45
MC1351P	1.25
MC1352P	1.40
MC1357P	2.15
MC1358P	1.48
MC14493P	5.50
MC14494P	2.15
MC14497	7.10
MC14510BAL	0.68
MC14511BCP	1.10
MC14528BCP	2.15
MC1712	3.88
MC5192	19.50
MC7724CP	3.49
MCR106-5/6	1.56
MCR220/7	1.25
ME0411	0.75
ME6002	0.26
ME6102	0.28
ME8001	0.34
ME0411	0.75
MJ2501	3.30
MJ3001	1.43
MJ481	1.53
MJE2955	0.90
MJE3055	1.15
MJE340	0.49
MJE520	0.49
ML231	0.99
ML232B	3.01
ML237B	1.95
ML238	5.65
ML923	3.10
ML926	3.58
MM5314N	8.99
MM5316N	3.50
MM5318N	3.11
MM5369N	2.01
MM5387AA/N	6.20
MM5841N	6.93
MN1400VL	13.65
MN1405	7.92
MN1435VX	12.32
MP1192	5.07
MP2794	4.00
MP2812	5.07
MP8512	1.57
MPC596	2.13
MPF256C	0.60
MPS6570	0.48
MPSA42	0.18
MPSA56	0.08
MPSA92	0.15
MPSU05	0.86
MPSU10	2.31
MPSU56	0.65
MPSU60	2.21
MR818	0.33
MR854	0.46
MR914	1.20
MSM5816RS	17.35
MSM5840H	12.26
MVS460-02	0.34
NE542	2.75
NE555	0.35
NE556	0.65
NP1106	11.51
OA202	0.11
OA47	0.16
OA91	0.14
OA95	0.09
OC28	2.52
OC29	2.15
OC36	7.53
OC44	1.95
OC45	0.18
OC72	0.44
OC75	0.44
ON236	1.06
ON782	1.65
OT121	1.45
PT6042	3.25
PT8504	5.13
R1038	2.19
R1039	2.19
R2008B	1.33
R2009	1.98
R2010B	2.98
R2029	1.33
R2030	1.33
R2257	2.35
R2265	1.49
R2305	1.18
R2322	0.67
R2323	0.76
R2354A	0.64
R2354B	2.01
R2443	1.36
R2461	1.50
R2540	1.65
R2540X	3.30
R2615	0.67
RCA2060	2.00
RGP01-15	0.70
RGP10	0.23
RGP30M	0.28
RT402	1.58
RT905A	3.28
S1299	5.34
S2800D	1.50
S2802	2.90
S2818	4.05
S3702S	5.21
S40W	13.10
S6080B	9.98
SA8063	15.55
SAA1006	1.85
SAA1020	4.76
SAA1025	4.40
SAA1024	2.50
SAA1075	4.25
SAA1121	7.44
SAA1124	2.60
SAA1130	6.69
SAA1174	7.77
SAA1250	3.95
SAA1251	3.20
SAA1351	8.11
SAA3027P	2.71
SAA5000	3.25
SAA5010	4.80
SAA5012	5.50
SAA5020	5.78
SAA5030	6.33
SAA5050	4.90
SAB1009B	5.98
SAB3011	7.34
SAB3013	4.69
SAB3021	3.95
SAB3024	6.36
SAB3209	5.82
SAB3210	3.21
SAF1032P	5.13
SAF1039	1.95
SAS5010	8.39
SAS560S	1.91

SAS560T	5.42
SAS570T	5.42
SAS570S	1.95
SAS580	2.85
SAS6600	1.33
SAS660	1.33
SAS6700	1.33
SAS670	1.33
SAS6710	2.21
SBA750	1.61
SC84203	19.35
SC9504P	1.95
SDA2006	17.10
SDA2112/2	9.20
SG264A	5.26
SG613	10.70
SG629	8.27
SG6533	9.00
SI1125H	7.50
SI1630HD	20.62
SKE2F1/04	1.25
SKE2G3/04	0.73
SKE4F1/06	0.30
SKE4F2/08	1.07
SKE4F2/06	0.80
SKE4F2/10	1.36
SKE4G2/02	0.96
SKE5F3/10	1.36
SKS1/10	2.15
SL1310	3.14
SL1430T	2.31
SL414	3.69
SL432A	2.32
SL439	2.48
SL471	4.45
SL480	7.24
SL490	2.37
SL901B	8.32
SL918A	9.07
SN16861AN0	0.82
SN16862AN	2.98
SN16966N	10.25
SN29717N	7.19
SN29716N	3.66
SN29715N	6.04
SN29722	11.95
SN29723AN	8.77
SN29764AN	2.60
SN29767	3.90
SN29770BN	4.17
SN29772BN	5.75
SN29771BN	5.59
SN29791	1.67
SN29798N	5.56
SN2709	0.44
SN7400N	0.61
SN7401N	0.36
SN7402N	0.65
SN7404N	0.52
SN7408N	0.27
SN7410N	0.27
SN74121	1.60
SN7413N	0.37
SN74141N	2.65
SN74151AN	1.51
SN74154N	1.27
SN74190	1.35
SN7420N	0.34
SN7430	0.49
SN7440N	0.27
SN7472	1.54
SN7474N	0.44
SN7490AN	0.75
SN74LS26N	1.45
SN76001N	1.65
SN76013ND	7.45
SN76023N	2.97
SN76023ND	3.91
SN76033N	5.54
SN76110N	0.90
SN76115AN	1.61
SN76131	0.82
SN76227N	2.45
SN76226DN	2.17
SN76228N	3.27
SN76242	5.23
SN76243	5.23
SN76396	2.90
SN76533N	2.47
SN76532N	0.91
SN76545	4.87
SN76546N	3.47
SN76549	2.45
SN76570	3.08
SN76611	2.59
SN76620	2.59
SN76660N	2.48
SN76666N	1.20
SN76708	4.86
SN76709N	9.63
SN76707N	1.23
SN76705N	2.97
SN76730	5.54
SN76810N	0.60
SN76832N	1.35
SN94041	5.54
SN94042	4.35
SPS5384	1.98
ST1702L	0.99
STA401	2.49
STA441C	3.13
STA471C	8.70
STK0029	5.70
STK0050	7.85
STK016	11.23
STK022	8.95
STK031	12.95
STK040	13.34
STK054	9.35
STK058	27.50
STK077	9.28
STK1039	5.75
STK2110	7.33
STK2145	13.77
STK2240	16.65
STK2250	18.95
STK3042	6.08
STK3044	5.75
STK4019	13.87
STK433	6.18
STK4332	4.75
STK435	7.12
STK4352	1.95
STK436	5.95
STK437	6.91
STK4372	13.13
STK460	9.36
STK466	10.10
STK4833	11.97
STK501	6.32
STK502	7.25
STK5314	9.48
STK5730	3.20
STK7216	14.90
STK772	3.71

STR1096	11.20
STR4090	6.43
STR440	6.18
STR451	5.68
STR453	8.16
STR454	5.52
STR6020	6.96
T6029V	7.98
T6035V	0.73
T6036	0.67
T6037	2.11
T6044V	0.97
T6045	1.20
T6049	1.45
T6052V	0.87
T6058	3.08
T6059	4.22
T9003V	1.25
T9005V	2.38
T9011V	1.40
T9013V	4.95
T9014V	2.42
T9016	1.02
T9019W	1.98
T9034V	1.34
T9035V	1.49
T9051	8.07
T9054V	5.98
T9057V	3.44
T9062V	0.49
T9064	4.20
TA7027	4.80
TA7050	1.74
TA7051	1.74
TA7054	2.55
TA7060AP	0.71
TA7061AP	1.27
TA7069	3.13
TA7070P	1.83
TA7072P	2.57
TA7074P	1.98
TA7076P	7.50
TA7089P	3.10
TA7092P	9.94
TA7093P	3.99
TA7102P	5.88
TA7108P	1.61
TA7109	3.71
TA7122B/P	0.87
TA7124P	2.34
TA7129P	1.90
TA7130P	1.27
TA7136AP	1.89
TA7137P	0.98
TA7141AP	3.87
TA7146P	4.85
TA7148P	1.67
TA7149P	3.26
TA7152P	3.16
TA7161P	16.54
TA7162P	3.61
TA7172P	1.41
TA7176P	1.75
TA7193P	4.80
TA7204P	1.95
TA7206P	12.49
TA7207P	1.68
TA7208P	2.15
TA7210P	1.45
TA7214P	3.63
TA7215P	2.58
TA7217AP	1.45
TA7222	1.95
TA7226	3.57
TA7229P	4.66
TA7230P	1.35
TA7233P	4.63
TA7240AP	2.55
TA7245P	1.95
TA7310P	2.15
TA7313AP	0.65
TA7314	3.50
TA7323P	3.15
TA7325P	1.15
TA7339P	1.85
TA7340P	5.95
TA7607AP	1.30
TA7609	2.35
TA7611AP	2.32
TA7616P	5.25
TA7622AP	8.94
TA7628P	1.73
TA7629P	7.50
TA7630P	0.95
TA7640AP	2.40
TA7672P	2.75
TA7676P	2.81
TA7726P	10.25
TAA320A	1.27
TAA350A	6.59
TAA570	1.85
TAA621AX1	4.85
TAA661B	0.95
TAA691	8.58
TAA700	2.37
TAA930	4.36
TAA970	2.83
TAG626-600	1.20
TBA120AS	1.45
TBA120SB	0.40
TBA120T	0.57
TBA120U	2.50
TBA120A	1.05
TBA1440	1.94
TBA1441	1.95
TBA395	1.10
TBA396	1.20
TBA400	2.39
TBA440C	2.34
TBA480Q	1.30
TBA510	1.37
TBA520	1.20
TBA530	1.30
TBA540	1.72
TBA560C	1.40
TBA570Q	1.60
TBA570A	1.71
TBA673	2.60
TBA700	1.85
TBA720	4.32
TBA730	3.55
TBA750Q	2.50
TBA760	1.71
TBA800	1.08
TBA810S	1.61
TBA810T	1.75
TBA820	0.66
TBA820M	0.82
TBA890	3.50
TBA920	1.65
TBA940	1.87
TBA950	1.55

TBA970	3.60
TBA990	1.98
TCA270S	2.15
TCA270SQ	1.05
TCA290A	2.39
TCA420A	2.16
TCA440	2.25
TCA530	2.24
TCA640	2.25
TCA650	3.05
TCA660B	2.60
TCA730	2.75
TCA750	2.25
TCA800Q	5.95
TCA830S	2.38
TCA890	5.44
TCA900	2.04
TCA910	1.65
TCA940	0.82
TCA940E	2.93
TD3F800R	6.51
TD3F900H	5.50
TDA1001B	2.31
TDA1003A	1.47
TDA1005A	2.02
TDA1006A	7.00
TDA1010AF	4.25
TDA1011	1.14
TDA1010	1.10
TDA1011A	1.54
TDA1028	2.45
TDA1034B	2.42
TDA1035S	2.95
TDA1035T	1.70
TDA1037	1.79
TDA1037D	2.05
TDA1044	2.10
TDA1047	3.25
TDA1059B	0.80
TDA1054M	1.21
TDA1060	2.60
TDA1082	3.25
TDA1151	0.95
TDA1190	1.27
TDA1190Z	2.48
TDA1200	1.51
TDA1235	3.88
TDA1236	4.30
TDA1270	3.74
TDA1327A	6.93
TDA1412	1.08
TDA1420	1.52
TDA1440	3.45
TDA1470	2.90
TDA1470P	4.25
TDA1506	5.74
TDA1510	4.60
TDA1512	2.57
TDA1515	2.55
TDA1559	3.15
TDA1670	2.47
TDA1770	2.88
TDA1905	1.27
TDA1908	2.55
TDA1940	3.89
TDA1950	2.50
TDA2005	1.76
TDA2006	1.35
TDA2004	1.10
TDA2002	0.90
TDA2003	1.00
TDA2030	1.05
TDA2140	4.77
TDA2150	4.48
TDA2151	2.47
TDA2160	4.01
TDA2161	5.81
TDA2170	4.75
TDA2270	2.50
TDA2520	2.25
TDA2522	13.41
TDA2524	4.50
TDA2525	5.58
TDA2532	2.50
TDA2530	2.20
TDA2541	1.00
TDA2540	0.99
TDA2545Q	5.94
TDA2560	2.50
TDA2575A	0.50
TDA2578A	2.95
TDA2576A + Kit	12.35
TDA2581	1.60
TDA2582	1.35
TDA2591	2.15
TDA2594	2.45
TDA2593	1.99
TDA2595	2.46
TDA2600	7.00
TDA2611AQ	2.80
TDA2612Q	6.58
TDA2611A	1.25
TDA2610	2.79
TDA2620	0.95
TDA2630	2.50
TDA2631	2.73
TDA2640	3.80
TDA2652	8.62
TDA2653	5.16
TDA2654	4.73
TDA2670	2.48
TDA2680	3.20
TDA2740	10.14
TDA2780AQ	9.12
TDA2795	2.78
TDA2791	1.81
TDA2910	13.25
TDA3300B	7.24
TDA3330	3.16
TDA3506	4.40
TDA3501	5.50
TDA3500	7.58
TDA3510	5.95
TDA3520	9.71
TDA3540	2.20
TDA3541	2.22
TDA3560	5.83
TDA3571Q	9.06
TDA3576	7.48
TDA3590	6.79
TDA3591	6.45
TDA3650	6.91
TDA3652	5.74
TDA3651AQ	3.95
TDA3651	1.28
TDA3651A	2.50
TDA3950	4.50
TDA4050B	3.40
TDA4280	7.20
TDA4290	1.95
TDA4400	4.90
TDA4420	2.30
TDA4422	8.32
TDA4427S	9.00
TDA4431	2.27

TDA4440	1.95
TDA4442	5.14
TDA4500	4.75
TDA4600-2	1.75
TDA4610	5.99
TDA4620	7.75
TDA5500	14.20
TDA5700	2.75
TDA7270S	1.60
TDA8190	4.30
TDA9403	3.70
TDA9503	2.92
TDA9513	3.15
TDB1033	2.68
TDE1081	7.24
TEA1002	4.93
TEA1009	1.65
TEA1014	3.00
TEA1020SP	4.93
TIC106C	0.61
TIC106M	0.65
TIC44	0.72
TIC45	0.55
TIC47	0.77
TIP120	1.55
TIP110	0.35
TIP112	0.49
TIP117	0.95
TIP121	0.40
TIP126	0.38
TIP132	0.99
TIP137	0.96
TIP29	0.84
TIP2955	0.86
TIP29A	0.46
TIP29B	0.63
TIP29C	0.40
TIP29D	0.75
TIP3055	0.66
TIP30A	0.41
TIP30C	0.40
TIP31A	0.34
TIP31B	0.38
TIP31C	0.39
TIP32A	0.35
TIP32B	0.46
TIP32C	0.28
TIP33	0.82
TIP33A	1.02
TIP33C	0.95
TIP34	0.75
TIP41A	0.36
TIP41B	0.31
TIP41C	0.51
TIP42A	0.29
TIP42B	0.79
TIP42C	0.50
TIP47	0.65
TIS43	1.43
TIS90	0.21
TL011CP	1.65
TL494CN	8.77
TLD72CP	1.45
TMP4320	10.75
TMS1024NLL	6.50
TMS1025N	13.61
TMS3720ANS	5.25
TMS3748NS	10.95
TMS3755	9.66
TMS3894NL	19.25
TMS5102NLL	6.25
TUA2000	8.98
TY6010B	2.97
ULN2204	8.50
UPA53C	4.94
UPC1003	5.95
UPC1009C	6.32
UPC1025H	2.90
UPC1028H	2.00
UPC1032H	0.82
UPC1042C	8.95
UPC1156H	3.94
UPC1161C	4.98
UPC1182H	2.19
UPC1186H	1.05
UPC1181H	1.35
UPC1185H	2.10
UPC1188	8.77
UPC1212C	0.80
UPC1225H	2.82
UPC1230	1.88
UPC1238	1.52
UPC1278H	5.95
UPC1351C	1.81
UPC1350C	0.75
UPC1353	1.63
UPC1355C	2.13
UPC1363	4.20
UPC1362	1.80
UPC1365C	2.50
UPC1366	1.65
UPC1360C	2.30
UPC1378H	1.95
UPC141C	4.95
UPC1458	2.00
UPC151C	2.95
UPC2002	1.48
UPC30C	2.51
UPC324C	4.70
UPC32C	4.95
UPC339C	4.35
UPC41C	2.99
UPC4558C	1.24
UPC474	5.11
UPC554C	1.85
UPC575C2	1.55
UPC580C	6.60
UPC587C2	1.34
UPC592H	2.15
UPC595	2.95
UPC596	1.98
UPD1514C	4.76
UPD2819C	4.98
UPD553-164	19.52
UPD8049C-1	11.50
X0022CE	5.75
X0029CE	7.09
X0031CE	6.32
X0035TA	6.60
X0040TA	4.50
X0042CE	4.35
X0043CE	2.75
X0056CE	6.25
X0057GE	6.00
X0065CE	5.77
X0074GE	15.29
X0077GE	14.60
X0079CE	4.95
X0092CE	4.95
X0096CE	6.20
X0109CE	11.25
X0113CE	9.48
X0195CE	9.60
X0204CE	8.74
X0261CE	8.98
2PY120	4.77

IF YOU DONT SEE IT LISTED ASK FOR QUOTE. GIVE MAKE MODEL LOCATION. REMEMBER TO ADD 0.60p POST & HANDLING U.K. MAINLAND ONLY. HANDLING CHARGE TO ALL EXPORT ORDERS AT COST. ADD 15% VAT TO TOTAL

CD Player Casebook

Reports from Mike Leach, Ian Bowden and Nick Beer

Technics SL-P110

A little experience can tell you when a laser unit is beginning to fail, as I thought it was in this machine. It would read the TOC quite quickly but when a track was selected the machine wouldn't play – it would shut down and go into the stop mode. The r.f. eye pattern was very low and noisy. So I began to suspect the laser unit – until I looked at it. The lens was filthy, covered in dust with a thick film of muck all over it. Cleaning the lens restored normal results – perfect in fact. Apart from cleaning and lubrication no other setting up was required. This brings me to another point.

We all know the state a VCR can get into when used in a dusty or dirty environment, and over the years we get to know the common faults that dust causes in various machines. CD players seem to be the same. I've found that Technics machines often need their lenses cleaning, and of course the mechanics associated with the movement of the laser assembly. Philips machines also often need a lens clean. On the other hand I've very rarely had to clean JVC or NAD lasers. Obviously the environment in which a machine is used plays an important part in determining its lifespan, but it seems that some makes suffer more than others from dust. How about some comments on this from other readers?
M.L.

Technics SL-P202A

Skipping was the complaint with this machine, and we were surprised to find that the fault occurred straight away. With the top cover removed the reason could be seen. The whole sprung part of the mechanism was shaking laterally, with variable force, the result being that the radial arm jumped tracks. Investigation showed that the cause was a deep pit worn into the white plastic angled plate on which the ball bearing presses. This plate is clipped to the clamping arm. As the arm isn't part of the sprung mechanism, the bearing was presumably forcing the mechanism to move as it went into and out of the pit. We replaced the plastic plate and fitted an anti-sticking pad to the inner end of the radial arm slot as suggested by Technics.
I.B.

Pioneer PD4100

The reported fault was that this machine wouldn't play any discs. On a training course we'd heard about a fairly common problem that gives this symptom with these machines – it's also been reported in this magazine. So we loaded a disc. When the machine had read the TOC we selected play, expecting the machine not to. Much to our surprise it worked perfectly. We then left it on soak, but when we tried to restart the machine after it had played through the disc the fault appeared. The disc span up to what appeared to be the correct speed but there was no track display and no sound. A scope check on the r.f. waveform then showed that it was expanding and contracting. This reminded us of something else said on the course – "think PLL". We put the machine in the test mode and checked the VCO frequency, which was far too low. With the adjustment potentiometer at nearly fully clockwise the VCO would reach the correct 4.275MHz and the machine would then play. Just a quick squirt of freezer on IC2 (CX1082AS) which contains the VCO increased the frequency greatly. A new CX1082AS chip put matters right.
I.B.

Pioneer PDM500

This machine had been in a couple of weeks previously with the complaint that while it would load discs it would then eject one and go on to the next until all six had been ejected. It wouldn't read any of them. When we tested the unit it performed without fault. Flexing the laser unit's flexi-PCB didn't provoke the problem, neither did gentle heating and tapping of the laser unit itself. Since the fault failed to appear we left the machine on soak test. A few days later it was collected.

After a few days it returned with the same complaint and this time the fault did occur. The machine would load a disc, achieve FOK and the disc would spin up. But focus was then lost and you could hear the lens tap rather loudly against the disc which was then ejected. The machine ran all right when sequenced through in the test mode, which rather threw some of the theories being put forward in the workshop. A look at the error waveforms and the r.f. however convinced me that the laser unit was a fault, which proved to be the case. The disc motor was also worn but this was not, as is sometimes the case with these symptoms, the cause of the fault.
N.B.

Technics SL-P250

These machines use a mechanism with one guide shaft and one roller. In our experience it has proved to be very reliable. This particular machine was reported to be skipping, but when we tested it the drawer wouldn't close – if closed manually it would open. The machine was very dirty, as were the enclosed discs which were also damaged. This made it necessary to replace the roller, guide shaft and laser unit, which had been affected by the very fine dust. When we'd done all this we investigated the drawer problem. A clue was given by the fact that the laser would come on and the lens would try to focus when the drawer was open. Investigation showed that the drawer-in switch was permanently short-circuit due to a whisker in the relevant connector to the main PCB.
N.B.

Pioneer PDM500

This system control fault could have occurred with many types of equipment, not just a CD player. When reverse search (not skip) was selected it worked but several erroneous display symbols were illuminated. In this circuit the display and key-scan lines are commoned and a quick look at the circuit diagram suggested that if eject and disc-1 were selected a similar effect would occur. It did. The obvious cause was D209 on the relevant line. We found that it had a 17·5Ω leak both ways. This illustrates the importance of checking the symptoms and "commoned possibilities" carefully when dealing with syscon faults. One could easily have accused the system control microcomputer chip as it drives both the keyboard and the display
N.B.

NICAM Digital Stereo Sound

Part 3

Eugene Trundle

In this concluding part we'll deal with Nicam decoder setting up, fault diagnosis, and add-on/separate units.

Setting Up

The TA8662 DQSPK demodulator chip has two clocks. There are three ways of setting up its 6.552MHz carrier clock. You can connect a frequency counter at pin 7 of the chip and adjust the trimmer connected to pin 6 for 6.55185MHz ±50MHz with no signal applied. You can connect a scope to pin 20, with external sync from pin 22, and, with a Nicam signal present, adjust the trimmer for the sharpest eye pattern possible – see Fig. 16(a). Or, if you have a scope capable of believable X-Y displays at 6.5MHz (check its specification!), you can connect the X channel to pin 19 of the chip, the Y channel to pin 20 and, at a setting of 1V/division, you then adjust the trimmer for a square, upright, clear and sharp eye pattern like that shown in Fig. 16(b).

There are two choices when it comes to setting the 5.824MHz data clock frequency. First, with a Nicam signal present, you can adjust the trimmer at pin 22 for a reading of 0V ± 30mV on a digital voltmeter connected between pins 12 and 21. Alternatively you can adjust the trimmer for 5.824MHz ± 20Hz with a counter connected to pin 26 and no signal input.

The clocks of later demodulator chips such as the Philips TDA8732 are controlled by means of varicap diodes and have no trimmers. It may still be necessary to check the frequencies. With the TDA8732 the carrier clock should read 13.104MHz at pin 10 while the data clock should read 11.648MHz at pin 20.

There's just one clock to adjust in the CF70123C demultiplexer chip. You can connect a counter at pin 11 and adjust the trimmer connected to pin 12 for 16.384MHz ± 50Hz, or alternatively you can check for 8.192MHz (I2S bus mode) or 16.384MHz (S bus mode) at the DA clock output pin 40. The Toshiba TC6011 and JVC VC5020 chips use the clocks in the QSPK chip and thus have no separate adjustments. Any crystal or ceramic filter oscillator associated with the DAC chip is non-critical and thus non-adjustable.

With one or two decoder designs, notably from Hitachi, there's an adjustable 6.552MHz bandpass filter in the signal path to the QSPK demodulator. Carry out adjustment for the best eye pattern at pin 20 of the TA8662N chip – follow the manufacturer's setting-up instructions to the letter.

Fault Diagnosis

Virtually all faults in the Nicam section of a receiver produce the same symptom – no Nicam sound at all, with indication by the panel LEDs. It's always this way with digital equipment! If you are faced with this symptom, first ensure that the TV transmitter's output includes Nicam sound then check the voltage at pin 18 of the TA8662N chip. If it's low, either there's no coherent Nicam input (check for a >150mV waveform, like an off-video head envelope pattern, at pin 4) or a PLL isn't locked. In the latter case check the clock frequencies as just described. If the voltage at pin 18 is high, the TA8662N chip is working, happy and locked, the fault being farther downstream.

Before getting too deeply involved with the operation of the demultiplexer chip when dealing with the no-Nicam symptom, check that the 5V supply is present and that the data and clock signals are reaching it from the QSPK demodulator chip. Next check the feeds to the DA converter – clock, ident and data. With the Texas CF70123 chip pin 34, mute output, is a useful point to check. With a good Nicam signal the voltage here should be low. If so the chip is working correctly, supplying data to the DA converter chip which, in these circumstances, is the next thing to check. If the voltage at pin 34 is high however the problem is with the demodulator or demultiplexer circuits. The first check in this case should be at pin 9 of the demultiplexer chip, where a rectangular waveform should have a 50:50 duty cycle. If it's out, try adjusting the 16.384MHz clock trimmer at pin 12 – correct setting up (see above) should follow this rough check. If the waveform at pin 9 is correct, check the frequency of the system clock input at pin 28. If it's not spot-on at 5.824MHz the demodulator chip is not locked and the voltage at its pin 18 will probably be low. Similarly the 728kHz clock signal at pin 22 of the demultiplexer chip will not be spot on with the demodulator chip unlocked. Incidentally these frequencies can be used to check and calibrate your counter when the decoder is producing Nicam sound. . .

There are some other test/switching pins around the Texas demultiplexer chip worth knowing about. Pin 8 goes high as an error flag when data on the S bus is bad. In some decoder designs this output is routed to the DA converter. Test pin 19 (C4 enable) switches the chip to produce unrelated programme sound when forced high. This is indicated by a high output at pin 35 (C4 output). If test pin 20 is forced high the internal mute system is overridden, permitting the chip to talk gibberish!

Other demultiplexer chips have similar test/switching pins that can be identified from the setmaker's service data and used as necessary. Where a separate memory chip is used for de-interleaving, use a logic probe or an oscilloscope to check the address, data, read/write enable and, where applicable, the chip select lines for stuck or open-circuit conditions.

Distorted Nicam sound is rarely due to a fault in the digital sections of the circuit – they tend to mute when not working perfectly. With this fault condition

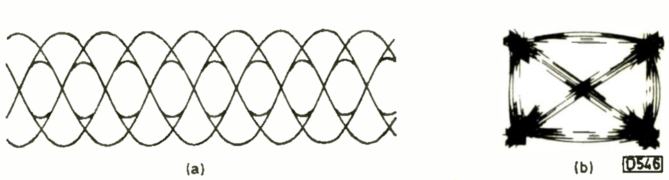


Fig. 16: Eye patterns associated with decoder setting up.

start at the outputs from the low-pass filters downstream of the DA converter chip(s). Any fault that affects only one of the stereo channels – no or low ouput, distortion, noise etc. – will definitely not be in the digital circuitry since the L and R information is inextricably mixed here. Check at the relevant low-pass filter's output. If the waveform here is bad, concentrate on the DA conversion operation. If all is well at the low-pass filter, check for good operation via the auxiliary and f.m. inputs to narrow down the field of search – these share most of the post-conversion circuitry.

Because the signal is always on tap fault diagnosis, testing and setting up are much easier with a Nicam decoder than with the signal-processing stages of a CD player. You don't need to have servos up and running, a laser throbbing or the vital TOC as a turnkey. It's unlikely that Nicam decoders will prove to be troublesome since the circuitry operates at low power levels, there are no moving or wearing parts and the decoder lives a quiet life. Once operating perhaps the only things that could cause damage are flashovers within the set or over-voltage due to the failure of a supply-line regulator. Soldered joint reliability and plug/socket performance with modern equipment is very good – it wasn't always so!

Add-ons and Separates

Some manufacturers produce retro-fit Nicam decoders for their more recent stereo TV models. In many cases however manufacturer's don't supply kits – they seem to look upon the advent of Nicam as a good opportunity to sell a new TV set or VCR. There are a couple of sources of "universal" Nicam decoders for plumbing in yourself. If this is not practical or possible you can buy a complete stand-alone Nicam receiver with aerial input, audio output and remote control. When the TV set has a "live" chassis this latter approach, in conjunction with separate amplifiers and loudspeakers, is the only possible choice.

The AVTS retrofit unit is 160 × 100 × 36mm and comes with a mounting kit plus fitting and wiring instructions for the most popular sets. It uses the Texas demultiplexer chip and requires two supply lines – 8V/250mA unregulated and 12V/100mA regulated. While it's best to use it with a set that has a parallel i.f. system it will in most cases operate with an intercarrier feed, the sensitivity being 70μV. Optional extras are four times oversampling and "personality modules" for various TV/VCR models. At the time of writing the one-off price was £78 plus VAT – there are progressive quantity discounts. AVTS is at Shelson House, 67A Shelson Avenue, Feltham, Middx TW13 4SQ (081 890 3010).

Maplin Electronics has a Nicam decoder that can be used in most modern colour TV sets. It uses the Toshiba demultiplexer chip and requires a single 12V supply at 200mA. Otherwise it has similar features and capabilities to the AVTS decoder. It's available in kit form for £99.95 (order no. LP02C) or fully assembled and tested for £129.95 (order no. AM00A). These are retail prices including VAT. The assembled decoders are available at trade prices with discounts depending on quantity.

Maplin also markets a tuner kit which, together with the Nicam decoder, gives complete independence of the TV set. This is useful where the set employs a live-chassis design or doesn't have the capacity to supply the operating power for a retrofit kit. The tuner kit is available for £44.95 including VAT (order no. LP09K).

More details can be obtained from Maplin Electronics, PO Box 3, Rayleigh, Essex SS6 8LR (0702 554 161).

At the time of writing there are two separate Nicam tuners. The cheaper one is the Motion Electronics Monitor Mk. III. It has FSS tuning with remote control, takes a standard 75Ω coaxial u.h.f. aerial feed and supplies L and R audio outputs at 250mV and 300mV levels. It also provides a composite 1V peak-to-peak video output for feeding to a TV monitor. Prices range from £140 plus VAT for the basic version without remote control to £152.20 plus VAT for the model with the highest specification including remote control and two 6W power amplifiers that provide direct drive to a pair of 4Ω loudspeakers. The address for Motion Electronics is Wisteria House, Tonbridge Road, Wateringbury, Maidstone, Kent ME18 5PU (0622 812 814).

The Arcam Delta 150 from A and R Cambridge Ltd. provides a 1V composite video output and two very high quality audio signals via scart or phono output sockets. These audio signals are obtained from four times oversampled digital filtering and twin 16-bit DA converters, one for each stereo channel. This arrangement gives optimum results. The recommended retail price is £349.90 including VAT and an IR remote-control handset.

Interfacing and Hook-ups

Regardless of the size and quality of any stereo speakers built into the TV set, if it's suitably placed in relation to external speakers (and it deserves to be!) the best option by far is to ally the Nicam receiver with a good hi-fi system. All Nicam TV sets and VCRs have audio outputs for this purpose, and the hook up to the auxiliary sockets of a hi-fi amplifier is not difficult – it works for both live and replayed stereo programmes. The performance of the sort of cheapie stacker system that can't afford an auxiliary input socket is an insult to Nicam sound! Most Nicam TV sets have external speaker sockets that can be used as an alternative to connection to a separate amplifier, but in this case beware of blowing up the sometimes hard-pushed internal audio amplifiers by using too low an external speaker impedance or parallelled speaker connections.

By now it must be obvious that to get stereo sound from a VCR into a TV set you must have a baseband AV cable link. VCRs don't incorporate a built-in Nicam encoder so that the stereo sound can be squeezed through an aerial link! A scart-to-scart lead between the TV set and the VCR is all that's required. In practice so long as a VCR fitted with a Nicam decoder is well connected it's not essential for the TV set to be of the Nicam, or even stereo, type. For off-air viewing select the same channel on both the TV set and the VCR, switch the hi-fi amplifier to aux and the VCR to stop. It will then all happen.

It's not widely known, especially amongst retail sales staff, that you can record broadcast stereo sound from a Nicam TV set on a non-Nicam VCR with hi-fi sound facilities. The L and R signals are available at the TV set's scart socket, pins 3 and 1 respectively, and can be fed into a VCR via a suitably wired scart lead. This is not such a practical arrangement as the previous one since the TV set has to be on to capture the stereo broadcast, something that may not be easy to arrange for an unattended or time-shift recording. There's an increasing trend however for hi-fi VCRs to be fitted with Nicam stereo decoders.

If you use a separate Nicam tuner/decoder in conjunction with a VCR or TV set it's safe to leave it on permanently – as we already do with satellite TV receivers.

Nicam Broadcast Schedules

The BBC has long been carrying out experimental Nicam broadcasts from the Crystal Palace transmitter: its full scheduled service is due to begin in the Autumn of 1991. At that time six main transmitters with their relays will come on stream simultaneously, covering about 80 per cent of the population of the UK. The IBA has been following a more gradual programme. At the time of writing the following transmitters and their relays are providing the service: Crystal Palace, Emley Moor, Wenvoe, Mendip, Winter Hill, Caradon Hill, Durris, Belmont, Rowridge, Sandy Heath and Black Hill (but not the Torosay group relays). Bilsdale, Caldbeck, Divis, Dover, Pontop Pike and Sutton Coldfield are due to be in operation by the end of the year, when 75 per cent of the population should be covered. Complete coverage is expected within five years.

Servicing Microwave Ovens

Nick Beer

Microwave ovens are becoming a familiar sight on the benches of TV/VCR engineers. There are a couple of reasons for this. First, they are produced by traditional brown goods manufacturers such as Sanyo, Panasonic, Sharp and Hitachi. As a result, non-white goods dealers sell them. Secondly the technology employed in the control and "consumer interface" circuits is similar to that used in TV sets and VCRs. Thus fault-finding is put out of reach of the average white goods engineer – unless the company concerned follows the undesirable practice of simply panel swapping. Servicing is best done by brown goods engineers who can do it more effectively, efficiently and profitably.

Ever willing to keep engineers informed, we're presenting this short introduction to the delights of servicing microwave ovens. The main emphasis is on servicing practice. If there's sufficient interest we can go into the subject in greater detail at a later stage – and also arrange to pass on those ever-helpful fault reports on particular models.

Safety

Before getting involved with microwave ovens it's vital to understand that they can be dangerous and that there are important safety requirements.

There are very high voltages in a working microwave oven. Since the capacitor used in the h.v. circuit can hold a hefty charge for some time after the unit is switched off it should be discharged safely with a bleed resistor before an unpowered unit is tested. With the unit on, avoid contact with the h.v. areas. Don't discharge the capacitor by shorting it to produce a big bang and arc. This is very bad practice, especially in units that employ a microcomputer chip in the control circuitry. When there seems to be a fault in the h.v. circuit it's advisable, wherever possible, to make cold checks on components. We all know that measuring e.h.t. voltages is not desirable and is usually unnecessary as cold checks will prove the point. For h.v. checks connect the meter before powering the unit: this will prevent arcs. The h.v. used in a microwave oven may be only 10-20 per cent of the e.h.t. voltage in a colour TV set, but the current is higher and shocks can be fatal.

The second major danger is the microwave energy itself. With a correctly working machine door interlock switches prevent radiation emission when the oven door is open. With the units I've handled I have found that there is no detectable emission from around the cavity and h.v. components with the top/side covers removed. Nevertheless common sense should tell you not to tempt fate. For your own protection, check for leakage before carrying out any repair work. Use a recognised quality leakage meter that's regularly checked and calibrated. A good example is the Apollo XI. The recommended test specification is for a reading of less than 5mW when the meter is moved along the seals around the cabinet and door. Retest the oven before returning it to the customer. In practice with a safe oven the needle rarely moves.

The main causes of excessive leakage are a build up of dirt around the door seals as a result of which they don't close properly, damage and wear of the seals and damage to the door. If the unit is dropped or someone walks into the door while it's open the result could well be door damage and leakage.

It should go without saying that you mustn't even consider testing the magnetron outside the unit. Correct assembly of the door is vital, also correct adjustment of the interlock switches and correct operation of the interlock switch monitoring circuitry. There are mandatory Health and Safety at Work regulations regarding warnings and cautions with respect to the h.v. and the microwave energy. Because of the built-in safety features microwave ovens should not be tackled by anyone who is unfamiliar with them.

User Problems

Misuse causes many faults. Cleanliness is important. Leakage and arcing can occur with a dirty oven – and we all know that for some customers cleanliness doesn't come easily!

There's a definite knack to microwave cooking, and the customer must get used to it. In addition to the instruction manuals the leading brands usually have available good cookery books.

Basic Operation

The basic circuitry used in a microwave oven is comparatively simple. Fig. 1 shows a typical example. Obviously there are many different designs, the differences relating mainly to the control arrangements. Things tend to get a bit more complicated when the microwave oven is combined with a conventional grill/oven, as in the very popular Panasonic Dimension Four series. Virtually all modern units incorporate digital control circuitry.

As you can see from Fig. 1 the incoming mains supply enters via a fuse and filter circuit. Depending on design, the fuse is rated at around 6-10A. The mains voltage is applied to a transformer which energises the magnetron. It's also used to supply the oven lamp and such items as the fan/blower motor, the timer motor and the turntable motor. The oven lamp is usually a pygmy bulb: the mains fuse can blow when it fails, a possibility that's often overlooked. You will notice that there are several switches in series with the mains supply. There are usually two door interlock safety switches that close only when the oven door is closed, preventing operation of the unit with the door open.

These interlock switches are usually situated by and operated by the door's hooks. Fig. 2 shows an example. A degree of adjustment is usually possible with the switches or the hook receptacles. If the owner continually slams the door it may shift to the extent that the oven doesn't work. Correct adjustment is obviously important to maintain the safety of the unit. The switches usually fail-safe, i.e. open-circuit. Both switches would have to go short-circuit to allow the unit to operate with the door open – except that there's another switch operated by the door. The shorting switch SW6 is connected across the transformer's primary winding to a point after safety switch 1. It closes when the door opens, which in normal operation means that the safety switches are open and thus the mains supply is removed before SW6 closes. If the interlock switches SW4/5 did go short-circuit SW6 would place a short across the mains supply, blowing the fuse – a real crowbar. Failure or misalignment of all three switches could result not only in no go but fuse blowing. A common fault is "it went bang when I slammed the door".

The other switches in the primary feed, SW1 and SW2, are thermal overload cutouts of the type used in many domestic appliances. They are usually found on the surface of the oven cavity and the body of the magnetron. Overheating leads to their failure.

The mains transformer is a pretty hefty affair, usually bolted to the floor of the unit. One secondary winding provides the magnetron's filament (heater-cathode assembly) supply. This is a low-voltage a.c. supply, with high current flow. The main secondary winding produces the h.v. supply in conjunction with the diode and capacitor. This is a negative supply which is fed to the magnetron's cathode, its anode being connected to the chassis line. About 2kV is fed to the capacitor, which with the diode and magnetron form in effect a half-wave voltage doubler circuit producing a pulsed d.c. voltage of about 4kV.

Fig. 3 shows the internal construction of a typical microwave oven magnetron. It could be considered as a rather special form of diode, having an anode, a cathode and a vacuum. So physical shock can cause damage: internal arcing is a common result. The really special bit is the anode, which is at chassis potential and consists of several cavities. Due to the action of the magnetron there are −4kV pulses at its cathode. A strong d.c. field exists between the cathode and anode. Permanent magnets within the magnetron produce a magnetic field at right angles to the electric field. This crossed-field affects the electrons given off by the cathode – they follow a spiral path. The resultant oscillations are tuned

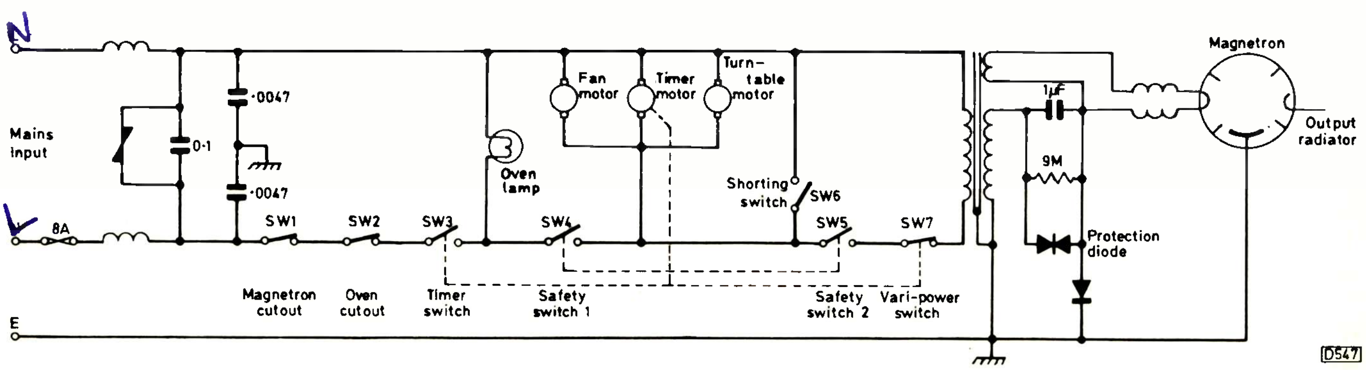
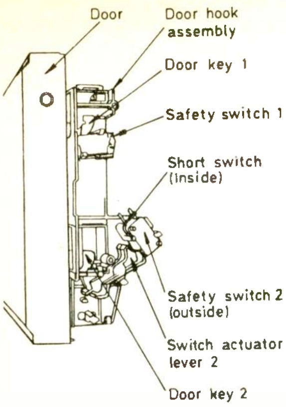


Fig. 1: Typical microwave oven circuit.



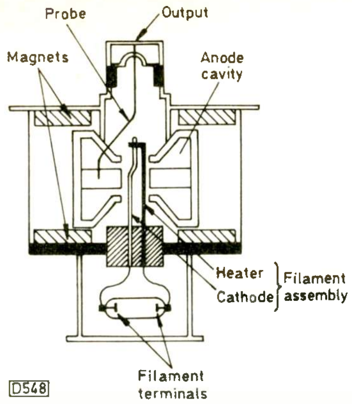


Fig. 2 (left): Interlock switches operated by the oven door.
Fig. 3 (right): Construction of a typical magnetron.

by the resonant cavities that form the anode. Microwave energy is picked up by a probe that's inserted in one of the cavities. It acts as a small aerial whose output is fed to the oven via a waveguide.

Fault Patterns

Disregarding electronic control system faults, the faults that occur in a microwave oven can be split into two groups – low-voltage (mains) faults and high-voltage ones. The former include defective door switches, motors etc. These are easy to find when their purpose in the scheme of things is understood. High-voltage faults usually result in a blown fuse. In many units, as shown in Fig. 1, there's a protection diode across the h.v. capacitor. Its failure will blow the fuse. The h.v. rectifier and capacitor often have a common encapsulation. They can be checked fairly quickly, and the fault will often be found to be here. The magnetron's filament and the transformer's windings are easily checked with an ohmmeter.

Overheating of the magnetron is usually caused by an internal fault. There will generally be other symptoms such as low output or arcing. Another cause of overheating is a faulty fan motor, the result here being that the case fins are not cooled.

Transformers can arc, burn up and go open-circuit – nothing here that a TV engineer isn't used to.

Low output or slow cooking complaints can be checked by placing two 500ml beakers of cold water in the oven and heating them at full power for a fixed time, say two minutes. Record the temperatures of both beakers of water before you start and when you've completed the heating. Then calculate the magnetron's power output (W) from the formula $t \times 70$ where t is the temperature rise. Two beakers are used to avoid freak happenings and provide some form of control.

When testing a microwave oven, whether for leakage prior to or after repair or for output power, use beakers of water as a load. Ovens shouldn't be run empty, i.e. with no load.

In Conclusion

The purpose of this article has been to provide an introduction to the subject. No one should assume that after reading these brief notes they are fully competent to repair microwave ovens. The article should prompt TV/VCR engineers to consider the possibility of taking on such work. For the average engineer microwave ovens will present few problems and money can be made – even under guarantee!

Typical Faults

To wet your interest, here are one or two typical faults.

Fuse blowing with a Tricity 2013 oven was due to shorted turns in the mains transformer's secondary winding. On several occasions we've had no-go due to open-circuit door switches.

The no-go symptom with a Panasonic NE671 gave the impression that the lower door switch didn't close. In fact the door hook moulding was deformed and failed to activate the switch.

Early Panasonic NE691 ovens suffered from auto-sensor elements that upset the autosensor functions. The microcomputer chip also causes this fault.

The Panasonic NE651/661/662/671/691 use the basic switch arrangement shown in Fig. 1. Failure to operate or mains fuse blowing should lead to a check on the three microswitches activated by the door. We've had several instances where the shorting switch has failed to open when the oven door is closed.

A problem we've had on a number of occasions with the Panasonic NE992/993 is that the display reads "h" when autosensor programs are selected. This suggests that the oven is hot, upsetting the autosensor which works on the humidistat principle, though the oven may well have been just switched on. The cause is usually the microcomputer chip in the digital programming circuit, but on one occasion the oven temperature sensor was corroded, causing the fault in conjunction with the chip.

TEST CASE

335

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 test case workshop handles a very wide range of makes and models, as previous items in these pages have shown. Every so often however we're confronted with a stranger bearing a badge such as Osaki, Sakura, Contec, Hinari or whatever. All very fine makes no doubt, but with no service data on file and no spares sitting on the shelf such items can be regarded as a challenge or a pain in the rear, depending on the workload at the time and the temperament of the man who gets landed with the job.

What we had this time was a GoldStar VCR, Model GHV1232I no less. The job seemed to be a simple one – perhaps one that could be dealt with despite not having the service manual. The problem was that the machine would shut down within three seconds of selecting any mode in which the tape moved. It couldn't be a loading problem, because the fault occurred in the fast-forward and rewind modes. Probably a broken reel drive belt or something like that.

In order not to damage any tape we started off with a dummy cassette. When this was inserted the head ran up to speed, the take-up spool turned all right, then the machine shut down. During the unlacing process the supply spool turned backwards, indicating that it was safe to load a genuine cassette. When we did this we got a brief glimpse of a picture during the few seconds before the machine once more returned to stop.

The classic opening move in a situation like this is to key in pause and see what happens. If the machine still shuts down, failure of the head-drum PG pulses to reach the syscon is likely. If, as happened in this case, the VCR remains happily in pause for several minutes the thing to check is the reel-rotation sensor pulse output, which may be weak or missing. We were beginning to miss the service manual! Fortunately there are only four wires to the deck-top mounted reel-sensor PCB. These are clearly marked – VCC, GND, LED and PULSE. Who needs a manual? We found that there was 5V on the VCC line, zero volts on the GND line, a small voltage appropriate to a LED on the LED line and that pulses were present on the PULSE line. Now we do need a manual!

Putting the machine into fast-forward give us two or three seconds of faster pulses from the reel sensor, but the machine then shut down just as surely. All we could do was to trace the reel-sensor pulses through the various plugs and sockets to their final, secret destination on the large PCB. They got there intact. In checking the progress of the pulses we noticed that they were misshapen – varying in height and noise content. We also saw, and this was the key to the solution of the problem, that the peak-to-peak pulse amplitude averaged about 2V. We couldn't be sure, with nothing to guide us, but this didn't seem to be quite enough. What to do? The only thing for it, we thought, was to order a replacement optocoupler, the heart of the reel-sensor system. So the order went in and the GoldStar VCR joined the row of partially-dismantled machines in the waiting-spares rack.

When the little, four-legged black bit arrived we were gratified to find that the take-up spool turntable could be lifted up and clear of its shaft once the retaining ring had been removed – there's no need to remove the front-loading cradle. Once we'd removed the turntable there followed a moment's silence then a roar of exasperation. The new optocoupler wasn't needed after all! What was the cause of the trouble, and how could it have been caused by previous less than professional attention? See next month for the answer and another test case item.

ANSWER TO TEST CASE 334
– page 948 last month –

Our video enthusiast customer last month was convinced that his VCR's heads were faulty. As tests proceeded the workshop staff also began to believe this. The symptoms with the Ferguson FV14T were just like those you get with lack of drum earthing: there were white spots and blips all over the picture, present in the playback mode only, but no amount of experimentation with the upper drum earthing arrangements made the slightest difference – and most of the other possibilities were ruled out when we discovered that the spots want away like magic with the machine in the pause mode.

This suggested that the interference was coming from either the capstan or the reel motor. In this design both are of the brush type. With the machine in the playback mode we disconnected each in turn electrically and watched the picture closely during the moment or two before the syscon brought about shutdown. When the reel motor was disconnected the interference on the picture cleared as the tape started to spill on to the deck.

Our first step was to check the decoupling capacitors associated with the feed to the motor. As these appeared to be in order we decided that the motor itself must be faulty. A replacement completely cured the trouble, proving that the interference was being produced by some form of sparking or poor contact at the commutator. It's an unusual fault with this type of deck, which is used in several JVC, Ferguson and other makes/models.

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HRS BARGAIN CORNER

COMMODORE SPARES

Order Code	Description	Price Each
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32550202	IIC 2017/6116 S-RAM	6.16
25146801	ILine Filter Assembly	1.15
90143501	IIC 6502A	3.45
90143701	IC 6522 VIA	2.59
90152232	IC 7402	1.03
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25126301	DC Power Jack Socket	0.58
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25153502	IC 8360	16.57
25184201	Filter Emi	0.13
31800601	IC 23128 ROM Ted Basic	13.29
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FB3	Ferrite Bead 4 x 3mm	0.03
90610601	Crystal 17.734MHz	4.03
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74LS74	IC 74LS74	0.56
74LS24S	IC 74LS24S	0.89
90145301	IC 2114L S-RAM	4.41
7406	IC 7406	1.05
90244229	Resistor Pack 3K3 8 Pin	0.23
2N3904	Transistor	0.49
C64/C64C — Continued		
74LS257	IC 3 State 4 x 2 Inp. Mulpxr 16 Dil	0.97
90450001	Power Switch	1.40
90610002	Expansion Socket 44 Pin	4.60
32557301	Video Socket 8 Pin Din	0.59
90612801	IC MC4044CP	4.72
90046241	Capacitor 150 PF 50V	0.23
90046245	Capacitor 220 PF 50V	0.62
74LS258	IC 3 State 4 x 2 Mulpxr 16 Dil	0.97
74LS629N	IC Dual VCO 16 Dil	2.39
90610601	Crystal 17.734MHz	4.03
74LS373N	IC 3 State Octal Latch 20 Dil	1.36
100104111	Serial Number 4/Pack	0.27
32616001	LED Plate	0.54
32629901	Power Connector Panel	0.41
25169701	RF Modulator (C64)	23.50
25230401	Logo Nameplate	0.18
25191602	RF Modulator (C64C)	10.39
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TT258C	Software For Paragon	7.95
C128		
32550202	IC 2016/6116 S RAM	6.16
31503501	Connector 9 Pin D RGB1	3.31
25184203	Filter	0.02
31501201	IC 8721 R3 PLA	9.03
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CBM128SGD	User Manual/System Guide	5.78
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25125901	Joysick Socket 8 Pin Mini Din	0.92
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32498050	Introduction To Basic Manual Part 1	2.62
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31705301	IC 8005-021 Function ROM Low	13.68
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74LS244	IC Octal 3 State Buffer 20 Dil	1.05
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60801054	Transformer Sub-Power	1.10
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60101345	IC 2732 EPROM	30.33
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MPS803		
60102005	T Belt MM310	3.31
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AF178	0.75	0.15
BC116A	0.15	0.05
B[illegible]25B		0.10
BC148A	0.12	0.05
BC160	0.45	0.25
BC172B	0.17	0.10
BC177A	0.16	0.05
BC178A	0.16	0.05
BC212LB	0.15	0.10
BC251A	0.10	0.05
BC252B	0.16	0.05
BC252A	0.12	0.05
BC304	0.72	0.50
BC327A	0.16	0.05
BC327B	0.16	0.05
BC460	0.54	0.35
BC477	0.29	0.15
BC556B	0.14	0.10
BC558B	0.09	0.05
BCY79	0.10	0.06
BD176	1.19	0.50
BD187	0.75	0.50
BD206	2.03	0.50
BD239D	0.44	0.20
BD440	1.30	0.50
BD561	0.32	0.10
BD681	0.22	0.15
BD907	0.50	0.15
BDX44	1.02	0.65
BDX47	1.08	0.30
BF114	0.58	0.20
BF161	0.58	0.20
BF423	0.25	0.10
BF659	0.75	0.25
BFR41	0.25	0.18
BFR52	0.25	0.10
BFR81	0.32	0.10
BSW67A	0.88	0.15
BU705	2.23	1.40
BU800S	1.54	1.00
BUW81A	1.35	0.95
MJ4035	3.64	2.40
MJE340AT	0.32	0.05
MJE350	0.60	0.35
MPSU56	0.75	0.40
TIP29	0.42	0.20
TIP30B	0.38	0.20
TIS92	0.32	0.10
S2000AF	1.84	1.25
S2802	2.20	0.50
ZTX300	0.20	0.15
ZTX500	0.20	0.10
2SA234	0.30	0.10
2SA342	0.36	0.10
2SB54	0.65	0.10
2SB186	0.40	0.10
2SB324	0.36	0.10
2SB405	2.10	0.15
2SB492	1.98	0.15
2SB566	1.84	0.15
2SC380	0.43	0.10
2SC388A	1.18	0.10
2SC460	0.40	0.15
2SC458	0.59	0.10
2SC461A	0.25	0.10
2SC580	5.25	0.20
2SC566E	0.54	0.10
2SC536F	0.20	0.10
2SC537F	0.22	0.10
2SC711	0.24	0.05
2SC732	0.58	0.10
2SC828	0.23	0.05
2SC838	0.50	0.10
TRANSISTORS — Continued		
2SC930C	0.40	0.10
2SC1129	0.50	0.10
2SD152	0.82	0.10
2SD155	2.19	0.20
2SD355	0.64	0.10
2SD389	0.60	0.10
2SD390	1.10	0.10
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DIODES/ZENER DIODES		
AA143	0.10	0.03
AA144	0.10	0.05
ADF3	0.30	0.05
B336	0.10	0.03
BA158	0.45	0.05
BA315	0.15	0.05
BA479G	1.88	0.10
BAV20	0.14	0.05
BAX13	0.05	0.02
BB119	0.11	0.05
BB417	0.60	0.05
BPW34	1.40	0.10
BY198	0.14	0.10
BY218-400	0.15	0.05
BY237	0.30	0.15
BY296	0.26	0.15
BYX36150	0.21	0.05
BZTO3C11	0.21	0.15
BZV15C12	1.10	0.10
BZV15C12R	1.10	0.40
BZV15C24R	1.10	0.30
BZV46C1VS	1.10	0.10
BZX79C51	0.10	0.05
BZX83C6V2	0.10	0.03
BZX83C12	0.10	0.03
BZX83C15	0.10	0.03
BZX83C28	0.10	0.03
CDG22	0.18	0.03
CDG23	0.10	0.03
DA131A	0.75	0.05
OA90	0.10	0.03
OA95	0.17	0.12
RGP15J	0.73	0.15
1K90	0.14	0.03
1N34A	0.35	0.03
1N60	0.10	0.02
1N4002L	0.07	0.03
1N4764A	0.22	0.03
1N5242B	0.12	0.03
1N5266B	0.14	0.04
1S86	0.55	0.05
1S923	0.09	0.02
1S990A	0.10	0.02
1S2076	0.20	0.02
1S2473HJ	0.22	0.02
1S2688	0.24	0.02
1S5012A	1.30	0.90
I.C's		
A1034	1.22	0.10
AN7106	2.85	2.40
AN7145M	2.60	0.95
BA1310F	1.72	0.20
CX130	5.95	1.00
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CX170	6.92	1.00
CX187	4.40	0.95
CX760D	7.56	1.00
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CX761A	7.25	1.50
CX832	3.85	0.95
CX20007	3.90	2.50
HA1374A	2.65	0.50
HA11107	1.98	0.98
LA3160	1.94	0.50
MC1307P	1.90	1.10
MC1310PQ	1.25	0.60
MN3001	20.48	1.00
MP1638	7.63	1.00
SC9053P	1.05	0.30
SN29773	2.28	0.10
SN76110N	1.82	0.10
SN76396N	0.95	0.10
SN76533N	1.75	0.15
SN76705AN	7.96	1.59
TA7226P	1.92	0.95
TA7227P	1.71	0.49
TA7283AP	1.27	0.80
UPC1263C2	3.78	0.80
UPD547C-049	9.73	1.00
X0043CE	3.95	0.50
TBA1440	1.47	0.95
TBA395	1.86	0.20
TBA395Q	1.86	0.20
TBA393Q	1.86	0.20
TBA440	1.44	0.35
TBA480Q	1.50	0.35
TBA520Q	0.80	0.30
TBA530	1.48	0.30
TBA530Q	1.80	0.95
TBA540Q	1.25	0.60
TBA560CQ	1.16	0.20
TBA570	1.96	0.30
TBA570Q	1.40	0.95
TBA625B	3.67	0.95
TBA625C	1.63	0.30
TBA651	2.20	0.60
TBA700Q	1.98	0.25
TBA750Q	1.85	1.35
TBA760	3.10	0.50
TBA800	0.69	0.30
TBA810P	0.98	0.20
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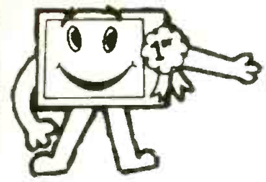

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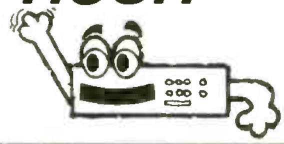

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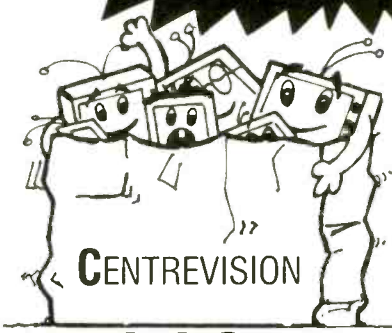

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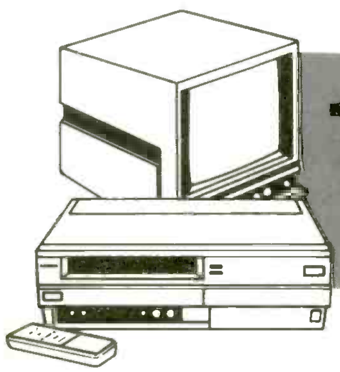

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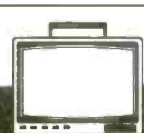

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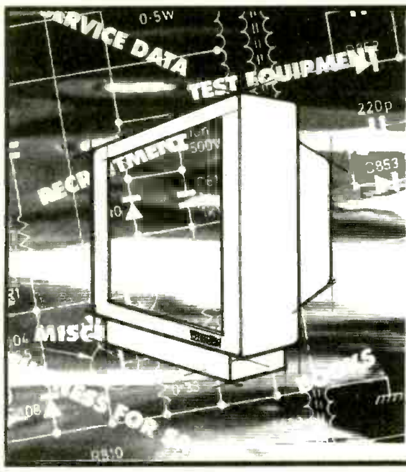

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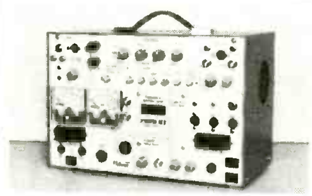

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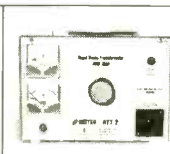

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BC114	10p
BC115	10p
BC116	20p
BC117	20p
BC119	20p
BC125	10p
BC126	10p
BC139	10p
BC140	30p
BC141	25p
BC143	25p
BC147	10p
BC148	10p
BC149	10p
BC153	10p
BC154	10p
BC157a	10p
BC158	10p
BC159	10p
BC160/16	25p
BC171	5p
BC172	5p
BC173	5p
BC174	5p
BC183	5p
BC184	5p
BC204	5p
BC207	5p
BC212	5p
BC213	5p
BC214	5p
BC237	5p
BC238	5p
BC239	5p
BC250	5p
BC251	5p
BC252	5p
BC262	10p
BC263b	20p
BC294	30p
BC298	10p
BC300	30p
BC301	30p
BC303	30p
BC307	7p
BC308	7p
BC309	10p
BC327	10p
BC328	15p
BC328/338 pair	10p
BC337	10p
BC338	10p
BC347	10p
BC349b	10p
BC350	10p
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
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BD240	50p
BD243c	30p
BD244	50p
BD250a	30p
BD252	20p
BD253B	30p
BD331	50p
BD373b	20p
BD416	25p
BD433	50p
BD437	25p
BD438	30p
BD139	50p
BD439	30p
BD544D	50p
BD650	40p
BD678	30p
BD681	30p
BD682	30p
BD507	30p
BD508	30p
BD509	30p
BD510	30p
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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	£1.00p
TA7265AP	£3.00
TA7608AP	£3.75
TA7680AP	£3.00
TA7750P	30p
TBA120A	40p
TBA120AS	50p
TBA120SA	40p
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
AF17A	25p	BF271	10p
AF139	25p	BF273	10p
AF181	£1.00	BF274	10p
AF239	25p	BF324	25p
AF367	25p	BF337	50p
AL102	£1.75	BF355	30p
AU110	£1.50	BF362	20p
BLY49	50p	BF363	15p
BF115	20p	BF367	15p
BF121	20p	BF391	15p
BF127	20p	BF394	10p
BF137	20p	BF419	30p
BF157	20p	BF422	15p
BF160	20p	BF423	15p
BF161	20p	BF448	30p
BF164	60p	BF470	30p
BF179	30p	BF471	30p
BF180	20p	BF597T	10p
		BF694	10p

Thorn Transformers

DT2076/78	£10.00
90D3-035-003	£10.00
90D4-106-003	£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	HA513385	£1.00
HD74HC86P	£1.00		