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A REED BUSINESS PUBLICATION

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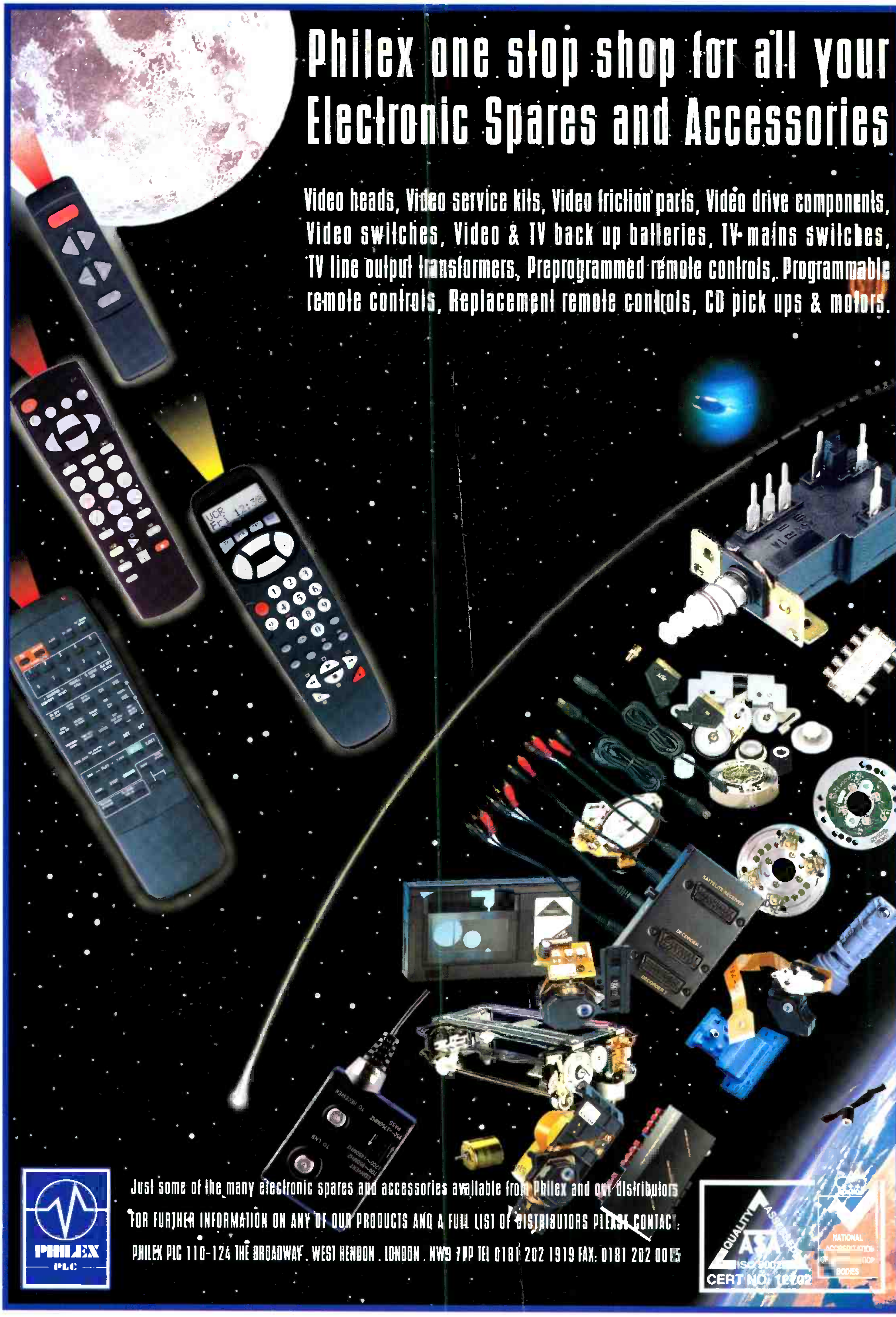

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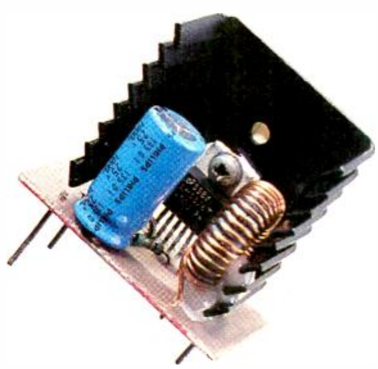

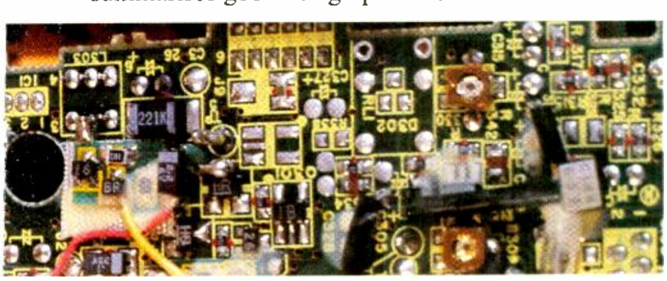

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Part	Price
AAY32	9p
AC107	40p
AC125	30p
AC126	30p
AC127	30p
AC128K	40p
AC141K	45p
AC176	22p
ACY18	48p
ACY19	48p
AD149	60p
AF125	50p
AF139	30p
AF239	30p
BB105B	18p
BB205B	24p
BC107	8p
BC108	8p
BC109	8p
BC109C	10p
BC140	20p
BC141	20p
BC142	20p
BC143	20p
BC147	8p
BC149	8p
BC159	8p
BC160	30p
BC171	10p
BC172	10p
BC177	14p
BC178	14p
BC179	14p
BC182	7p
BC182L	7p
BC183	7p
BC183L	7p
BC184	7p
BC184L	7p
BC212	7p
BC212L	7p
BC213	7p
BC213L	7p
BC214	7p
BC214L	7p
BC237	7p
BC238	7p
BC239	7p
BC300	20p
BC301	20p
BC302	20p
BC303	20p
BC304	25p
BC327	7p
BC328	7p
BC337	7p
BC338	7p
BC441	28p
BC446	8p
BC477	18p
BC516	22p
BC537	25p
BC546	8p
BC547	8p
BC548	8p
BC549	8p
BC550	8p
BC556	8p
BC557	7p
BC558	8p
BC559	8p
BC560	8p
BC637	20p
BC639	20p
BC640	20p
BCY33	200p
BCY34	200p
BCY70	18p
BCY71	18p
BCY72	18p
BD115	30p
BD124P	50p
BD131	25p
BD132	25p
BD133	50p
BD135	20p
BD136	20p
BD137	20p
BD138	20p
BD139	20p
BD140	20p
BD144	90p
BD157	38p
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BD184	60p
BD187	30p
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BD204	42p
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BD233	30p
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BD236	30p
BD237	21p
BD238	24p
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BD240	40p
BD241A	40p
BD243A	50p
BD244	50p
BD245	50p

Part	Price
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BD265	45p
BD267	45p
BD269	45p
BD278	50p
BD311	100p
BD314	100p
BD315	150p
BD317	150p
BD331	40p
BD332	40p
BD361	60p
BD362	60p
BD370	30p
BD371	30p
BD410	50p
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BD434	30p
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BD436	30p
BD437	28p
BD438	36p
BD439	40p
BD440	40p
BD441	40p
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BD534	38p
BD535	38p
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BD538	40p
BD643	50p
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BD647	50p
BD649	50p
BD675	40p
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BD679	40p
BD680	40p
BD681	45p
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BD705	50p
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BD736	50p
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BD828	50p
BD839	55p
BD897	50p
BD899	50p
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BDX33	60p
BDX65	80p
BDW24	55p
BDW93	50p
BDW94	50p
BDY92	100p
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BF167	30p
BF181	18p
BF183	20p
BF195	7p
BF199	8p
BF200	16p
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BF245	25p
BF254	15p
BF255	12p
BF256	18p
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BF617	30p
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BF871	22p
BF960	35p
BF961	38p
BF964	85p
BFR90	99p
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BFT43	20p
BFX29	20p
BFX84	20p
BFX85	15p
BFX87	15p
BFX88	60p
BFX89	14p
BFY50	14p
BFY51	14p
BFY52	14p
BFY56	25p

Part	Price
BFY64	25p
BFY90	45p
BLY48	85p
BR100	14p
BR103	37p
BR303	85p
BSS74	33p
BSX20	15p
BT100A	70p
BT106	180p
BT109	90p
BT119	100p
BT146	99p
BTY79	140p
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BU920	100p
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BU2520DF	225p
BU2525AF	325p
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BUT12	80p
BUT56A	100p
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BUY69A	200p
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BUZ11	200p
BUZ71	75p
BUZ80	200p
BY448	20p
BYT11	25p
C106D	28p
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J174	38p
J300	50p
MJ900	200p
MJ1000	200p
MJ1001	200p
MJ10012	300p
MJ15003	250p

Part	Price
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MJ3000	100p
MJ3001	100p
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MJE30A	30p
MJE340	25p
MJE350	80p
MJE520	30p
MP8112	45p
MPSA05	15p
MPSA06	15p
MPSA13	15p
MPSA20	15p
MPSA42	15p
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MPSA70	15p
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MR856	38p
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OC29	250p
OC35	350p
OC36	250p
OC45	50p
OC200	180p
R2008B	100p
R2010B	100p
S2000A3	175p
S2000AF	175p
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S2055AF	200p
S2530A	100p
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TIP29	15p
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TIP30C	25p
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TIP31C	27p
TIP32	24p
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TIP33C	60p
TIP34	50p
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TIP35C	65p
TIP36C	65p
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TIP41C	22p
TIP42A	20p
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TIP151	60p
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TIS90	15p
TIS93	20p
VK1010	88p
VN10KM	60p
ZTX107	11p
ZTX108	11p
ZTX109	12p
ZTX212	20p
ZTX300	10p
ZTX301	16p
ZTX302	10p
ZTX303	20p
ZTX304	10p
ZTX320	20p
ZTX501	13p
ZTX502	10p
ZTX503	18p
ZTX504	25p
2N696	26p
2N697	22p
2N698	40p
2N78	22p
2N914	28p
2N930	18p
2N1131	28p
2N1132	28p

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2N1613	24p
2N1711	24p
2N1893	30p
2N2102	50p
2N2218A	24p
2N2219	24p
2N2221	23p
2N2222	23p
2N2369	15p
2N2484	15p
2N2646	40p
2N2904	20p
2N2905	20p
2N2906	18p
2N2907	18p
2N3019	28p
2N3053	18p
2N3054	40p
2N3055	38p
2N3055H	50p
2N3442	85p
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2N3703	9p
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2N3706	9p
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2N3819	29p
2N3903	11p
2N3906	11p
2N4031	25p
2N4401	12p
2N4403	12p
2N5061	20p
2N5088	20p
2N5192	50p
2N5241	500p
2N5245	45p
2N5294	30p
2N5296	30p
2N5448	12p
2N6107	40p
2N6292	40p
2N6385	120p
2N6403	160p
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BY127	8p
BY133	8p
BY164	40p
BY179	35p
BY184	32p
BY206	11p
BY207	20p
BY227	19p
BY228	28p
BY298	15p
BY299	18p
BY448	20p
BYX10	15p
BYX55/600	25p
BYX70/500	32p
OA47	10p
OA91	10p
OA202	10p
IN4001	3p
IN4002	3p
IN4003	3p
IN4004	3p
IN4005	3p
IN4006	3p
IN4007	4p
IN4148	2p
IN5400	9p
IN5401	8p
IN5402	8p
IN5403	8p
IN5404	8p
IN5405	11p
IN5406	12p
IN5407	12p
IN5408	12p
RGP15	25p
RGP30	16p
SKE4F2/06	60p
SKE4F2/08	80p
SKE4F2/10	100p
SR2M	60p
I.C. SOCKETS	
8 PIN	5p
14PIN	6p
16PIN	7p
18PIN	10p
20PIN	12p
22PIN	13p
24PIN	14p
28PIN	18p
40PIN	18p
ZENERS	
400 mWatts	
2V7 to 39V	5p
1.3 Watts	
2V7 to 39V	9p
CRYSTALS	
Freq in MHz	
2.4576	180p

Part	Price
3.276	115p
4.0	110p
5.0	130p
10.0	140p
11.0	250p
12.0	120p
14.756	200p
15.0	160p
24.0	250p
VOLTAGE REGULATORS	
7805	25p
7806	25p
7808	25p
7812	25p
7815	25p
7818	25p
7824	25p
7905	25p
7906	30p
7908	30p
7912	30p
7915	30p
7918	30p
7924	30p
78L05	24p
78L08	24p
78L12	24p
78L15	24p
78L18	24p
78L24	24p
79L05	35p
79L08	35p
79L12	35p
79L15	35p
LM309K	100p
LM317T	100p
LM323K	350p
78H08KC	800p
79H12KC	700p
79HGKC	800p
VALVES	
DAF96	100p
DY87	80p
EBF80	60p
ECC84	80p
ECH84	90p
ECL84	100p
EF183	75p
EF184	85p
EL500	100p
EY86	70p
EY87	70p
EY88	80p
PC97	100p
PCC85	60p
PCF80	100p
PCF801	110p
PCF806	115p
PCH200	100p
PCL81	65p
PCL82	80p
PCL84	60p
PFL200	110p
PL36	120p
PL83	60p
PL84	80p
PL95	180p
PY81	100p
PY500A	190p
LEDs	
3mm	
RED	5p
YELLOW	8p
GREEN	8p
5mm	
RED	5p
YELLOW	8p
GREEN	8p
RECTANGULAR LEDs	
5mm × 2.5mm	
RED	5p
YELLOW	8p
GREEN	8p
OPTO COUPLERS	
4N37	48p
4N38	68p
AN203	210p
BRIDGE RECTIFIERS	
W005	16p
1A/50V	
W01	18p
1A/100V	
W02	19p
1A/200V	
W04	21p
1A/400V	
W06	23p
1A/600V	
W08	28p
1A/800V	
BR81D	33p
2A/100V	
BR82D	33p
2A/200V	

Part	Price
BR84D	37p
2A/400V	
BR86D	43p
2A/600V	
BR88D	43p
2A/800V	
BR32	43p
2A/200V	
BR34	43p
2A/400V	
BR36	44p
2A/600V	
BR62	80p
6A/200V	
BR64	72p
6A/400V	
BR251	150p
25A/100V	
BR252	165p
25A/200V	
BR254	185p
25A/400V	
BR256	200p
25A/600V	
BR258	240p
25A/800V	
BR351	185p
35V/100V	
BR352	200p
35V/200V	
BR354	220p
35V/400V	
BR356	230p
35V/600V	
BR358	260p
35V/800V	
BY164 1.5A/	
100V	40p
BY176 1.5A/	
800V	40p
TRIACS	
TIC206D	60p
4A/400V	
TIC225D	69p
6A/400V	
TIC226D	68p
8A/400V	
TIC236D	85p
12A/400V	
TIC246D	105p
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TIC253D	190p
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TIC263D	205p
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TIC116D	70p
8A/400V	
TIC126D	75p
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TIC126M	90p
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BR103	37p
BR303	85p
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BT119	100p
17088	200p
17089	200p
17127	200p
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SG264	800p
SG613	1600p
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Z80ACPU	100p
Z80ADMA	200p
Z80ACTC	140p
Z80ASIO-1	210p
Z80ASIO-2	210p
75107	65p
75110	75p
75113	100p
75122	110p
75150	100p
75154	100p
75162	700p
75182	95p
75183	95p
75195	185p
2114	150p
2532	200p
2716	100p
2732	200p
2732A	220p
2764	150p
27C64	200p
27128	150p
27256-25	150p
27512	300p
4116	40p
4164-15	80p
4164-12	90p
41256-15	80p
41256-12	100p
41256-10	110p
41464-12	150p
6116	80p
6264-10	210p
62256-12	300p

Part	Price
6502A	360p
65C02	930p
6522	280p
6800	210p
6802	220p
680	500p
36808	500p
6809	500p
6810	150p
6818	380p
6821	130p
6840	290p
6845	200p
6850	90p
8085A	300p
8086	500p
8088	480p
8156	300p
8224	240p
8226	240p
8250	750p
8251	200p
8253	160p
8257	220p
8271	3400p
8279	270p
8283	400p
8284	440p
8287	260p
8288	650p
8748	700p
8755	800p
8T26	95p
8T28	110p
LINEAR ICs	
AN203	210p
AN210	165p
AN214Q	170p
AN228	280p
AN252	150p
AN253	250p
AN262	140p
AN271	230p
AN274	250p
AN301	330p
AN303	250p
AN304	380p
AN315	210p
AN316	350p
AN360	100p
AN362	140p
AN366	150p
AN610	160p
AN3312	350p
AN3821K	600p
AN3822K	600p
AN3990K	300p
AN3991K	400p
AN5025	250p
AN5033	400p
AN5132	250p
AN5150	400p
AN5151	600p
AN5215	100p
AN5256	150p
AN5262	175p
AN5265	80p
AN5352	800p
AN5411	450p
AN5421	150p
AN5429	420p
AN5512	100p
AN5515	160p
AN5520	550p
AN5521	100p
AN5612	200p
AN5613	200p
AN5615	300p
AN5620	250p
AN5622	275p
AN5625	400p
AN5712	180p
AN5722	140p
AN5730	160p
AN5732	120p
AN5753	130p
AN5763	450p
AN5790	240p
AN5791	225p
AN5836	450p
AN5900	130p
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AN6247	200p
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AN6362	400p
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AN6387	480p
AN6884	200p
AN7105	170p
AN7110	75p
AN7114	120p
AN7115	110p
AN7116	90p
AN7120	100p
AN7130	75p
AN7140	170p
AN7145	195p
AN7146	210p
AN7154	180p

Part	Price
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AN7168	200p
AN7178	180p
AN7222	75p
AN7254	150p
AN7256	250p
AN7310	60p
AN7311	90p
AN7410	150p
AY3-1015	290p
AY3-1270	800p
AY3-1350	450p
AY3-8910	380p
AY3-8912	400p
BA301	55p
BA311	80p
BA313	60p
BA333	80p
BA401	60p
BA402	50p
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BA516	150p
BA521	100p
BA524	240p
BA526	180p
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BA534	220p
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CA3160	85p
CA3189E	230p
CA3193E	230p
CA3260E	170p
CA3290E	150p
CX108	950p
CX136	600p
CX139A	750p
CX141	750p
CX145	725p
CX150B	325p
CX175	325p
CX187	825p
CX804A	775p
CX867	575p
CX868	525p
CX877	300p
HA1125	120p
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HA1339A	350p
HA1377	120p
HA1388	120p
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HA11235	120p
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HA11724	650p
HA12002	250p
HA12003	250p
HA12005	180p
HA12017	100p
HA13001	110p
HA13002	200p
HA13006	200p
HA13007	400p

Part	Price
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HA13412	600p
HA13432	400p
HA17524	250p
ICL7106	650p
ICL7660	240p
KA2102	150p
KA2130	150p
KA2206	150p
KA2209	125p
KA2210	230p
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KA2264	100p
KA2284	100p
KA2401	150p
KA2412	350p
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KA2914A	300p
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LA7806	260p
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LF353	48p
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LF398	300p
LM301	26p
LM311	35p
LM319	165p
LM324	30p
LM335Z	120p
LM339	35p
LM348	50p
LM358	45p
LM380	80p
LM381	150p
LM382	130p
LM386	60p
LM387	100p
LM393	45p

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Prices quoted are subject to stock availability and may be changed without notice.
TV & video parts sold are replacement parts.

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LINEAR ICs / JAPANESE TRANSISTORS

Part	Price
LM431	50p
LM710	45p
LM723	40p
LM741DIL	18p
LM741MET	45p
LM747	55p
LM1889	300p
LM1894N	200p
LM3900	40p
LM3909	100p
LM3914	160p
LM3915	160p
LM3916	270p
L200	200p
M491BB1	600p
M494B1	700p
M50115P	320p
M50117P	500p
M50119P	525p
M50784	300p
M50786	500p
M50790	600p
M51161	300p
M51381P	200p
M51387P	800p
M51544	150p
M51848	150p
M54523P	200p
M54563P	200p
M58484	500p
M51516	260p
M51518	200p
MB3712	140p
MB3713	130p
MB3714	270p
MB3715	250p
MB3722	280p
MB3730	160p
MB3731	220p
MB3756	160p
MB3759	200p
MB8719	360p
MC1455	45p
MC1496	65p
MC3401	45p
NE555	20p
NE556	40p
NE558	80p
NE565	110p
NE567	115p
NE571	290p
NE592	85p
NE5532P	140p
SAA1006	300p
SAA1008	450p
SAA1010	400p
SAA1024	250p
SAA1025	250p
SAA1075	350p
SAA1124	200p
SAA1250	280p
SAA1251	380p
SAA1274	280p
SAA1293	550p
SAA3004	400p
SAA5000	200p
SAA5010	220p
SAA5012	400p
SAA5020	350p
SAA5030	440p
SAA5040A	280p
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SAA5050	650p
SAA5231	300p
SAA5243PE	800p
SAB3013	200p
SAB3035	600p
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STA401A	220p
STA403A	270p
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STA432A	220p
STA434A	270p
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STA441C	220p
STA456C	240p
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STK0029	360p
STK0039	600p
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STK011	330p
STK015	440p
STK016	760p
STK025	650p
STK050	1600p
STK077	520p
STK078	580p
STK080	550p
STK082	540p
STK084	600p
STK085	900p
STK086	800p
STK0100	900p
STK0100II	1200p
STK420	400p
STK430	500p
STK433	400p
STK435	375p
STK436	430p
STK437	460p
STK439	500p

Part	Price
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STK461	620p
STK463	950p
STK465	720p
STK501	550p
STK561	450p
STK563	415p
STK583	500p
STK760	600p
STK770	400p
STK772B	480p
STK780	575p
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STK1050	650p
STK1060	700p
STK1070	850p
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STK2029	480p
STK2038	700p
STK2048	950p
STK2110	550p
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STK4021	380p
STK4024II	550p
STK4025	530p
STK4026	480p
STK4028	550p
STK4032II	510p
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STK4038	680p
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STK4042II	800p
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STK4046	950p
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STK4231II	700p
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STK4392	500p
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STK4843	720p
STK4853	730p
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STK5335	350p
STK5337	500p
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STK6982	600p
STK7216	420p
STK7217	400p
STK7225	500p
STK7226	600p
STK7251	500p
STK7308	350p
STK7309	400p
STK7310	470p
STK7348	400p
STK7356	425p
STK7358	440p
STK7402	560p
STK7404	400p
STK7406	650p
STK7408	675p
STK7410	900p
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STK7562	1000p
STK7563	800p
STK8050	750p
STK8250	500p
STK8260	1200p
STK8280	1850p
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STK73410II	500p
STK73605	375p
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STR371	400p
STR380	350p
STR381	390p
STR383	410p
STR384	350p
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STR450	520p
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STR453	500p
STR454	400p
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STR2015	550p
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STR10006	450p
STR11006	400p
STR12006	450p
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STR20005	450p
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Part	Price
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STR40090	350p
STR41090	400p
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STR50103A	260p
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TA8691N	550p
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TBA540	90p
TBA560	90p
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TBA810AS	40p
TBA820	55p
TBA820M	35p
TBA920	100p
TBA950	100p
TBA990	60p
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TDA1571	300p
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Part	Price
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TDA1675	250p
TDA1701	300p
TDA1771	250p
TDA1870A	200p
TDA1872A	275p
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TDA2558	500p
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TDA2577A	200p
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JAPANESE TRANSISTORS

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2SC2721	120p
2SC2738	200p
2SC2740	450p
2SC2749	350p

Part	Price
2SC2750	300p
2SC2751	270p
2SC2752	140p
2SC2767	300p
2SC2769	400p
2SC2773	700p
2SC2774	500p
2SC2785	60p
2SC2786	20p
2SC2787	10p
2SC2791	500p
2SC2792	220p
2SC2793	700p
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2SC2810	360p
2SC2812	40p
2SC2814	40p
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2SC2825	900p
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2SC2827	200p
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2SC2988	150p
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2SC3075	150p
2SC3077	120p
2SC3086	150p
2SC3089	130p
2SC3101	750p
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2SC3116	75p
2SC3117	120p
2SC3122	50p
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2SC3149	180p
2SC3150	125p
2SC3151	230p
2SC3152	130p
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2SC3173	180p
2SC3175	150p
2SC3178	175p
2SC3179	70p
2SC3181	200p
2SC3182	120p
2SC3199	40p
2SC3209	120p
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2SC3211	220p
2SC3212	260p
2SC3225	50p
2SC3244	45p
2SC3246	50p
2SC3259	350p
2SC3260	220p
2SC3261	230p
2SC3262	280p
2SC3263	280p
2SC3264	390p
2SC3269	50p
2SC3270	50p

Part	Price
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2SC3870	200p
2SC3883	280p
2SC3884A	300p
2SC3886A	400p
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Part	Price
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2SD836	60p

Part	Price
2SD836A	60p
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2SD838	300p
2SD841	110p
2SD844	200p
2SD845	250p
2SD850	170p
2SD856	48p
2SD858	250p
2SD863	23p
2SD864	200p
2SD866	120p
2SD866A	140p
2SD868	260p
2SD870	190p
2SD871	300p
2SD879	60p
2SD880	40p
2SD882	25p
2SD892A	75p
2SD894	35p
2SD895	100p
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2SD970	170p
2SD973	60p
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Part	Price
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2SD1760	80p
2SD1762	50p
2SD1773	160p
2SD1783	100p
2SD1796	180p

Part	Price
2SD1815	100p
2SD1825	60p
2SD1843	100p
2SD1846	350p
2SD1849	325p
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2SD1877	175p
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2SD1910	280p
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2SD1929	60p
2SD1939	75p
2SD1941	500p
2SD1959	280p
2SD1961	50p
2SD1978	50p
2SD1984	450p
2SD2012	50p
2SD2125	225p
2SD2333	200p
2SJ48	425p
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2SJ75	280p
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2SJ79	225p
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2SJ108	60p
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2SJ119	700p
2SJ161	650p
2SJ162	680p
2SK19	45p
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2SK49	50p
2SK55	100p
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2SK125	100p
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2SK168	40p
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2SK218	400p
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2SK415	500p
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2SK538	350p
2SK539	1100p
2SK555	400p
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2SK557	400p
2SK566	475p
2SK695	550p
2SK719	300p
2SK724	600p
2SK725	600p
2SK727	800p
2SK735	600p
2SK758	300p
2SK787	900p
2SK794	500p
2SK872	650p
2SK903	500p
2SK1057	600p
2SK1058	800p
2SK1117	250p
2SK1118	225p
3SK45	100p
3SK51	100p
3SK59	100p
3SK74	50p
3SK77	50p
3SK81	50p
3SK85	160p
3SK88	70p
3SK121	150p

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PINCH ROLLERS / VCR BELT KITS

Model	Price
AKAI	
VS10, VS9300, VS9500, VS9700, VS9800, VP7100, VP77	165p
VS1, VS2, VS3, VS4, VS5, VS6, VS8, VS9	165p
VS105, 112, 115, 116, 126, 205, 220, 240, 244, 245, 247, 248, 250, 512, 515, 516, VSX9	165p
VS201, VS301, VS303, VS304, VS603, VS606, VS607, VP58-P82	165p
VS125, VS155, VS165, VS220, VS240, VS250, VS512	165p
VS22, 23, 25, 35, 37, 38, 53, 66, 75, 422, 425, 426, 427, 462, 465, 467, 485, 965, 967, VSA77	165p
VSF260, 261, 262, 265, 270, 274, 280, 290, 410, 440, 400, 455, 480, 490, 497, 560, 599	165p
AMSTRAD	
VCR4000, 4600, 4700, 5200, 6000, 6100, 8600, 8602, 8603, 8604, 8700, 8704, 8714, 8800, 8804, 9000, 9340, DD8904, TVR1, 2, 3, 4	165p
VCR7000	165p
AIWA	
AV66, AV77	165p
G700, G900	165p
ALBA	
VCR3000X, VCR4000	165p
VCR5000, VCR6000	165p
AUTHENTIC	
N850	165p
BLAUPUNKT	
RVT100, 200, 202, 222, 224, 301, 306, 307, 309, 311, 312, 315, 316, 317, 319, 320, 328, 404, 414, 434, 444, 478, 707, RTX100	165p
RTV211, 214, 321, 322, 348, RTX250, 260	165p
RTV324, 325	165p
RTV330, 454, 520, 530, 535, 560, 660, 670, 720, 730, 740, 800, 810, 900, 910, 920	165p
DAEWOOD	
VCR12, VCR32, VCR52	165p
VCR30, VCR500	165p
DECCA	
VR8300	165p
VRH8495DK (Pressure Roller Assembly) PS403-40205	350p
FERGUSON	
3V00, 3V01, 3V16, 3V22, 3V23, 3V24, 3292, 8900, 8901, 8902, 8903, 8904, 8906, 8909, 8912, 8922, 8923, 8924, 8925, 8929	165p
3V29, 3V30, 3V31, 3V32, 3V52, 8930, 8931, 8933, 8940, 8941, 8942	165p
3V35, 3V36, 3V38, 3V39, 3V42, 3V43, 3V44, 3V45, 3V48, 3V49, 3V53, 3V54, 3V55, 3V56, 3V57, 3V58, 3V59, 3V65, FV10, FV11, FV12, FV13, FV14, 8943, 8944, 8945, 8947, 8948	165p
3V52	165p
8950, 8951, FV10B, 11R, 13H, 14T, 20B, 21R, 26D, 31R, 32L, 41R, FV42L, 50B, 51R, 52L, VC141L	165p
FV44L, FV46T, FV43H	165p
FISHER	
FVHP420, 520, 530	165p
FVHP615, 618, 620, 622, 710, 711, 715, 716, 720, 721, 722, 725, 730, 830, 840	165p
FVHP905, 906, 908, 910, 911, 915, 916, 918, 970, 975, 980, 990, 5000, 5005, 5050, 5075, 5100	165p
VBR330, VBS3500, 7000, 7500, 7600, 9000, 9900	165p
FVHD250, 270, 370, 2000D, FVHP3, 210, 250, 300, 310, FVSD2095	165p
FIDELITY	
HQS200, VCR100, 600, 6100	165p
VTR100	165p
FUJITSU	
HS760, VX715, VX720D	165p
FUNAI	
V1, V2, VCR4000, 4000, 4530, 4540, 4600, 4800, 5200, 5400, 5600, 5800, 5840, 5843, 6000, 6400, 6600, 6800, 6803, 8007, 8103, VIP150, 3000, 5000, 6000	165p
VIP1000, VIP1400	165p
G.E.C.	
V4004	165p
GRANADA	
VHSAH1, 3, VHSVH4, VHSWH1, VHSXH1, VHSYH2	165p
VHSAN3, VHSBP1, VHSVN1, VHSVN2	165p
VHSAY3, VHSX42	165p
VHSBH1, VHSCH1, VHSFS1, VHSFS2, VHSEH2, VHSEH3	165p
VHSBY3, VHSCC1	165p
VHSDS2, VHSXN2	165p
VHSDP1, VHSFP2 (Pressure Roller Assembly) PS403-40205	350p
VHSEY1, VHSEY2, VHSFY2	165p
VHSFG2, VHSFG3, VHSFG4, VHSFH6	165p
VHSFJ2, VHSFJ4	165p
VHSF63, VBXAS1	165p

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Model	Price
VHSTJ1, VHSTJ2, VHSTJ3	165p
VHSWJ1, VHSWJ3, VHSXJ3	165p
VBXYB3	165p
VHSEH3, VHSES2	165p
VHSF34	165p
VHSFP2	165p
GRUNDIG	
BARCELONA, MADRID, MVS500, 510, 600, 620, 660, 710, 720, 910, 9105, SE5110, 5140, 6100, 6110, 7120, 9100, 9120, TVR4000, 4510, 5510, VERONA, VS500, 505, 510, 520, 530, 540, 550, 600, 610, 620, 630, 640, VS650, 660, 680, 700, 710, 720, 740, 790, 800, 810, 900, 910, 920, 930, VS940, 5180, 5480, 6190, 6690	165p
MVS400, 440, 400, 410, 440, 441, 400, 456, 460	165p
VS120	165p
VS150	165p
VS180, 200, 220, 226, 262, 265, 267, 300, 310, 315, 320, 326, 345, 380	165p
GOLDSTAR	
GHV51, 1221, 1232, 1240, 1241, 1242, 1243, 1244, 1245, 1246, 8000, 8200, 8210, 8215, GHVP1240, 1241, 1247, 1248, 1290, 1291, 1295, 1296, VCP4000, 4100, 4130, 4200, 4300, 4301, 4305, 4306, 4310, 4311, 4315, 4316, 4320, 4321, 4325, 4326	180p
HINARI	
V20H, VXL5, VXL6, VXL7, VXL8, VXL9, VXL10, VXL11, VXL19	165p
VXL2, VXL3	165p
VXL4, VXL20, VXL35	165p
HITACHI	
VT7, 11, 14, 16, 17, 19, 33, 34, 35, 38, 39, 88, 330, 680, 6500, 6800, 5000, 5500, 7000, 8000, 8300, 8500, 9300, 9500, 9700, 9900	165p
VT8, 52, 57, 61, 62, 63, 64, 65, 85, 86, 88, 100, 110, 111, 113, 115, 118, 120, 122, 125, 130, 135, 138, 145, 150, 168, 175, 220, 225, 250, 255, 258, 260, 400, 405, 410, 413, 414, 415, 418, 420, 425, 426, 428, 430, 431, 435, 438, 400, 498, 510, 518, 520, 525, 526, 576, 580, 585, 588, 640, VTD660, 665, VTF770, 775, VTL30, VTL35, VTLC50, VTM620V, TM625, 626, 630, 635, 636, 640, 645, 646, 720, 722, 725, 726, 728, VTM730, 731, 735, 736, 740, 745, 746, VTS80, 85	165p
VT3000	165p
I.T.T.	
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VR3913, 3914, 3943, 3954, 3984, 3993, 3994	165p
VR3907	165p
VR3908	165p
VR3912, VR3963, VRP3833	165p
VR3917, VR3833	165p
VR3927, 3929, 3968 (PRESSURE ROLLER ASSEMBLY) PS403-40205	400p
SVR3799, VR3520, 3701, 3719, 3720, 3721, 3730, 3731, 3749, 3759, VR3761, 3781	165p
VR3918, 3919, 3958, 3998	165p
VR670, VR680, VR681	165p
VR3927, VR3977	165p
VR482, VR580, VR581, VR582	165p
VR9720	165p
J.V.C.	
HR2200, 3300, 3330, 3360, 3660, 4100, 7700	165p
HR2650, 7200, 7300, 7350, 7600, 7610, 7650, 7655	165p
HRD110, 111, 120, 121, 140, 150, 157, 158, 160, 225, 257, 455, 565, 566, 725, 755, HRP50	165p
HRD520, 540, 550, 580, 600, 620, 637, 641, 650, 660, 830, 860, 960, HRS5800	165p
HRD170, 180, 210, 230, 300, 320, 321, 330, 337, 350, 370, 400, 430, 440, 441, 470, 500, 530, 700, 750, 950, HRS5000, 5500, 9000	165p
HRS10	165p
LOGIK	
VR955	180p
LUXOR	
9245, 9251	165p
8252, 8253, 8256, 8285	165p
9254	165p
9255	165p
9270, 9271, 9273, 9274	165p
9272, 928017, 928077, 928097, 928217, 929017, 929117, 929317	165p
9281, 9283, 9284, 9292, 9295, VR3701, 3721, 3731, 3761, 3781	165p
MATSUI	
VX850	165p
MITSUBISHI	
HS200, HS300, HS301, HS302, HS303, HS304, HS310, HS320, HS330, HS700	165p
HS306, HS307, HS318, HS319, HS337, HS338, HS347, HS349, HS400, HS410, HS411, HS412, HS421, HS710, HSB10, 20, 30, HSE10, 20, 30, 70	165p
HSE11, HSE12, HSE21, HSE22, HSE31, HSE32, HSE41, HSE51, HSE52	165p
NATIONAL PANASONIC	
NV100, 180, 300, 332, 333, 340, 366, 600, 688, 777, 788, 3321, AG6010, 6015, 6100, 6200, 6400, 6800	180p
NV230, 250, 260, 280, 370, 380, 430, 431, 433, 400, 460, 465, 470, 480, 630, 650, 730, 770, 780, 810, 830, 850, 870, 890, 2000, 2010, 3000, 7000, 7200, 7800, 8050, 8150, 8200, 8300, 8400, 8600, 8610, 8620, NVG14, NVG7, 10, 12, 15, 18, 30, 130, 400, AG1000, 1050, 1200, 1500, 2100, 2200, 6810, NVH70	165p
NVG9, NVG120	165p
AG6840, NVH65, 75, NVJ30, NVL20, 23, 25, 28, NVG300, NVF65, NVF70, NVFS1, NVFS100, NVG19, 20, 25, 33, 40, 50	165p
NVD48, NVD80, NVG21, NVG45	165p

Model	Price
N.E.C.	
N830, 831, 832, 833, 895	165p
PVC2300, 2400, 740, 744, 746, 760, 764, 766	185p
DX1000, 1600, 2000, 3000, N9012, 9013, 9014, 9016, 9033, 9034, N9053, 9054, 9055, 9066, 9110, 9120, 9510, 9520, 9530, 9610	165p
ORION	
VH1, VH2	165p
VC150, 180, VH3, 33, 200, 201, 205, 212, 250, 254, 288, 300, 303, 312, VH404, 555, 700, 704, 712, 770, 780, 844, 900, 1000, 2948, 3030, 3312, VHF2A, VP2948	165p
COMBI15000, 16000, HV03, LVH50, NEVH, NEVHM, NEVHML, TVP230RC, VCP, VH04, 30, 103, 300, 358, 360, 362, 400, 416, 512, VH530, 532, 535, 536, 600, 630, 635, 640, 666, 730, 735, 744, 774, 790, 800, 820, 850, 888, 893, 900, 930, 940, 942, 974, 1012, 1040, 1050, 1060, 1070, 1100, 1120, 1204, 1440, 1500, 1660, 1800, 2004, 2151, 2308, 2204, 2400, 2500, 2600, 2700, 2960, 2970, 3050, 3060, 4000, 4008, 4010, 4012, 4015, 4020, 4300, 5020, VP10, 200, 220, 225, 245, VR821, 925, 1032, 2949, 2959, 2957, 2966, 2979, 2980, VTV300, VXL20, 25, 30	165p
PHILIPS	
VR6460, VR6920	165p
VR2020, VR2021, VR2022, VR2023, VR2024	165p
VR6711	165p
VR6540	165p
DV856, 586, VR702, 703, 6485, 6589, 6785, 6880, 6948	165p
VR445, VR6442, VR6542, VR6843, VR6943	165p
DV464, VR2220, 2300, 2324, 2330, 2334, 2340, 2350, 2414, 2480, VR2485, 2486, 2489, 2490, 2498, 2840, 6462, 6463, 6464, 6560, 6660, 6860, 6861, 6862, 6863	165p
N-1700, VR2870	165p
VR2025, VR6580	165p
VR6548, VR6648	165p
PRESSURE ROLLER ASSEMBLY PS403-40205, DV186, 190, 286, 291, 292, 486, 471, 562, 582, 571, 761, VR201, 202, 203, 302, 303, 305, 6180, 6182, 6185, 6285, 6290, 6291, 6293, 6362, 6367, 6390, 6391, 6393, 6467, 6468, 6470, 6561, 6570, 6581, 6670, 6676, 6760, 6761, 6762, 6870, 6970, 6975, 86B1, 63SB7, 68SB4, 71SB4, 72SB8, 92SB31	350p
SANYO	
VHR1100, 1150, 1200, 1300, 1500, 2100, 2300, 2500, 2700	165p
VTC5000, 5150, 5300, 5350, 5400, 5500, 6000, 6500, 9100, 9300, VTCM10, 20, 11, 21, 31, 50, VPR5800	165p
VHR3100, 3300, 3310, 3400, 3700, 3800, VHRD500, 700	165p
VTC3000	165p
VHR4100, 4150, 4200, 4300, 4350, 4770, 5100, 5200, 5300, 5350, 5700, 7100, 7200, 7500, 7530, 7540, 7800, 8100, 8200, 8250, 8500, VHRD4400, 4410, 4000, 4600, 4610, 4710, 4890, 6700, VHRS700	165p
VCR100	165p
SHARP	
VC200, 381, 384, 385, 386, 388, 390, 393, 800, 2300, 3300, 6000, 6200, 7300, 7700, 7750, 8300, 9100, 9300, 9500	180p
VC300, 387, 402, 471, 473, 477, 481, 482, 483, 486, 488, 496, 500, 571, 573, 581, 582, 583, 584, 585, 8481, VC5F3, VC5W20E, VCA1031	165p
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VC220	165p
VCA10, 30G, 60, 103, 105, 106, 211, 244, 505, 605, 1015, 1031, VCD806, 810, 815, VCH80, 865, 910, VCS1000, VCT310, 410, 610, VCT1314, 5313	165p
SAISHO	
VHL3, VR1000, VR2000, VR2500, VR3800	165p
SALORA	
SV6500, SC6600	165p
SV7300, SV8200, SV8300, SV9200, SC9300	165p
SV7400, 8400, 8420, 8500, 8520, 8550, 8600, 8620, 8700, 8710, 8720, 8800, 8830, 9500, 9600, 9810	165p
SV8000, SV8100	165p
SV601, SV800, SV900, SV901, SV6910, SV9800, SV9900	165p
SV6700, SV8710, SV8750, SV9700	165p
SV6800, 6900, 8820, 8850, 8870, 8910, 8920, 8970	165p
SAMSUNG	
SV716, 717, VB510, 520, 610, 616, 617, 619, 620, 626, 627, 629, 900, SV910, VI510, 520, 611, 616, 621, 626, 900, 910, VX510, 520, 616, 617, 619, 626, 627, 629	165p
SVX301, 303, 305, 307, 319, 322, VB710, 770, 971, 8220, 8225, V1730, 1790, 18220, 18225, VX710, 712, 720, 730, 750, 770, 790, 825, 970, 971, 972, 8220	165p
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SVR5030	165p
SVR7010	165p
SIEMEN	
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FM361, FM362, FM363, FM364	165p
FM391, FM392, FM394, FM461, FM462, FM464, FM468, FM561	165p
FM484, FM485	165p
FM585, FM602, FM604, FM622, FM624, FM627	165p
FM600	165p
FM204, 303, 304, 314, 325, 328, 374, 375, 376, 384, 386, 388, 404, 424, 428, 429, 488, 489	165p

Model	Price
FM556, FM558, FM560, FM562, FM564, FM574, FM578	165p
FM601, 603, 605, 607, 608, 617, 619, 620, 621, 623, 625, 626, 628, 630, 632, 634, 636, 638, 639	165p
SOLAVOX	
NCVR1000, NCVR5000	165p
SONY	
SLC5, 6, 7, SL3000, 8000, 8080, 8200, SLJ10, SLT6ME, SLT7ME	165p
SLC9, 20, 24, 30, 33, 44, SLHF100, SLF1, 11, 20, 25, 30, 60, 100, 200, SLF60PS, SLF90E, SLHF150, 850, SLK88, 95, SLT20ME, SLT30ME, SLT50ME	165p
BMC100, BMC200, BMC500	165p
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SLV210, 270, 273, 275, 300, 353, 373, 410, 415, 474, 656, 715, SLV757, 777	165p
SLV255	165p
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VR1935, VR2915	165p
VR1970, VR1980	165p
VR400, 410, 440, 449, 400, 510, 519, 540, 549, 610, 640	165p
VR520, 529, 530, 535, 539, 550, 620, 630, 650, 920	165p
THOMSON	
SV1000, TX8500, V320, 321, 323, 326, 342, 343, 351, 352, 353, 360, 364, 368, 410, 430, 400, 510, 520, 530, 540, 620, 630, 640, 4200, 4210, 4230, 4240, 4260, 4300, 4340, 4400, 5500, 5540, 6000, 8540	165p
TX8000, V309, 316, 357, 309, 410, 411, 3801, 4100	165p
V333, V340	165p
VX300, 301, 302, 305, 306, 312, 3301	165p
TOSHIBA	
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V5470, V5480	165p
V108, V109, V199, V209, V609	165p
PRESSURE ROLLER ASSEMBLY – PS403-40205, V91, V95	350p

VCR BELT KITS

Model	Price
AKAI	
VP7100, VS9300, VS9500, V9700, VS9800	120p
VS1, VS2, VS4, VS5	100p
VS10	65p
VSX9, VS105, 112, 115, 116, 205, 220, 24, 244, 245, 247, 248, VS250, 512, 515, 516	300p
VS22, VS23, VS25, VS35, VS37, VS38, VS53, VS55, VS66	80p
VS4, VS6	120p
VSA77	140p
AIWA	
AV66	125p
AV77	140p
G700	160p
G900	180p
ALBA	
VCR4000	130p
VCR5000, VCR6000	105p
AMSTRAD	
TVR123, VCR4600, VCR4700, VCR5200	120p
VCR7000	80p
VCR6000, 6100, 8600, 8602, 8603, 8604, 8700, 8704, 8714, 8800, 8804, 9000, 9340, DD8900, DD8904, TVR4	120p
AUTHENTIC	
N850	120p
BLAUPUNKT	
RTV100	200p
RTV200, RTV222, RTV224	90p
RTV202, RTX200	150p
RTV322, RTV244	100p
RTV306, 307, 309, 310, 311, 312, 328, 414, 434, 444, 707	135p
RTV211, RTV214	140p
RTV324, RTV325	65p
RTV315, RTV316, RTV319, RTV320, RTV317	50p
RTV301, RTV334, RTV338, RTV404, RTV424	85p
BONDSTEC	
BT100	110p
BT300, BT310	170p
BT350	140p
BT50	150p
BOSCH-BAUER	
VRH50	100p
VRH60	140p
VRP20	180p
DAEWOOD	
VCR12, VCR32, VCR52	110p
VCR30DAP	150p
VCR30DBD, VCR500BD, VCR50DFD, VCR50DFP	170p
DECCA	
VR8300	90p
VRH8945DK	80p
DUAL	
VR4430	90p
VR91, VR93, VR97	75p
VR70, VR71, VR74, VR81, VR90	85p
VR80	90p
VR96	85p

Model	Price
FERGUSON	
3292, 3V00, 3V01, 3V16, 3V22, 8900, 8901, 8904, 8906	120p
3V23, 8923, 8924, 8929	65p
3V29, 3V30, 8930, 8931, 8933, 8940	75p
3V31, 3V32, 8941, 8942	75p
3V35, 3V36, 3V38, 3V39, 3V49, 8943, 8944	75p
3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57, 8945, 8947, 8948	60p
3V43, 3V44, 3V58, 3V65, 8950, 8951, FV10, FV11, FV12, FV13, FV14, FV20, FV21, FV22, FV26, FV32, CV141L	65p
FV31R	110p
FIDELITY	
HQS200, VCR600, VCR6100	180p
VCR100	160p
VTR1000	100p
FINLUX	
VR2005, VR2010, VR2020, VR2025, VR2040	105p
VR2008	160p
VR3009	140p
FISHER	
VBS7000	245p
VBS9000	120p
FVHP520, FVHP530, FVHP420	60p
FVHP615, 618, 620, 622, 710, 711, 720, 721, 722, 725, 730, 840	80p
FVHP905, 906, 908, 910, 911, 915, 916, 918	80p
VBR330, VBS7500, VBS7600, VBS9900	100p
VBS3500	75p
FUJITSU	
HS760, HS750, VGX715, VGX720D	160p
FUNAI	
V1, V25, VCR4600, 4800, 5200, 5400, 5600, 6400, 6600, VIP3000, VIP5000	160p
VCR4530, 5840, 5843, 6800, 6803, 8007, 8103, VIP150, 6000	160p
G.E.C.	
4005	100p
V4004	100p
GOLDSTAR	
GHV1221, 1232, 1241, 1242, 1243, 1244, 1245, 1246, 1247, 1248, 8210, 8215, VCP4100, VCP4130	80p
GHV1290, 1291, 1295, 1296, VCP4000, 4200, 4300, 4301, 4305, 4306, 4310, 4311, 4315, 4320, 4321, 4325, 4326	120p
GRANADA	
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VHSBH1, VHSCH1	150p
VHSBP1	135p
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VHSAY3	125p
VHSBY3	100p
VHSEY1, VHSEY2	70p
VHSCC1	100p
VHSDP1, VHSFV2	80p
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VHSTJ3	65p
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VHSXJ3	85p
VHSFJ2	140p
VHSFS1, VHSFS2	130p
VHSFG1, VHSFG4, VHSF63	180p
GRUNDIG	
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VS180, 200, 220, 226, 262, 265, 267, 2X40800, 0850, 0880, 1600, 2000, 2080, 2200, 2280, MVS200RC	90p
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HINARI	
VXL2	80p
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VXL4, VXL35	70p
VXL5, VXL6	160p
VXL3, VXL20	90p
HITACHI	
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VT5000, VT5500	120p
VT7000, VT8000, VT8300, VT8500	60p
VT680, VT6500, VT6800, VT9300, VT9500, VT9700, VT9900	75p
VT52, VT57, VT61, VT62, VT63, VT64, VT65, VT85, VT86, VT640	105p
VT3000	120p
VT100, 110, 111, 113, 115, 118, 120, 125, 128, 130, 135, 138, 145, 150, 168, 175, 220, 225, 250, 255, 258, 260, VTL30	110p
I.T.T.	
VR3605, VR3905, VR3935, VR3954, VR3985	90p
VR3913, VR3914	70p
VP3826, VR3906, VR3916, VR3926, VR3946, VR3948, VR3976, VR3986, VR3995, VR3997, VR6948	65p
VR3927, VR3977	65p
VR3993, VR3994	75p
VR3963	65p
VR3912	130p
VR3917	150p
VR3929, VR3968	85p
VR3907	100p
SVR3799, VR3520, 3701, 3719, 3720, 3721, 3730, 3731, 3749, 3759, 3761, 3781	90p
VR3908	180p
VR3918, VR3919, VR3958, VR3998	115p
J.V.C.	
HR3300, HR3330 HR3360, HR3660, HR4100	130p
HR7200, HR7300	70p
HR7350, HR7600, HR7610, HR7650, HR7655	75p
HR7700	75p
HRD110, HRD111, HRD120, HRD121, HRD225	90p
HRD140, 150, 157, 158, 160, 250, 257, 455, 565, 566, 725, 755, HRP50	65p
HRD170, 180, 210, 230, 300, 320, 321, 330, 337, 350, 370, 400, 430, 440, 441, 530, 700, 750, 950, HRS5000, 5500, 9000	60p

TV in Transition

There is so much going on at present that it's hard to see exactly how TV services will be provided in the not too distant future, and whether they will form just one part of a vast telecommunications network. We are seeing not only rapid technological change but also the formation of strategic alliances between service organisers and providers. There was some hard bargaining recently over who is to work with who in providing satellite pay-TV services to Germany. The market is a lucrative one, and whoever gets established first is likely to mop up. Then we have announcements on almost the same day that British Telecommunications and Cable and Wireless are preparing to merge to form a £33bn international telecommunications giant while International CableTel, the UK's third largest cable TV operation, is to pay £235m for NTL, the former transmission and technical side of the Independent Broadcasting Authority. The latter move will again establish a powerful force in telecommunications, this time on the technical/provision side, by bringing together cable networks and radiocommunications.

CableTel points out that the merger "will create a unique, national full-service telecommunications network, believed to be the first of its kind in the world. By connecting CableTel's local loop fibre-optic systems to NTL's high-capacity national network, the alliance will form the first national competitor in the UK market with end-to-end broadband capabilities covering the full range of voice, video and data services. Business and residential customers will be able to benefit from better, faster and cheaper local and national telecoms services". NTL has created an extremely cost-effective national telecoms network by installing microwave radio links between its mast sites and supplementing these with fibre-optic transmission as capacity needs have warranted. Over the five years since the company was privatised, NTL has diversified widely beyond its core broadcast operations in areas such as satellite transmission and mobile radio services. CableTel is installing broadband local networks to deliver telephone, TV and telecommunications services to domestic and commercial customers in a number of regions.

So there are going to be various ways of linking you to the services available – via cable, the Internet, satellite and terrestrial microwave links. You'll probably plug into a network that uses all these technologies as required. The winners will be those who are able to assess the possibilities and offer the most cost-effective solutions. That is not going to be easy for anyone, given the way in which costs can vary dramatically as production runs increase and new materials or devices are introduced.

It is particularly interesting that Panasonic's parent company Matsushita has decided to get into broadcasting by taking a stake in the digital satellite broadcasting company DirecTV Japan. Sony has already made some small investments in broadcasters. Both companies brought huge problems on themselves with earlier moves into the film and recording industries. One has to assume that they learnt from this and are making more astute moves this time round.

The key to all this is a shift to paid-for services. Once, an annual licence fee and a couple of receivers, one for radio and the other for TV, gave you access to the BBC's excellent though limited services. Then ITV came along and introduced advertising as a means of providing the funds to increase the programming on offer. This worked nicely with traditional analogue communications technology. Change to digital technology and the scope for programme provision increases dramatically – all those hundreds of channels – while encryption makes pay-to-view simple to implement. What we are witnessing is a change to a world in which almost anything will be available to those willing to pay the relevant price.

Viewing costs overall should be reasonable, given the competition likely amongst service providers. But it will be possible to make a lot of money from popular programmes/events, as BSkyB demonstrated with the recent Bruno-Tyson battle. The public is clearly willing to pay good money for what it wants. Further confirmation of this comes from BT's recent video-on-demand experiment that involved 5,000 of its customers in Ipswich and Colchester. The company says that the results have been "really exciting – well up to expectations". Previous VOD experiments, mainly in the USA, have been disappointing. BT claims however that by providing a wide range of programming and information services and marketing them on screen, encouraging levels of use have been achieved. Of the 5,000 households that took part in the experiment, twenty per cent made use of the service for ten hours a week, with the average use being five hours a week. In a typical week 90 per cent of households made use of the service at least once.

The new broadcasters and service providers will have to bear one thing in mind however. Viewing has declined in recent times, and shows no sign of increasing to any great extent when extra services are provided. There is just so much time people are prepared to spend in front of a TV or a PC screen.

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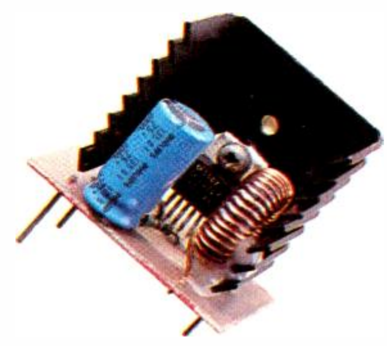
A Switch-mode Power Supply for the Nikkai Baby 10

These popular colour portables suffer from a common fault that greatly affects reliability. You can put an end to the trouble by fitting the module that Michael Dranfield describes in this article

Over the past year a Nikkai Baby 10 colour portable has been a regular visitor to the workshop. Each time the problem has been the same, failure of the regulator chip IC402. So far we've fitted four new regulators, three of them free of charge as we give a twelve-month parts and labour guarantee with all new components fitted.



Initial Experiments

I remember seeing, some time ago, an article in *Television* suggesting the use of a fixed 12V regulator as a replacement for IC402. This seemed worth a go, but IC402's output is 10·9V, not 12V. So I experimented with an RS Components 12V, 5A regulator, using two 1N5408 diodes in series to provide a 1·4V drop. The output would then be 10·6V, which is near enough. The problem with this was that the two diodes, passing the 2·4A required to run the set, got too hot.

After some thought I decided to shunt the two diodes with a 1Ω, 4W wirewound resistor to pass two thirds of the total current, leaving the diodes to pass only 700mA. I made up a small PCB to carry the resistor and diodes, and fitted it in the space occupied by IC402. The 12V regulator was mounted above the line output transistor on the set's chassis frame. All was well – until the 12V regulator failed a week or so later as a result of excessive heat dissipation, probably because the chassis, being made of steel, is a poor conductor of heat.

My next idea was to build a linear series regulator on the base of the original regulator's heatsink. A suitable circuit was devised and the top of the heatsink was drilled to take a TO3 transistor. I selected a BUT13 transistor which has a 28A maximum collector current rating. This again worked well, but the heatsink wasn't large enough to dissipate the 60W odd required. As a result the transistor soon suffered from thermal runaway. Use of a larger heatsink within the set was not possible, so it was back to the drawing board.

The Solution

To reduce the dissipation, I started to think about the possibility of a chopper circuit. After searching through some catalogues I came across a National Semiconductors device, the LM2576-ADJ, which is referred to as a "simple switcher". Its specification is impressive. The case is a TO220, like a TDA2020, and only six external components are required to form a complete switch-mode power supply.

To quote from the manufacturer's data sheet: "The

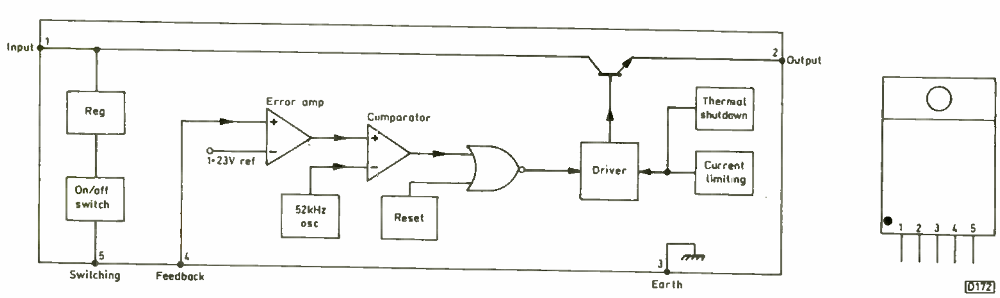


Fig. 1: Block diagram of the LM2576-ADJ switch-mode power supply chip. Also pin connections, viewed from the front.

LM2576-ADJ series offers a high-efficiency replacement for popular, three-terminal adjustable linear regulators. It reduces the size of the heatsink required substantially – in fact in some cases no heatsink is required."

A block diagram of the circuitry within the device is shown in Fig. 1. The oscillator's frequency is 52kHz, fixed. The unregulated input is fed to pin 1, while the output is at pin 2. There is feedback to pin 4, which is one of the inputs to the error amplifier stage. This compares a potted-down sample of the output voltage with an internal 1·23V reference. Any difference will vary the pulse width of the output at pin 2.

Pin 5 enables the device to be switched on/off. This feature is not required here. High is off, low on. The device has full thermal shutdown and current limiting, and a maximum switched current capability of 3A.

Fig. 2 shows the complete circuit. C1 decouples the input at pin 1. The chopper transistor within IC1 provides a squarewave output at pin 2. It's driven by a pulse-width modulated squarewave at 52kHz. Feedback is taken from the junction of R1 and R2 to pin 4.

The output at pin 2 is fed to a low-pass filter that consists of L1 and C2. When the chopper transistor is switched on, diode D1 is reverse biased and C2 charges via L1. When the chopper transistor is off, D1 conducts and the energy stored in L1 and C2 supplies the load. Our original prototype developed about 10mV of ripple across C2. If you think that the circuit looks familiar, this is probably because it's the basic series chopper circuit used in several TV chassis from the Thorn 3000/3500 series on.

D1 is a fast-switching Schottky barrier diode. C1 and C2 are of the low ESR (effective series resistance) type, especially suited for switch-mode power supply use. If you try to use components other than those specified in positions D1, C1 and C2 the result may be poor stability and incorrect regulation. The output voltage is set at 10·9V by the values of the potential divider resistors R1 and R2, which have a one per cent tolerance. This is the full-load output voltage: off-load the output may rise slightly to 11V.

Testing

The first regulator I built worked well on the bench, even when it was run at slightly above 3A. But problems were encountered when the module was fitted in the TV set. The original bobbin inductor used generated too much EMI (electromagnetic interference), which was picked up by the scan coils. The interference produced fine horizontal lines that ran up the picture. Use of a toroid inductor solved the EMI problem – this type tends to hold the magnetic flux within the core. The one used was obtained from Maplin – neither Farnell nor RS Components stock a suitable toroid inductor.

Construction

Fig. 3 shows a suitable PCB layout. The board is the same size as the original regulator. Thus the module can be made up as a plug-in, pin-for-pin replacement for IC402. The heatsink specified gives good results in free air but runs on the warm side within the set. A good alternative is to use the original IC's heatsink, turned upside down with a hole drilled to take the LM2576-ADJ – see Fig. 4. Apply heatsink compound to IC1's tab before fitting it to the heatsink. An insulating washer is not required as the tab is connected to the earth line.

The leadout wires trimmed from D1 can be used to make the three mounting pins. A blob of Araldite can be used to hold L1 against the heatsink.

One advantage of this module is that individual components can be replaced should they fail. This is not possible with the original regulator, which is potted in epoxy resin and is thus non-repairable. ■

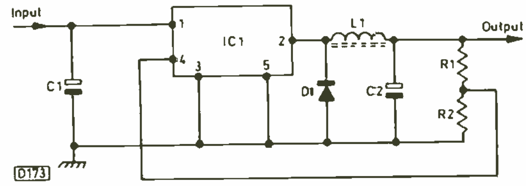


Fig. 2: Circuit diagram of the module.

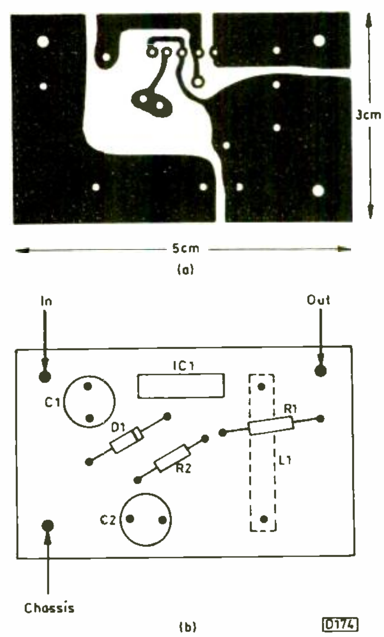


Fig. 3: PCB layout, shown with Farnell 179-935 heatsink. (a) Underside, (b) top.

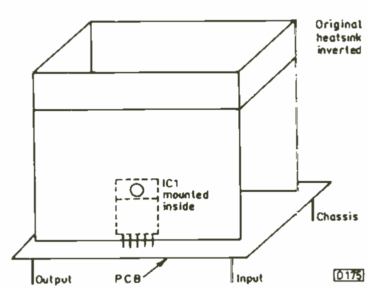


Fig. 4: Alternative arrangement using the original heatsink mounted upside down on the PCB.

Component details

C1	100μF, 35V low ESR	Farnell 580-533
C2	1,000μF, 25V low ESR	Farnell 236-767
D1	SB340 Schottky diode	Farnell SB-340
R1	8·06kΩ 1%	Farnell 340-042
R2	1kΩ 1%	Farnell 339-179
IC1	LM2576-ADJ	Farnell LM2576-ADJ
L1	150μH, 3A	Maplin JL72P
TO220 heatsink		Farnell 179-935

Camcorner

Reports from David C. Woodnott

Sony CCDF450

Intermittent playback colour with one of these machines was cured by replacing the 4·43MHz crystal X301. **D.C.W.**

Canon E60, E110 etc

Because so many varied faults are now occurring with these models we will now repair them only after replacing the 31 miniature can electroyltic capacitors. It's important to clean up the leaked electrolyte on the PCB thoroughly before fitting the replacements. The larger electrolytics do not usually cause problems.

Care is required when fitting the replacements, as they are very densely packed in groups. In view of the high percentage of capacitor related problems with these models, we are looking into the possibility of obtaining an ultrasonic cleaning tank of the type used by watchmakers. Apart from this problem, these camcorders are remarkably reliable. **D.C.W.**

Sony CCDTR105

It's not uncommon, when there has been an impact, to find that the E-E pictures are intermittent or flicker, etc. The usual cause is that connectors CN801 and CN901 on the sensor and process PCBs are disconnected from the print and in need of resoldering. **D.C.W.**

Panasonic NVS1B

This unit would power up for about thirty seconds then de-power. Whilst it was in operation the E-E pictures were OK via the AV lead but the viewfinder remained blank. Eject was the only other working function. We also noticed that only a partial mechanical reset occurred at power-up.

The viewfinder problem was a red herring as its cause was doubtless impact damage: replacing the case-mounted viewfinder socket B801 restored operation – at least during the brief period before de-powering. The main fault was cured by replacing R6021 on the main PCB. It's part of a composite assembly of four 1kΩ resistors and was open-circuit. **D.C.W.**

Sanyo VMEX25P

An intermittently sticking autofocus drive has been the problem with several of these camcorders. We now replace the unit, as cleaning rarely provides a lasting cure. Note that if the autofocus motor windings are open-circuit the zoom motor won't work. Also that care is required when fitting a replacement autofocus motor – if the soldered pins to the ribbon cable are overheated the plastic moulding can melt. **D.C.W.**

Canon E200E

Severe mistracking is common when the slant guides are loose. They become loose in the coaster guide base and work their way out – sometimes they fall right out. It's usually possible to refit them and secure them in position with a suitable Loctite product. If they are loose and catch during the loading sequence, the result can be damage to the vee-block assemblies. **D.C.W.**

Sony CCDV30

This old-timer was OK apart from the fact that it had no viewfinder picture. We found that C954 (100μF, 16V) was short-circuit and PS951 (N15) open-circuit. These items are on the electronic viewfinder PCB. Replacing them restored correct operation. **D.C.W.**

Sharp VLMX7

This twin-lens wonder had a mechanical problem – it chewed tapes! The mechanism is vaguely similar to the Sony Q one, and required replacement of the same parts that also fail in the latter, i.e. the TV stopper assembly, the TV guide arm assembly and the arm TV loading. The build quality is below that of the Sony mechanism, but then so is the price of these items.

We must admit to a degree of trouble in getting this one set up: the reason could in part be our lack of familiarity with the Sharp version. In the end however all was well. If you attempt one of these and, like us, you are not familiar with the mechanism it's as well to drive the loading motor very slowly while making alignment checks, as the thin material used for some items tends to bend. **D.C.W.**

Panasonic NVM40B

Although the chroma content was present there was no luminance in the E-E signal. Playback and all other functions were OK. A look at the circuit diagram showed that pin 4 of the luminance processing chip IC3001 is linked directly to pin 23 of the chroma processing chip IC8001, the line (A6) controlling an input switch (line/cam) in IC3001. Because pin 4 was permanently high, the switch was stuck in the line position. Hence no E-E pictures.

Line A6 is normally held low by a 47kΩ resistor to chassis (substrate) in IC8001 (pin 23). We were able to confirm that this resistor was intact. The connection to pin 4 of IC3001 was not intact however. A wire link between IC3001 and IC8001 provided a cure, but despite a close inspection no print break or dry-joint could be found. A puzzle!

What we did discover is even more interesting however. It appears that with later production (?) models the circuit was modified, the link between the two chips being dispensed with. An additional resistor, R3063 (47kΩ), is added between pin 4 of IC3001 and chassis. This resistor was open-circuit. It's not shown on the circuit diagram. **D.C.W.** ■

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VS9500, VS9800	IDLER		
VP7100, VS9300	REW IDLER	PU46380	500p
VS9500, VS9800			
VP88	IDLER	BV336067	£5.00
VS1, 3, 4, 9, 12	REEL TABLE	BR347731	450p
VS15, 58			
VS23, 35, 37, 53, 55	CLUTCH	ML373043	1100p
VS66, 75, VSA77			
VS9700	FF IDLER	BV321761	£3.20
VS9700	REW IDLER	W321762	£4.25

AMSTRAD

VCR7000	IDLER	150280	£1.50
TVR1, VCR4500	CLUTCH	150873	£3.75
VCR4600, VC5200, VCR9000			
TVR1, VCR4500	GEAR HOLDER	151284	£3.50
VCR4600, VCR5200, VCR9000			
TVR1, VCR4600	REF CLUTCH		£3.50
VCR5200			
VCR6000, VCR6100	CLUTCH	153202	£3.80
VCR4500, VCR9000	CLUTCH		£4.00
VCR4500, VCR4600	MOD KIT	(TAPE CREASING)	300p
VCR4700			
MOD KIT TAPE CREASING FOR AMSTRAD			
VCR4500, 4600, 4700			£3.00

FERGUSON

3V00, 3V01, 3V16	T-UP IDLER	PU47752	£4.50
3V22, 3292, 8900, 8901, 8904, 9806			
3V16, 3V22	T-UP IDLER	PU49280	£5.50
8903, 8909, 8912, 8922			
3V23, 3V29 3V30,	REEL IDLER	PU48967	175p
3V31, 3V32, 3V35, 8923, 8924, 8929, 8930, 8931, 8940, 8941, 8942			
3V23, 3V31	ROLLER ASSY	PU49042A	350p
3V29, 3V30, 3V31	T-UP IDLER	51402	100p
3V32, 3V35, 3V36, 3V38, 3V39, 3V49, 8930, 8931, 8940, 8941, 8942			
3V29, 3V30, 3V31	T-UP CLUTCH	PU51380	200p
3V32, 8930, 8931, 8940, 8941, 8942			
3V35, 3V36, 3V38	REEL IDLER	PU55374	200p
3V39, 3V49, 8943, 8944			
3V35, 3V36, 3V38	T-UP CLUTCH	PU55373	150p
3V39, 3V49, 8943, 8944			
3V58, 3V59, 3V64	IDLER ARM	PU58645	£2.25
3V65, FV10, FV11, FV12 FV13, FV14, FV20, FV21, FV22, FV26			
FV30, FV32, FV33, 8950, VC141L			
3V42, 3V43	CLUTCH ASSY	PU55822	1200p
3V43, 3V44, 3V45	CLUTCH ASSY	PU57658	1050p
3V48, 3V53, 3V54, 3V55, 3V57, 8947, 8948			
3V42, 3V43, 3V44	T-UP CLUTCH	PU56043-1-4	240p
3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 8947, 8948			
3V42, 3V43, 3V44	SUPPORT CLUTCH	PU56044-1-5	160p
3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 8947, 8948			
3V00, 3V01, 3V16	LOADING IDLER	PU43681	£4.00
3V22, 3292, 8900, 8901, 8902, 8903, 8904, 8906, 8909			
8912, 8922			
3V00, 3V01, 3V16	REW IDLER	PU46380	500p
3292, 8900, 8901, 8904, 8906			
3V16, 3V22, 8902	IDLER	PU49281	£1.70
8909, 8912, 8922			

FISHER

FVHP420, 520, 530	FF-REW PULLEY	HI638531	80p
FVHP615, 618, 620	COMP. IDLER ASSY	FI1430420400300	£220p
FVHP622, 710, 711, FVHP720, 721, 722, FVHP725, 730, 830			
FVHP840,905, 906, FVHP908, 910, 911, FVHP915, 916, 918			
FVHP615, 618, 620	GEAR IDLER ASSY	FI1430490400900	380p
FVHP622, 710, 711, FVHP720, 721, 722			
FVHP725, 730, 830, FVHP840			
FVHP615, 618, 620	REEL T-UP ASSY	FI1430410400900	£5.50
FVHP662, 710, 711, FVHP720, 721, 722			
FVHP725, 730, 830, FVHP840			
FVHP905, 906, 908,	GEAR IDLER ASSY	FI1430490402400	275p
FVHP910, 911, 915, FVHP916, 918			
FVHP975, 980, 990,	IDLER	FI1430420400700	300p
FVHP999, 5000, 5005			
FVHP5050, 5075, 5100			
FVHD40, 55, 140	REEL DRIVE ROLLER		£6.00
FVHP1, 10, 20			
FVHP975, 980, 990	CLUTCH	F12430510404200	£9.50
FVHP420, 520, 530	IDLER		£2.80
FVHP420, 520, 530	TAKE UP IDLER		290p
FVHP990	LOADING GEAR		90p
VBS3500	REEL DRIVE PULLEY		£3.20
VBS3500	IDLER		250p
VBS7000	REW IDLER		95p

GOLDSTAR

GHV1221, 1232, 1240	CLUTCH GEAR	435038A	£2.50
GHV1241, 1242, 1243, GHV1244, 1245, 1246, GHV1247, 1248, 8000,			
GHV8200, 8210, 8215, GHVP51, VCP4100, 4130			
GHV1221, 1232, 1240	IDLER		110p
GHV1241, 1242, 1243, GHV1244, 1245, 1246, GHV1247, 1248, 8000,			
GHV8200, 8210, 8215, GHVP51, VCP4100, 4130			

HINARI

VXL3, VXL20	REEL IDLER	40000009	110p
VXL2	IDLER		110p
VXL4, VXL35	IDLER		£2.75
VXL4, VXL35	CLUTCH		£6.50
VXL4, VXL12, VXL25	LIMITER POST		£1.30
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VXL5, VXL6	CLUTCH		£3.75
VXL5, VXL6	GEAR HOLDER		£3.50
VXL7, VXL8, VXL9	CLUTCH		£3.80

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VT11-33, VT63-64	CLUTCH ASSY	6879515	£7.50
VT14, 17, 19, 38, 57, 86, 88, 34, 35, 39, 52, 61			
62, 65, 85, 330, 640, VT16S			
VT120-220, 100, 110	CLUTCH ASSY	6886824	£7.50
111, 113, 115, 118, 200		6886972	
125, 128, 130, 135, 138, 145, 150, 175, 225, 250,			
255, 258, 260, VTL30			
VT8000-8300, 7000	FF-REW IDLER	6413663	£2.80
VT8500-8700			
VT8000-8300, 7000	PLAY IDLER	6414221	290p
VT8500-8700			
VT8000-8300, 7000	FF-REW PULLEY	6383531	80p
VT8500-8700			
VT9300-9500, 6500	FF-REW IDLER	8681471	250p
VT680, 6800, 9700, 9900			
VT9300-9500, 6500	PLAY IDLER	6861482	230p
VT680, 6800, 9700		6861481	
VT 9900			
VT9300-9500, 9700	IDLER	681505	230p
VT9900, 6500, 680, 6800	IDLER	687043	£3.80
VT11-33, VT63-64	FF-REW IDLER	6886971	125p
VT14, 16S, 17, 19, 34, VT35, 38, 39, 52, 61, 62			
VT65, 85, 86, 88, 330, 640			
VT1000, 110, 111, 113	FF-REW ARM	6886792	240p
VT115, 118, 119, 120, 125, 128, 130, 135, 138, 145, 150			
VT175, 220, 225, 250, 255, 258, 260, VTL30			
VT400, 405, 410, 413	FF REW ARM	6897094	£1.30
VT414, 415, 418, 420, 425, 426, 428, 430, 431, 435			
VT438, 450, 498, 510, 518, 520, 525, 526, 530, 535			
VT536, 540, 545, 546, 548, 570, 575, 576, 580, 585			
VT588, VTM625, 626, 630, 635, 636, 640, 645, 646, VTS80, 85			
VT400, 405, 410, 413	CLUTCH BASE	6896951	£5.00
VT414, 415, 418, 420, 425, 426, 428, 430, 431, 435			
VT438, 450, 498, 510, 518, 520, 525, 526, 530, 535			
VT536, 540, 545, 546, 548, 570, 575, 576, 580, 585			
VT588, VTM625, 626, 630, 635, 636, 640, 645, 646, VTS80, 85			
VT3000	T-UP IDLER (LARGE)		£4.50
VT3000	REW IDLER		£6.00
VT680, 6500, 6800	FS-BRAKE	6861505	230p
VT9700, 9900			

HITACHI TV

OUTPUT MUDULE HM 6251	£5.50
OUTPUT MODULE HM 6232	£8

JVC

HR330, 3660, 4100	T-UP IDLER SML	PU49280	£5.50
HR7200, 7600, 7650	T-UP CLUTCH	PU53462A	220p
HR7655, 7300, 7350, 7610			
HR7200, 7300, 7350	REEL IDLER	PU48967	175p
HR7600, 7610, 7650, 7655, 7700			
HR7600, 7610, 7650	ROLLER ASSY	PU49042A	350p
HR7655, 7700			
HR3300, 3660, 4100	T-UP IDLER LRG	PU47752	£4.50
HR7200, 7600, 7650	T-UP IDLER	PU51402A	100p
HR7655, HRD110, HRD111, HR7300, 7350, 7610, HRD120-121, 225			
HRD110, HRD120-121,	T-UP CLUTCH	PU55373	150p
HRD225, HRD111,			
HRD110, HRD120-121,	IDLER ARM	PU55374-3-8	200p
HRD225, HRD111			
HRD170, 180, 210, 230	IDLER ARM	PU58465	£2.25
HRD320, 370, 400, 430, 470, 530, 700, 750, 950, 3000			
HRS5000, HRS5500			
HRD455, HRD725	CLUTCH MECH	PU558822	1200p
HRD140, 150, 157, 158	CLUTCH MECH	PU57658	1050p
HRD160, 250, 257, 565, 566, 755, HRP50			
HR3300, HR3330	REW IDLER	PU46380	500p
HR3660, HR4100			
HRD140, 150, 157, 158	TAKE UP CLUTCH	PU56043-1-4	240p
HRD160, 250, 257, 455, 565, 566, 725, 755, HRP50			
HRD140, 150, 157, 158	TAKE UP CLUTCH	PU56044-1-5	160p
HRD160, 250, 257, 455, 565, 566, 725, 755, HPR50			

MATSUI

VX730, 735, 750, 755,	CLUTCH	850A00005	420p
VX810, 820, 850, 880, 990			
VX730, 735, 750, 755	LIMITED POST LEVER		£1.30
VX770, 800, 810, 880	ASSY		
VX990			
VX800A, VX900	IDLER REEL		£1.50
VX800A, VX820	REEL UNIT CLUTCH		280p

MITSUBISHI

HS306, 307, 318, 319,	GEAR ASSY	522B00201	£6.25
HS400, 410, 710			
HS337, 338, 347, 349	IDLER	552B01701	325p
HS411, 412, 421, HSB10, HSB20, HSB30, HSE10, HSE20, HSE30,			
HSE70			
HS306, 307, 318, 319	IDLER	641C34301	£2.00
HS400, 410, 710			
HS347, 349, 412	IDLER	522902002	£3.00
HSB10, HSB20, HSB30, HSE10, HSE20, HSE30, HSE70			
HS337, 338, 411, 421	IDLER	552B01801	320p
HS200	TAKE UP IDLER (LARGE)		£4.50
HS200	UNLOADING IDLER		£4.00
HS200	REWIND IDLER		£6.00
HS306, 307, 318, 319	SUPPLY REEL	522A00101	£3.20
HS400, 410, 710	DISK		
HS306, 307, 318, 319	TAKE UP REEL	522A00102	£3.20
HS400, 410, 710	DISK		
HS320	REEL DISK	522C06301	£3.00
HS337, 338, 411, 421	REEL DISK	522P00601	£5.00
HS300, 301, 302, 310	PULLEY	522C05201	£2.25
HS306, 307, 318, 319	GEAR WHEEL	641D71101	£1.50
HS400, 410, 710			
HS306, 307, 318, 319	GEAR WHEEL	641D71001	£1.50
HS400, 410, 710			

NEC

N830, N831, N832, N833	TAKE UP CLUTCH		150p
N830, N831, N832, N833	TAKE UP IDLER		100p
N830, N831, N832, N833	REEL IDLER		200p
N895	TAKE UP IDLER SMALL		550p
N911, N915, N916, N917	REEL DRIVE PULLEY		350p
N9012, 9013, 9014, 9016, 9033, 9034, 9054, 9055, 9066, 9110			
N9510, 9520, 9530, 9610			

NATIONAL

NV322, NV600, NV688,	IDLER UNIT	VXP0463	£2.75
NV777, NV788, NV332, AG6100, 6200, 6800, 6810			
NV300, NV333, NV340	IDLER ARM	VXL0997	£3.60
NV366			
NV300, NV330, NV333	IDLER UNIT	VXP0401	60p
NV340, NV366			
NV300, NV330, NV333	PLAY IDLER	VXP0433	£2.75
NV340, NV366, NV8620			
NV230, NV332, NV333	ACTION GEAR	VDG0616	£0.60
NV340, NV366, NV600, NV777, NV788, NV2000, NV2010, 3000, 7000			
AG6010, AG6015			
NV333, NV688, NV2000	LOADING GEAR	VXP0325	£2.00
NV3000, NV7800			
NV300, NV332, NV333	INTERMEDIATE GEAR	VXG0617	£0.65
NV340, NV366, NV600, NV777, NV788, NV2000, NV2010, 3000, 7000			
AG6010, AG6015			
NV330, NV333, NV340	CAM GEAR	VXG0158	£1.00
NV366, NV777, NV788			
NV230, NV250, NV260	IDLER ARM	VXP0521	110p
NV280, NV370, NV380, NV430, NV450, NV460, NV465, NV470, NV480			
NV630, NV650, NV730, NV780, NV810, NV830, NV850, NV870			
NVG7, NVG9, NVG10, NVG11, NVG12, NVG14, NVG15, NVG16, VG18			
NVG30, NVG400, AG1000, AG1200, 1500, 1810, 2100,			
AG2200, NVH65, NVH70			
NV370, NV430, NV870,	CAM GEAR	VDG0200	£1.20
NV730, NV830, NV850, NVG10, NVG12, NVG18			
NV730, NV770	IDLER UNIT	VXP0581	£2.50
NV2000, 2010, 3000	IDLER UNIT	VXP0331	80p
NV2000, 2010, 3000	IDLER UNIT	VXP0329	80p
NV2000, NV3000	CAM GEAR	VDG0069	£1.00
NV7000, 7200, 7800	IDLER UNIT	VXP0344	75p
NV7000, 7200, 7800	CLUTCH	VXP0343	300p
NV8150, 8200, 8300,	IDLER UNIT	VXP0245	80p
NV8400, 8600, 8610, 8620			
NV8200, 8400, 8600	PLAY IDLER	VXP0243	80p
NV8610, 8620			
NV8620	CLUTCH	VXP0343	250p
NV332, NV600, NV688	IDLER	VXP0488	300p
NVG20, NVG21, NVG25	PULLEY UNIT	VXP0767	400p
NVG40, NVG45			
NV230, NV250, NV280	WORM WHEEL	VXP0604	160p
NV430, NV450, NV460, NV465, NV650, NV730, NV770, NV810			
NV870, NV890, AG1000			
NV370, NV380, NV630	IDLER	VXP0523	300p
NV780, NV830			
NV370	CLUTCH GEAR	VXP0595	£1.00
NVG7, NVG11, NVG12	WORM WHEEL	VXP0691	£1.50
NVG14, NVG15, NVG18, NVG30, NVG120, NVG130, NVG400, NVH70			
NV2000, 2010, 3000	LOADING GEAR	VDG0035	£0.60
NV7000, 7200, 7800, 8050			
NV230, NV250, NV370	LOADING GEAR	VXP0520	£1.50
NV430, NV450, NV460, NV630, NV730, NV770, NV780, NV810			
NV830, NV890, NVG7, NVG10, NVG12, NVG15, NVG30, NVG120			
NGV130, NVG400, NVH70, AG1000			
NV230, NV250, NV260	CLUTCH GEAR		£2.50
NV280, NV430, NV450, NV730, NV770, NV810, NV870, NV890			
NVG7, NVG10, NVG11, NVG12, NVG14, NVG15, NVG18, NVG30			
NCG120, NVG130, NVG400, NVH70, AG1000			
NV230, NV250, NV260	LIMITER ROLLER		£1.50
NV280, NV300, NV330, NV340, NV366, NV370, NV430, NV450, NV460			
NV465, NV630, NV650, NV777, NV780, NV788, NV810, NV830, NV850,			
NV870, NV890, NV2000, NV2010, 7200, 7800, NVG7, NVG10, NVG12,			
NVG14, NVG15, NVG18, NVG30, NVG120, NVG130, NVG400, NVH70,			
AG1000			

SAISHO

VR605, VR800, VR900	CLUTCH	850A20000	420p
VR1100, 1200, 1600, 2500, 3200, 3300			
VR3500, 3600, 3800	LIMITER POST		£1.30
VR1100, 1200, 1600, 2500, 3200, 3300, 3500, 3600, 3700			
VR605, VR800, VR900	IDLER		280p
VR2500, 3200, 3300, 3500, 3600, 3800			
VR705, VR805, VR905	IDLER		110p

SANYO

VHR1110, 1150, 1200	IDLER	143-0-662T-14730	£5.00
VHR1300, 1500			
VTC5000, 5150, 6000	FF-REW IDLER	143-0-741T-20001	250p
VTC6500, VTCM10, M11, M20, M21, M30, M31, M50			
VTC9100, VTC9300	IDLER	143-0-551T-01400	95p
VTC9300	FF ROLLER ASSY	143-0-547T-00200	200p
VTCM10, M11, M20, M21	REEL DRIVE PULLEY	143-0-662T-10350	£5.00
VTCM30, M31, M50			
VHR2100, 2100, 2500	IDLER	6130374899	300p
VHR2700			
VTC5000, 5150, 6000	PULLEY	143-0-662T-01201	£5.20
VTC6500			
VTCM10, M11, M20, M21	PULLEY	143-0-662T-10350	£5.50
VTCM30, M31, M50			
VHR3100, 3300, 3310	REEL DRIVE	143-0-662T-15621	350p
VHR3400, 3700, 3800	ROLLER		
VHRD500, VHRD700			
VPR5800, VTC5300	LOADING ROLLER	143-0-661T-03800	80p
VTC5400			
VTC3000	FWD LIMITER		£3.50
VTC3000	IDLER		750p

SHARP

	IDLER ASSY	NIDL0005GEZZ	110p
	IDLER	NIDL0006GEZZ	110p
VC600, 651, 681, 682	IDLER ASSY	NPLYV0107GEZZ	£6.15
VC684, 685, 693, 699, 700, 783, VC6FR, VC6V3			
VC7300, VC7700, 7750	PLAY IDLER KIT	NPLYV0041+ NDA1V1007	£7.50

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MAKE & MODEL	ORDER CODE	PRICE
PACE PRD800, PRD900	SATPSU1	650p
PACE SS9000, 9200, 9010, 9020, 9220	SATPSU2	650p
AMSTRAD SRD510, SRD520	SATPSU3	650p
AMSTRAD SRD500	SATPSU4	650p

Replacement Video Heads

MAKE	MODELS	PRICE
HITACHI	VT570, VT575, VT576, VT580, VT585 VT588, VTF70	3100p
I.T.T.	VR3761	3100p
JVC & FERGUSSON	HRD950, HRD960, HRD980, FV46	5000p
LUXOR	VR3761	3100p
MITSUBISHI	HSE51	3000p
NATIONAL PANASONIC	NVFS200, NVFS90, NVV8000	4600p
	NVHD100, NVHD101, NVHF100	3100p
	NVSD	1400p
	AG7330, AG7350, AG7355, AG7450	5000p
	NVFS100	5000p
N.E.C.	D5600	3500p
SANYO	TLS1000P, TLS1001P, TLS1100	3100p
	VHR7800, VHR7810, VHR8000SP, VHR8801SP, VHRD4800	3100p
SHARP	VCH80, VCH81, VFH815	2800p
	VCA33, VCA36, VCA43, VCA44, VCA46, VCA49	1500p
	VCA55, VCA63	2200p
SONY	SLV656, SLV715, SLV757, SLV777, SLV815, SLV825	4600p
	SLV353UB	3200p
	CCDF340E, CCDF500E, CCDV90E, CCDV95E, CCDSP5E	4800p

Original Video Heads

MAKE	MODELS	PRICE
NATIONAL PANASONIC	NVG20, NVG21, NVG22, NVG25 NVG25, NVG28, NVG200, NVD48 PART NO: VEH 0343	3000p
	NVG33, NVG45, NVG46, NVL23 NVL25, NVL28 PART NO: VEH 0417	2900p
	NVJ30, NVHJ33, NVL20, NVL21, NVG30, NVG31, NVG40, NVG130 PART NO: VEH 0416	2700p

Audio Control Head

AMSTRAD ORIGINAL NO: 150751
Used on: AMSTRAD TVR1, 2, 3, VCR4600, 4600MKII, 4700, FUNAI VS2, VCR4600, 4800, 5200, 5600, 6600, VIP3000, 5000
Also fits: FIDELITY, FUNAI, HINARI, PROLINE, SCHNEIDER, TOWADA, UNIVERSUM **ORDER CODE: AH01 PRICE: 1350p**

AMSTRAD ORIGINAL NO: 153134
Used on: AMSTRAD DD8900, 8904, VCR2000, 6000, 6100, 8600, 8602, 8603, VCR8604, 8700, 8704, 8714, 8800, 9005, 8244
Also fits: ANITECH, BONDSTEC, CASIO, CROWN, FIDELITY, GOLDHAND, GRANADA, HINARI, MARQUANT, OMEGE, PROFEX, SCHNEIDER, SEG, SENTRA, SHINTOM, TASHIKO, TATUNG, TOWADA, UNIVERSUM **ORDER CODE: AH02 PRICE: 1450p**

Replacement Audio Control Video Sound Head for National Panasonic

PART NUMBER	MODELS	PRICE
VBR 0091	NVG7 etc	875p
VBR 0050	NV300, NV340 etc	875p
VBR 0061	NV777 etc	875p
VBR 0103A	NV250, NV450 etc	625p
VBR 0125		625p

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FERGUSON & J.V.C.	3V38, 3V39, 8943, 8944, 9951, 3V35, 3V36, 3V49, HRD 110, 111, 120, 121, 225	CH01	2800p
	3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57, 8945, 8947, 8948, HRD140, 141, 150, 157, 158, 160, 250, HRD257, 455, 565, 566, 725, 755	CH02	2800p
	8948, 8950, FV10B, 12L, 13H, 14T, 20B, 21R, 22L, 26, 395, HRD230, 430, 530	CH03	2600p
	3V58, 3V59, 3V64, 3V65, FV11R, 8950, 8951, HRD170, HRD180, HRD370	CH04	2600p
	FV31R	CH19	4300p
	HRD515, 520, 527, 540, 550, 580, 600, 610. 620, 660, 670, HRD830, 840, 850, 860, 4050, 6600, FV37H	CH20	2400p
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	VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2800p
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1.6A	FUSE10	60P	FUSE26	60P
2A	FUSE11	50P	FUSE27	60P
2.5A	FUSE12	50P	FUSE28	60P
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10A	FUSE40	100P
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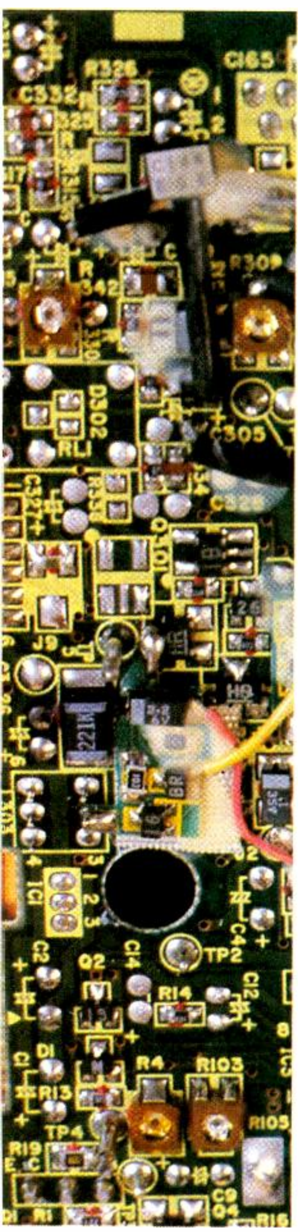
Surface-mount Technology: Design Guidelines

Martin T. Pickering, B.Eng., discusses the factors that determine the reliability and cost-effectiveness of SMD board assemblies



The following notes aim to summarise good design practice for surface-mounted assemblies. The idea is not to lay down hard and fast rules but to highlight what should be done and why. Some points may be regarded as contentious. They are however based on my experience over fifteen years as a designer.

Copper Track Width

In general tracks should be 0·5mm (20 thou) wide wherever space permits. The minimum currently recommended track width is 0·2mm (8 thou). Tracks of this width should be used only where absolutely necessary, since they can cause a significant number of 'fall outs' during bare board manufacture, thereby increasing the unit price. In addition the increased possibility of fractures in tracks of such small width will affect long-term reliability. Local 'necking' of tracks is often unavoidable however, for example where a track must pass between the legs of an IC. But it will affect reliability and can result in solder shorts during board assembly.

Wider tracks may be required where the current flow is significant. But widths greater than 2·5mm (100 thou) should be avoided since they can cause problems with bare board manufacture and there is a risk of the solder resist wrinkling and peeling when soldering takes place. Because of this, wider tracks should be divided in the form of a ladder, permitting the solder resist to adhere to the board material between the areas of copper. For the same reason ground planes, where required, should be divided by cross-hatching.

A further point is that large areas of copper act as heatsinks during the soldering process and can lower the temperature of a solder wave sufficiently to increase its viscosity – this can result in poor solder joints or even prevent the formation of a joint altogether.

Gaps between Tracks

Inter-track spacing should in general be at least 0·5mm (20 thou). This will minimise the possibility of short-circuits during bare board manufacture. The spacing may need to be wider with high-voltage or high-impedance circuitry. In addition it may be necessary to include a chassis-potential 'guard rail' to trap possible leakage currents. Where a decrease in spacing is unavoidable, it should be used in as few places as possible. Tracks should be spaced evenly, and not bunched together in localised areas unless correct electronic functioning specifically requires close spacing.

Close track spacing increases the risk of short-circuits, leakage current and inter-track capacitance effects. It also maans that the unit will be prone to failure in humid conditions.

Moisture

Moisture penetrates solder resist. The ingress is usually slow, but can increase in humid air conditions when the temperature is raised and lowered in cycles. This effect is known as 'breathing'. It occurs naturally as the temperature varies between day time and night time, and can be accelerated in a cyclic humidity chamber.

Moisture penetration is fastest at the boundaries and where the resist layer is thin. Once it has penetrated the resist it can be removed only slowly, by long-term exposure to hot, dry air. It might never be removed completely.

The effect of moisture, when combined with atmospheric oxygen, is to react with metal to form salts. Active flux agents (e.g. halides) and any impurities or reagents not cleaned from the board before the application of resist will increase the metal corrosion.

Copper salts are soluble and form an electrolyte that readily conducts current between tracks. Tin is prone to whickering (dendritic growth), which again forms conductive paths. The chemical reactions are accelerated by current flow and temperature increase.

Solder Resist

Most solder resist is epoxy based. The exact type should be chosen with care and specified by the designer on the relevant drawing. If the copper tracks are tinned before the solder resist is applied there will be less chance of bare copper being left exposed, but resist wrinkling can occur on wider tracks. Wrinkling may be the lesser evil however, because bare copper unprotected by tin-lead can cause reliablity problems – it is susceptible to corrosion. Unless the copper is tinned before resist is applied, there will always be unprotected copper at the boundary of the resist – especially when a screen is used to apply the resist.

Non photo-definable solder resist cannot be placed with a guaranteed accuracy of better than 0·25mm (10 thou). The artwork for the board should allow for this tolerance by making the resist-free areas larger than the corresponding solder or test pads. Resist placement accuracy can be improved by using photo-definable solder resist, albeit at a cost. Accuracy will inevitably decrease as board size increases.

SM Device Pads

Pads for chip surface-mounted devices (SMDs) should be circular or oval and the width should not exceed 75 per cent of the component width. In fact pads should be made as small as possible in accordance with the placement machine's abilities and the ability of the soldering equipment to produce a good joint. Small, circular or oval pads create less stress in a componant than larger pads do. The small size ensures that the amount of solder used is minimised, reducing the cost, and provides a degree of flexibility in the joint (flexibility is undersirable in military applications however, or where vibration is experienced: in such cases the SMDs will be mounted on ceramic substrates that don't flex).

Lack of sharp corners to the pads reduces the risk of short-circuits and poor joints, since the solder naturally assumes a curved meniscus. The amount of solder increases considerably with larger pads: the joint becomes rigid, and stress caused by thermal contraction or mechanical bending of the PCB can result in fractures within the component. Such fractures may not become apparent until after the unit has been brought into service (stress fracturing will be discussed in a subsequent article).

Pads for gullwing, J-lead and spear- or butt-lead devices can be circular or oblong, preferably with rounded corners, as dictated by the lead contact area. Leaded components don't suffer from stress problems in the way that chip SMDs do. Pad areas should be minimised however, to avoid the risk of short-circuits between leads. The suggestion that pad areas should be maximised to take component misplacement into account is not valid: soldering will still be satisfactory when a component lead covers only 50 per cent of the pad width. It is more important to maintain adequate gaps between pads.

Where a pad adjoins or forms part of a larger area of copper (for example a power supply track) that's more than 1mm (40 thou) wide, the solder pad should be separated from the track for most of its circumference. The connection should be via one or more 'necks' of no more than 1mm (40 thou) width. Otherwise heatsink effects during soldering may cause stress and dry-jointing. This requirement also applies to test pads and plated-through holes (vias).

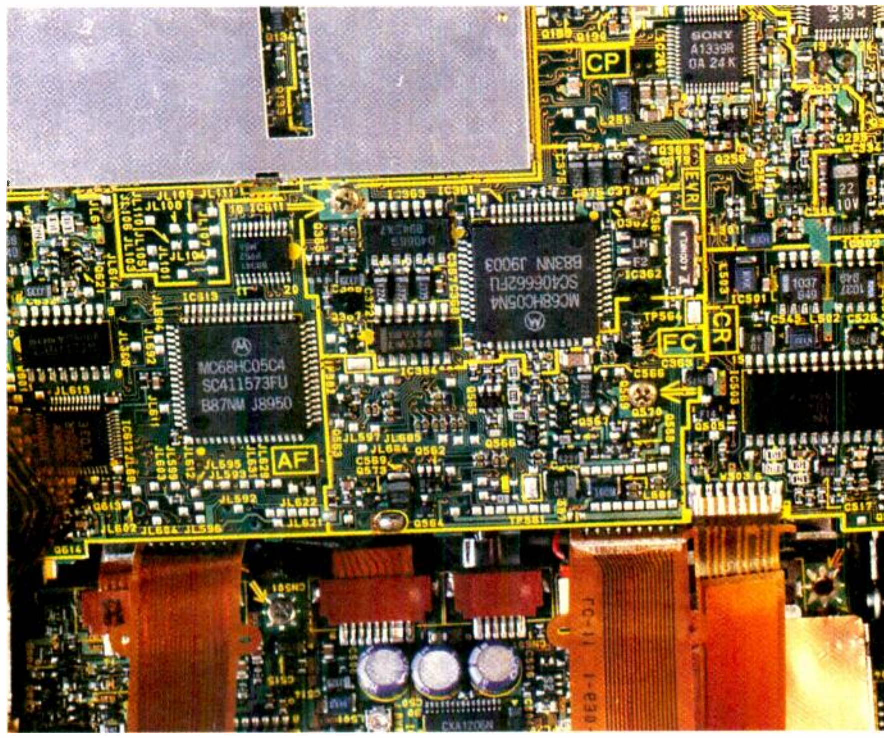
A via should not be placed beneath a component, where inspection is impossible and flux can be trapped. If this requirement cannot be met, provision must be made for testing the integrity of the through connection electrically and the height of the component above the board must be a minimum of 0·25mm (10 thou) for cleaning, if required, to be feasible.

Infra-red Reflow

Infra-red reflow is not a hot-oven technique. It is a direct radiation method, where any part of a component that's exposed to the radiating elements can become hot enough for solder to melt and any part not not exposed cannot melt solder. Hot air build up is detrimental to component reliability and must not be relied upon to melt solder.

The colour of components and leads is important – black parts can become appreciably hotter than white or reflective parts. Unfortunately we have very little control over colours at present, but bear this in mind because it's a serious drawback with the infra-red method.

Care is required over component selection. Some IC carriers for example have J leads that are out of sight beneath the plastic moulded body and can be reliably soldered only by using a vapour-phase process. Conventional leaded components such as electrolytic capacitors should not be exposed to infra-red radiation because damage can occur.



An example of surface-mounted component technology: part of board VC60 in the Sony CCDTR55 camcorder.

Wave Soldering

The orientation of components is important with wave soldering and the spacing between them is generally more critical. High or wide components should not have other components within their 'shadow boundary'. Since this is determined by the direction of travel over the wave, the direction must be decided at the very beginning of the design process and must be stated clearly on the relevant production drawing. While a vibrating-wave technique can greatly reduce both shadowing effects and dry-joints caused by flux vapours being entrapped, the technique should not be adopted to eliminate bad design practice.

Board area is important, because bow and twist effects as the board is heated and cooled put enormous stress on SMDs and tend to increase with board area. Provided the interconnection method is suitable, a number of small boards connected to a mother board after soldering can be more reliable than the same number of components arranged on one large board. The maximum practical board size for optimum reliability is about 100mm (4in.) square – bear in mind that it will probably be equivalent to a conventional component PCB with an area three to four times as great.

If a large board is essential, the effects of bow and twist can be minimised by predefining the lines along which the bending will occur: put the components into individual clusters separated by milled or punched slots between which the interconnecting tracks run. The lines of greatest weakness thus contain only tracks. To avoid sag during the soldering process, minimise the width of the board or use a supporting structure.

If a number of small daughter boards are to be soldered to it, the mother board should again be narrow or supported to minimise sag, or a rigid palate should be used to carry the daughter boards. Whichever method of supporting the daughter boards is selected, it should be considered during the early design stages since the choice is affected by the soldering machine's requirements, the boarder that's required to be free of components, the supporting structure material (metal can affect wave temperature), the width of the solder machine tracks (has it been standardised for previous boards?), the direction of travel, the amount of sag that can be tolerated and other considerations.

Cleaning

SMD assembly cleaning should be avoided if at all possible, being an extra, costly process. Unfortunately even the 'synthetic' fluxes leave considerable residues unless the soldering process is specifically tailored to meet their requirements. Preheat control is especially important with synthetic fluxes, since the solvent must be evaporated before soldering takes place. Synthetic fluxes can also cause solder 'webbing' when used with certain types of solder resist. The possibility of using such fluxes to avoid the problems and expense involved in washing should be considered most carefully. If the decision is in favour of cleaning, a flux with very low solids content will make the process easier.

Chlorinated fluorocarbon solvents used for cleaning can introduce a health hazard as well as being an environmental risk. The cost of CFC solvents has increased, and there are severe restrictions on their use.

Water-soluble flux provides a reasonable compromise, being cheaper and less environmentally harmful than CFC solvents. In addition, water tends to remove corrosive flux activators that CFC leaves behind.

Inspection

Because of the small size and large number of almost identical components mounted on an SMD board, visual inspection is difficult and often unreliable. Magnification is necessary, but this reduces the instantaneously visible area while increasing eye fatigue. Automatic assembly or guided manual assembly techniques will, together with carefully written test software, minimise the need for inspection. Since automatic testing is limited in its ability to deal with every type of component, it is important to carry out a comprehensive functional test as well.

Qualification Tests

SMDs are more prone to moisture ingress and the effects of temperature change than their conventional counterparts. A small number of assembly samples should therefore be subjected to environmental conditioning and testing to ensure that the equipment will meet its specification reliably.

Rework

Rework can be difficult, and every effort should be made to avoid the need for it. Rework involves the application of heat to components, introducing the risk of reduced reliability or damage to the PCB and adjacent components.

In Conclusion

It would be impossible to cover all aspects of SMA design in a short article like this. I have concentrated on the considerations that are most often overlooked or unknown to younger engineers. In a previous article, on design reliability, I mentioned that a lot of design knowledge and experience fails to be passed on to younger designers. Because of this, avoidable mistakes continue to be made. Hopefully the advice given here will redress the situation. ■

Self-diagnostic SYSTEMS

Many VCRs and TV sets now incorporate self-diagnostic systems, which have advantages and disadvantages. John Coombes on the new approach to servicing

The move to using microcomputer control via a data bus has made it possible to incorporate self-diagnostic systems in many VCRs and TV sets. This can cut down the amount of time spent during a field call. But because of surface mounting and component miniaturisation, with the need for specialist tools to carry out replacements, it can be impractical to complete repairs in the field. As a result we might have to go back to the practice of panel swapping, with faulty panels taken back to the workshop for attention. This could in turn lead to decreased reliability, with plugs and sockets giving rise to poor contact and dry-joint problems.

The data bus, which links most of the ICs used in a microcomputer-controlled TV set, enables service adjustments such as height, linearity etc. to be carried out using an 'electronic screwdriver', i.e. a remote control unit that contains the necessary codes. With this type of arrangement it is usually possible to reprogram the set's EEPROM so that different standards, tuning arrangements etc. can be selected.

Another helpful feature is the ability to enter an ideal set up in the remote control unit. This makes installation very easy. If there is a problem or fault, this can be shown via a remote control unit display. So you can get clues even when there's no tube display.

Philips GFL Series

With the new Philips GFL series receivers, numbers displayed by the dealer service tool (DST – a remote control unit) provide error codes that indicate the nature of the fault present. There is also a default mode: this tunes the receiver to 475·25MHz, with the sound and picture seetings in a predefined state. Two service pins provide an alternative way of entering the default mode. An error memory can store the last ten errors to occur, which is an advantage when dealing with intermittent faults.

DST operation is simple. The relevant circuit diagram has a flow chart which interprets the error code, telling you which area or even component to check or change. I have been pleasantly surprised by the DST. Initially I thought that an experienced engineer should be able to make a diagnosis after a quick look. While this is true, the DST does speed things up and helps you to get to the cause of a fault with the minimum of hassle. It is of particular help with intermittent faults.

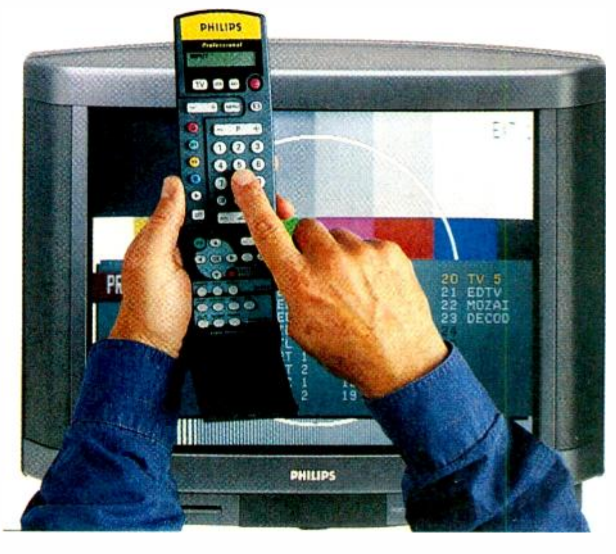
Toshiba V3 VCRs

The current Toshiba V3 range of VCRs, which has been the subject of previous articles (see January and March issues), incorporates automatic fault self-diagnosis. When a tape transport or power fault occurs, a special chip detects this and poduces an error code display. With the top-of-the-range Models V804B/V854B the code is shown visually, using the display at the front of the machine.

When the machine powers down or the tape stops running, the fault is noted by the EEPROM for display. The VCR buttons and the remote control unit buttons have to be used to produce the error code display. Code details are as follows.

First two numbers/letters: these indicate the mode in which the fault occurred, as follows:

00	Standby
01	Stop
02	Rewind
03	Review
04	Fast forward
05	Cue
06	Playback
07	Still, slow playback
08	x2 playback
09	Stop (moisture detected)
0A	Reverse playback
0B	Reverse playback still/slow
0C	Record
0D	Record pause
0E	Power off eject
0F	Eject
10	Short FF
11	Short REW
13	Audio dub



Our picture shows the Philips Professional dealer service tool.

Code	Fault	Check
H01	Drum stops and doesn't start even after tape unloading.	Drum motor drive circuit.
H02	Tape not wound up during unloading, except eject.	Capstan motor drive circuit.
F03	Mechanism stops during mode transition, except eject.	(1) Loading motor drive circuit. (2) Mechanism phase alignment. (3) Mode switch.
F04	Mechanism stops during tape unloading.	(1) Loading motor drive circuit. (2) Mechanism phase alignment.
F05	Tape not wound up during unloading/eject.	(1) Capstan motor drive circuit. (2) Supply/take-up reel pulses.
F06	Mechanism stops after unloading in eject mode.	(1) Loading motor drive circuit. (2) Phase alignment of cassette holder unit.
F07	Record mode supply voltage missing.	Record power supply.
F08	Record supply voltage present but not in record mode.	Record power supply.
F09	No clock pulses between IC6001 and IC7501.	Serial clock data circuit.

Table 1: Self-test checking

14 Audio dub pause

The centre section of the display indicates the basic fault, as follows:

01 Drum stopped
02 Take-up reel fault
03 Supply reel fault
04 Cassette in/out fault
05 Threading fault

The right-hand numbers/letters indicate the mechanism state when the fault occurred:

01 Front loading out
03 Loading down
05 Tape threading
07 Reverse rotation, pinch roller on
09 Playback, pinch roller off
0B Stop, main brake on
0D Fast forward/rewind
0F Position not certain

Panasonic NVSD200B/400B

Panasonic uses delf-diagnostic codes in its NVSD200B and NVSD400B VCRs. When the machine detects a fault during installation or normal use it automatically shows an error code on the display screen.

This consists of five digits. The first indicates the area where checks are required (service mode), the second and third indicate the basic nature of the fault (service data) while the fourth and fifth indicate the the circuit that senses the malfunction (service information).

The engineer can obtain service information displays by pressing FF (fast forward), REW (rewind) and eject at the same time or by short-circuiting the service test point (TP SERV) to chassis.

Service mode checks are as follows:

1 Tape protection circuit
2 Tape transport mechanism
3 Mode switch operation
4 Control buttons
5 Capstan motor
6 Drum motor
7 Load/unload operation
8 See below

The mode 8 display occurs only when connecting TP SERV to chassis.

Service data codes are as follows:

00 No problem (operation is normal)
01 Drum has stopped
02 Tape reel has stopped
03 Stop other than 04 or 06
04 Stop during unloading
05 Capstan rotation fault
06 Stop during cassette in/eject
07 Voltage error in record mode
08 Voltage error except in record mode
09 Data communication error between system control and timer

Mode 1 means check the sensor LED supply and the take-up sensors. The latter can be checked by blocking the light from the LED. If all is well, the service data numbers will show 00. When the light to an end sensor is blocked the data indication will be 01, meaning that the drum has stopped. To carry on, press FF, REW and eject together to obtain mode 2.

In this mode the mode switch circuit is checked and the mechanism position indicated. The data numbers provide the indication.

The next mode, 3, checks that the mode switch circuitry has completed its operations. After each of its mechanism movements has been completed, the data number 00 should be shown if correct.

Mode 4 makes sure that the operation circuit is working correctly. This checks whether system control/servo chip IC6001 is receiving data from the buttons and/or remote control unit.

Mode 5 checks the capstan motor circuitry and whether IC6001 has received information to drive the capstan motor.

Mode 6 does the same for the drum drive.

Mode 7 checks the loading and unloading operation. To check the loading function press the play button. Press the stop button to check the unloading. This mode will be displayed indefiniately until the power button is pressed.

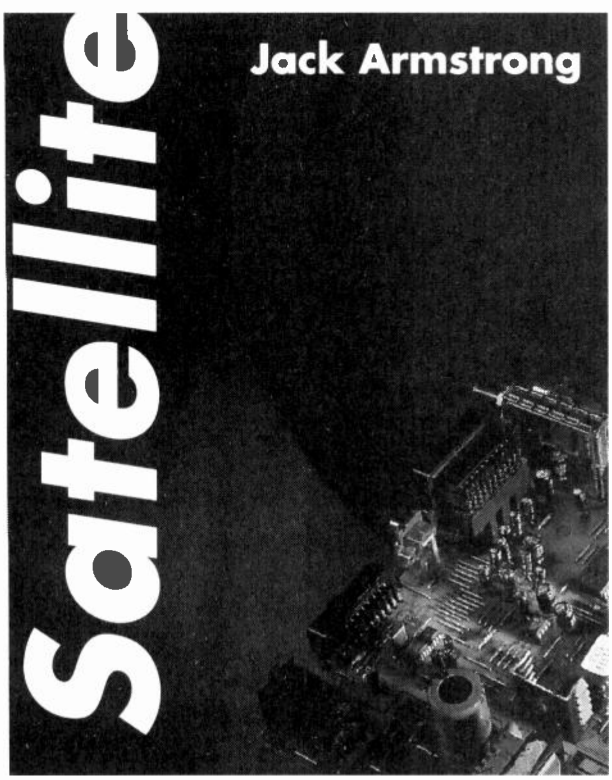
There is some additional service data for mode 4. This is obtained when an operating button is pressed, giving a service data number shown in the complete service manual for the Panasonic Model NVSD200B.

The self-test display code consists of a single letter and two numbers. Table 1 provides details.

In Conclusion

The developments outlined here show how servicing is changing. Such aids should help us to complete jobs more quickly and increase daily throughput, thus keeping down costs. The problem remains that if the price of new equipment remains low, repairs may still be uneconomical. ■

Satellite WORKSHOP



Jack Armstrong

Until recently I've been doing only trade repairs. To generate some extra business I decided to run a small advertisement offering "instant satellite repairs". My experience has been that the suggestion of a fast turnaround with a fixed charge attracts more customers than an advertisement that says "repairs from £25" or whatever. Certainly Mr Wilkinson thought so, because he phoned and asked me to look at his Amstrad SRD550 which was "flashing red and green".

The Amstrad SRD550 Problem

A quick test at Mr Wilkinson's house confirmed that both LEDs did flash, even with no LNB cable connected. The cause could have been a faulty transistor in the LNB supply, but Mr Wilkinson mentioned that the fault was intermittent. My guess was that the chassis connection to the power supply output plug had gone high-resistance, a common fault with this range of receivers.

Nowadays I can't get away with burning holes in the customer's carpet, and I don't like to work in the back of the van. So I took the receiver back to the workshop and fixed it by adding a wire between the power supply and decoder screening can. As a precaution, I adjusted the low-voltage rail to 4·95V – with some receivers this voltage has risen as high as 6V when the earth wire has been added.

When I reinstalled the receiver at Mr Wilkinson's house it worked very well, but the pictures were distinctly grainy. Terrestrial TV pictures were better but not perfect. To ensure lowest possible losses, I made up an RF lead using satellite cable. This was used to link the satellite receiver to the VCR. It produced "the best pictures I've had for years" according to Mr Wilkinson, who paid my fixed charge quite happily and assured me that he would recommend me to his friends.

Tardis Electronics

In a previous report I mentioned Terry Boyd who runs Tardis Electronics. Being desperately in need of an EPROM to replace a defunct one in a D2MAC decoder, I rang Terry – I remembered having seen some in his shop. He was in a bit of a state because three enormous warehouses next door had burnt to the ground the day before. Luckily he'd been there to ensure that the firemen kept his shop roof nice and wet. He was able to send me a used but erased EPROM at a very reasonable cost. His stock ranges from the very old 2708 to the more recent 27C512. Pity he has no Megabit EPROMs, but you can't have everything!

After a further problem Terry moved Tardis to Station House, Hind Heath Road, Sandbach, Cheshire. The phone number remains 01270 763 029 (8 am to 6 pm except saturdays).

An Impossible

A shop some miles away passes me its 'impossibles'. This week it was a Pace SS9200 which I was told "simply ticked". On first inspection it looked as if the receiver had not been touched. In fact nearly every component on the primary side of the power supply had been replaced – but what a nice, clean job!

The cause of the problem turned out to be an open-circuit, 100Ω surface-mounted resistor beneath the board. Once the receiver was up and running however I noticed that the characters in the on-screen displays were 'embossed' – instead of the usual stark white, the channel names were outlined in black and were not easy to read.

The 5V supply was a little low. The 12V supply also produced a low reading on the d.c. range of my meter. I replaced the usual culprits for ripple, C21 and C25 (both 2,200µF), but this only made the problem worse! The voltage on the 12V rail had now risen to 13V, though the 5V supply was correct. This was clearly an impossible situation, so I replaced the brand new chopper transformer T2 with one from my own stock. Problem solved.

Exploding SRD540s

According to the installer who brought me an Amstrad SRD540 it had gone bang, belched smoke and destroyed the LNB at the dish. I took his account with a good dose of salt until I checked the unit on the test bench and found that the LNB output voltage measured 54V!

After hurriedly disconnecting the receiver I opened it and discovered that several capacitors had burst. A quick look at the circuit diagram showed that that these were associated with the 12V supply as well as the LNB supply. I had an awful feeling that repairing the power supply fault would be only the start!

Feedback from the power supply's 5V output sets all the other outputs. If the 5V output is low, the power supply will increase all its outputs in an attempt to get that 5V. I checked the following: C622 (2,200µF), D608 and the optocoupler. In addition I checked for a broken copper track between the 5V supply and the optocoupler, since this has been known to be the cause of high output voltages. In fact D608 was open-circuit, though it produced quite a sensible reading in circuit. Luckily I knew that 0·7V was far too high a forward voltage reading for this type of diode.

I replaced D608, C622 and, for good measure, the optocoupler. The capacitors in the 12V and LNB supplies also had to be replaced, along with TR303 and TR304. Once this had been done the receiver lit up, but produced a blank screen and very distorted sound. A new decoder unit resulted in an excellent picture, while the cause of the audio fault was traced to IC3. All in all a very expensive repair!

Later that day I had an SRD550 with precisely the same symptom. This time the cause was C622, not D608. Someone had already attempted to repair it, and as a result the power supply contained several incorrect parts that had to be replaced.

When I finally got a picture there were two distinct hum bars that travelled down the screen. I replaced the mains bridge rectifier's 68μF reservoir capacitor but this made no difference. It took me a time to realise that the cause of the fault lay with the yellow-banded transformer, which must have come from an SRD510. Fitting the correct red-banded transformer restored correct operation.

D2MAC Problems and e-mail

I've received a large number of interesting enquiries since I published my e-mail address in the magazine. Most of them I have been able to answer, but one that comes up regularly is "why does my ABC D2MAC decoder do such and such with my XYZ receiver?" Now if a man goes out to buy a tyre for his car he invariably takes at least the wheel, if not the car, to make sure that the tyre fits. Unfortunately the same principle is not followed when it comes to D2MAC decoders, and as a result problems arise.

My first question is always "has the decoder ever worked correctly with your receiver?" Some receivers and some decoders are able to accept various kinds of input signal, provided the correct baseband selection is made with the respective menus. Some have no such option, so that choosing a suitable decoder becomes a game of Russian roulette. To make matters worse, the connecting cable will sometimes degrade the input signal and thus prevent the decoder from working reliably.

My advice therefore is to buy the decoder only after you've checked that it works with your receiver. This will add to the expense, but at least it will guarantee that you get one that works. Alternatively, buy a receiver and D2MAC decoder combined, or at least one manufactured by the same company. This way you won't get into arguments, should a problem arise, about which unit is faulty.

Bear in mind that most D2MAC programmes use some form of Eurocrypt encoding, and that the official smart cards are generally not available in this country. This may put you in the hands of pirate card suppliers. With the best will in the world they can't guarantee that their card will work with your decoder and keep on working.

Keep sending the e-mail enquiries. But remember that I answer, on average, ten an evening after a hard day's work! Include all relevant information – make, model, connections, symptoms, fault history, tests carried out, location – but keep it short. See box for details. Even if you don't have a question, you can send an e-mail to say hello or exchange information about new faults.

Jack Armstrong is willing to try to sort out readers' satellite TV receiver problems via e-mail. You can reach him via the Internet at:

jackarm@netcentral.co.uk

No letters or phone calls please: he can cope with e-mail requests only. One model per message – state make/model and fault symptoms.

Test Case 401

It's spring! – well almost. On the strength of that thought Resident Workshop Sage decided to abandon his stool in the corner and take himself off in search of his beloved steam trains and coal smoke. As a result Television Ted, burdened with Sage's video repairs as well as his own TV workload, was even more grumpy and contrary than usual. This did little for Cathode Ray's morale, as he struggled against the tide of awaiting-repair TV sets and VCRs.

He staggered into the workshop with a 25in. Mitsubishi TV set – the accompanying job card suggested that it was one of the few sets that wasn't suffering from an intermittent fault. "Scrambled picture" it said. Sure enough the picture that appeared did look rather like a scrambled satellite display, though more Nagra-Syster than VideoCrypt. The image had a basket-weave effect, with line tearing and wildly-drawn, sometimes steeply-sloping, scan lines. In the middle of the picture there was a horizontal band, about 1in./3cm high, that was less affected. And at the top and bottom there were black gaps that were intersected with odd scanning lines which sloped up and down. There was clearly something very strange about this set's field scanning.

Ray's first action, after removing the back cover, was to check for hash or ripple on the LOPT-derived field output stage supply. There was no significant disturbance at supply pin 7 of the AN5521 field output chip IC401. On transferring the scope's probe to pin 2, the field scan output pin, Ray found a messy, noisy waveform. There was a field-rate ramp of sorts, complete with flyback pulse, but the display was marred by spurious hash and spiky ripple. Some of this interference was found, at a lower level, riding on the field flyback pulse at pin 3 of the chip.

The input to the field output chip is a ramp waveform, at pin 4. There was some evidence of disturbance here. The ramp comes from a jungle chip, via R401 (3·9kΩ). Upstream of R401 there seemed to be very little wrong with the waveform.

This all suggested that the root of the problem was in the field output stage, so Ray concentrated on IC401 and its immediate circuitry. The PCC panel attracted his suspicion: a transductor that carries line and field waveforms is mounted on this panel. It was soon proved innocent by fitting a substitute panel from a good working set.

Electrolytics and diodes can do funny things thought Ray as he replaced the flyback voltage generator components C411 and D401. They can indeed, but these hadn't been doing so – as the reappearance of the strange, strangled picture proved. Replacement of C412 and C567 in the field output chip's 24V supply made no difference either. Must be the chip then. But it wasn't, a new AN5521 giving exactly the same results. What now?

The minutes ticked by to become hours as Ray puzzled and probed. He finally got Television Ted interested in the problem. With just a single glance at the twisted and torn picture, this worthy went straight to the faulty component. While fitting a replacement he asked Ray if he had ever serviced old Finlux sets. Of course he hadn't!

The cost of the faulty component was a matter of pence. It wasn't far from the field output chip or, electrically, the field scan coils. So what had been the trouble with this TV set, and which two-legged component had been the cause? You'll find the answer on page 490.

Long-distance Television

DX-TV conditions and reception, news from abroad and on the satellite scene. Roger Bunney reports

February was another quiet month for terrestrial DX-TV reception. The awful weather put paid to any tropospheric openings, while Sporadic E propagation continued to be at minimal levels, which is not surprising at this time of the year.

There was one small SpE opening, on the 3rd, when Ryn Muntjewerff (the Netherlands) received Russian signals on chs. R1-4 during the period 1020-1205GMT, including St. Petersburg R3 and ORT chs. R1 and R3. He also received Eesti-TV (Estonia) ch. R2, still using the EBU bar pattern.

Apart from that the only SpE signals noted were from TVE (Spain) on the 5th (ch. E2) and an unidentified ch. E4 signal on the 10th. There are signs that an improvement is on the way – the mid-winter double-hop transatlantic reception reported last month and the prolonged, good season in the southern hemisphere. In addition we've had the lowest sunspot count in cycle 22 and cycle 23 is just about to start. New Zealand ch. 1 (45·25MHz) was received in California on January 17/18th; also during that month Australia ch. A0 (46·25MHz) was received in Port Elizabeth, South Africa.

AsiaSat-2 (100·5°E) on test: a 3·905GHz PAL test signal (vertical polarisation) received by Bandula Gunasekera in Sri Lanka on December 29th 1995, at 11.45GMT.

Transatlantic SpE

Six News, the amateur radio bulletin for 50MHz enthusiasts, has recently published an extensive report on transatlantic SpE reception, reprinted in part from the American magazine *QST*. Though the conclusions will be well-known to TV-DXers, the findings nevertheless make interesting reading.

The 50MHz openings on July 5th, 6th and 7th 1995 were the most extensive on record, with UK/Benelux operators in contact with hams as far west as San Antonio, a distance of some 7,800kms. The 1995 tables show that UK-US amateur radio contacts were made on June 13th, 19th, 20th, 21st and 27th and July 2nd-10th inclusive. Mid-June to mid-July is the peak period for potential transatlantic reception. Graphs show a daily pattern with a first peak at around 1230-1430GMT and a higher, sharper peak at 2000-2230GMT. The latter is certainly borne out by DX-TV results, though few TV signals have been seen during the lunch period in the UK.

From experience, once multiple-hop SpE propagation is established the signal levels can be high. The maximum usable frequency rises from ch. A2 (55·25MHz) upwards (ch. A3 is at 61·25MHz, ch. A4 67·25MHz, A5 77·25MHz and A6 83·25MHz – these are vision carrier frequencies). Chs. A2-5 inclusive have been received in the UK in the past. The signals are often subject to multipath ghosting/smearing.

Really good openings spread along the eastern seaboard of the USA and Canada and have continued until past our midnight. So this year try turning your aerials to the north west (280°) and tune, from June 15th, to ch. A2. You may receive something startling! Remember that North America uses system M (525 lines, 60 fields), so the pictures may need locking. A scanner is very useful for monitoring the nominal video carriers – listen for the first 60Hz buzz of incoming video.

Satellite Sightings

Brian Phillips TV Services (Edgware) has provided the answer to the mystery caption shown in the March column (page 340). It is indeed Hebrew, the translation being "transmission direct from the Synagogue in Jerusalem". Brian wonders whether any Israeli programmes will be available now that signals from most Arabic countries are available across the south-eastern sky. The Israeli AMOS satellite, with Ku-band transponders, was due up in January, but nothing has been seen. Brian reckons that if an Israeli TV service was available he'd have many customers in his area.

The tanker Sea Empress hit the rocks outside Milford Haven on February 15th. Several SNG vehicles were present during the salvage attempts over the following week. The 12·536GHz vertical transponder aboard Eutelsat II F3 at 16°E, a favourite with Sky, was used extensively. An identification variant "TSG 95" caused some uncertainty: it was later seen with the "UKI 149" identification caption. BBC Network and BBC Wales used transponders aboard the Orion Atlantic satellite at 37·5°W, both with sound in syncs (SIS) and clear PAL.

The IRA bomb at Canary Wharf led to several SNG signals. Roy Carmen (Lake, IW) was sat zapping with his new installation when, at 1950 hours, he came across the first link from Canary Wharf via Eutelsat II F4 at 7°E. A BBC UKI 118 feed (with SIS) was later seen via Telecom 2C at 3°E, using the 12·606GHz horizontal transponder. This was followed by a facilities house providing a feed to News at Ten via Eutelsat II F4, using the 11·003GHz horizontal transponder, then UKI 76 via Eutelsat II F3 at 16°E (12·525GHz vertical). A further signal from this satellite, at 11·161GHz horizontal, provided very detailed information. Ray was able to follow developments at Canary Wharf as the news unfolded during the evening.

UKI 149 is a busy little SNG van. It was outside the gates of Kensington Palace on February 29th at 0800, awaiting any news on the Princess Di divorce, then on March 1st it was at Newbury to cover the tree people, both lots of signals being sent via Eutelsat II F3 at 12·536GHz.

Paulo Raymundo lives in an 8th floor flat by the sea at Bahia, Brazil. Despite this limitation he has a 1·5m dish, with 0·8dB SSM LNB, aimed at Intelsat K at 21·5°W for Ku band reception and an 87cm tracking dish with 18°K noise Drake LNB for C band reception. He receives 16 unscrambled channels from BrasilSat B1 at 70°W, sparklie-free with threshold extension, and five scrambled analogue channels. Twelve digitally compressed channels are also available from this satellite, via just two transponders. Raymundo reports that GloboSat (Murdoch, News Corporation) opens with 72 compressed channels via eleven transponders aboard Intelsat 707 (50°W) in May. This satellite is above our horizon.

If your daytime Clarke Belt pictures were a little snowy over the period February 29th-March 4th, blame Sun outrages which typically affected PAS-4 (68·5°E) at 0737, Astra (19·2°E) at 1046, Intelsat 702 (1°W) at 1212 and PAS-1 (45°W) at 1525, all times GMT. Thanks to John Locker (Wirral) for this information.

Terrestrial TV

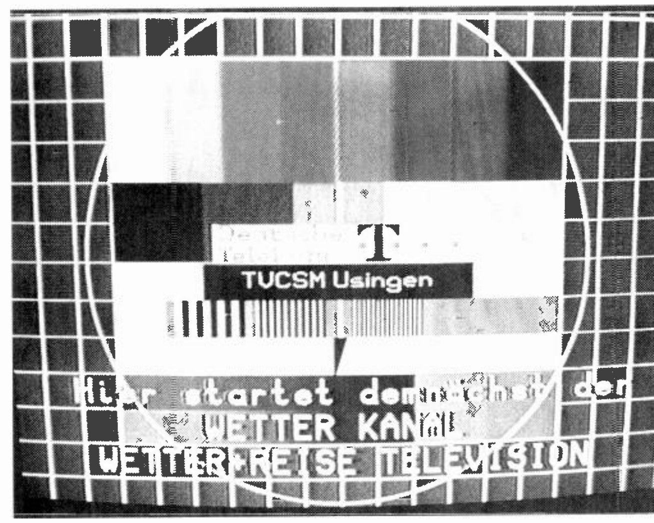
Radio-operated car keys: More information on this subject from RSGB EMC committee member Dave Lauder, following my mention of it in the February column. The keys operate at 433·92MHz, with the transmitter in theory limited to 10nW and the local oscillator in the receiver running continuously with a radiation limit of 2nW e.r.p. Transmitter powers can in practice be as high as 1mW. With the greater use of radio-controlled locks, problems are increasing. A 70cm radio amateur operating with 5W into a colinear array can immobilise car locks within a radius of 100-200 yards.

LT communication systems: Peter Schubert (Rainham) has sent me an article from *Buses*, dated January 1996, describing London Transport's Countdown communication system. Bus odometer (distance recorder) data is transmitted back to the Wood Green base in Band III, which is also used for LT transceiver voice operation (emergencies only).

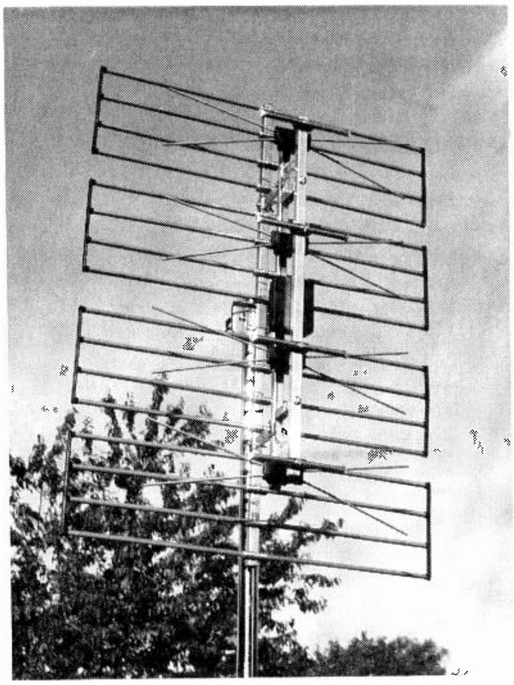
The Netherlands: Regional broadcasting via Nederland-2 transmitters is to start this September in thirteen regions. An earlier opening, in April, applies in the Drenthe and Zuid Holland regions. Lopik continues to use ch. E4 although parallel 1,000kW e.r.p. transmitters operate in chs. E37/52.

Norway: NRK is already carrying the corner identification 'NRK1'. NRK-2 should come on air this August carrying satellite (Telenor) distributed signals, initially in analogue PAL form.

Thirty regional TV franchises have been awarded by the Media Administration Department, most operating at UHF with relatively low powers. Band III may be used in several remote areas,



A new weather channel has been opened via DFS-3 (Kopernikus) at 23·5°E.



The JJB/4 Bilboard high-gain wideband bowtie dipole assembly, with grid reflectors and single directors, which is available from HS Publications – see the accompanying text for the address and further details.

such as Finnmark and Svalbard, to extend coverage. The regions are Ostfold, Romerike, Vest-Agder, Stavanger, Romsdal, Nordmore, Tromso, Oslo, Hedmark/Oppland, Aust-Agder, Bergen, Sunnmore, Helgeland, Ost-Finnmark, Asker and Baerum, Drammen/Numedal, Ovre Telemark, Sogn, Nord-Trondelag, Bodo, Vest-Finnmark, Follo, Vestfold, Grenland, Fjordane, Sor-Trondelag, Harstad, Svalbard. Transmitter power and channel details will follow when known. Our thanks to A.G. in Oslo for this information.

Russia: At least twenty private TV transmitters are in operation in chs. R1-5. Possible SpE 'catches' (powers over 1kW e.r.p.) are as follows:

Ch. R1 Ulyanovsk 'Provintsiya', 1kW.

Ch. R2 Krasnodar 'Yekagerinodar' 5kW and Novozhatkovo (Primorsk kray) 'Gama' 5kW.

Ch. R4 Novosibirsk 'Region TV' 5kW.

Ch. R5 Vladivostok 'Gamma' 5kW and Amursk (Khabarovsk kray) 'AMV' 1kW.

The last four are located in the Asian part of Russia.

UHF DXing Aerial

The Triax BB wideband bowtie/grid type UHF aerial has been popular with DXers, having a relatively flat response across 470-860MHz with useful gain at 435MHz as well (70cm amateur band). HS Publications, 7 Epping Close, Derby DE3 4FS (01332 381 699) has introduced an upgraded version of the four-bay array, Model JJB/4 Bilboard Grid, which has a bolted on strip carrying four directors, one ahead of each dipole. Gain is 13·5dBd mid band. A single JJB/4 costs £34.96 (plus £5 carriage) including the director unit. Stacked versions are also available.

Satellite TV News

The Italian national TV channel RAI-3 has joined RAI-1 and -2 via Hot Bird at 13°E, with a Superbeam footprint. The full-time unscrambled transmissions are available at 11·530GHz (vertical).

Intelsat 708 was lost when a new-generation Chinese Long March 3B rocket exploded seconds after take-off on February 14th. It was due to take up orbital position at 50°W, serving Latin America. Instead Intelsat 707 will take up this position.

The new Spanish satellite channel Canal Sur is now in operation via Hispasat at 30°W.

RTE (Ireland) is expected to take an Astra 1E transponder to provide a digital TV service once reception hardware becomes available.

Jean-Louis Dubler reports that TMC, M6 and Euronews have joined the digital package available via Eutelsat's Hot Bird at 13°E, along with TF1, France 2 and 3 and France Supervision 16/9, using MPEG in the clear. TMC and LCI are to join the future Canal Plus digital package via Astra. Their analogue transmissions via Telecom 2B will then cease.

The Malayan MEASAT-1 is now in orbit at 91·5°E. It will provide twenty TV channels from mid-Summer. Apstar-2R is to be launched in late spring at 77·5°E, with coverage that extends from Australia (just touching) to Eastern Europe. Major broadcasters have taken transponders. Apstar 1A is in orbit at 130°E and AsiaSat-2 at 100·5°E. Alan Smith in Thailand reports reception of several AsiaSat-2 transmissions, including RTP (Portugal) at 3·98GHz and VideoCrypt type scrambled programming at 3·76GHz, with audio that sounds like Cantonese.

Global Access Telecommunications Services (GATS) of the UK is now using the Serbian transponder aboard Eutelsat II F4 at 7°E (11·175GHz horizontal) for news feeds and outside broadcasts, having signed a sublease for two years' use. ■

Answer to Test Case 401

– see page 487 –

It's not only old Finlux TV sets that can suffer from the trouble described in this month's test case. Many models from different manufacturers can display the same symptoms when the equivalent part fails, though this is not a common occurrence. You will get the same effect should the component be dry-jointed.

A TV set's field and line scan coils, which are wound on the same ferrite saddle yoke, form a fairly tightly-coupled pair. As a result, the throbbing line-rate magnetic energy in the yoke induces sizeable 15·625kHz pulses in the field scan coils. If these find their way back into the field timebase they will, at best, upset the interlacing of the scan lines. At worst they will, as in this case, completely upset the operation of an i.c.-based field output stage.

The cause of the trouble was that C413 (47nF, 100V) had become open-circuit. It is connected directly across the field scan coils, but is mounted on the main PCB for convenience. Its job is to bypass the line-rate energy while having negligible effect on the much lower-frequency field scan waveform.

A replacement brought back a normal picture once the height and vertical linearity controls, which Ray had twiddled, had been reset.

TELETOPICS

Disc Marketing Plans

Widely different plans to enter the digital video disc (DVD) market have been announced by major consumer electronics firms in Europe. Thomson Multimedia plans to be first, with Matsushita-sourced players being made available this October. Toshiba has pencilled in a UK launch next spring. Philips seems to be taking a more realistic view: the firm has postponed its DVD launch until the second half of next year, pointing out that the DVD standard itself has not yet been finalised while software support is not, on present plans, going to become available in any great hurry. All three firms showed prototype DVD players at the Electrical Retailing Show in Birmingham last month (March).

GoldStar has announced that it will be launching CDi players in Europe, though no further details have been released.

Philips has forecast that the number of CD-ROM drives installed worldwide will rise from a 1995 level of 70m to 120m by the end of this year. The company also expects ten million PCs to have MPEG-1 video capability by the end of the year, and thinks that sales of Video CDs in 1996 will reach five million.

Trade Shows

CETI '96, the Consumer Electronics Trade Interface, is being held on April 27-29th at four hotels in Harrogate. The event will consist of training seminars and workshops and a trade exhibition. It is backed by the British Federation of Audio, the British Audio Dealers Association and the Custom Electronic Design and Installation Association (CEDIA UK). For further details, phone 0181 954 6645.

Service '96 is being held at the Hertfordshire Conference Centre, Stevenage, on May 17-18th. The aim, with seminars and an exhibition, is to bring together all sectors of the service industry, both white and brown goods, to enable those involved to assess developments in this rapidly changing field. For further details phone 01462 480 024. The white goods side is represented by DASA (the Domestic Appliance Service Association) while the brown goods side is represented by the recently established CESA (Consumer Electronics Service Association). A joint code of practice is currently being drawn up by the two associations. Steve Beeching will be giving a workshop seminar on Software Servicing at 11 a.m. on the 17th.

There will be a stand for the *Consumer Electronics Service* magazine at Service '96. This new magazine is to be made available on subscription only to those in the industry. Steve Beeching will be responsible for the technical editorial and also, presumably, the "bit of fun and nonsense" we are promised.

The CAI (Confederation of Aerial Industries) Trade Fair '96 is to be held at the Heathrow Park Hotel, Bath Road, Longford, West Drayton, Middx on June 18-20th. There will be seminars and workshops on motorised dish installations, fitting a dual-LNB and the Internet, a Channel 5 conference and a retail symposium. The seminars and training sessions are free. For further details phone 0181 902 8998.

Spares Guide

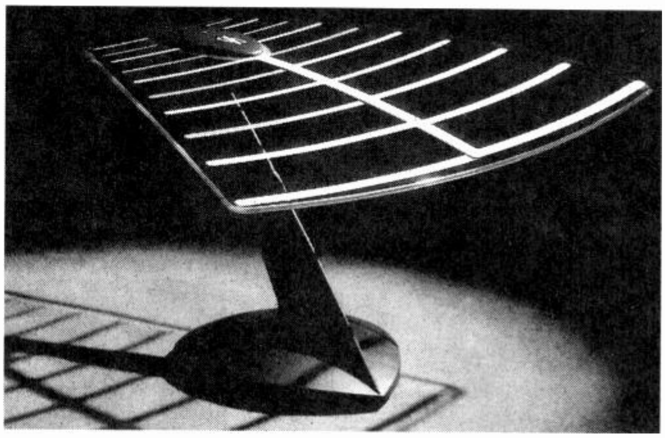
Casio was not included in our Spares Guide (April issue). Should you need spares they are available from Casio Service, Unit 1, Brent Trading Estate, 390 North Circular Road, London NW10 0JH, telephone 0181 451 6111, fax 0181 459 2963.

WVE's Log-periodic

Willow Vale Electronics (11 Arkwright Road, Reading, Berks RG2 0LU, phone 01734 876 444, fax 01734 867 188) has been appointed main distributor of the Telecam log-periodic indoor TV aerial to the independent retail market. This sophisticated aerial, with its elements aligned in straight strips of reducing thickness, is claimed to provide a signal power increase of as much as 3dB in comparison with standard designs using wire or pressed metal in triangular form. The elements are printed in silver amalgam on a plastic sheet that provides electrical separation. Efficient dielectric loading has enabled the overall size of the aerial to be scaled down with no loss of performance.

WVE is also distributing the Telecam range of TV signal amplifiers.

The Telecam log-periodic aerial being distributed by WVE.



DAB Developments

NTL is launching a Digital Audio Broadcasting service in the London area. Programme material will consist of a multiplex of seven currently available analogue transmissions – Classic FM, Heart, Kiss FM, Melody, Sunrise, Talk Radio and Virgin. In addition experimental sound and data formats are to be tried.

Manufacturers who are developing DAB products include Philips, Sony, Panasonic, Pioneer, Bosch and Grundig. DAB trials are being conducted in Sweden, Denmark, Norway, Germany, Switzerland and the Netherlands. The BBC launched its DAB service, in the south, in September 1995.

SURVEILLANCE TELESCOPE Superb Russian zoom telescope adjustable from 15x to 60x! complete with metal tripod (imposible to use without this on the higher settings) 66mm lense, leather carrying case £149 ref BAR69

RADIATION DETECTOR SYSTEM Designed to be wall mounted and connected into a PC, ideal for remote monitoring, whole building coverage etc. Complete with detector, cable and software. £19.95 ref BAR75.

WIRELESS VIDEO BUG KIT Transmits video and audio signals from a minature CCTV camera (included) to any standard television! All the components including a PP3 battery will fit into a cigarette packet with the lens requiring a hole about 3mm diameter. Supplied with telescopic aerial but a piece of wire about 4" long will still give a range of up to 100 metres. A single PP3 will probably give less than 1 hours use. £99 REF EP79. (probably not licensable!)

CCTV CAMERA MODULES 46X70X29mm, 30 grams, 12v 100mA. auto electronic shutter, 3.6mm F2 lens, CCIR, 512x492 pixels, video output is 1v p-p (75 ohm). Works directly into a scart or video input on a tv or video. IR sensitive. £79.95 ref EF137.

IR LAMP KIT Suitable for the above camera enables the camera to be used in total darkness! £5.99 ref EF138.

REMOTE CONTROLTANDATA TD1400 MODEM/ VIEWDATA Complete system comprising 1200/75 modem, auto dialler, infra red remote keyboard, (could be adapted for PC use?) psu, UHF and RGB output, phone lead, RS232 output, composite output. Absolute bargain for parts alone!!£9.95 ref BAR33.

9 WATT CHIEFTAN TANK LASERS

Double beam units designed to fit in the gun barrel of a tank, each unit has two semi conductor lasers and motor drive units for alignement. 7 mile range, full circuit diagrams, new price £50,000? us? £349. Each unit has two gallium Arsenide injection lasers, 1 x 9 watt, 1 x 3 watt, 900nm wavelength, 28vdc, 600hz pulse frequency. The units also contain an electronic receiver to detect reflected signals from targets. five or more units £299 ea. £349 for one. Ref LOT4.

TWO WAY MIRROR KIT Includes special adhesive film to make two way mirror(s) up to 60"x20". (glass not included) includes full instructions. £12 ref TW1.

NEW HIGH POWER RF TRANSMITTERS AMPLIFIERS Assembled PCB transmitters, 4 types available,
12.6vdc 90 watt 1.5-30mhz 75 ohm in/out FM/AM £75 ref RF1
12.6vdc 40 watt 50-200mhz 50 ohm in/out FM/AM £65 ref RF2
28vdc 125 watt 1.5-30mhz 75 ohm in/out FM/AM £85 ref RF3
28vdc 100 watt 50-200mhz 50 ohm in/out FM/AM £75 ref RF4
A heat sink will be required, ring for price and availability.
If you intend using these as audio transmitters you will need a also need a preamp. Complex module available at £40 ref RF5.

COMPUTER/WORKSHOP/HI-FI RCB UNITS Complete protection from faulty equipment for everybody! Inline unit fits in standard IEC lead (extends it by 750mm), fitted in less than 10 seconds, reset/test button, 10A rating. £9 each Ref MM5.

RADIO CONTROLLED CARS FROM £6 EACH!!!! All returns from famous manufacturer, 3 types available, single channel (left,right,forwards,backwards) £6 ref LOT1. Two channel with more features £12 ref LOT2. Two channel proportional (plug in crystals etc) £35 ref LOT3.

THOUSANDS AVAILABLE RING/FAX FOR DETAILS!

MAGNETIC CARD READERS (Swipes) £9.95 Cased with flyleads, designed to read standard credit cards! they have 3 wires coming out of the head so they may write as well? complete with control elctronics PCB. just £9.95 ref BAR31

WANT TO MAKE SOME MONEY? STUCK FOR AN IDEA? We have collated 140 business manuals that give you information on setting up different businesses, you peruse these at your leisure using the text editor on your PC. Also included is the certificate enabling you to reproduce (and sell) the manuals as much as you like! £14 ref EP74

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COIN OPERATED TIMER KIT Complete with coinslot mechanism, adjustable time delay, relay output, put a coinslot on anything you like! TV.s, videos, fridges, drinks cupboards, HIFI takes 50p's and £1 coins. DC operated. price just£7.99 ref BAR27.

ZENITH 900 X MAGNIFICATION MICROSCOPE Zoom, metal construction, built in light, shrimp farm, group viewing screen, lots of accessories. £29 ref ANAYLT.

AA NICAD PACK Pack of 4 tagged AA nicads £2.99 ref BAR34

PLASMA SCREENS 222x310mm, no data hence £4.99 ref BAR67

NIGHTSIGHTS Model TZS4 with infra red illuminator, views up to 75 metres in full darkness in infrared mode, 150m range, 45mm lens, 13 deg angle of view, focussing range 1.5m to infinity. 2 AA batteries required. 950g weight. £199 ref BAR61. 1 years warranty

LIQUID CRYSTAL DISPLAYS Bargain prices,
16 character 2 line, 99x24mm £2.99 ref SM1623A
20 character 2 line, 83x19mm £3.99 ref SM2020A
16 character 4 line, 62x25mm £5.99 ref SMC1640A

TAL-1 110MM NEWTONIAN REFLECTOR TELESCOPE Russian. Superb astronomical 'scope, everything you need for some serious star gazing! up to 169x magnification. Send or fax for further details £249 ref TAL-1

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PP3 NICADS Unused but some storage marks. £4.99 ref EP52

DELL PC POWER SUPPLIES (Customer returns) Standard PC psu's complete with fly leads, case and fan. +12v,-12v,+5v,-5v **SALE PRICE £1.99 EACH** worth it for the bits alone! ref DL1. **TRADE PACK OF 20 £29.95** Ref DL2.

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ENERGY BANK KIT 100 6"x6" 6v 100mA panels, 100 diodes, connection details etc. £69.95 ref EF112.

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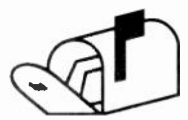
BIG BROTHER PSU Cased PSU, 6v 2A output, 2m o/p lead, 1.5m input lead, UK made,220v. **SALE PRICE £4.99** REF EP7



Check out our WEB SITE

http://www.pavilion.co.uk/bull-electrical

RACAL MODEM BONANZA! 1 Racal MPS1223 1200/75 modem, telephone lead, mains lead, manual and comms software, the cheapest way onto the net! all this for just £13 ref DEC13.

4.5mw LASER POINTER. BRAND NEW MODEL NOW IN STOCK!, supplied in fully built form (looks like a nice pen) complete with handy pocket clip (which also acts as the on/off switch.) About 50 metres range! Runs on 2 AAA batteries. Produces thin red beam ideal for levels, gun sights, experiments etc. just £39.95 ref DEC49 TRADE PRICE £28 MIN 10 PIECES

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PC PAL VGA TO TV CONVERTER Converts a colour TV into a basic VGA screen. Complete with built in psu, lead and s/ware.. Ideal for laptops or a cheap upgrade.Supplied in kit form for home assembly. **SALE PRICE £25** REF SA34

EMERGENCY LIGHTING UNIT Complete unit with 2 double bulb floodlights, built in charger and auto switch Fully cased. 6v 8AH lead acid req'd. (secondhand) £4 ref MAG4P11.

YUASHA SEALED LEAD ACID BATTERIES Two sizes currently available this month. 12v 15AH at £18 ref LOT8 and 6v 10AH (suitable for emergency lights above) at just £6 ref LOT7

ELECTRIC CAR WINDOW DE-ICERS Complete with cable, plug etc **SALE PRICE JUST £4.99** REF SA28

AUTO SUNCHARGER 155x300mm solar panel with diode and 3 metre lead fitted with a cigar plug. 12v 2watt **£8.99** REF SA25.

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UNIVERSAL SPEED CONTROLLER KIT Designed by us for the C5 motor but ok for any 12v motor up to 30A. Complete with PCB etc. A heat sink may be required. £17.00 **REF: MAG17**

PHONE CABLE AND COMPUTER COMMUNICATIONS PACK Kit contains 100m of 6 core cable, 100 cable clips, 2 line drivers with RS232 interfaces and all connectors etc. Ideal low cost method of communicating between PC's over a long distance utilizing the serial ports. Complete kit £8.99. Ref comp1.

VIEWDATA SYSTEMS made by Phillips, complete with internal 1200/75 modem, keyboard, psu etc RGB and composite outputs, menu driven, autodialler etc. **SALE PRICE £12.99** REF SA18

AIR RIFLES .22 As used by the Chinese army for training puposes, so there is a lot about! £39.95 Ref EF78. 500 pellets £4.50 ref EF80.

PLUG IN POWER SUPPLY SALE FROM £1.50 Plugs in to 13A socket with output lead. three types available, 9vdc 150mA £1.50 ref SA19, 9vdc 200mA £2.00 ref SA20, 6.5vdc 500mA £2 ref SA21.

VIDEO SENDER UNIT. Transmits both audio and video signals from either a video camera, video recorder, TV or Computer etc to any standard TV set in a 100' range! (tune TV to a spare channel) 12v DC op. Price is £15 **REF: MAG15** 12v psu is £5 extra **REF: MAG5P2**

***MINATURE RADIO TRANSCEIVERS** A pair of walkie talkies with a range up to 2 km in open country. Units measure 22x52x155mm. Including cases and earp'ces. 2xPP3 req'd. £30.00 pr.**REF: MAG30**

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***FM BUG BUILT AND TESTED** superior design to kit. Supplied to detective agencies. 9v battery req'd. £14 REF: MAG14

TALKING COINBOX STRIPPER COMPLETE WITH COINSLOT MECHANISMS originally made to retail at £79 each, these units are designed to convert an ordinary phone into a payphone. The units have the locks missing and sometimes broken hinges. However they can be adapted for their original use or used for something else?? **SALE PRICE JUST £2.50** REF SA23

GAT AIR PISTOL PACK Complete with pistol, darts and pellets £12.95 Ref EF82B extra pellets (500) £4.50 ref EF80.

6"X12" AMORPHOUS SOLAR PANEL 12v 155x310mm 130mA. **SALE PRICE £4.99** REF SA24.

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MIXED GOODIES BOX OF MIXED COMPONENTS WEIGHING 2 KILOS YOURS FOR JUST £5.99

4X28 TELESCOPIC SIGHTS Suitable for all air rifles, ground lenses, good light gathering properties. £19.95 ref R/7.

RATTLE BACKS Interesting things these, small piece of solid perspex like material that if you try to spin it on the desk it only spins one way! in fact if you spin it the 'wrong' way it stops of its own accord and go's back the other way! £1.99 ref GI/J01.

GYROSCOPES Remember these? well we have found a company that still manufactures these popular scientific toys, perfect gift or for educational use etc. £6 ref EP70

HYPOTHERMIA SPACE BLANKET 215x150cm aluminised foil blanket, reflects more than 90% of body heat. Also suitable for the construction of two way mirrors! £3.99 each ref O/L041

LENSTATIC RANGER COMPASS Oil filled capsule, strong metal case, large luminous points. Sight line with magnifying viewer. 50mm dia, 86gm. £10.99 ref O/K604.

RECHARGE ORDINARY BATTERIES UP TO 10 TIMES! With the Battery Wizard! Uses the latest pulse wave charge system to charge all popular brands of ordinary batteries AAA, AA, C, D, four at a time! Led system shows when batteries are charged, automatically rejects unsuitable cells, complete with mains adaptor. BS approved. Price is £21.95 ref EP31.

TALKING WATCH Yes, it actually tells you the time at the press of a button. Also features a voice alarm that wakes you up and tells you what the time is! Lithium cell included. £7.99 ref EP26.

PHOTOGRAPHIC RADAR TRAPS CAN COST YOU YOUR LICENCE! The new multiband 2000 radar detector can prevent even the most responsible of drivers from losing their licence! Adjustable audible alarm with 8 flashing leds gives instant warning of radar zones. Detects X, K, and Ka bands, 3 mile range, 'over the hill' 'around bends' and 'rear trap facilities. micro size just 4.25"x2.5"x.75". Can pay for itself in just one day! £79.95 ref EP3.

SANYO NICAD PACKS 120mmx14mm 4.8v 270 maH suitable for cordless phones etc. Pack of 2 just £5 ref EP78.

3" DISCS As used on older Amstrad machines, Spectrum plus3's etc £3 each ref BAR400.

STEREO MICROSOPES BACK IN STOCK Russian, 200x complete with lenses, lights, filters etc etc very comprehensive microscope that would normally be around the £700 mark, our price is just £299 (full money back guarantee) full details in catalogue. Ref 95/300.

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Servicing the Sony BE3B Chassis

The Sony BE3B is a full-specification chassis designed for use in low-cost sets with 21-29in. tube sizes. Circuit operation and servicing are described in this two-part series by Giles Pilbrow

The Sony BE3B chassis was introduced in 1994. It was designed for use in low-cost sets but nevertheless has a full specification that includes teletext, Nicam and remote control. It can drive 1R (conventional), 2R (very flat) and widescreen Trinitron tubes with screen sizes in the range 21-29in. In this two-part article we will be looking at the operation of some of the less usual circuit features and provide guidance on servicing. We'll look first at the organisation of the chassis.

The bulk of the circuitry is arranged on three PCBs. As with other Sony chassis, each board is identified by a letter. The main PCBs are as follows:

PCB A: This double-sided fibreglass board houses the signals and control circuitry, including the tuner, the microcontroller chip and the teletext and Nicam chips. The bus-controlled TDA8366 jungle chip (IC301) contains the colour decoder, the sync and timebase generator circuits and other circuitry.

PCB C: This is the tube base panel which houses the RGB output amplifiers.

PCB D: This is the main board at the base of the set. It houses the power supply, the deflection circuits and the audio output chip. Board A plugs into it at the rear, right-hand side looking in from the back.

Four small PCBs are used for the local control switches, the mains switch, the remote control receiver and the front-mounted input/output sockets.

In contrast with some previous Sony sets that used surface-mounted components throughout, only PCB A uses this technology. It can be easily removed to assist with component replacement. In addition an extender PCB is available to provide better access during servicing.

We will start with PCB D.

The Power Supply

The chopper power supply is based on the Sanken STR-S6708 chip (IC600) which contains much of the circuitry on the primary side of the circuit including the chopper transistor. Feedback for voltage regulation is from the secondary side of the circuit via an optocoupler (IC601). The error voltage detector is thus on the secondary side: it consists of IC602.

Power consumption is up to 180W with the set in normal operation, less than 5W in the standby mode. Fig. 1 shows in block diagram form the arrangements within IC600.

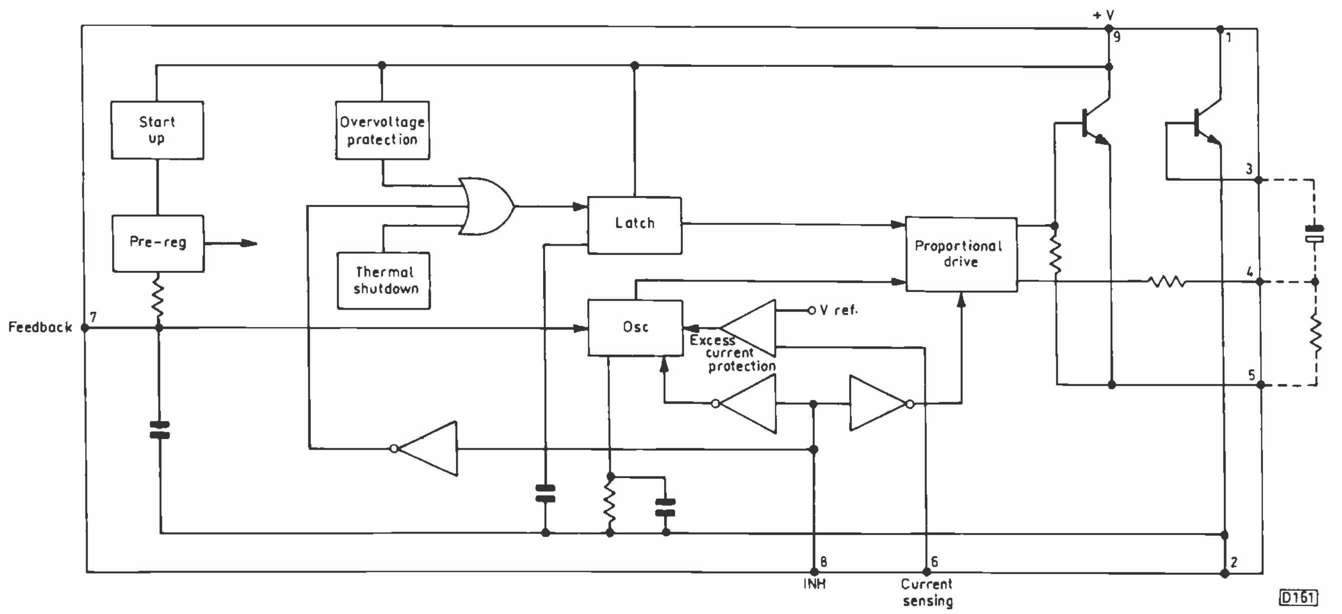

Fig. 1: Block diagram of the Sanken STR-S6708 chopper chip.

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QUALITY TV & VIDEO SPARES SUPPLIED FOR ENGINEERS *BY ENGINEERS*

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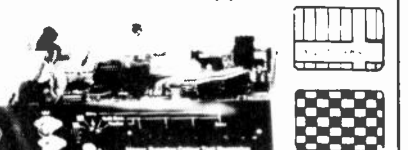

★ 40 different patterns and variations.
★ Fully interlaced sync pulses with correct picture blanking.
★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
★ Chequerboard.
★ Mono outputs with border castellations, cross hatch, grey scale, vertical lines, horizontal lines and dots. UHF modulator output plugs straight into receiver aerial socket.
★ Additional video output for CCTV & VCR.
★ Facilities for sound output.
★ Easy to build kit, standard parts. Only 2 adjustments. No special test equipment required.
★ Mains operated with stabilised power supply.
★ All kits fully guaranteed with back-up service.
★ Also available with VHF Modulator.

Price of Kit	**£79.00**
Case (10″×6″×2¼″) app	**£19.00**
Optional Sound Module (6MHz or 5.5MHz)	**£5.90**
Built & Tested in Case including Sound Module	**£139.00**

Post/Packing £4.50
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PAL COLOUR BAR GENERATOR (Mk4)

★ Output at UHF, applied to receiver aerial socket.
★ In addition to colour bars R-Y, B-Y etc.
★ Cross-hatch, grey scale, peak white and black level.
★ Push button controls, battery or mains operated.
★ Simple design, only five i.c.s on colour bar P.C.B.
★ Backup service available.

PRICE OF Mk4 COLOUR BAR GENERATOR KIT £39.00.
CASE £6.90. BATT HOLDERS £4.20
MAINS SUPPLY KIT £5.80
(Combined P&P £5.00)
VHF MODULATOR (CH 1 to 4) FOR OVERSEAS £6.80
EASILY ADAPTED FOR VIDEO OUTPUT & C.C.R.V

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★ Service Aid.
★ Saves time and Money.
★ Checks short turns.
★ Simple to use.
★ Reliable.
★ Battery operated.
★ Pocket size

ADD VAT 17.5%

PRICE £24.00
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VIDEO (PAL) TO R.G.B. CONVERTER

NEW

★ Ready built & tested
★ Incl. Power Supply
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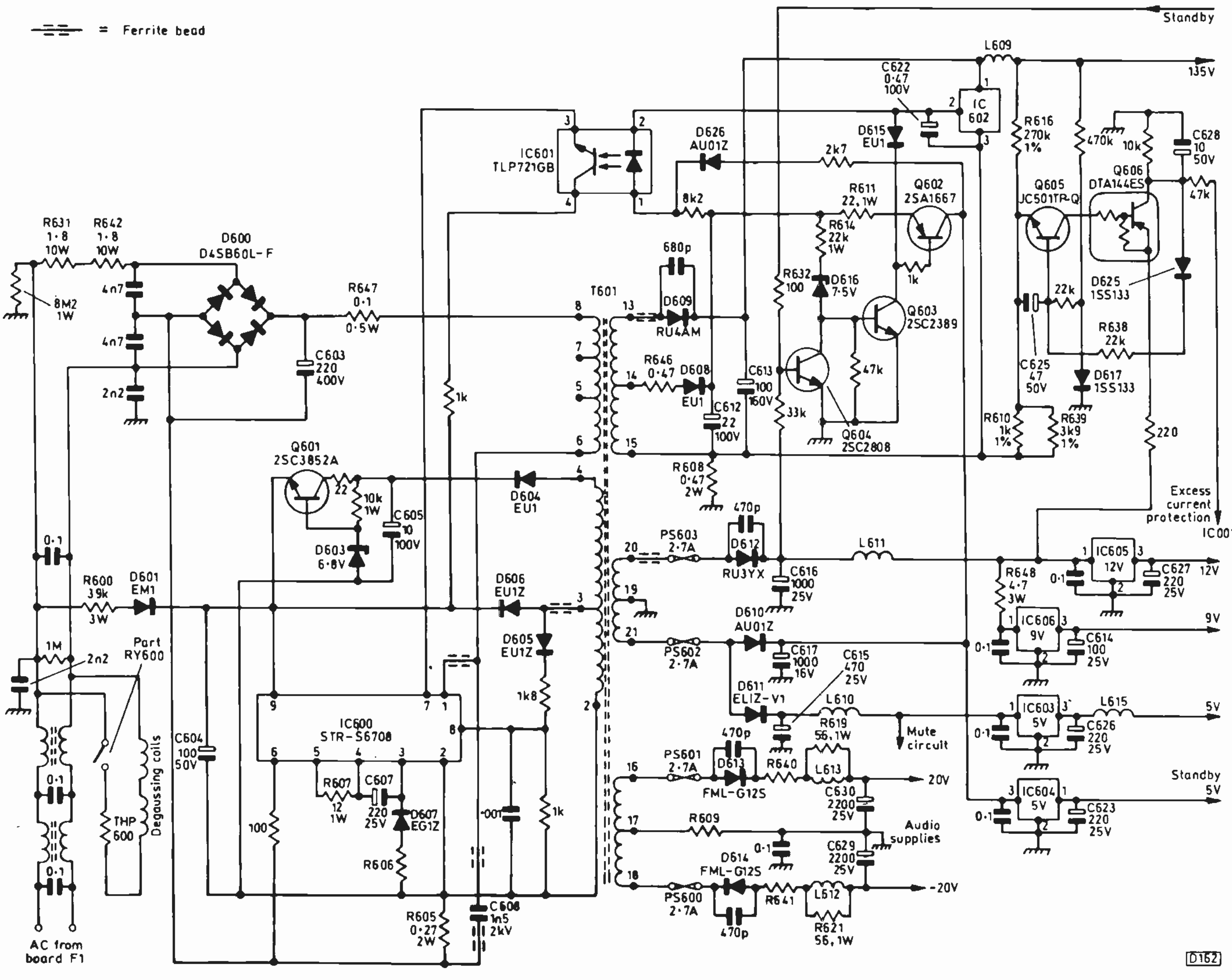


Fig. 2: The power supply circuit used in the Sony BE3B chassis. The mains switch S601 and fuse F601 (5A) are on board F1.

Start Up

Fig. 2 shows the complete power supply circuit. To get the circuit started, R600 and D601 provide a feed from the mains side of bridge rectifier D600. This feed charges C604, providing a ramp voltage at pin 9 (the voltage supply pin) of IC600. When the voltage at pin 9 reaches 8V, the IC starts up and produces chopper drive pulses at pins 4 and 5. These are fed back in to the base of the integrated chopper transistor at pin 3. When the chopper transistor switches on it links pin 6 of the chopper transformer (T601) to chassis, via the current sensing resistor R605. As a result current flows in the transformer's primary winding (pins 6-8) and a magnetic flux builds up.

At a point determined by the timing circuitry within IC600 the chopper transistor will be switched off. The magnetic field established in T601 then collapses and energy is transferred to its secondary windings. Diodes D606 and D609-D614 conduct, charging their reservoir capacitors.

After the initial start-up the supply for IC600 is provided by D606, with C604 now acting as its reservoir capacitor. The voltage at pin 9 will be around 7·7V.

Transistor Q601 is active during the start-up period and in the standby mode. During the start-up period the ramp voltage at pin 9 of IC600 could fall below the minimum permissible level of 6V. As a result the power supply would start up and shut down at the same rate as the ramp. Q601 prevents this by switching on to supplement the voltage at pin 9 – it receives a supply at its collector from rectifier circuit D604/C605. Once the circuit is running normally the 7·7V across C604 reverse biases Q601.

Regulation

Voltage regulation is achieved by feedback to pin 7 of IC600 via optocoupler IC601, which is driven by the SE135N error sensing chip IC602. Fig. 3 shows the circuitry within this chip. Pin 1 is connected to the 135V HT line. It feeds zener diode D1 via R3 to produce a reference voltage at the emitter of Q1, also Q1's base via the potential divider network R1/2. Thus Q1 senses any HT variations at its base, producing a correction voltage at its collector (pin 2). This varies the current flowing via the LED in optocoupler IC601 and its light output, which is detected by the phototransistor on the output side of IC601.

The voltage at feedback pin 7 of IC600 is thus varied, altering the mark-space ratio of the drive pulses produced at pins 4 and 5 and the on/off timing of the chopper transistor.

Standby Operation

To minimise the power consumption in the standby mode IC600 produces very narrow pulses to drive its chopper transistor. As a result, the power supply produces sufficient energy to supply the microcontroller chip and the infra-red receiver only.

When the standby command is received, pin 2 of the microcontroller chip IC001 goes high. This pin is linked to the base of Q604 via R632 and Q4 (on board A). Q4 switches on, Q604 switches off and Q603 switches on. As a result the current that flows through the LED in IC601 is increased. IC600 reduces its output pulse width (it assumes that the HT is high) and the HT voltage falls to 29V. All the other power supply output voltages fall in proportion.

Reducing the output voltages in the standby mode creates two problems. The voltage developed across C604 by D606 to power IC600 is no longer sufficient, while the voltage developed across C617 by D610 is too low to operate the regulator (IC604) for the standby 5V supply.

The first problem is overcome by the operation of Q601 and its associated components. We have already seen how this circuit contributes to the start-up operation. When the set is running normally the voltage developed across C605 is around 70V. In the standby mode it falls to 9·5V and zener diode D603 switches off. This enables Q601 to switch on and supplement the supply at pin 9 of IC600.

To boost the input to IC604 in the standby mode Q602 switches on, adding the voltage developed by D608 across C612.

Protection

The power supply incorporates four protection circuits, as follows:

(1) Overvoltage. Should the output voltages developed by the power supply rise excessively this fact will be apparent at pin 9 of IC600. Once the voltage at this pin exceeds 10V the over-voltage circuit within the chip will operate, shutting IC600 down. The circuit latches in this state until the mains input is interrupted.

(2) Primary side excess current. The emitter of the chopper transistor within IC600 is connected to chassis via the low-value resistor R605. During normal operation the voltage developed across this resistor is negligible. Should an excess-current condition arise, the voltage across R605 will increase. This voltage is detected at pin 6, the result being that the over-current circuit within the chip operates. The mark-space ratio of the chopper drive pulses is then reduced. The circuit works on a pulse-by-pulse basis, producing what can be described as self-limiting. When an overload brings this circuit into operation an audible 'tripping' sound may be heard coming from T601.

(3) Secondary side excess current. Should an overload that is not sufficient to trigger the primary side excess-current circuit occur, a secondary side circuit will come into operation to prevent excessive HT current. The HT current is monitored by R608. If the current is excessive, the voltage across R608 will fall and Q605 will switch on. Q606 in turn conducts, producing a high at pin 38, the protection line, of the microcontroller chip IC001 (PCB A). This puts the set in the standby mode.

To prevent the set being brought out of standby, the collector of Q606 is linked to the base of Q605 via D625 and R638. Thus once triggered the circuit latches on.

As an additional safeguard, the line drive is removed by Q805 which puts a short-circuit across the input to the line driver transistor Q803.

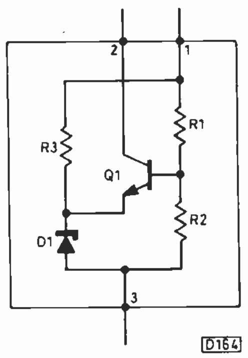
Voltage Checks

Test point	Normal working	Standby
IC600 pin 3	0V	–0·4V
IC600 pin 4	0·5V	0V
IC600 pin 5	1V	0V
IC600 pin 6	0V	0V
IC600 pin 7	0·2V	0·2V
IC600 pin 8	1·2V	0V
IC600 pin 9	7·7V	6·3V
IC601 pin 1	64·3V	4·7V
IC601 pin 2	63·5V	3·6V
IC604 pin 1	5V	5V
IC604 pin 3	7·7V	8V
Junction D609/C613	135V	29V
Junction D612/C616	15·6V	2V
Junction L613/C630	20V	3V
Junction L612/C629	–20V	–3V
Q601 emitter	7·7V	6·3V
Q601 base	7V	6·9V
Q601 collector	67·4V	8·8V
Q602 emitter	75·4V	8V
Q602 base	74·4V	–
Q602 collector	–	8V
Q605 emitter	0·3V	–
Q605 base	0·5V	–
Q605 collector	15·6V	–
Q606 emitter	15·8V	–
Q606 base	15·6V	–
Q606 collector	0V	–

(4) Thermal. IC600 is designed to shut down should its internal temperature exceed 150°C. When this occurs IC600 will remain in the shut-down state until it has cooled and the mains supply has been interrupted.

Servicing

First a precaution: before carrying out any cold checks in the power supply or replacing components, ensure that the mains rectifier's reservoir capacitor C603 is discharged. It bites!



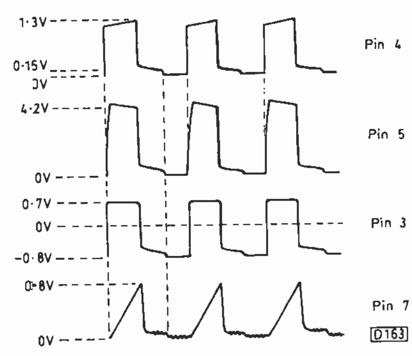


Fig. 3 (left): The circuitry within the SE135N voltage error detector chip IC602.
Fig. 4: The waveforms that should be obtained when IC600 is tested in circuit using a 9V battery to provide the power. Connect the positive side of the battery to pin 9 and the negative side to pin 2.

If the set is dead, the first step should be to find out whether the power supply is working by checking the output voltages produced by T601. Remember that very low voltages could simply mean that the power supply is in the standby mode.

If there are no outputs from T801's secondary windings, carry out checks in the primary side of the circuit. There should be around 300V at pin 1 of IC600. If this voltage is absent, check resistors R631, R642 and R647. If any of them are open-circuit, the chopper transistor in IC600 could be faulty. It is easy to check this since the terminals are all accessible – the collector at pin 1, the emitter at pin 2 and the base at pin 3. If you find that the chopper transistor has failed, the following components should be checked: Q601, R606, R607, D607 and C607. Ensure that the connections to C608 are sound, and replace R605 – even a slight increase in the value of this resistor can cause random tripping problems.

If there is 300V at pin 1 but IC600 is not working, check that the start-up voltage is present at pin 9. This is best checked with a scope, which should display a ramp waveform that peaks at about 8V. If this is low or missing, check R600, D601 and D606, and ensure that C604 is not leaky or low in value.

It is simple to check IC600 if you suspect it. This can be done either in circuit (with the mains supply disconnected!) or out of circuit by connecting a 9V battery between pins 9 (positive terminal) and 2 (negative terminal). A working chip should produce waveforms similar to those shown in Fig. 4, at a frequency of around 12kHz. Current consumption, with the device in circuit, should be around 105mA.

If the start-up and 300V supplies are both present and IC600 tests OK with a battery, it could be that the overvoltage circuit is in operation, suggesting a regulation loop problem. Once this circuit has triggered, it will prevent IC600 from operating until the mains supply has been disconnected. The overvoltage circuit fires very rapidly. To check whether it has, use a scope to see if the supply to pin 9 exceeds 10V. This will happen only once after the mains supply has been switched on. If this is the case, check the circuitry associated with the optocoupler IC601 and the error detector chip IC602.

Field Output

The field output stage employs an STV9376 chip (IC500) which requires ±15V supplies. These are derived from the line output transformer T803. The stage is unusual in that the scan coils are DC coupled to the output. This means that there is increased risk of damage to the tube, the scan coils and the output stage should a fault develop. Protection circuitry is therefore incorporated.

The field ramp waveform fed to the scan coils is monitored to ensure that it is symmetrical about chassis potential. Should the picture be shifted excessively or the height be set too low, the protection circuit will come into operation.

Transistors Q501 and Q502 monitor the output from IC500, charging capacitors C521 and C522. Should the voltage across either of these capacitors exceed a threshold value, the protection line (pin 38 of the microcontroller chip IC001) will go high and the set will revert to standby. The software in IC001 incorporates a short delay, allowing 1·5 seconds for the circuitry to stabilise before the set shuts down.

The protection circuit can be disabled for test purposes by removing diode D505. Caution is required however to prevent damage to the tube or the output stage.

Since the supplies for the field output chip are derived from the line output transformer T803, any fault here that results in a low or missing supply to IC500 will trigger the protection.

The protection input to IC001 is shared with the over-current protection circuit in the secondary side of the power supply (mentioned earlier). A permanent high on this line indicates that the latter circuit has been triggered, a brief high suggesting a field output stage problem.

It's normal practice for sets with an on-screen display to use a sample of the field flyback waveform for sync purposes. The BE3B chassis is no exception, a 5V peak-to-peak field pulse being applied to pin 60 of IC001. This is also used for protection purposes: should no field pulse reach IC001 within approximately 15 seconds after switching on, IC001 will put the set into the standby mode. Thus even with D505 disconnected the set can be operated for only 15 seconds at a time when fault finding.

Line Output Stage

The line output stage follows conventional practice and is very reliable. Those not familiar with Sony designs should note that the tube's G2 (first anode/screen) supply is obtained by rectifying the flyback pulses at the collector of the line output transistor. The rectifier circuit consists of R830, D809 and C821. In previous sets failure of this diode would result in a very dark, flaring picture.

EW Modulator

All versions of the chassis, including sets fitted with a 90° (21in.) tube, incorporate EW correction. EW modulator driver transistor Q801 controls the picture width by varying the potential across the lower modulator diode in D812. When Q801 is switched on, the lower section of D812 is shorted out and the energy applied to the scan coils is increased, the result being greater width. Q801 receives its base drive from IC800, via Q800.

IC800 (LM393P) is a comparator which is fed with a fixed line-frequency ramp waveform at pin 5 and, at pin 6, a variable parabolic waveform that comes from pin 63 of the jungle chip IC301. The latter waveform can be adjusted by the microcontroller chip. The result, at pin 7 of IC800, is a pulse-width modulated line-frequency squarewave whose duty cycle is proportional to the amplitude of the waveform at pin 6.

The point to note is that the longer the on-time of Q801, the greater the picture width.

This circuit adjusts the width and pincushion correction, the settings being electronically controlled via the service mode.

NS Correction

Large-screen sets fitted with 2R tubes, for eaxmple the KVX2982U, require additional correction to prevent bowing at the top and bottom of the picture. The NS correction circuitry is on PCB D2.

Dynamic Focusing

Some sets incorporate dynamic focusing circuitry to maintain optimum focusing over the entire screen area. A line-rate parabolic waveform, derived from pin 6 (+15V supply) of the line output transformer, is fed via T802, with AC coupling, to the focus voltage output from the line output transformer.

Velocity Modulation

Velocity modulation is used in 29in. models to enhance the picture sharpness by emphasising black-white and white-black transitions. This is done via a coil that's mounted on the neck of the CRT. It's used to speed up the scanning spot during these transitions, after which the spot is slowed down briefly to compensate. The entire velocity modulation circuitry is housed on PCB VM which is also mounted on the neck of the tube.

Part 2

In part 2 next month we'll look at the circuitry on the other panels in the chassis and provide further advice on fault finding.

Help Wanted

The Help Wanted column is intended to assist readers who require a part, circuit etc. that's not generally available. Requests are published at the discretion of the editor. Send them to the editorial department – do not write to or phone the advertisement department about this feature.

Wanted: Connecting cable and details of its pin connections for linking the Akai VC90 camera and VP77EG/EK VCR. Does anyone have any BPN77 batteries for sale? Malcolm S. Simpson, 64 Britannia Road, Milnsbridge, Huddersfield, W. Yorks HD3 4QF. 01484 658 684.
Wanted: Circuit diagrams and/or user manual (photocopies would do) for the Iwatsu SS-5705 oscilloscope. C. Bennett, 43 Penybryn Avenue, Cefn Fforest, Blackwood, Gwent NP2 1JS. 01433 835 614.
Wanted: SN75439NE stepper motor driver chips and carriage stepper motor for the XL2700 Smith-Corona electronic typewriter, also any circuit diagrams/manuals (photocopies would do). Also require a keyboard membrane and a tape deck for the ZX Spectrum + (the black one with a heatsink running down its side). Owen O Reilly, Belfield, Gaybrook, Mullingar, Co. Westmeath, Ireland.
Wanted: YC board from a scrap Saisho VRS4400/Matsui VS888 VCR (PCB101 VV0134). Also a scrap Sanyo Sanfax 100 fax machine, for the modem. David Smith, Tyddyn Bach, Bethel, Caemarfon, Gwynedd LL55 1YD. 01248 670 952.
Wanted: LOPTs for the ITT Model CP340 (CVC40 chassis) and National Model TC381G (M6A chassis). Also still seeking documentation for the Unaohm EP684R pattern generator. David Barfoot, 48 Wellington Road, Bournemouth, Dorset BH8 8JW. 01202 553 350.
Wanted: Instruction book, service manual or any other information for the Taylor 45C valve tester. Even if you only know how to drive it, please call. Also require a circuit diagram for the Advance voltmeter Model VM78. Henry Dulat, Garden House, St. Nicholas Avenue, Great Bookham, Surrey KT23 4AY. 01372 456 921.
Wanted: Any information on the Intercept N7118 colour bar generator – circuit diagram etc. H.L. Smith, 1 Tremont Gardens, Leasowe Road, Leeds LS10 2EP. 01132 703 199.
Wanted: Sony Betamax SLC30UB VCR for spares, also a service manual for this model. Alan Stubbings, 7 Church Road, Saxilby, Lincoln LN1 2HH. 01522 702 601.
Wanted: Microcontroller panel for the B&O 5502/7702/8802 etc. Would consider a complete set. Also service manuals for the B&O LS5000 and MX2000. I have for disposal some new B&O teletext boards for the 5502 etc. Stuart Adamson, 48 Crosshill Road, Strathaven, Lanarkshire ML10 6DS. 01357 520 049.
Wanted: Outer casing to suit the Amstrad VS1000/VS1140 or Orion/Matsui VSR1500 video satellite receiver. Patrick Gallagher, No. 2 Collins Flats, Castle Street, Castlebar, Co. Mayo, Ireland.
Wanted: CD7609CP chip for the Huanyu Model 37C3, or posibly a complete board. Also diode type ER26-06 for the Hinari CT16. C. Ingrey, 14 Andrews Walk, Bury St. Edmonds, Suffolk IP32 6SJ. 01284 752 291.
Wanted: U-View Servicing Guide for 1987-88 VCRs. Justin Smith, ATV, 4 Shenstone Road, Sheffield S6 1SQ. 01142 854 254.
Wanted: An A66EAS00X02 tube. We have accidentally damaged one in the workshop. TV Service, 18 Benfleet Road, Hadleigh, Essex. 01702 558 444.
Wanted: Type A48KLD90X CRT for the Akura Model CX25, also a circuit diagram for this model. Ken Cargill, 1 Stradowen Drive, Strathfoyle, Londonderry BT47 1XN. 01504 861 268.
Wanted: Murphy V600/V700 series TV with VHF radio. Heathkit MM1U multimeter. LOPT for the Bush TV113/115/118 series. Volume (or tone) control knob and mains power unit for the Grundig Yacht Boy 210 radio. 405/625 knob (beige) for the Thorn 850 chassis. Drive belts for the Philips EL3576/00 open-reel tape recorder. Remote control gun for the Network NW2044R (or equivalent). Dave Hazell, 126 Sevenfields, Highworth, Wilts SN6 7NQ. 01793 765 390.
Wanted: Instruction manual for the RCA WT524A transistor tester. Michael J. Frey, 18 Rushington Avenue, Maidenhead, Berks SL6 1BZ. 0162 827 350.
Wanted: Circuit diagram for the Leak Stereo 70 amplifier, also circuit diagram and power on/off/overdrive switch for the Mini Marshall guitar practice amplifier (photocopies will do). Andrew Tebbutt, 34 Coronation Road, Loftus, Saltburn by sea, Cleveland TS13 4SL. 01287 642 820.
For disposal: Mid-Fifties vintage Decca Model 1000 projection TV set, not in good condition. Free but buyer to collect. Bill Wright, 43 Greaves Sike Lane, Micklebring, Rotherham S66 7RR. 01709 813 419.
Wanted: Circuit diagram (photocopy OK) for the CTV14 made in Korea for Boots. F. Nezda, 40 Brynhyfryd, Glynneath, Neath SA11 5BA. 01639 720 429.
Wanted: Front channel up/down and volume buttons for the Ferguson 51L7 and a front cover/flap for the Ferguson 59B4. Stuart Fletcher, 131 Walsh Avenue, Hengrove, Bristol BS14 9SQ. 01275 891 893.
Wanted: Front panel unit for the JVC HRD337MS VCR and a back pull-out box for the Goodmans GEC230 car radio-cassette player. V. Smith, 175 Lyon Park Avenue, Wembley, Middx HA0 4HD. 0181 902 5447.
Wanted: Circuit diagram (photocopy OK) for the CM1448M 14in. VGA colour monitor marketed by Lite-On Technology Corporation, Taiwan, and manufactured in Singapore. Ray Stansby, Tatton House, Woodseaves, Stafford ST20 0NU. 01785 284 505.
Wanted: Service sheet for the Saisho Model CT147R, or component values for R116/7 and types for Q605/6. B.J. Powell, Suncot, Chapel Street, Taliesin, Machynlleth, Powys SY20 8JH.

The Problem of Pre-echo

This concluding instalment deals with ways of reducing direct signal pick-up in a distribution system. Bill Wright on the precautions to take and also the ultimate answer – frequency shifting

In Part 1 (March) the basic pre-echo effect and its causes were described and illustrated. The way to overcome the problem is to improve the signal-to-noise ratio. There are two aspects to this: to increase the distribution system signal levels, as discussed in Part 1; and to reduce the amount of signal that finds its way, by whatever route, to a TV set's tuner without passing through the system. The present article deals with this aspect. First however an apology to readers. Because of a computer problem at the printers, Fig. 13 on page 362 of the March issue was omitted. There were also some typeface inconsistencies. Fig. 13 is reproduced below.

Since the signal level at the head amplifier output and along the trunk cable is high, any direct signal pick-up here will normally have no effect. The potential for harmful direct pick-up starts at the downlead terminals of the tap-off unit. Each possible direct signal entry point will be considered in turn.

The Tap-off Unit

Because a tap-off unit is likely to be mounted in a position where the field strength is relatively high – in the loft or high up on an outside wall – direct signal reception at this point is a distinct possibility. If you suspect the tap-off unit, move the TV set and the flylead about a bit. If this has no effect on the phase or intensity of the secondary image, the tap-off unit is probably the cause of the problem.

Tap-off screening is all important. The worst offenders are the plastic-cased units that were popular about twenty years ago. The metal-cased ones with skimpy push-on lids are also suspect. For outdoor use the type housed in a diecast box, with a cover that screws on firmly, is best. An example is the Teleste CM9000 series. For indoor use the small F connector taps are excellent, being 100 per cent screened. Some don't have a power throughpass however – this is essential when line-powered repeaters are in use.

If the outer conductor of either the trunk cable or the download isn't making good contact at the tap-off unit, pre-echo will be one likely symptom. If the tap-off unit's lid or cover is missing, pre-echo may occur.

The Downlead

A good-quality, copper-foil wrapped cable such as Raydex CT100 or Ace QC100 should be used as a matter of course with a new system, pre-echo or not. Where a cheap 'low-loss' cable is used in an existing system, it might be worth replacing one or two downleads with CT100 as an experiment. A type of downlead cable widely used in the Sixties and often still found had a foam dielectric and two copper screens separated by insulation. This sounds good, but unfortunately the cable is very lossy at UHF. Replacing it with CT100 cable can give as much as a 6dB increase in the signal at the outlet, with proportional easing of any pre-echo problem.

The Outlet Plate

Check that the braid is properly connected to the outlet. If not, pre-echo and other unwanted signal pick-up is likely. Unless the system carries satellite IF signals as well as terrestrial UHF ones, the wallplate should be an isolating type. An examination of isolating outlets of different makes will show that some are better than others, both in

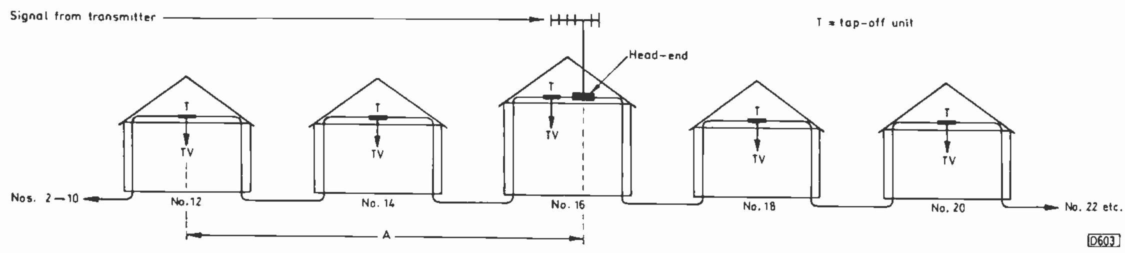


Fig. 13: The diagram that should have appeared on page 362 of the March issue. For the full caption and relevant text see Part 1.

terms of direct signal pick-up and through loss. Both of these are relevant to the avoidance of pre-echo.

Avoid outlets with large, untidy, unscreened connectors and capacitors. There is in particular one type, imported from the Far East, that's popping up all over the place. Although it is supposed to be a simple, straightforward isolated outlet, the PCB is obviously a multi-purpose design, with a large printed inductor and various short lengths of track, all connected to the inner of the coaxial cable. The other end of the inductor isn't connected to anything. I'm surprised that this item isn't sold as "the outlet that doesn't need an aerial", because I think they'd get away with it in strong signal areas. To make matters worse, the through loss is awful (–4 to –10dB, varying with frequency).

The connection to the outlet should be made as neatly as possible, with the minimum amount of bared inner conductor. Some electricians seem to think that they should separate the braid from the inner, twist the former into a pigtail, and leave about three inches of unscreened inner coiled up inside the back box.

I was once called out to a system in a large new private house, which had line-of-sight reception from a nearby relay transmitter. The electricians had fitted the outlets, back boxes and downleads. The local rigger had then installed (or, rather, slung) a cheap aerial and amplifier in the loft. Reception was most peculiar. The cause of the trouble was the type of outlet fitted by the electricians, with a long inner terminal that protrudes backwards. In every case this terminal was in contact with the shallow steel back box, which was receiving quite a good signal. The signal from the aerial and the amplifier wasn't up to much. As there was virtually no delay with the signal from the aerial, the effect was of pure phase cancellation: at its worst it was as if a pair of stacked aerials were pointed with the null towards the transmitter.

Flyleads

The short leads that link the wallplate, the VCR, the satellite receiver and the TV set are a prime cause of pre-echo. Quite often this is simply because the braid hasn't been connected within the plugs.

If pre-echo is a problem at an outlet where it's not expected and there isn't such an obvious cause, the first step to take is to unplug the aerial lead at the wallplate. The chances are that this will leave a snowy picture, or at least some evidence of a transmission, on the screen. You could plug the lead back in and mess about with it, making the pre-echo come and go, but why bother? You'll never get it right this way. Make up new flyleads using CT100 cable, all-metal plugs and all-metal line connectors. Ensure that the plugs and sockets all fit tightly. There should, with everything reassembled but the flylead still disconnected from the wallplate, be nothing but snow on the screen.

If you find one of those cheap, ready-made flyleads with moulded plugs, throw it away without hesitation. As we all now know, these are responsible for a lot of the channel group A patterning problems associated with satellite receivers. They are also quite remarkably bad for causing pre-echo.

I've carried out a few simple tests. Standing in my backyard, where the Emley Moor transmitter is visible twenty miles away, I found that a two metre flylead produced around 0dB/mV – this is only about 15dB less than a reference half-wave dipole! The signal obtained from a similar length of CT100 flylead was about –25dB/mV. These figures are only approximate, as the signal level jumps all over the place as the flylead is moved, but a difference of 25dB is unmistakable. The figures are the maximum that could be obtained from each flylead. It made little difference whether the other ends of the leads were terminated or unterminated.

Why these cheap leads pick up so much signal is a mystery. The way the braid is connected to the plugs tends to be a bit hit and miss, but replacing the plugs with properly fitted metal ones seems to reduce the signal pick-up only slightly. With the leads I've used for these experiments the cable is of quite reasonable quality. It has a very thin aluminium foil wrap under the braid. This is 100 per cent screening, so theoretically there should be minimal pick-up. Can anyone suggest why this form of cable construction performs so badly?

Sometimes an architect's idea of the best position for a TV set doesn't concur with that of the occupier. A long coaxial cable may be the result, going along two sides of the living room. Take nothing that disappears under a carpet for granted. These cables often have joints made with a blunt table knife and Sellotape wrapping. The cable may have been extended using 50Ω CB coax connected to a beer-sodden 30A joint box. Do you think I'm kidding? Believe me, I've found things that would make your hair curl under carpets. Before you do anything else, bypass the sub-carpet enigma with a length of CT100.

When you approach a system after being asked to cure pre-echo, budget for new CT100 flyleads at every dwelling. Replace all the flyleads, even where pre-echo is not visible at the moment when you make your call.

The Occupier's Equipment

A TV set with nothing connected to the aerial socket should not receive RF signals. If, as a TV distribution system repairer looking for the cause of pre-echo, you come across a set that shows a picture with no aerial connected, the problem passes to the occupier's TV dealer (sorry, lads!). The only thing that the communal aerial repairer can do is to use another TV set to test reception at the outlet concerned.

It's a nuisance, but the occupier will probably need a bit of convincing and this is a good way to go about it. Such a situation often arises when someone moves from their own house to sheltered accommodation. The TV set will have performed perfectly until the move. "Now we've got double vision, and this impudent fellow from the coucil says it's our telly that's faulty."

VCRs and satellite receivers don't seem to cause pre-echo. Game switches and plastic splitters do. Where the occupier has fitted a cheap plug-in splitter at the wallplate, everything that's connected is about 6dB worse off from the pre-echo point of view. In addition, the splitter itself could be receiving direct signals.

In houses with several bedrooms, you might well find a splitter feeding more splitters, with the signal at the living room TV set 12dB down. The only thing that you can do is to demonstrate the improved reception when the TV set is connected directly to the wallplate and advise the occupier accordingly. I usually suggest that a screened distribution amplifier is used to replace the splitters.

Silly Causes of Pre-echo

I've occasionally found pre-echo in areas of relatively low signal strength, where it just shouldn't be a problem. In one case the occupier had fitted a Labgear indoor aerial and amplifier in the loft to receive an alternative ITV station. In order to get the signal down to his living room, he'd connected the output to the trunk terminals of the tap-off unit, which was also in the loft. The house was only six back from the end of the trunk, so the system signal level wasn't high at that point. The alternative ITV station came in a treat, and the silly person wasn't bothered by the faint outline produced by the four normal channels. The neighbours were, though.

To make matters worse, our man had wired his amplifier to his immersion heater circuit, which was switched on only during the evenings. The neighbours had to make a video recording of the fault before I could believe them. Even then it took several visits before the cause of the fault was pinpointed. I'm not normally malicious but I made sure that the cause of the problem was clearly stated on the invoice, in the hope that the tamperer would have the cost added to his rent.

I once had to visit a most unpleasant and aggressive young man who was threatening hell and high water if the council couldn't get rid of the 'ghosting' displayed by his living room TV set. He met me on the street as I got out of the van, shouting about "my solicitor" and "my rights". Like many of this sort, he was well versed about his rights but not about his responsibilities. There were three very young children in the flat with their rather clueless young mother. The place was in a dreadful state. Anyway, my concern was with the TV reception.

A VCR supplied signals to TV sets in the living room and the bedroom, via a taped joint. For reasons that escape me, the bedroom TV set had this feed and its loop aerial connected via a resistive splitter. The loop was producing enough signal to cause pre-echo with both TV sets.

The pre-echo at a block of eight flats occupied by elderly people was horrendous, the two signals being of roughly the same strength. This was in an area where pre-echo is a major problem. For years I'd been dealing with complaints from the surrounding blocks, and one by one new systems had been installed. But no one from this block had ever complained and the original system, installed primarily for 405-line reception, was still intact. If the pre-echo was this bad, and it had to be with such an antiquated system, how come no one had ever complained before?

It turned out that the door entry system repairers had been at work. Their intercom and electric door locking system is connected to the landlord's electricity supply, to which the TV system is also connected. They had turned off the supply when they started work, and had turned it on again when they had finished. But when turning it back on they had also turned on a switch labelled "TV system – dop not switch off". This had in fact been switched off for years, with the tenants happily watching TV on a system with no electricity supply! With the supply off, reception was snowy. With it on, TV was unwatchable because of the pre-echo. It's my guess that someone had discovered many years previously that reception was better with the system off than on. I bet he got paid as well!

Use of a Different Transmitter

Faced with the pre-echo problem, you might be tempted to redirect the system's aerial towards a different transmitter and distribute these signals instead. This might seem like a good idea. But it isn't, and I think I can justifiably say "don't do it". The idea is that very strong local signals would not be used, the more distant and less strong signals taking their place. This will cause problems.

It's unlikely that the signals from the more distant transmitter will be as reliable as those from the nearby station. Even when the second-choice transmitter is providing good-quality reception, which is unlikely in an area swamped with signal from a close by transmitter, there are drawbacks. Occupiers will persist in tuning in the weak signals from the local transmitter – these will inevitably still be present at the outlets.

The Ultimate Answer: Frequency Shifting

There is an assured, cast-iron solution to the problem of pre-echo. If each incoming signal is frequency shifted ('translated') before being distributed, it won't matter how much direct signal gets into the TV set. In a location where the field strength is exceptionally high, there may be no alternative to this course. As frequency shifting is quite a large subject, I'll consider it here only from the point of view of pre-echo.

The main disadvantage of frequency shifting is its cost. The addition of channel converters to an existing system will cost a minimum of around £750, including labour, for four channels. This figure would pay for simple direct converters.

One notch up the scale of cost and quality is double conversion: the incoming signals are converted to an IF of 38·9MHz and then to the final output frequency. An even more expensive option is to demodulate and then remodulate each channel. If good quality equipment is used, the cost would be about £3,000 for four channels.

In some circumstances such costs would be of little consequence. If pre-echo has been a major problem with a system that serves say 600 dwellings, the cost per dwelling of £5 will not raise eyebrows, particularly when the technicalities can be explained to the purchasing authority. A more typical set of circumstances however would be as follows.

Maths

If the distance between two images on the screen is measured, the total delay time between the two signals can be calculated. Although it's not possible to distinguish between the free space and cable contributions to the delay with this method, an approximation of the overall extra path length can be obtained.

To calculate the signal delay for a given screen image displacement, and hence the signal path extension, the delay factor is given by D1/D2, where D1 is the distance between the screen images and D2 is the total scan width.

Where all the extension is in free space, the signal path extension E = the delay factor x the distance. The calculation is E (space) = (D1/D2) x 19,200 metres (the distance a signal travels in free space in the time taken to scan one line – about twelve miles).

Where all the extension is in a cable run and the cable has a velocity factor of 0·8, the signal path extension E (cable) = (D1/D2) x 15,360 meters (the distance a signal travels along a cable with a velocity factor of 0·8 in the time taken to scan one line).

For example, the long-delay screen shots shown in Part 1 had pre-echo images 3mm to the left of the main image. The line scan, including the sync and overscan, is about 190mm (estimated from the screen width). The aerial and the TV set are about the same distance from the transmitter, so all the delay is within the system. Thus (3/190) x 15,360 = a path extension of 242 metres.

The installer is quoting on a competitive tender basis for a system to serve forty bungalows. His quotation is to go to an electrical firm, which has the TV system included in its work schedule. This firm is in turn putting together a tender for the main contractor, who is himself in competition with other builders. No one wants to know about an obscure problem called 'pre-echo'. One thing is certain if the installer allows for the cost of channel changers: he won't get the job.

When finances do allow the use of channel changing, the technical aspects require careful consideration. The first question is which channels to use? Since signal attenuation in a cable is less at lower frequencies, use of lower-frequency channels is always an advantage. Channels that have other signals of significant strength in the area should not be used. Where possible, a standard set of four channels should be used. These sets are n, n + 3, n + 6 and n + 10, or n, n + 4, n + 7 and n + 10. Channels 34-38 should not be used.

When channel changers have been installed, the original unchanged channels will still be present at each outlet where pre-echo had previously been a problem. Anyone arriving with a TV set to install will assume, not unreasonably, that it should be tuned to the local transmitter. A glance at the aerial will appear to confirm this. Tuning may have been carried out in advance at the shop. We are often called out shortly afterwards, to find the TV set carefully tuned to these weak signals while the strong, translated signals have been ignored.

We maintain one system where this has become a serious problem. Explanatory labels have been stuck to every outlet plate with little or no effect. I'm considering the extreme measure of adding a 'spoiler' signal at the head-end to make it impossible to tune in the untranslated channels.

Another approach to this problem is for the system to carry both translated and untranslated channels. Those who are troubled by the pre-echo can retune to the translated channels while those who aren't need not bother. The main disadvantage is that the system must carry eight instead of four channels, which implies extra cost if the head-end is channelised or reduced output levels if it's broadband. But it simply isn't worth the trouble, because call-outs still arise. Those with pre-echo usually don't think to retune, even when an explanatory leaflet has been distributed.

Despite all this, channel changing is sometimes the only answer. Typical of an installation where frequency shifting had to be used was a high-rise hospital building half a mile from a 5kW transmitter. Some wards had floor-to-ceiling glass at the side facing the transmitter, with the TV set standing just in front. There was nothing wrong with the TV sets, the flyleads or anything else, but pre-echo was an annoying niggle with an otherwise excellent system, and eventually something had to be done.

Why, you might reasonably ask, should anything be done? If there's so much signal, why not just connect all the sets to set-top aerials? In fact the hospital technicians had fitted set-top aerials in some of the wards that faced the transmitter, but this meant that the satellite channels, which were being distributed at UHF, were lost. It's not acceptable to have patients and staff fiddling about behind the TV sets changing aerial connections all the time. There will soon be aerial socket damage.

A more serious disadvantage of using set-top aerials arose in the wards that faced away from the transmitter. The field strength was less here, but still enough to cause direct signal pick-up. But most of the direct signal was not in fact so direct, having been bounced off a nearby tower block. As a result the set-top aerials were useless because of ghosting.

Where responsibility for all the TV sets at a site rests in one place, incorrect tuning (to the untranslated channels) is less likely. Patients and nursing staff are less likely to tamper than people in their own homes.

In Conclusion

Pre-echo is often an unexpected problem that spoils the results obtained from a well planned and executed communal TV system. Even when the installer is aware of the possibility of pre-echo, the constraints of cost and competitive tendering may lead to chances being taken. In such circumstances assessing the possibility of pre-echo is very difficult.

I hope that the facts presented in this article will help contractors to take into account the likelihood of pre-echo problems and thus be able to tender more competitively.■

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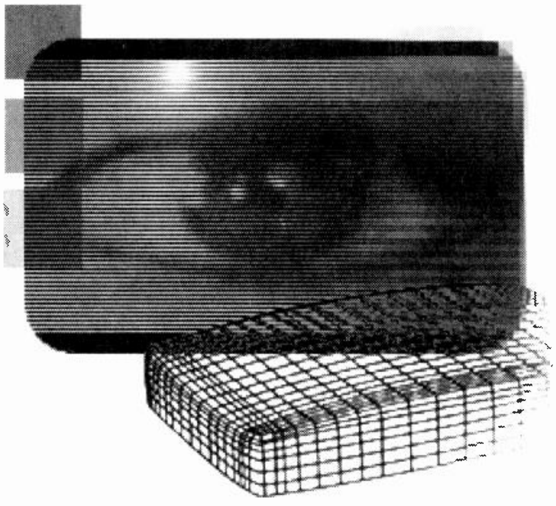
TV Fault Finding

Reports from Philip Blundell, AMIEEIE, Glyn Dickinson, Mike Orr, Stephen Leatherbarrow, G.M. Colebourne, Brian Storm, Nick Beer, Terry Lamoon and Chris Watton



Hitachi CPT1454 (NP84CQ Chassis)

This set would come on for a split second then go dead. The overvoltage thyristor was firing. If the set was started up gradually by using a variac, it would keep working and the 103V and 200V supplies would be established correctly – the overvoltage circuit monitors the 200V supply. Resistance checks in the protection circuit showed that R909 (180kΩ) had fallen in value. As a result the set tripped early. **P.B.**

Grundig P17/649/12 (CUC5200 Chassis)

There was no sound or vision, just a blank white screen. Voltage checks showed that the 12V +B supply was low at 8V. Tests in the 12V regulator circuit showed that the voltage at the base of transistor T672 was also low. It's connected to the U/standby control line, which is used to switch off the +B supply for standby operation. Transistor T835 (BC548) turned out to be leaky. **P.B.**

Hitachi CPT2078 (NP83CQ 2 Chassis)

There was a strange picture with no colour: the verticals were bent and smeared. The teletext panel was not to blame, but the picture was restored to normal when the AV panel was bypassed. The cause of the trouble was the HEF4066 chip IC1201. **G.D.**

Philips GR1-AX Chassis

This portable wouldn't start up, though the HT was present and a slight grunt could be heard. The start-up pulse was present at the volume input of the TDA8305 chip, which contains the line oscillator, but the set wouldn't kick off. The chip wasn't to blame however. Much investigation brought us to L5524 (1·5mH) in the start-up feed to the line driver stage. It had gone high-resistance, a replacement restoring the line drive. We've since had a second set with the identical fault. **G.D.**

Blaupunkt FM120

This is a chassis that will not be familiar to most readers. The sets are very reliable, the main trouble being caused by the line output transformer which, when faulty, causes tripping at switch on (arcing can usually be seen through the casing). The focus control usually has to be replaced at the same time.

After we'd carried out these repairs to one particular set the customer complained that it took progressively longer to come on. There's no mains switch on this model, as a relay powered from the standby transformer switches the main power supply on. The relay clicked as usual, but the power supply remained dead. Replacing the three electrolytics C420 (1µF, 63V), C426 and C429 (both 100µF, 25V) and the TDA4600 chopper control chip restored normal operation. **G.D.**

Mitsubishi CT25A2STX

This set had an intermittent fault with rather obscure symptoms. A wavy dot pattern was superimposed on the picture. The luminance response was also affected, and at times the picture blanked out completely. Teletext was OK.

Tests showed that the luminance signal was present wherever it should be. In the fault condition the feedback pin of the VCJ chip was at 1·5V instead of 3·5V. Freezing this chip cured the fault – but replacing it didn't! When we checked the blanking voltage from the teletext board we found that it was at 0·6V instead of 0V. The culprit turned out to be the JC501Q transistor Q7705 on the text board. **M.O.**

Panasonic TX21V1 (Alpha 2 Chassis)

Most of the Nicam faults we get are caused by incorrect adjustment or a faulty IF unit. This set failed to produce Nicam sound and the display showed neither the Nicam symbol nor the mono one. On investigation we found that the 6·55MHz oscillator wasn't running. The cause of this was eventually traced to the 0·01µF capacitor C2549 which is connected to pin 9 of IC2502, the carrier APC detect pin. After replacing this capacitor and carrying out 6·55MHz adjustment the set worked correctly. **M.O.**

Toshiba 210T6B

This set produced a pale, indistinct raster whose brightness didn't alter when the brightness control was adjusted. I suspected that a sort of reflected brightness within the tube was the cause of the trouble, as a result of the raster being deflected off the viewing area. This proved to be the case, the culprit being the field scan coupling capacitor C316 (4,700µF, 25V). This fault can also cook up R327, which is in the supply to the field output chip. **M.O.**

Mitsubishi CT29B2STX

This set had a rare fault these days, north/south distortion. With the

29in. tube, the symptom looked pretty bad. There's a 2SA950 30V switch transistor (Q4009) on the NS correction panel. It was supplying only 2·3V. A replacement cured the fault. **M.O.**

Panasonic TX25A2X (Alpha 3 Chassis)

The picture had no colour. Checks around the colour decoder chip IC601 showed that the reference oscillator wasn't working. Instead, there was a pulsating line pulse at this pin (21). In addition the chroma input at pin 15 was going from zero to maximum amplitude.

This is a multi-standard colour decoder chip, with an NTSC as well as a PAL crystal. Removing the NTSC crystal stopped the pulsating waveforms, but replacing the crystals and oscillator components didn't help. The culprit turned out to be the 0·01μF ceramic capacitor connected to pin 14 (labelled DC feedback) of the chip. Well, you would know by now that these ceramic capacitors in Panasonic receivers have a bad reputation. **M.O.**

Philips CP90 Chassis

There was intermittent tripping, also patterning on the screen. It was difficult to narrow down the cause of the patterning to a particular section of the set, because there was both a dot pattern of the sort caused by arcing and the more usual herringbone effect. The latter also varied wildly, being reminiscent of sound-on-vision. These effects were all caused by C2691 in the power supply. This 330μF, 25V electrolytic had gone low in value. **S.L.**

Goodmans 2575

This 25in. Nicam set produced no red output from the TEA5181A RGB output chip, which is mounted on the tube's base panel. We soon traced the cause to the 68kΩ resistor R26, which was open-circuit. We replaced the corresponding resistors in the G and B channels as well, R28 and R29 respectively, as their values had drifted somewhat. **S.L.**

Salora J Chassis

This receiver would at random produce the dead set symptom. In fact it produced the sort of half working/low output state that's characteristic of one of these sets in trouble. DB720, a 15V zener diode connected to pin 5 of the LF0041 chopper control chip HB1, was found to be intermittently leaky.

The cause of a recent case of a dead set with no 15V input to the 12V regulator chip ICB500 was traced to rectifier diode DB507 (EGP20D) being open-circuit. **S.L.**

Philips CP90 Chassis

This seems to be something of a stock fault with these sets. D6665 (1N4148) becomes leaky, producing the dead set symptom. It's connected to pin 5 of the CNX62 optocoupler in the power supply, via R6665 (4·7Ω). **S.L.**

ITT Monoprint B Chassis

This set would go to standby very intermittently. We found that as the temperature rose the TDD1605S 5V regulator chip IC405 became leaky between its input pin and chassis. **S.L.**

Salora 1G3A

An alarming set of symptoms had a very simple cause. The symptoms were a bright, blank raster, no sound and lack of width. All were caused by a dry-joint at the base of transistor TB18. **S.L.**

Goodmans 5160

At switch on this set produced a flooded white raster in both the TV and text modes. If the set was left to run in the TV mode a picture would gradually emerge from the fog. The text display remained white and blank. When we checked the supplies to the text board (there are 12V and 5V rails) with a scope, large line-rate pulses were seen on the 12V supply. C629 (100μF, 25V) was found to be partially open-circuit. **S.L.**

Philips 2A Chassis

This set came to us dead with a leaky BU508V line output transistor. A replacement quickly failed, accompanied by squealing. By unloading the line output transformer's secondary windings in turn, we found that the set operated with a blank raster when D6644 was lifted. We eventually discovered that the TDA2579/N5 timebase generator chip IC7535 was faulty. **S.L.**

Tatung 160 Chassis

Intermittent loss of signals is a fault you sometimes get with these sets. While the tuner can be responsible, on several occasions we've found that the resistors which supply the 33V regulator are the cause. In a recent case one of these 3·9kΩ resistors (R007) had a burn mark around it. The symptoms were normal pictures following a slight drift/sudden signal loss etc. **S.L.**

Hitachi CPT2478 (G6P Chassis)

There was sometimes no text and very occasionally jumbled text. It didn't take us long to discover that the 12V input at pin 2 of PL1204 on the text board measured only 10·5V. R761 had risen in value from the correct 1Ω to 5Ω. **S.L.**

Panasonic TX29AD1DP (Euro 2 Chassis)

Excessive width plus parabolic distortion was the problem with this set. When the EW diode modulator driver transistor was removed the width came back in, but a replacement still gave excessive width. The parabolic waveform from the digital pack looked good when checked with a scope, and all the transistors in the EW drive circuit checked all right when out of circuit. Despite this, a new BC547B transistor in position Q593 – this is the emitter-follower at the base of the EW driver transistor – restored normal scanning. **B.S.**

Panasonic TX25X1DP (Alpha 4 Chassis)

This Dolby Pro-Logic set had no output from the front speakers. The reason for this became obvious when the back had been removed: C81 and C83 on the sound processor board had exploded. They are the output coupling capacitors associated with the two-channel audio amplifier chip U11 which was short-circuit, placing 35V across C81 and C83. The fact that they are rated at 25V explains their distress. A replacement LA4280 audio chip and two new 2,200μF capacitors restored the sound. **B.S.**

Panasonic TX29AD1 (Euro 2 Chassis)

This set displayed dark vertical lines down magenta or purple parts of its picture. As the luminance and chroma signal processing is carried out digitally, in I1601 on board A, it seemed sensible to replace this VDP3108-25 chip. Fortunately this cleared the fault. **B.S.**

Panasonic TX2 (Alpha 1 Chassis)

Dark, defocused bars would move slowly down the screen when this set was switched on from cold. Increasing the brightness made the effect worse, but the symptom cleared after a few minutes to leave a good picture. The cause of the trouble was an ageing picture tube. We were able to minimise the effect by careful adjustment of the tube's drive and first anode voltages. **B.S.**

JVC C210EKY

The owner of this set complained of intermittently excessive red – adding that the aerial socket seemed to be the cause because he could clear the fault by moving the aerial plug. Tuner-mounted aerial sockets make a wonderful handle with which to disturb a set's inner workings! The cause of the fault turned out to be intermittent loss of the luminance signal, which we traced all round the set from its source at pin 9 of the IF module to an invisibly cracked joint at pin 18 of the colour decoder chip IC201. There should be an 0·6V peak-to-peak luminance signal at this pin. **G.M.C.**

Goodmans 1410

Two of these portables were completely dead when they arrived. In both cases there was no power supply start up because one of the three series-connected 68kΩ resistors was open-circuit. One of them, RP44, is rated at only 0·25W. It hides beneath two large, green power resistors. The other two 68kΩ resistors are rated at 0·5W. We replaced them all with 1W resistors to ensure a long and happy life. **G.M.C.**

Philips 2A Chassis

No results with a low HT output from the power supply, recovering to 140V when the H-scan drive plug M17 is removed, can be caused by a faulty line output transformer. Richard Newman reported no faulty LOPTs back in December 1992, when he wrote an excellent article on the chassis. But I've had three cases of LOPT failure recently. **G.M.C.**

Samsung CI5030AN

This six-month old set had been taking an hour to produce a picture – and the time was getting longer! "No picture" turned out to be no line lock. Restoring the H sync preset to the centre of its lock-in range, about 20° clockwise, was all that was needed. The set has been OK for over four months now. **G.M.C.**

JVC AV21F1 (JX Chassis)

The cause of intermittent shut down was quickly traced to faulty line output transformer connections, especially pin 18 which is connected to the collector of the line output transistor. To prevent these joints cracking the pins are soldered into board eyelets, as in Panasonic sets. As a result the joint doesn't crack around the pin, it cracks around the eyelet instead.

The 5V regulator IC522 in this chassis also suffers from cracked joints. But my favourite one is intermittent loss of signals because of a crack at the 4MHz crystal inside the synthesis tuner. **G.M.C.**

Hikona RM2002

The fault with this 14in. portable led me a dance for a while. The symptom was a very intermittent crackle, which was fairly loud, over the sound. I was able to establish quite quickly that the symptom occurred even with the volume control at minimum – in fact the volume control setting had no effect on it – and also that the cause was not associated with the output stage – disconnecting the input to the TDA820 audio output chip silenced the crackle.

The cause of the noise had to come after the volume control, which I discovered (I had no circuit diagram) is in the TA7608AM IF chip – the volume control connection is at pin 3. When this pin was disconnected the fault cleared – but the noise wasn't coming out of this chip!

There are various coupling and decoupling capacitors between these two ICs, also a screened lead across the top of the PCB. The cause of the problem turned out to be a 47µF tantalum coupling capacitor – under the screening can. When hooking it out and thinking about the fault I couldn't help remembering Les – even though it wasn't a blue tant! **N.B.**

Panasonic TX21V2 (Alpha 4 Chassis)

There was an interesting problem with this delightful set: all the on-screen displays, i.e. the channel numbers, the control bars etc., were black. In other words the blanking was correct but there were no on-screen display RGB drives. Teletext was OK.

The RGB drives for the features affected come from pins 42, 43 and 44 of the microcontroller chip, with the blanking coming from pin 41. The signals were all present and correct at these pins. They should have arrived at pins 11, 12 and 13 of IC3302, but were very low here.

The signals are buffered by transistors Q3330/1/2, where the DC conditions were correct. They were not correct at regulator Q3301 however. In fact the circuit voltages here were the wrong way round, with Q3301's base voltage being very low. Cold checks in this area failed to reveal any faults, but this is a Panasonic set and C3304 is an 0·01µF ceramic capacitor! A replacement put matters right. N.B.

B & O 7100

The height was very slightly down, the customer complaining that it varied as well. It's not unknown in this chassis. The field linearity control, a vertically-mounted miniature preset on the bottom deflection PCB, had poor wiper contact. The metal of the wiper assembly tends to crack. As a result the wiper contact becomes poor or open-circuit. **N.B.**

Sony KV1462

This little portable had been working fine until someone tried to retune channel 4 after some aerial work. The set searched, and the stations could be seen, but it didn't stop at any station – the AFT LED never came on. This set contains an infamous IF can. Sure enough there were dry-joints at the AFT and vision demodulator transformers. The usual symptom is loss of vision, because the vision demodulator transformer becomes dry-jointed first. **N.B.**

Matsui 1436

Field collapse was the symptom with this set. The supply to the field output stage was OK, and I was beginning to suspect the chip. But I decided to check the service switch to make sure that it was in the correct position – I've been caught out by this before. It didn't work, but I did notice that when the switch was moved the field tried to expand. Investigating this further brought me to Q601 where the voltage was low. Its feed resistor R608, a safety type, was open-circuit. Replacing this resistor and Q601 restored full field scanning. **T.L.**

Alba CTV10

This is one of those 10in. portables that can be powered by a 12V car battery and are thus very popular with lorry drivers and carvanners. You get a lot of them in during the summer months. This model is the same as the **Akura CX10,** and suffers from the same problem.

The usual complaint is that the set goes off after a while. I tested this one for several days but the fault wouldn't show up, even when I tapped the set. I knew the fault was there however, so I eventually tried some heating with the hairdryer, concentrating on the regulator. Sure enough the set shut down. A check then showed that there was no output voltage from this chip. After replacing it there were no more problems. The chip is prone to break down when hot. When fitting the replacement, remember to put on heatsink cream and tighten it together well. **T.L.**

Matsui 2091

This set showed no signs of life, though the power supply was working all right. On closer inspection of the power supply outputs I noticed that there was a dry-joint at D803S. Resoldering this restored the sound and picture. As a precaution some other poor connections, in the line output stage, were resoldered as well. **T.L.**

Philips CP110 Chassis

Poor start up was the complaint with this set, which had been a real pain. Now on its third visit to the workshop in five days, it worked perfectly no matter whether it was hot or cold. By now we had changed various bits in the power supply, read up on all the stock faults, been there, done that. I took it back to the customer and assured him that it would be OK – I must stop doing this. Much red-faced embarrassment when, after fixing the set to its stand and switching it on, there was trip, trip, trip.

If only to try to lay the blame at someone else's door, I decided to check the mains supply voltage. It was 244V. I knew that our workshop mains supply voltage is only 235V, so I connected the set via a variac and tried various input voltages. This proved that it wouldn't work above 240V. The culprit turned out to be C2690 (100μF, 50V) on the mains overvoltage subpanel. It read only a few microfarads. After fitting a replacement the set worked fine, starting perfectly at all inputs between 200-265V from our variac. **C.W.**

Sanyo CBP3024

This set was slightly off tune all the time, had a kink in the verticals and slight background grain on some pictures. Attempts at adjusting the AFC and vision detector circuits only made matters worse. The cause of the fault was eventually traced to C115, an 0·47μF, 63V electrolytic. **C.W.**

Salora L50 Chassis

This set's power supply wouldn't start up. Experience has shown us that electrolytics are suspect in these sets. The culprit turned out to be C601 (10μF, 63V). **C.W.**

Sony KV1412

If the set is dead and the mains supply components are OK, check whether R602 (2·2MΩ) is open-circuit or high in value. This seems to be a fairly common fault with these sets. **C.W.**

Ferguson ICC5 Chassis

The tuning mode could be entered and the correct channel number could be set. But there was no variable tuning voltage at the input to the tuner and thus no signals. The voltage just stuck at 20V. There was plenty of activity at pin 9 of the phase-locked loop chip IT20, but because TT12 (BC547) was open-circuit it couldn't affect the tuner unit. A new transistor restored all stations. **C.W.** ■

VCR audio servicing

This concluding instalment in Eugene Trundle's series describes audio fault diagnosis with rotary-head systems

The first VHS Hi-Fi VCR to appear on shop shelves in the UK, in 1983, was the Panasonic NV850. The sound system it employed, one that's still with us today in scores of models from different manufacturers, uses a clever technique called depth-multiplex recording. There are two separate layers of magnetic patterns in the tape, at different depths, one for the vision and the other for the sound signal. The advantage is that the sound signal gets the benefit of the same very high record/playback rotary-head/tape speed as the vision signal, banishing the noise, bandwidth and 'mechanical' problems of the longitudinal recording technique considered last month. Other sound recording systems based on rotary heads are used in Video-8 machines: we'll consider them later.

The Depth-multiplex Concept

In-depth descriptions of the principles of Hi-Fi sound recording in VCRs are to be found in a number of books. We'll give only a brief account here, the aim being to provide a context for the fault-finding and alignment advice to follow.

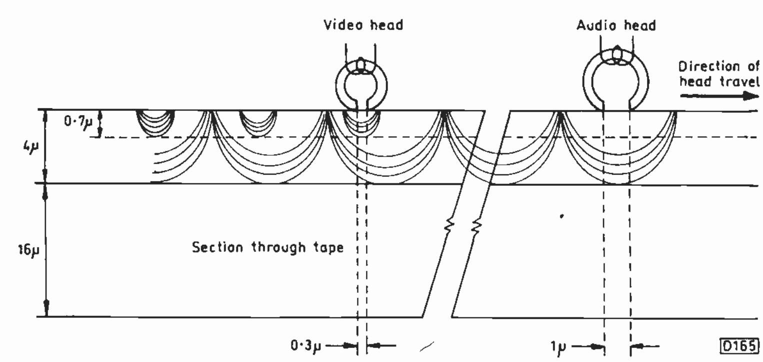


Fig. 1: How the separate audio and video magnetic layers are recorded in the tape, using different head-gap widths. The 1μ audio head gap records to a depth of 4μ while the 0·3μ video head gap records to a depth of 0·7μ. The Hi-Fi track is 26μwide, head azimuth being –30°. The video track is 49μ wide, with +6° head azimuth.

VHS Hi-Fi VCRs have two pairs of heads mounted in the upper drum, one pair for video and the other for the sound. Each Hi-Fi head leads its video counterpart on to the tape, using a comparatively wide (one micron) head gap to write a track that's about 26 microns wide. The magnetic pattern produced penetrates the tape relatively deeply (about four microns), and has an azimuth angle of ±30° to minimise crosstalk with the video signal during playback.

About 4·5msec after the passage of the audio head, the partnering video head follows across the same path (see Fig. 1). Its narrower but but longer head gap erases the upper region of the sound recording, replacing this with shallower 'pools' of video information. The track recorded by the video head is twice as wide (49 microns) as the audio track it partly replaces – and in effect burries.

The signal fed to the audio heads, only one of which is in contact with the tape at any one time, consists of two FM carriers. Each is deviated to a maximum of 150kHz. One carrier, at 1·4MHz, is used for the left-hand stereo channel; the other, at 1·8MHz, is used for the right-hand stereo channel. It's important to note that both carriers are recorded and played back by both heads, i.e. the audio head that's in contact with the tape handles both carriers simultaneously.

During playback the audio head again leads the partnering video head. The large azimuth difference between the audio and video head gaps ensures that there is very little crosstalk, so that the presence of the audio track has a negligible effect on the video picked up from the tape. The layer of video information in the tape does however impede pick up of the audio information – to the tune of about 12dB. As a result, audio playback is much more critical than video playback, especially with regard to tracking and head wear.

In addition dropouts affect audio reproduction more than video – a small speckle on the picture is less noticeable than a crackle on the sound. The analogue

FM modulation this system uses does not permit the sorts of interleaving, redundancy and error-correction techniques that digital recording and transmission systems use. With no suits of armour, and just a fig leaf (so to speak) in the form of dropout compensator and level-hold circuits, these audio carriers are vulnerable ones indeed.

Signal Processing

On their way to their separate FM modulators, the left- and right-hand audio signals pass through compressors that reduce their dynamic range to limit the FM carrier deviation to the permitted ±150kHz. The degree of logarithmic compression depends on the amplitude of the signal, as shown on the left-hand side in Fig. 2: a range of 80dB is reduced to about 45dB for recording. During playback an equal and opposite expansion factor is applied. This pushes the noise floor way down and restores the full audio signal amplitude – see the right-hand side of Fig. 2.

This processing is carried out, for both channels, inside a single chip in the VCR's electronics section. During playback the left and right signals are separated by bandpass filters downstream from the audio carrier preamplifier. These filters are centred on 1·4MHz (left channel) and 1·8MHz (right channel) of course.

Hi-Fi Audio Performance

The depth-multiplex and dynamic companding systems, together with the relatively high tape/head speed, result in excellent VHS Hi-Fi sound performance. A signal-to-noise ratio approaching 80dB is achieved over a bandwidth of 20Hz to 20kHz by a typical VCR, with a distortion figure of less than one per cent and channel separation of greater than 55dB. Wow and flutter variations are virtually unmeasurable at less than 0·005 per cent. And there is no performance degradation in the LP mode.

All this is many orders better than the conventional longitudinal sound system. This is the upside of Hi-Fi audio. Now let's look at the downside.

Hi-Fi Sound Faults

Most VHS Hi-Fi sound reproduction problems are caused by poor signal recovery from the tape, either because the signal wasn't properly recorded in the first place or because of signal transfer problems in the playback process. As a result you'll seldom hear hissing or fading, and you certainly won't hear any sort of wow. Any amplitude flutter will be caused by threshold effects in the muting circuit.

When things do go wrong, the usual symptoms are crackling, buzz or intermittent or permanent dropout of one or both sound signals. If the audio FM carriers go missing for more than a second or so, the machine defaults to longitudinal 'lo-fi' mono sound.

One of the few exceptions to this, a rare one, is distortion in one or both channels, especially on sound peaks. This indicates that the FM carrier is running out of space as it were. If it occurs when the signal is being recorded, either the carrier frequency is wrong or the deviation is excessive. If the cause of the problem is a playback fault the relevant bandpass filter (1·4/1·8MHz) is suspect.

Distortion can be caused by a processing circuit fault, but this is unusual. Any imbalance in the left/right record/playback levels will be caused by an electrical fault – but ensure, during playback, that the problem is not just unbalance of any level indicators present. Unbalanced recorded signal levels should lead to a

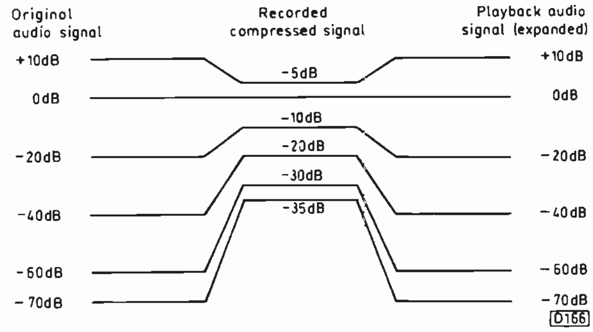
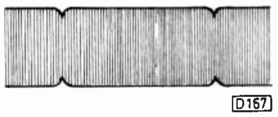


Fig. 2: The action of the compander used with rotary-head sound recording systems.



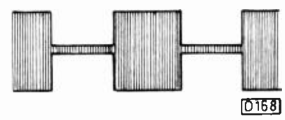


Fig. 3:(left) The rounded shoulders of this off-tape waveform can give rise to severe Hi-Fi sound crackling and dropouts.

Fig. 4:(right) Loss of signal from one of the audio heads produces an envelope waveform like this. The result is complete loss of the Hi-Fi sound.

check on the record deviation ranges, though adjustments for these are provided on older models only. Excessive deviation in one channel can, in addition to distorting its own playback, result in 'birdie' effects in the other channel.

Perhaps the most common Hi-Fi sound problem is poor reproduction (snap/crackle/buzz/dropout) of commercially-recorded tapes that customers buy or rent. The first thing to do is to try the effect of tracking control adjustment: if this fails to cure the trouble, the cause of the problem is the recording of the tape itself or a playback tape path fault.

Clean the drum heads and check the back tension. Then, while monitoring the off-tape signal envelope, align the drum entry and exit guides – for the flattest and 'meatiest' carrier signal. Do this ideally with the Hi-Fi sound carrier output of an alignment or test tape. It should work just as well when observing a test tape's video carrier signal however. If, with a known good recording, the sound and vision carriers peak at different points there's something wrong with the drum's factory-sealed head height settings. Fig. 3 shows an FM playback envelope that could have little effect on the video signal but may completely blow the audio one.

Some VCRs have a useful front-panel indication of Hi-Fi tracking in the form of a switch-selectable LED or fluorescent display. This shows the off-tape carrier amplitude: don't confuse it with the audio level indicators commonly provided for the left and right channels.

A buzz or hum effect with tapes recorded elsewhere may also be caused by an incorrect Hi-Fi head switching point – this will result in a gap or glitch in the off-tape carrier signal. Adjust the head switching point in accordance with the manufacturer's instructions. In some designs this is done by software: call up a service menu then manipulate front panel or remote control unit keys.

Close examination of the off-tape Hi-Fi FM envelope waveform, using an oscilloscope triggered by the head flip-flop (SW25) pulses, will reveal any head switching problems.

When a VCR is correctly aligned with respect to tape path and tension, its head switching point is correctly adjusted, and it can produce good audio with an alignment or similar tape, it should be able to cope with any properly recorded commercial cassette. Any tapes that give trouble once these conditions have been met are likely to be out-of-tolerance recordings. Get them back to the distributors and, hopefully, the duplicating houses!

Worn Heads

If a machine provides good Hi-Fi audio playback from an alignment or a known-good prerecorded tape but suffers, during playback of its own recordings, from the symptoms described above, the likelihood is that its heads are worn or faulty and that the upper drum is in need of replacement. Before condemning it however, check the tape's back-tension setting, the FM audio record current, and the luminance record current which, if excessive, can swamp the tape's audio carrier tracks.

If one head is not working (see Fig. 4) the result will be no Hi-Fi sound at all, with reversion to longitudinal (mono) playback sound.

In my experience head wear is the most common cause of sound problems with machines that are over five or six years old. Because its carrier frequency is higher, the right-hand channel may be affected first, spasmodically. Most service manuals quote an off-tape audio FM signal level that provides a useful indication of head wear.

Reducing the audio and/or luminance record current can sometimes temporarily restore the performance with a worn head, but the problem will return as the wear progresses. Thus drum replacement is the best course.

When a recording is out of specification, it may well be that a worn playback head cannot cope but a new one can.

A tape that will provide a useful guide to head wear is a commercially-recorded one with borderline Hi-Fi playback performance. I found such a tape by chance. It will play all right, just, with a good machine when the tracking bar graph is taken about three-quarters of the way up. With a worn or out-of-specification VCR the sound splatters or mutes. This is a useful and quick gauge: I don't even have to remove the machine's top cover!

Record Faults

Apart from the faults already described, a record-only fault that can cause borderline playback is insufficient audio carrier record current. There is no adjustment for this with most VCRs, but if you are lucky the service manual will provide a calibrated oscilloscope reading against which it can be checked.

Excessive audio FM record current has a greater effect on the picture than the playback sound: it can cause noise, patterning and interference effects.

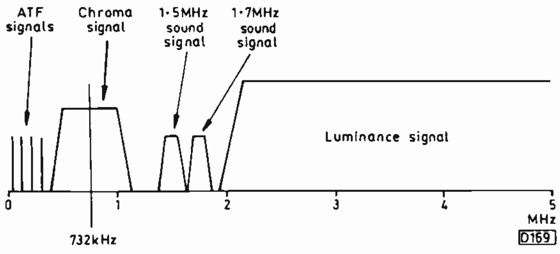


***Fig. 5:* Positions of the sound carriers in the signal spectrum recorded by the video heads in an 8mm camcorder or VCR.**

If a machine's recordings of Nicam transmissions are crackly or suffer from intermittent dropout be sure, by switching to mono FM sound reception or by careful monitoring in the E-E mode, that the cause is not a reception or Nicam decoder problem. The latter have been considered in previous issues of *Television*.

If you get a complaint about no sound recording with TV broadcasts, check whether any simulcast (SC) switch provided is correctly set.

Many reported recording faults with Hi-Fi-equipped camcorders are caused by their characteristics rather than the equipment. Possibilities are auto-level control and the pick up of wind, handling and motor noise, particularly under quiet conditions. Air currents can cause strange muting effects out of doors without necessarily being heard as 'wind noise'.

Playback Faults

Most of the troubles that affect playback only, i.e. the machine's recordings play back all right via other machines, have already been dealt with above. A very common one, caused by misuse, is a strange, distorted-echo and 'phasing' effect when the Hi-Fi/normal/mix switch has been left in the mix mode. In older machines this switch is mounted on the front panel. With newer ones switching is done via a remote-control key menu selection in software.

The only other odd playback-only faults we've encountered, both in older models, have been incorrect dropout compensation and incorrect Hi-Fi muting circuit operating level. The former gives rise to crackles and interference, while the latter results in reversion to longitudinal (mono) playback at points other than where the off-tape audio FM signal falls just below the threshold of the playback amplitude limiter.

Upper Drum Replacement

Hi-Fi head drums are more expensive than video-only ones and, especially with older models, need more care and time in setting up after replacement. The number of electrical presets in the Hi-Fi section of a machine can vary from six or more to none at all. Follow the manufacturer's instructions closely and, where necessary, convert RMS to peak-to-peak readings by multiplication by 2·828.

Correct tape path adjustment is critical for Hi-Fi operation. The tracking must be spot on. Because of the narrower tracks used when monitoring its off-tape audio carriers, a Hi-Fi alignment tape gives more precise adjustment than a standard alignment tape.

Take particular care, where provision is made for manual adjustment, in setting the head-switching point after drum replacement.

Electrical Faults

Electrical circuit faults are rare in comparison with 'physical' ones. Note that electrical modifications have been issued by manufacturers for various models, notably the Sony SLV625-825 and E7-80 ranges.

Incorrect audio levels or one channel missing will certainly be the result of an electrical fault, but the causes of such faults are not difficult to locate using a scope and multimeter, aided by the fact that with one working channel you have a complete check system that provides voltages and waveforms for comparison. In practice we've found that bandpass filters, connections/joints and electrolytic capacitors (in the sound or even the power supply section) are more likely to cause trouble than signal processing chips – these lead quiet lives.

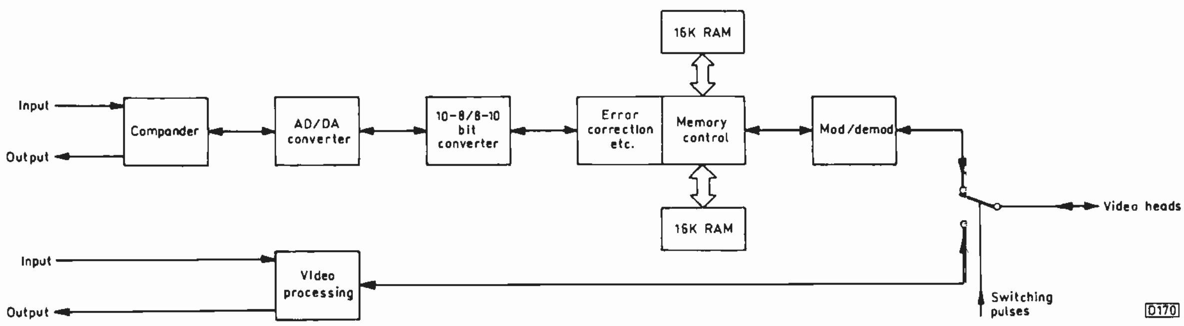


Fig. 6: Block diagram showing the basic arrangement of the PCM audio record/playback system used in some Video-8 equipment. The 8-10 and 10-8 bit conversion process is a selective one, similar to that used for Nicam sound.

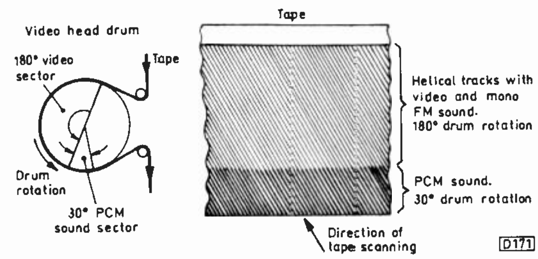


Fig. 7: The time-compressed PCM data is recorded as a 'forward extension' of the video tracks on the tape: an extra 30° of head rotation is reserved for this purpose.

Frequency-multiplex Audio System

So far we've considered only the depth-multiplex system used in VHS and S-VHS decks and camcorders. Video-8 equipment, in both low- and high-band form, uses a different arrangement, AFM (Audio Frequency Multiplex). The tape has only one signal layer, reducing the drum head count and helping no end with signal recovery, but the system doesn't perform quite as well as VHS Hi-Fi in terms of dynamic range, frequency response and signal-to-noise ratio.

The AFM system uses FM carriers and the same type of record/playback compander action previously described (see Fig. 2). The big difference is that the mono audio carrier, at 1·5MHz, is slotted into a gap in the video recording spectrum and is recorded/played back by the video head pair, see Fig. 5. The original plan provided only a mono carrier with a deviation/sideband spread of about 300kHz. A second carrier, for stereo use, was soon squeezed in at 1·7MHz however.

When servicing, the important thing to bear in mind is that the 1·5MHz carrier signal contains mono (L + R) information, for compatibility with mono equipment, while the 1·7MHz carrier signal contains difference (L – R) information. This is rather like the stereo subcarrier arrangement used with VHF-FM radio transmissions. Thus loss of the 1·5MHz off-tape signal mutes the sound completely (no fall-back longitudinal-mono track here) while loss of the 1·7MHz signal deletes the stereo effect, with reversion to mono sound. Loss of one signal with the AFM system is more likely to be the result of an electrical fault, possibly a filter, than a head/tape problem.

In fact AFM playback is for several reasons more reliable than depth-multiplex playback: there's no magnetic barrier for the off-tape sound signal to penetrate; the ATF system used provides better tracking; and there are few prerecorded tapes to cause trouble! Where they arise from tape/head signal transfer problems, most audio faults are accompanied by more obvious vision ones. The relatively low sound FM carrier recording level (18dB below the luminance level) makes sound recovery more difficult in borderline situations however, for example where the heads or tapes are worn.

As with VHS Hi-Fi the main factors in getting the sound right are to ensure that the heads are clean, not excessively worn, and correctly aligned to sweep across the narrow tape.

PCM Sound

Apart from the new Digivision camcorders, which are too new for servicing information to be available, PCM (Pulse Code Modulation) sound is currently obsolete in the consumer/domestic market. It was used with some Hi-8, high-end camcorders and deck machines a few years ago – and has been promised for years in domestic VHS machines without ever appearing! Because of its relative rarity, the technique does not justify much space here. So we'll do a quick nutshell job.

In its Video-8 form PCM recording involves sampling and quantising the L and R channel signals and storing the resulting data in 8-bit form in a 32K RAM, see Fig. 6. Once during each TV field – the time slot is 3msec (approximately 7:1 compression) – the L and R data is extracted from the memory and tone-modulated at 2·9MHz and 5·8MHz for recording on the tape as a 'helical extension' to each video track, as shown in Fig. 7. During playback the tones are converted back to binary data, time-stretched in the RAM, then D-A converted to form analogue L and R signals. The AFM recording system is used as well, for compatibility and back-up.

If a PCM machine reverts to AFM sound, either intermittently or permanently, the thing to do is to check the tape path and the off-tape carrier signal at the beginning of each head sweep, where the PCM sound signal is read off. As with all such problems, use a known-good tape, this time with a PCM recording. More often than not the cause of the trouble will be found here, with the usual tension, mechanical, alignment or head wear/pollution problems being responsible.

If the off-tape signal envelope looks good, and assuming that the picture and AFM sound are OK, the cause of the trouble will be faulty connections or defective filters etc. Such problems are quite rare. Ensure that the carrier tones reach the demodulator, and that the binary data from its slicers gets to the RAM. Also that the clock is running, and that the address and data lines are active.

As Fig. 6 shows, virtually all the signal processing circuitry is common to the record and playback modes. Thus most faults can be diagnosed during playback. Much of the digital circuitry is eliminated from the search when a fault is confined to record or playback operation.

We are going to have to become better acquainted with PCM systems in the near future, for vision as well as sound. ■

TELEVISION reader offer

30V, 5A power supply

For a limited period, Vann Draper is offering over **25% discount** on the 305 LDD – a bench power supply featuring digital display of both voltage and current. Normally, the 305 retails at £159 excluding VAT and delivery but it is available to *TV* readers filling in the coupon on the right at the 25% discount price of £139 – fully inclusive of VAT and delivery. Infinitely variable between 0 and 30V – with coarse and fine controls – and adjustable between 0 and 5A, the 305 LDD has a ripple figure of typically 10mV. Its load regulation is also excellent, at typically ±0.2%.

Accuracy of the supply's dual 3.5-digit liquid crystal displays is 0.1 decimal digit. The output can handle a continuous short-circuit, overloading at 5.5A ±0.5A. When the overload circuit is activated, it causes both audible and visual alarms, resettable via a push-button on the front panel.

Dimensions of the 305 LDD are 310 by 260 by 120mm and its weight is 5.5kg. Housed in a light-grey steel enclosure, the unit is built to comply with UL, CSA and TUV safety standards.

Features of the 305 LDD

0-30V fine and coarse adjustments
0-5A adjustable
10mV ripple
Digital displays for V and I
Continuous short circuit protection
±0.2% load regulation

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Satellite Notebook

Reports from Hugh Cocks and Christopher Nunn

Pace MSS100

This brand new receiver, straight from the box, failed to provide LNB polarisation change. When the LNB should have moved to the high-voltage horizontally-polarised channels it stayed stubbornly on the lower-voltage vertically-polarised ones.

A check on the voltage at the receiver's F socket, with no LNB connected and hence no load, showed that the 13/17V switching was OK. With an LNB connected however the voltage for horizontal polarisation dropped back to around 13V. The vertical-polarisation voltage remained virtually constant, independent of loading. A look at the circuit diagram showed that D10 provides a 20V supply which is fed via L4 to transistors Q1 and Q2. These adjust the LNB supply voltage. A separate 17V supply comes from D11.

This latter voltage was spot on, but the voltage at D10 was high at nearly 30V. Checks at both ends of L4 didn't produce readings anywhere near 30V. I found that there was a hairline crack in the print where D10 had been soldered to the PCB. A wire link between D10 and L4/C12 restored normal voltages and polarisation changeover.

Almost the entire switch-mode power supply is contained within IC U1, which is shown as type TOP200 in the circuit diagram but is a TOP202 in all the units I've seen. It runs at around 100kHz. When the TOP202 is unhappy for any reason the case seems to rupture, producing a loud noise. This happened recently (the noise didn't do much for my nerves!): replacing U1 and the 10Ω chip resistor R2 restored normal operation.

It may be a good idea to check that C3 (47μF, 400V), the reservoir capacitor for the mains bridge rectifier, is in good condition – the U1 may not take kindly to a varying HT supply.

I wonder what would happen if the 100kHz, modulated at 50/100Hz, reached the IF coaxial cable braid? If the cable acted as a long-wire transmitting aerial, the signal could be received at great distances!

The latest MSS100 receivers no longer suffer from low-sensitivity sound, as earlier ones did.

Intermittent remote control operation was a problem I had recently with a brand new MSS100. The remote control unit itself and manual receiver operation were OK. A slight tap on the case restored normal RC operation (of course!). Delving into the innards, I found that when the fault returned there was no 5V supply at the infra-red sensor IR700. This comes via a 100Ω, 0·25W resistor (R702), one end of which was making poor contact with the PCB.

There's a knack to removing the receiver's lid. Undo the fixing screw at the top rear of the case and the two at the bottom front (underneath). Insert a thin, flat-bladed tool (minimum blade width 6mm) in the left and then the right bottom slots at the front of the case, with the blade going between the grey and black areas right at the front of the slot (see Fig.1). Apply gentle force at each slot in turn and the two halves will come apart. The top can then be lifted up from the front: it's hinged at the rear by the two plastic lugs that are readily visible. You may be tempted to try and push in the lugs and pivot up from the front. If you do try this, as likely as not the lugs will break off. You have been warned! **H.C.**

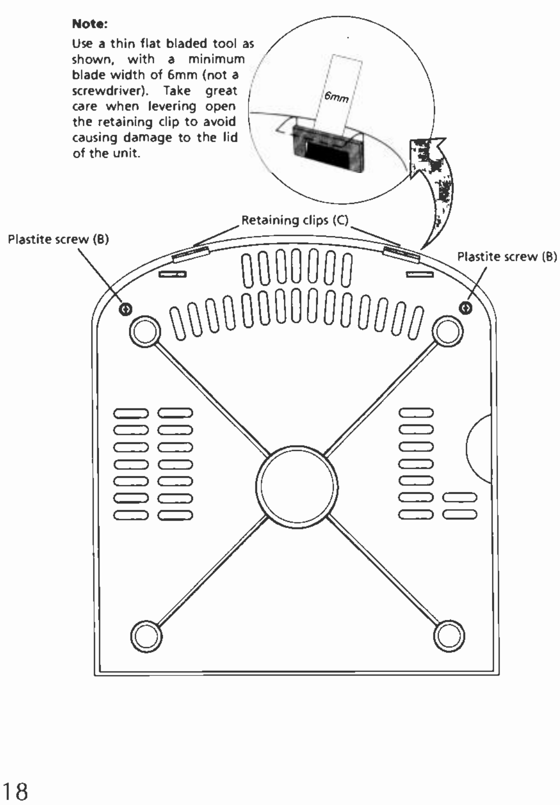

Fig.1: Case removal, Pace model MSS100.

Pace PRD900

The sound and picture produced by this receiver were OK, but it refused to unscramble signals and lacked on-screen messages to insert the card etc. The cause of the trouble was traced to coil L20. It measured OK, but had broken away from the flimsy print. **C.N.**

Amstrad SRD510

After replacing the usual open-circuit 47kΩ resistors and power supply capacitors I was left with sound and streaky white pictures. I dived for the usual cause, R80 (10kΩ). But this time I was wrong. The trouble was caused by a faulty mixer/booster unit, which is quite rare with these receivers. **C.N.**

Pace PRD800

This receiver's power supply worked but whistled very loudly. The cause of the trouble was C5, which was a 22μF, 16V electrolytic. Odd – my manual says the value is 4·7μF. I fitted a 22μF replacement, as found in the receiver. **C.N.**

Pace PRD900 Plus

The video output from the UHF modulator came and went intermittently, reception via the scart connectors being OK. When the PCB was removed from the case the fault became, naturally, more elusive. When it did occur, I found that there was no video at L30 inside the modulator module. The signal comes from R558 (75Ω) in the middle of the PCB. There was no video here either. A PCB disturbance check made the signal come and go. Repair consisted of a long wire from R558 to L30. **H.C.**

Cambridge LNBs

We've had quite a number of faulty Cambridge LNBs recently. The symptoms have been either no signals, very weak signals or signals of one polarisation poor, the others being OK. The problems have not been caused by water getting in, and the LNBs have been installed for anything from four weeks to nine months.

When signals of one polarisation are OK, the others being poor (coming and going), the trouble seems to be caused by breakthrough of signals of the unwanted polarisation. This can be demonstrated here with Sky News, as we have no opposite polarisation signals from Astra 1A. Sky News is received with vertical polarisation: if you switch to horizontal polarisation with a faulty LNB, Sky News appears with varying strength. The effect with wanted horizontally polarised signals is varying sparklies.

Older Cambridge LNBs (prior to 1995) seem to be OK, the troublesome LNBs being the Juno II AE6 type. Very strange. **H.C.**

Mobile Phone Interference

A satellite IF distribution system that we installed in an apartment block a few years ago started to suffer from problems caused by a GSM digital mobile phone transmitter. This has been installed recently, at very close range. Interference was getting into the IF line amplifiers. As a result, RTL-5, UK Living and ZDF all exhibited radar-line type interference to some extent, varying when the cables and line amplifiers were moved.

The problem was resolved by moving the dish to a site atop the building farther away from the GSM transmitter (the distance was originally 30m) and installing the line amplifiers in metal enclosures. GSM transmitters seem to have very high peak powers. This one can be resolved at a distance of five miles using a scanner with no aerial connected. **H.C.**

Astra 1D Problem

We've recently encountered two cases of 'reverse' Astra 1D interference when using an older type 10GHz LNB. The problem is caused by a semi-local UHF transmitter. With Superchannel at an IF of around 730MHz, the picture had a moiré-type beat pattern. Increasing the receiver frequency by 2MHz or so removed the problem, Superchannel being strong enough not to go into white sparklies with this frequency change.

The transmitter concerned uses ch. 53, i.e. around 730MHz. The quality of the coaxial cable was good, and the receivers involved were Pace MSS100s. Probably the IF drive from the old LNB was dropping off. Problems could no doubt be expected at up to 10,847MHz (ch. 68 is 847MHz), but in practice the IF level will by this point be increasing in comparison with the lower channel, so less interference is likely. In a stubborn case the answer would be to use a 9·75GHz type LNB, which would shift the IF out of the UHF band. **H.C.** ■

What a life

Satellite dealers, James' first TV repair, chip resistance tables – all in a day's work for Donald Bullock

The long road that stretches down the east coast of Spain is dotted with satellite TV dealers. They seem to be mainly German or English owned and are generally unpretentious places with little by way of a showroom. You often enter to find a simple counter, a few repaired TV sets and satellite receivers in the middle of the floor, and a sign advertising sound conversions at quite reasonable rates. One or two sets will be showing a very good picture.

The dealers themselves are an assorted bunch, always casually dressed. They are usually quite informal and are happy to sit soaking up the sun that floods through their windows, occasionally sipping at the yellow brew that passes for beer in these parts.

I've got to know one or two of the British ones. They reckon to be just getting by, and are happy enough with that. For most installations they use an 80cm or 1m dish with an 0·8dB LNB.

Competition

Smaller dishes can be seen as you drive about. I assume that they are for reception of transmissions with a narrow footprint. While flicking through the channels the other day, I was struck by the vast number and great variety of non-scrambled programmes of German or similar sounding origin. This made me wonder why most British-language satellite transmissions are of Murdoch origin, and how it is that the Germans (amongst others) manage to finance and produce so many channels without the need for scrambling.

Since Mr Murdoch went over to his latest card technology, dealers here can only make promises when approached for pirate cards. This means that unless people are prepared to fork out something like £300 for the privilege of watching rather banal commercial programmes, a proposition that would have seemed to be a non-starter to me, they have only Sky News – which, to give it its due, could be worse – and the TNT film channel. I wonder how long it will be before Mr Murdoch sees some proper British competition?

Senor, you wanna buy a video or maybe discuss some football, eh?!

First Steps

I go to Spain to write in peace, but it never happens that way. The word has got about that we are the local Mr Fixits, and items keep being brought along. Fortunately son James, who is now fifteen, can step in and work with little help.

The other day someone brought us a 14in. Spanish colour set, a First Line 1433GR. It had a Toshiba tube and a Toshiba look, but I couldn't place it – and we had no circuit diagram. James reported that it was dead, and that the chassis looked sweet and innocent.

"Appearances can be deceptive" I said, glancing at Greeneyes. "Mark the setting of the first anode potentiometer on the line output transformer, then advance it gingerly to see if a bright line appears across the screen. If it does, this will indicate that the cause of the trouble is field collapse." Shortly afterwards James announced that there was indeed field collapse.

"Is there sound?" I asked. "If there isn't, the cause of the problem could be a power supply that's used by both the audio circuit and the field timebase. The correct course of action would be to check any 18-20V lines. If the sound is all right, we have to concentrate on the field timebase."

The sound was all right. "How do I find that field timebase?" he asked.

"Look at the scan coils on the neck of the tube" I replied. "They consist of a pair of line drive windings and a pair of field drive windings. The line windings work hardest, so they are wound on the inside, closest to the tube. They will also have the fattest connecting leads, which will trail off towards the line output transformer. Follow the other pair. They will take you to the field output stage. This could be based on a pair of flat transistors on heatsinks or a flat i.c., again on a heatsink.

James reported that the pair of field output transistors, a 2SC2073 and a 2SA940, tested perfectly out of circuit and that their 20V supply was present and correct.

"Check nearby transistors" I said. "Something has to generate a waveform to drive the output transistors."

He found a 2SA1013 transistor that was dead short-circuit and started to get excited. After lots of searching he discovered a transistor with similar characteristics and fitted it. He then switched on, expectantly. Still no field scanning. His face fell.

"We're winning" I said. "That transistor needs 12V or so to make it work. Is this supply present?"

It wasn't. "Now check the resistors in its collector circuit. Check back until you find the missing 12V."

He did. "R256" he said, "it's colour coded 33Ω and has over 12V at one side, nothing at the other. But it looks all right."

"Looks can be deceptive" I said, as

Greeneyes brought us some tea. She stiffened slightly and gave me a look.

"It's open-circuit" James cried, holding the resistor across our meter. He replaced it in no time and switched on. It started to burn.

"Finger on the new transistor" I barked. It was cold. "Switch off and measure the resistance between your new resistor and chassis, both ways round. He got two dead short-circuit readings.

"Something on that line is shorting it to chassis" I said, "check for it."

The cause of the trouble turned out to be a 12V zener diode which was dead short both ways. When he fitted a replacement and switched on the field scan came up. After resetting the first anode potentiometer there was a perfect picture.

"Congratulations Jim" I said, "you've just done your first TV set repair!"

Parts Problems

Obtaining spares for products that are Spanish or made for distribution in Spain can be tricky. They won't have been heard of in the UK, and it's difficult to know where to start. But some of the advertisers in *Television* are particularly helpful.

We recently needed an on-off switch for a Kneissel TV set and some belts for VCRs that were unknown in the UK. We did a careful drawing of the switch and wrote a note outlining our belt problem and faxed these to JJ Components. Shortly after the machine had grunted to a halt Jay Popat phoned us to say that the switch would be in the post that day, also a handful of various belts. As always with this firm, it all happened. When the package arrived here a few days later we were able to complete our repairs.

Jay also sent us his latest catalogue, which is in A4 format, has a colour cover and runs to 125 pages. The layout is excellent, and Jay commented "I cannot tell you how much midnight oil its production cost me".

Some Toshibas

The gate clanged the other day and Senor Edgie ran into the drive, carrying a Toshiba colour set. "I shall hit him" he cried. "I will. . . and when I do. . ."

"What's up?" I asked, "hit who?"

It seemed that Grasperos had quoted him £60 deposit to look at his set and told him that it could take a year to obtain the spares required. He left the set with us, still foaming like a bull.

It was a 215R8B whose problem was field collapse. Being familiar with the set we checked plug P570's sockets on the main panel. It provides the scan coil connections and as usual was an oasis of dry-joints. Easy enough and, fearful of a clout from Senor Edgie, we priced it at a tenner.

He was all smiles when he came to collect it. Then Senor Loper sprang in with another Toshiba set – slightly different model number, but the same chassis.

"Dead" said Senor Loper. "Yesterday the cat died. Now this. These things come in threes."

"Better do the set quick" I said to James.

F801, the 2A mains fuse that lives on a little subpanel with the switch, was open-circuit. So we checked the R2M over-voltage avalanche diode D808 which was short-circuit. The 6·2Ω surge limiter resistor R801 would also have failed, wouldn't it? The bin clanged again.

We looked at the STRD4420 chopper chip Q801, but this seems to be a pretty rugged device. So we replaced the items we'd found to be faulty and started the set up with a variac. There was a flash and the 2A fuse and D808 said goodbye.

We took out the chip and checked it against the figures in our notebook, where amongst other things we keep a pin resistance table for this i.c. The readings didn't tie up. As it was clearly defective we fitted a replacement, then started up again via the variac. When the input reached 100V the set sprang to life, bringing smiles to our miserable faces. The picture was excellent.

An Hitachi CPT2578

Our next caller brought along a dead Hitachi CPT2578. It's fitted with the G8Q chassis – the one with the odd power supply that uses two chopper transistors. On test the set didn't even make it to standby. There was HT at the output from the mains bridge rectifier but nothing more. The start-up circuit contains a thermistor, TH902, that's given us trouble on previous occasions. We went straight to it and found that it was open-circuit. A replacement restored the set to life.

An Amstrad WP Monitor

The Amstrad PCW8512 wordprocessor monitor we were presented with suffered from field collapse. Most of the field timebase circuitry is contained within an LA1385 chip, and we didn't have one to hand. Again out little book came in handy. We turned to the appropriate page and read off the resistance readings for a good LA1385. These are shown in the accompanying table, measured using our meter's 20kΩ range.

The letter R indicates the pin to which the meter's red probe is connected: connect the black probe to the other pins in sequence. Where no reading is shown, it should be above 20kΩ. We found that the chip in question was full of shorts. Field scanning was restored after ordering and fitting a new one.

It takes only a minute or two to chart the readings for a good chip, with one of you taking the measurements while the other jots down the readings. The resulting table will save on diagnostic time and can avoid the dreaded business of ordering an expensive chip you find you don't need. With VCR signal processing chips, creating such charts can be positively therapeutic! ■

LA1385 resistance table

Pin	1	2	3	4	5	6	7	8	9	10
1	R								1·44	
2		R	0·38					13·3		
3		0·38	R					13·7		
4				R						
5					R					
6						R				
7							R			
8		1·33	1·37					R		
9	1·44								R	
10										R

Connect the meter's red probe to the pin shown as R and the black probe to the other pins in sequence. A blank space in the table above shows that the reading should exceed 20kΩ. Measurements carried out using the meter's 20kΩ range.

Tables like this can be easily drawn up with a known good chip and will save diagnostic time with suspect chips.

VCR CLINIC

Reports from Eugene Trundle Philip Blundell AMIEEIE Simon Bodgett John Coombes Brian Storm Gerald Smith Mike Leach Robert Marshall Stephen Leatherbarrow Terry Lamoon Michael Maurice Keith Evans

Daewoo V415 etc

Tuning drift is an increasigly common fault with this series of models. While other things can be responsible, the usual cause lies with the three 100nF capacitors C140/1/2 in the tuning voltage integrator/filter circuit. **E.T.**

Finlux VR2030/Philips

If there is no tacho feedback from the capstan FG to the control system the machine will shut down almost instantaneously. This particular VCR would accept and load a cassette but then ejected it as soon as any deck function was selected. Checks showed that there was no +11a supply to the tacho amplifier on the deck because the decoupling capacitor C2206, at the front of the main PCB, was short-circuit. **E.T.**

Panasonic NVG25

The customer may not be aware of this fault unless the machine is, for any reason, disconnected from the mains supply – it generally crops up when the machine is on the repair bench for attention to some other fault. The symptom is complete lack of action, the cause being a dried-up kick-start capacitor in the power supply. Look for C1109 (1μF, 400V). **E.T.**

GoldStar GHV1296PQ

The playback picture would sometimes roll vertically because of poor head/tape contact at the start of the drum wrap. We found that the back-tension lever was not always moving fully to the left, because of a faulty mode switch. It's much easier to replace than with many other types of VCR. **E.T.**

Hitachi VTM822/922 etc

We've had three of these machines in recently with front-loading problems. The trouble starts during eject, when the cassette may jam when half way up or collide with the back of the still closed cassette flap.

The cause is a loose metal side plate at the right of the FL assembly. It's labelled the 'RHS bracket gear 411' in the parts diagram. What happens is that the platic claws that should retain it become fatigued and bent. One cure is to replace bracket 403, but I fit a suitable (that's important!) self-tapping screw into the hollow end of FL shaft assembly 424 – in the hole marked F in the drawing of bracket 411. I then wedge the plastic clickers back into position, and warm the plate with a hairdryer to set them properly. Remove the wedges only when everything has fully cooled (leave the self-tapping screw in place). **E.T.**

Hitachi VTM720

For low take-up torque (should be 80-170g) check the clutch base assembly for wear. The gear train in the assembly can become stiff because of wear under the take-up gear. **P.B.**

JVC HRJ420

This fault note could apply to other models. The problem was intermittent E-E picture blanking/video recording, playback of a known good tape being OK. A scope check showed that in the E-E mode there was a healthy input at pin 62 of the video processor chip IC201, and that it didn't drop out. The output at pin 64 was being disrupted intermittently however, with compressed sync pulses, or half the signal or no signal. What do you do – replace IC201? Wrong!

The signal is probably being disrupted because Q207/212 in the following stage are being switched on by control line 'P. mute', which is going low at random. Having discovered this, some people have changed the microcontroller chip since there are no other obvious problems. But problems there are! One of its input lines, 'sync. det.', is instructing the micro to mute the picture.

The guilty components have been found to be the sync ringing coil T901 and/or the IF module. There should be a distorted sinewave of at least 4V peak-to-peak amplitude at C905, otherwise Q905 will remain off and 'P. mute' is then on. If the sinewave is of lower amplitude and the positive potential above earth is varying by less than 3V, check Q904's input signal.

Another culprit is IF unit TNR2. The 'sync sep' output should be at a DC level of almost 9V, with a 3V negative-going triangular waveform on it. If there is any video signal content here, the IF unit is faulty.

Follow this advice and save JVC the cost of video processing and microcontroller chips. **S.B.**

GoldStar RF900i

These machins have a fully-enclosed chopper power supply which is therefore inclined to heat up. Failure of the chopper transistor can be caused by a 1μF, 50V electrolytic drying up and thus going low in value. The best way to tackle this is to replace the transistor, the control chip, rectifier, fusible resistor and the two electrolytics in the feedback supplies around the optocoupler. **S.B.**

Ferguson FV62

This machine wouldn't accept tapes. The cause was simply dust in the timing slots at the bottom of the drum assembly. A thorough clean restored normal operation. **J.C.**

Toshiba V110B

When the mains supply was switched on this machine went into the stop mode. After a lot of tests we discovered that replacing the end and supply sensors restored normal operation. **J.C.**

Akai VSF33

The complaint with this machine was that the tape stuck. When we checked it we found that the tape was sticking in the cassette housing. A replacement damper arm restored normal operation. **J.C.**

Panasonic NVJ30

When this machine was switched on from cold the top half of the E-E picture would show bad distortion. The distortion would gradually decrease until, a few minutes later, the picture was fine. As with all such ephemeral faults, it took many days of soak bench testing to find the culprit, which turned out to be C768. This 10μF capacitor decouples the 12V supply on the demodulator board. **B.S.**

Panasonic NVHD90

Reception was consistently disturbed by a 'glitch' – a transient flash that muted the sound momentarily and made the stereo indicator flicker. Since this looked a bit like tuner flashing we tried fitting a replacement. The glitch returned almost immediately. After much scoping and measuring we traced the cause of the fault to C1130, a leaky 1,000pF ceramic capacitor in the power supply. A replacement restored the tranquility of the 12V supply. **B.S.**

Panasonic NVSD25

This machine played back all right but any attempt to cue forwards or backwards would result in loss of line lock as the machine tried to default to the NTSC mode. A number of defects, e.g. worn video heads, poor tape path alignment, incorrect back tension etc., can cause this problem. In this case the cause turned out to be the capstan motor's top bearing, which was almost seized because of a build up of dirt. Once the capstan spindle and bearing had been cleaned and lubricated line lock was maintained in all modes. **B.S.**

Panasonic NVF55

There was no normal sound or Nicam sound in the E-E mode. After making a few voltage checks we found that the audio defeat line to the Nicam pack was permanently high. The audio defeat line is produced by the M66006FP chip IC7001. A replacement removed the silence. **B.S.**

Panasonic NVL20

Because the VL and VU lines were wrong we were unable to tune in any channels. These two signals are set by the front panel microcontroller chip IC7501, determining the tuning bands. A replacement M37422V4AF microcontroller chip produced the correct band. **B.S.**

Panasonic NVJ45

There was an unusual complaint with this machine. When the record mode was selected, some channels on the TV set were affected by heavy diagonal patterning. On a hunch we checked the luminance and chrominance pack carefully for ageing capacitors. Sure enough when C831 (4·7μF) had been turfed out and a replacement fitted the problem had gone. **B.S.**

Nokia VR3784

This machine had faulty hi-fi sound, the left channel output being very low - in fact virtually missing. Checks carried out around the AN3961NFBP-A hi-fi processing chip IC231 showed that the input side was OK but the left channel output was very low. Replacing this chip cured the fault. **G.S.**

Samsung VIK316

This machine was completely dead, with no functions whatsoever. Checks in the power supply revealed that the always 5·8V supply at pin 6 of connector CN02 was missing. The rectifier diode in this supply (D34) was OK, but its 470μF, 16V reservoir capacitor C35 had dried up.

When a replacement had been fitted the machine sprang to life, but the display was rather dimly lit. The cause of this was another dried up capacitor, this time C38 (100μF, 10V). **M.L.**

Akai VSF310

This machine wouldn't front load a tape. All the usual checks were carried out: the mechanism timing was checked and a new mode select switch was fitted, all to no avail. I have to admit that it took a lot of investigation before the cause of the fault was found – a dry-joint on the machine's bottom board.

Although the machine wouldn't front load, if a tape was wound in by hand to the stop position all functions would work. In the end I assumed that an end sensor problem had to be the cause of my woes. The dry-joint was where the leads from the left-hand end sensor join the panel, near the mode switch. It couldn't be seen with the naked eye.

Basically, the logic levels at the microcontroller chip weren't quite right when a tape was pushed into the housing. This is what led me to the end sensors. It's one that I would rather forget! **M.L.**

Samsung VI710

The display produced random flashes and there were no other functions. When one of these machines comes in with the no operation symptom you can usually bet that the STK5333 regulator chip is faulty. On this occasion it was OK, the cause of the rather unusual symptom being the 3,300μF, 16V smoothing capacitor C103. **M.L.**

Matsui VX2500

No picture was the complaint with this machine. When attempts to clean the video heads didn't help we found that there was no drum servo lock. This was put right by replacing IC2001 (OEC6014B).

With the machine running on its side the drum assembly made a noise. We found that the collar under the dome-shaped flywheel was coming loose. If this collar is not in the correct position relative to the video heads the flywheel, which contains the magnet for the PG head to detect, will also be incorrectly positioned. As a result only a part of the picture will be seen on the screen, the rest of the display consisting of noise. **R.M.**

Ferguson FV31R

Although this VCR was dead the fuse was OK and so were all the transistors in the power supply. The start-up oscillator signal could be seen at the junction of RP28/29 but not at the base of TP28. The diodes were all OK except for one – DP16 was very leaky! Incidentally, never leave the base of TP28 disconnected when power is applied. **R.M.**

Ferguson FV41

The complaint was rolling pictures with some tapes. A look at the FM waveform at BF14/6 revealed all – the switching points were incorrect. Adjustment does not involve presets and an oscilloscope with these machines. You simply play back an alignment tape and press and hold 0 and 8 simultaneously. Then, after about two seconds, press stop. This completes the alignment. A tweak on the left-hand guide to straighten up the FM waveform completed the 'repair'. **S.L.**

Mitsubishi HSM Series

We still get a lot of these machines with a cracked plastic capstan motor belt pulley. The pulley and belt jump off the motor, with obvious results. A quick cure, with which we've had a 100 per cent success rate, is to use a pulley from a JVC HRD series motor. It's a perfect fit and the replacement takes just a few minutes. **S.L.**

Ferguson FV11R/JVC HRD170

The cause of a recent case of intermittent signals proved to be extremely difficult to track down at component level, because of its irritating habit of clearing itself as soon as fault finding commenced. Tuning seemed to be normal when the fault was present, with ch. 55 (our local BBC-1) appearing on cue during search tune. But no signals were evident, because there was no output from the BC182 transistor TR15. The input to its base comes from IC4 (TD6359N), which receives data for tuning etc. from the front panel.

After an extended period of testing, TR15's emitter capacitor succumbed to an attack with freezer. It's a 22nF disc capacitor – but the value had fallen to about 3-4nF. **S.L.**

Mitsubishi HSMS9

This machine was completely dead – there was not even a clock display. With the ever-increasing use of switch-mode power supplies in VCRs we were not surprised to find one here. A recent cold spell led me to suspect the electrolytics in the primary side of the supply. I was quickly rewarded: C912 (220μF, 16V) had gone low in value. It seemed as well to replace the other two electrolytics on the primary side of the circuit, C906 (2·2μF, 200V) and C911 (100μF, 50V). **S.L.**

Amstrad VCR4600

Sound warble was the complaint with this dual-speed machine, the symptom being more apparent in the LP mode. A previous engineer had replaced the capstan motor, the belts, the pinch roller and the capstan drive chip.

A check showed that the capstan control waveform at TP22 was incorrect, with a couple of extra negative-going pulses present. These drifted and, when coincident with the control pulse, reduced its effective amplitude. The capstan control loop then failed. We eventually found that the extra pulses were being produced by the BA718 dual op-amp chip IC302. **S.L.**

Matsui VP9501OP

This machine came in with mechanical problems such as not loading correctly. Someone had already fitted the usual replacement mode switch. I checked the alignment, which was OK underneath. When I inspected the top area however I noticed that the idler lever was disengaged from the idler wheel. The machine worked correctly when this item had been put back in its correct position. **T.L.**

Philips VR712

There was no front display although all the functions worked. The display was receiving data and its main LT supply was present, but there was no heater voltage. When I traced the source of this back to the power supply I found an open-circuit Wickman fuse, 1216. A replacement restored the display. **T.L.**

Matsui VP9401 etc

A warning about this and similar models: when you put the deck back into position after replacing the mode switch, make sure that you do not crush the central LED tower as you can short the two unprotected leads together, causing strange mechanical symptoms. It's easy to do this, not so easy to find the cause of the resultant faults. **T.L.**

Sanyo VHR390

Whatever function was selected, the tape would stop after a few seconds. This can be caused by dirt on the take-up spool or its sensor, or a faulty sensor. The first thing to do is to remove the take-up spool and examine the black and silver sectors. Check whether the black sectors are really black. If in doubt, replace the take-up spool and sensor.

When cleaning the spool use a clean, dry cloth. Don't apply much pressure, otherwise the black paint will come off. **M.M.**

Ferguson FV33H

This VCR was dead. When it was switched on at the mains, a small arc could be seen near the chopper transistor's heatsink. We cured the problem by cutting the track near the heatsink lug and replacing it with a small length of insulated wire. **M.M.**

Ferguson FV80L

I'm not sure how this machine, which came from another dealer, came to be so badly misaligned. The carriage was in the eject position, the pinch roller was approximately 3mm from the capstan shaft and the guides were a quarter of the way into their travel! Fortunately nothing was broken or damaged and deck realignment put matters right. **M.M.**

Fisher FVHP716

This machine would occasionally drop into the timer mode and refuse to come out. During our investigation, the LT fuse F902 failed for no apparent reason – but maybe this was a clue. When the fault finally reappeared, the LT voltages were all very low. The main 22V feed to the power chip had dropped to just 9V. On checking back to the transformer we found that there was a dry-joint at connector PV903, which links the 18V AC supply to the regulator board. **K.E.**

Sanyo VHR291

This hi-fi stereo machine would occasionally fail to eject the cassette. The problem could usually be cured by briefly disconnecting the mains power, thus resetting the microcontroller chip. This didn't always work however, and was causing the user some frustration. This not uncommon symptom pointed to our old friend the mode select switch. But beware! It's buried under the loading motor block. Thus a service manual is almost essential, to be able to reset the timing marks on the cam gears and sprockets.

It's worth checking the condition of the loading motor belt while the loading block is out and you have easy access to it. **K.E.**

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LETTERS

PCs and Mobile Phones

After reading your April leader I would like to make a few comments on the PC scene, also a suggestion about something that could well turn out to be a nice little earner for the brown goods workshop.

Until recently computers, including PCs, were the only items of domestic equipment I serviced. Two factors have queered the computer repair pitch. First, older machines such as the Spectrum and Commodore 64 have long since fallen into disfavour. It is well nigh impossible to obtain the ASICs (Application Specific ICs) used in Amiga machines since Commodore went bust. Dealers who have any Amiga spares naturally hang on to them for their own use. When it comes to games, apart from very simple faults it's impossible to fix Nintendo and Sega games consoles as the importers won't supply spares.

The second factor that affects the PC repair business is the modular construction of the PCs and the low cost of the boards. Even when you have access to spares and service information, the repair of plug-in adaptor boards is not an economic proposition. For example CPC lists a multi I/O board for a little over £7 plus the dreaded VAT. Just one of the two 8256 UART chips used in this board costs £8.25 (plus VAT) from Farnell. Catch my drift? What about motherboard failure? I've seen brand new 486 motherboards on offer at under £50 complete with processor and warranty. At this rate it's not worth attempting to fix the old one. In fact the major expensive item in the latest Pentium machines is the processor chip itself – unless I'm very much mistaken, you won't get much change from half a grand!

In the event of switch-mode power supply failure, a new one will set you back only around £30 with a year's warranty. Floppy disc drives are so cheap that they are disposable. Hard discs are rapidly going the same way. In passing if, like me, you use a PC for work, it's quite likely that your software and work are worth more than the machine itself. So make regular backups of the contents of your hard disc on floppy discs or tape streamer and store them in a safe place.

The modular construction of PCs means that even users with limited technical knowledge can repair and upgrade their own machines – it's literally a matter of swopping panels. As long as the sick machine can load DOS and produce a display, there's plenty of diagnostic software that will tell you exactly what is wrong with it. Dead PC? No problem! Check that the power supply is working then plug a diagnostic card into a spare card slot. It's surprising how many faults are caused simply by grubby edge connectors and loose cards or SIMMs. Accessories like CD-ROMs and sound cards are advertised as being "plug in and play" devices. Any schoolboy can fit and configure them.

This leaves the monitor and printer as perhaps the only parts of a PC system that are worth repairing. But with new VGA displays now costing little more than £100, even monitors may shortly come to be regarded as disposable. The only area that may still offer technicians future scope is system building. This requires software skills, most of which you have to pick up on the way – especially when installing and configuring networks such as Ethernet.

Lack of memory is easy to deal with – if you can, just ditch Windows! It ties up a lot of RAM that your application software could othewise use. I own two PCs, an elderly Tandon 286 that I was given and an Elonex 386 laptop that set me back £100 – the previous owner suspected that the lead/acid battery pack was on its way out, and I wanted a portable machine so that I could work out-of-doors in the summer! The Tandon's memory is a mere 1Mb, while the Elonex PC has 2Mb. Yet in addition to a wordprocessor package I use a full Autodesk CAD package together with No. 1 System's excellent PCB design and circuit simulation software. All these are DOS programs, and I've never run out of memory while using either machine. I suspect that I may not be the only PC user who finds the DOS command line far easier to use than Windows. Software writers please note: there are still plenty of us DOS dinosaurs out here!

Oops, I nearly forgot that potential nice little earner! One area of consumer electronics is very much in the bandwaggon mode at present: the mobile phone. While jobs such as reprogramming or repairing and lining up the RF sections call for test gear that's not usually found in the average brown goods workshop, much cellphone repair work just involves the replacement of broken aerials, keypads and case parts.

Don't forget that the purchase price (typically £300 or so) of the "£10" phone is heavily subsidised by the air-time provider. So you won't get a replacement on the same terms. Break your phone and you may have to pay the full replacement cost. This makes repair of the old one very much an economic proposition.

All that's needed is for at least one of the trade suppliers to start stocking, or at least offering to obtain, cellular phone spares. This shouldn't be a problem, as most of the mobiles in use in this country carry familiar brown goods brand names or come from the well-known radiocom specialist Motorola. Meanwhile, pattern cellular accessories such as batteries and chargers, car aerials and leather cases are already available from CPC amongst others. To stock these could well bring you extra custom from mobile phone users, who are quite likely to return

when their TV sets and VCRs need to go into dry dock.
Peter Roberts,
Runcorn, Cheshire.

Comments

The following are intended as constructive comments on some of the points raised in the April issue.

Mature markets (page 395): The private car market is also mature, but until over capacity developed recently profits were high at all stages in the distribution chain. The low profitability in the brown goods market in the UK, compared with say Germany, is the result of the low price/low margin policies adopted by the industry's leaders twenty or thirty years ago. The hi-fi sector has found a way out – sell mystique and snake oil. Unfortunately, this probably won't work with tellies and videos.

Interference from CFLs (page 398): This is interesting information. Is Dave Lauder aware of the move to allow some types of energy-saving lamps rather high emission levels (compared to present limits) at around 2·3MHz?

Test Case 400 (pages 411 and 437): The video enhancer might have been mentioned. Although some of these give quite dire results, others are reasonably effective in 'restoring' what's been lost through previous processing.

Electrolytic problems (page 415): It's unlikely that a change in value from 100μF to 70μF would cause quite such drastic symptoms. If the capacitors concerned are at the input side of the regulators, and are in fact the rectifier reservoir capacitors, the DC voltage produced should vary little with decreased capacitance until, at a sufficiently low level (depending on the circuit being supplied), there is a sudden drop from approximately the peak value of the AC input to approximately (full-wave rectification assumed) the average rectified value of $2/\pi$ times the peak value, which is about 0·64 times. It seems more likely that the leakage resistance was varying, though this normally falls with increased temperature. This isn't the first time that such an effect has been attributed to a relatively small capacitance decrease in you pages, and could mislead inexperienced readers.

Small changes in the value of coupling, timing and tuning capacitors can have a large effect of course, but 100μF capacitors are not common in such positions. Even when used as speaker coupling capacitors, a 30 per cent value change will produce effects that only the golden-eared could detect. The following 'yet another' case supports this – a very faint hum bar caused by a fifty per cent fall in capacitance value.

Jitter cancellation (VCR signal processing, pages 434-6): This very good series came slightly unstuck in Figs. 1 and 3 and the mathematics department. A true phase-retard block introduces a phase shift, not a frequency change; and you can't add frequencies and phase angles. I sympathise with the wish to keep things simple: we don't want to bring in animals like cos *wt*, but since half a step was taken by introducing the phase error as the differential dØ perhaps we could take the whole step and add to the frequencies 'the rate of change of the phase error', dØ/dt, which *is* a frequency. I mention this only because the better trainees will be more mystified than the weaker ones by the lack of rigour.

Interference (page 449): The EMC Directive, which is what Geoff Darby refers to in his second paragraph, does not apply to 'radio amateur apparatus not commercially available'. If your home-built gear causes interference, the licence regulations and/or the remaining parts of the Wireless Telegraphy Acts can be used to stop it. You would be 'advised' before being prosecuted however.
John Woodgate,
Rayleigh, Essex.

Next Month

June issue – on sale May 15th

Inside the Pace MSS1000
Start of a new series in which J. LeJeune takes us on a guided tour of the technology in this satellite receiver. Good reading to gain insight into satellite receiver design and prepare for any fault finding that may be required.

Servicing the Hitachi VTM720/722
John Coombes summarises the fault conditions he has experienced with these VCRs to help you sort out any difficulties you may have with them.

Line Output Check Power Supply
This cunning but simple power supply was devised by Ian Rees to enable the operation of the line output stage in a dead set to be assessed. It can save you a lot of time when preparing estimates and making initial checks.

Monitor Fault Reports
In response to many requests, further fault-finding notes from our computer monitor experts.

Starting a TV/video Repair Business
So you think you can go it alone? Many succeed despite the trade's poor reputation. The most important thing is to be aware of the likely problems and how to deal with them. Advice from John Pitt-Francis, who has made a success of Otter Vision.

Plus all the regular features

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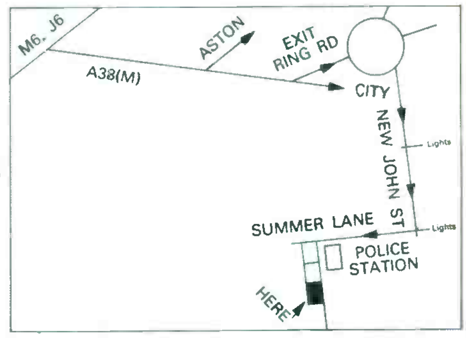

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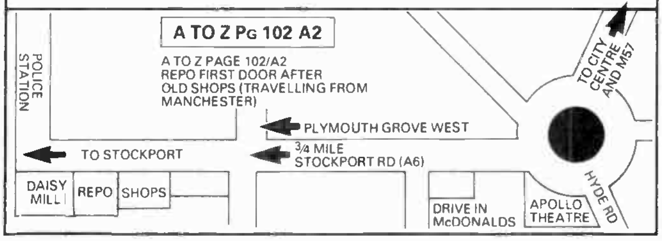

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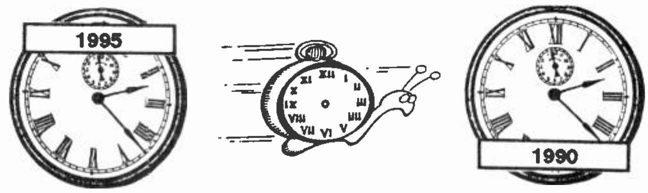

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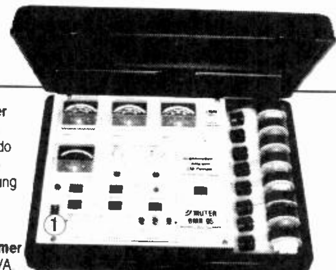

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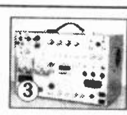

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5827-02-51
5827-03-51
5828-04-10
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24V OUT
9 AMPS

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BU207	£1.00
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BU208D	90p
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BU326	£1.00
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BU508AF	£1.00
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