NOVEMBER 1992 £2·20

TELEVISION

SERVICING·VIDEO·SATELLITE·DEVELOPMENTS

TWO FREE CATALOGUES

Satellite TV Installation Guide
VHS Deck Alignment •Camcorner
DX-TV •Service Briefs – Philips
Ceramic Resonators •DCC Audio
VCR Clinic •TV Fault Finding

A REED BUSINESS PUBLICATION

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● LNB's ● CABLES AND CONNECTORS
● SCART LEADS ● RF AND AUDIO LEADS
● PROGRAMMABLE REMOTE CONTROL
● ELECTRICAL ACCESSORIES
UNIVERSAL CONTROLLER

TELEVISION

November 1992

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OUR NEXT ISSUE DATED DECEMBER WILL BE PUBLISHED ON NOVEMBER 18th

BC107	8p
BC108	8p
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BC109C	10p
BC140	20p
BC141	20p
BC142	20p
BC143	20p
BC147	8p
BC148	8p
BC149	8p
BC157	8p
BC159	8p
BC160	30p
BC171	10p
BC172	10p
BC177	14p
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BC183L	7p
BC184	7p
BC184L	7p
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BC304	25p
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BC550	8p
BC556	8p
BC557	7p
BC558	8p
BC559	8p
BC560	8p
BC637	20p
BC638	20p
BC639	20p
BC640	20p
BCY70	16p
BCY71	16p
BCY72	16p
BD115	30p
BD124P	50p
BD131	25p
BD132	25p
BD133	50p
BD135	20p
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BD144	90p
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BD645	50p
BD647	50p
BD649	50p
BD675	40p
BD676	40p
BD677	38p
BD678	40p
BD679	40p
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BD681	45p
BD682	45p
BD705	50p
BD707	50p
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BD711	50p
BD736	50p
BD826	50p

BD828	50p
BD897	50p
BD899	50p
BD901	50p
BD977	50p
BDX32	100p
BDX33	60p
BDX65	80p
BDW23	55p
BDW24	55p
BDW93	50p
BDW94	50p
BDY92	100p
BF137	35p
BF167	30p
BF180	16p
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BF270	18p
BF273	15p
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BF337	20p
BF338	20p
BF362	30p
BF367	13p
BF371	17p
BFR40	25p
BFR90	52p
BFR91	99p
BFT43	30p
BFX29	20p
BFX84	20p
BFX85	20p
BFX87	15p
BFX88	15p
BFX89	60p
BFY17	30p
BFY18	40p
BFY50	14p
BFY51	14p
BFY52	14p
BFY56	25p
BFY64	25p
BFY90	45p
BLY48	85p
BR100	14p
BR103	37p
BR303	85p
BRY49	38p
BSS74	33p
BSX20	15p
BSX26	18p
BT100A	70p
BT106	180p
BT109	90p
BT119	100p
BT146	99p
BT151	58p
BTY79	140p
BU100A	110p
BU104	80p
BU105	80p
BU108	100p
BU109	80p
BU110	110p
BU111	140p
BU124	60p
BU126	65p
BU180	150p
BU184	100p
BU204	75p
BU205	70p
BU206	100p
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BU208AT	90p
BU208D	80p
BU209	140p
BU225	190p
BU226	190p
BU312	120p
BU325	55p
BU326	75p
BU406	70p
BU406D	85p
BU407	55p
BU407D	80p
BU408	75p
BU408D	85p
BU409	95p
BU426A	70p
BU500	100p
BU508A	70p
BU508AF	95p
BU508D	80p
BU508DF	115p
BU526	75p
BU536	100p
BU546	140p
BU608	150p
BU626	150p
BU636	150p
BU801	80p
BU806	75p
BU807	70p
BU902	130p
BU903	130p
BU920	130p
BU922	130p
BU930	130p
BUT11AF	70p
BUT12	80p
BUT56A	150p
BUX80	180p
BUX84	50p
BUX85	50p
BU69A	200p
BUY71	300p
BUZ71	75p
C106D	28p
MJ1000	200p
MJ1001	200p
MJ10012	300p
MJ15001	325p
MJ15002	300p
MJ15003	325p
MJ15004	370p
MJ2501	110p
MJ2955	55p
MJ3000	115p
MJ3001	115p
MJE29A	30p
MJE30A	30p
MJE340	25p
MJE350	80p
MJE520	30p
OC28	350p
OC29	250p
OC35	350p
OC36	250p
OC45	50p
OC72	50p
OC200	180p

R2008B	100p
R2010B	100p
S2800D	52p
S2800M	72p
T2800D	52p
T2800M	72p
TIP29	15p
TIP29A	22p
TIP29C	25p
TIP30	25p
TIP30C	30p
TIP31A	22p
TIP31C	30p
TIP32	24p
TIP32A	21p
TIP32C	28p
TIP33	50p
TIP33C	60p
TIP34	50p
TIP34C	60p
TIP35C	65p
TIP36C	65p
TIP41A	20p
TIP41C	22p
TIP42A	20p
TIP42C	22p
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TIP107	65p
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TIP121	46p
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TIP125	47p
TIP126	56p
TIP127	56p
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TIP141	90p
TIP142	90p
TIP145	65p
TIP146	90p
TIP147	100p
TIP150	90p
TIP151	90p
TIP2955	42p
TIP3054	45p
TIP3055	42p
TIS44	40p
TIS61	15p
TIS90	15p
TIS91	18p
TIS93	20p
VK1010	88p
VN10KM	60p
VN66AF	100p
VN88AF	115p
ZTX107	11p
ZTX108	11p
ZTX109	12p
ZTX212	27p
ZTX300	13p
ZTX301	16p
ZTX302	16p
ZTX303	24p
ZTX304	17p
ZTX320	29p
ZTX500	13p
ZTX501	13p
ZTX502	18p
ZTX503	18p
ZTX504	25p
ZTX550	24p
2N696	26p
2N697	22p
2N698	40p
2N706	22p
2N708	22p
2N914	28p
2N930	18p
2N1131	28p
2N1132	28p
2N1613	24p
2N1711	24p
2N1893	30p
2N2102	50p
2N2218A	24p
2N2219	24p
2N2221	23p
2N2222	23p
2N2369	15p
2N2484	20p
2N2646	40p
2N2904	20p
2N2905	20p
2N2906	18p
2N2907	18p
2N2926	8p
2N3019	28p
2N3053	18p
2N3054	40p
2N3055	38p
2N3055H	50p
2N3440	58p
2N3442	85p
2N3585	120p
2N3702	9p
2N3703	9p
2N3704	9p
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2N3706	9p
2N3707	9p
2N3708	9p
2N3710	12p
2N3711	12p
2N3771	85p
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2N3773	100p
2N3799	18p
2N3819	29p
2N3866	68p
2N3903	11p
2N3904	11p
2N3905	11p
2N3906	11p
2N4031	25p
2N4036	25p
2N4062	12p
2N4064	100p
2N4401	12p
2N4403	12p
2N4443	76p
2N5061	20p
2N5088	20p
2N5192	50p
2N5241	500p
2N5245	45p
2N5294	30p
2N5296	30p
2N5366	25p
2N5401	12p
2N5448	12p
2N5496	80p
2N6107	40p
2N6292	40p

2N6385	120p
2N6403	160p
3N143	65p

DIODES

Rectifier Diodes

BY127	8p
BY133	8p
BY164	40p
BY179	35p
BY184	32p
BY196	20p
BY206	11p
BY207	11p
BY210	22p
BY225	120p
BY227	19p
BY228	28p
BY296	20p
BY298	23p
BY299	22p
BYX10	15p
BYX55/350	30p
BYX55/600	25p
BYX70/500	32p
OA47	10p
OA90	10p
OA91	10p
OA200	10p
OA202	10p
IN.914	2p
IN.4001	3p
IN.4002	3p
IN.4003	3p
IN.4004	3p
IN 4005	3p
IN.4006	3p
IN 4007	4p
IN 4148	2p
IN 5400	9p
IN.5401	8p
IN.5402	8p
IN 5403	8p
IN.5404	8p
IN.5405	11p
IN.5406	12p
IN.5407	12p
IN 5408	12p
RGP15	15p
RGP30	16p
SKE4F2/06	60p
SKE4F2/08	80p
SKE4F2/10	100p
SR2M	60p

I.C. SOCKETS

8PIN	5p
14PIN	6p
16PIN	7p
18PIN	10p
20PIN	12p
22PIN	13p
24PIN	14p
28PIN	16p
40PIN	18p

ZENERS

400 MW
BZY88 RANGE
2V7 to 39V 5p
1.3W
BZX61 RANGE
2V7 to 39V 9p

CRYSTALS

Freq in MHz

1.0	260p
2.4576	180p
3.276	115p
4.0	110p
4.194	130p
4.43	95p
5.0	130p
6.0	115p
10.0	140p
11.0	250p
12.0	120p
14.756	200p
15.0	160p
18.0	130p
18.432	130p
24.0	250p
48.0	160p

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
7818KC	100p
7824KC	100p
LM309K	100p
LM317K	200p
LM317T	100p
LM323K	350p
LM723	35p
78H08KC	800p
78H12KC	700p
79HGKC	800p

VALVES

DAF96	100p
DY87	80p
EB91	50p
EBF80	60p
EBF89	60p
ECC84	80p
ECH83	100p
ECH84	90p
ECL80	65p
ECL82	80p
ECL84	100p
ECL85	80p
EF85	80p
EF183	75p
EF184	85p
EL34	300p
EL95	85p
EL500	100p

EY86	70p
EY87	70p
EY88	80p
PC97	100p
PCC85	60p
PCF80	100p
PCF801	110p
PCF802	80p
PCF806	115p
PCH200	100p
PCL81	65p
PCL82	80p
PCL84	60p
PCL85	80p
PCL805	80p
PFL200	110p
PL36	120p
PL83	60p
PL84	80p
PL95	180p
PL504	120p
PL508	200p
PL519	430p
PY81	100p
PY88	100p
PY500A	190p

LED's

3mm	
RED	5p
YELLOW	8p
GREEN	8p
5mm	
RED	5p
YELLOW	8p
GREEN	8p

RECTANG. LED's

5mm × 2.5mm	
RED	5p
YELLOW	8p
GREEN	8p

LINEAR IC's

AN203	210p
AN210	165p
AN214Q	170p
AN228	280p
AN240P	130p
AN252	150p
AN259	250p
AN262	140p
AN271	230p
AN274	250p
AN301	330p
AN303	250p
AN304	360p
AN315	210p
AN316	350p
AN360	100p
AN362	140p
AN366	150p
AN610	160p
AN612	160p
AN3312	350p
AN3320K	800p
AN3331K	900p
AN3792	400p
AN3794	450p
AN3795	500p
AN3821	800p
AN3821K	600p
AN3822K	700p
AN3830K	800p
AN3990K	300p
AN3991K	400p
AN5010	450p
AN5011	400p
AN5015	350p
AN5020	200p
AN5025	250p
AN5030	550p
AN5033	400p
AN5034	500p
AN5111	550p
AN5132	250p
AN5135	600p
AN5138	450p
AN5150	600p
AN5151	600p
AN5215	100p
AN5250	150p
AN5256	150p
AN5260	350p
AN5262	175p
AN5265	150p
AN5352	600p
AN5355	450p
AN5410	375p
AN5411	450p
AN5421	150p
AN5429	420p
AN5431	300p
AN5440	400p
AN5510	400p
AN5512	250p
AN5515	200p
AN5520	550p
AN5521	280p
AN5612	400p
AN5613	200p
AN5615	300p
AN5620	330p
AN5622	350p
AN5625	400p
AN5712	350p
AN5722	140p
AN5730	160p
AN5732	160p
AN5753	170p
AN5763	450p
AN5790	300p
AN5791	350p
AN5836	450p
AN5862	300p
AN6135	150p
AN6238	400p
AN6247	200p
AN6270	400p
AN6300	600p
AN6306	550p
AN6307	260p
AN6320	300p
AN6328	400p
AN6332	390p
AN6337	420p
AN6341	250p
AN6344	440p
AN6350	610p
AN6359	500p
AN6360	320p
AN6362	480p
AN6371	470p
AN6387	560p
AN6811	130p
AN6884	240p
AN7105	210p
AN7110	130p
AN7114	150p
AN7115	150p
AN7116	90p
AN7120	130p
AN7130	110p
AN7140	450p

AN7145	195p
AN7146	210p
AN7154	180p
AN7156	240p
AN7168	260p
AN7178	270p
AN7222	180p
AN7254	150p
AN7256	250p
AN7310	90p
AN7311	90p
AN7410	250p
AY3-1015	290p
AY3-1270	800p
AY3-1350	450p
AY3-8910	360p
AY3-8912	400p
BA301	65p
BA311	80p
BA313	60p
BA333	100p
BA340	150p
BA401	60p
BA402	60p
BA511	160p
BA514	160p
BA516	150p
BA521	160p
BA524	240p
BA526	180p
BA527	95p
BA532	140p
BA534	290p
BA536	180p
BA546	180p
BA612	160p
BA656	150p
BA658	380p
BA684	400p
BA685	400p
BA1310	160p
BA1320	110p
BA1330	160p
BA1360	160p
BA4403	220p
BA5101	400p
BA5102	220p
BA5204	200p
BA5402	180p
BA5406	180p
BA5408	180p
BA6104	250p
BA6208	250p
BA6209	260p
BA6304	120p
BA6305	140p
BA6410	220p
BA6411	250p
BA6993	150p
BA7001	150p
BA7004	200p
BA7007	200p
BA7021	180p
BA7022	350p
BA7751LS	150p
BA7752	250p
BA7755	150p
BA7767AS	200p
CX108	950p
CX134A	950p
CX136	600p
CX139	1450p
CX139A	750p
CX141	750p
CX143	800p
CX143A	1250p
CX145	725p
CX150B	325p
CX158	825p
CX175	325p
CX186	750p
CX187	825p
CX804A	775p
CX832	825p
CX867	575p
CX868	525p
CX877	300p
HA1125	150p
HA1137W	135p
HA1197	150p
HA1199	145p
HA1319	240p
HA1338	300p
HA1339A	350p
HA1377	160p
HA1388	320p
HA1389	210p
HA1392	200p
HA1394	280p
HA1397	250p
HA1398	240p
HA11219	280p
HA11221	180p
HA11225	150p
HA11235	145p
HA11251	240p
HA11423	210p
HA11724	800p
HA12002	300p
HA12003	250p
HA12005	320p
HA12017	130p
HA13001	170p
HA13002	250p
HA13006	400p
HA13007	400p
HA13108	350p
HA13412	600p
HA13432	400p
HA17524	250p
HA17805	100p
ICL7106	650p
ICL7611	90p
ICL7660	240p
ICM7555	60p
ICM7556	80p
KA2101	100p
KA2102	150p
KA2130	150p
KA2206	150p
KA2209	125p
KA2210	230p
KA2212	80p
KA2213	130p
KA2214	150p
KA2261	100p
KA2263	100p
KA2264	100p
KA2284	100p
KA2401	150p
KA2412	350p
KA2912	125p
KA2914A	300p
LA1130	240p
LA1150	150p
LA1185	150p
LA1201	75p
LA1210	140p
LA1222	80p
LA1230	130p
LA1231	210p
LA1364	200p
LA1365	120p
LA1368	220p
LA1385	170p
LA1460	220p

LA2000	150p
LA2101	270p
LA2200	190p
LA3160	120p
LA3201	80p
LA3210	65p
LA3220	100p
LA3300	140p
LA3301	110p
LA3350	110p
LA3361	100p
LA3375	300p
LA4030	180p
LA4031	140p
LA4032	140p
LA4051	160p
LA4100	85p
LA4101	80p
LA4102	100p
LA4110	120p
LA4112	120p
LA4120	270p
LA4125	200p
LA4126	240p
LA4137	180p
LA4140	60p
LA4160	100p
LA4180	300p
LA4182	180p
LA4190	300p
LA4192	140p
LA4200	130p
LA4201	120p
LA4220	120p
LA4260	230p
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LA4270	300p
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LA4430	130p
LA4440	230p
LA4445	200p
LA4460	130p
LA4461	130p
LA4500	200p
LA4505	220p
LA4507	360p
LA4508	260p
LA4510	160p
LA4520	230p
LA4550	200p
LA4555	190p
LA4570	150p
LA5112	120p
LA5523	150p
LA5527	150p
LA5700	300p
LA6324	200p
LA7011	220p
LA7031	250p
LA7033	400p
LA7040	280p
LA7042	280p
LA7046	300p
LA7224	150p
LA7505	250p
LA7507	250p
LA7520	200p
LA7620	500p
LA7800	180p
LA7801	100p
LA7802	300p
LA7806	260p
LA7808	250p
LA7820	150p
LA7823	280p
LA7910	150p
LA7940	200p
LC7131	260p
LC7132	400p
LC7137	450p
LF347	110p
LF351	45p
LF353	48p
LF355	60p
LF357	70p
LF398	300p
LM301	26p
LM311	35p
LM319	165p
LM324	30p
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LM339	35p
LM348	50p
LM358	45p
LM380	80p
LM381	150p
LM382	130p
LM386	60p
LM387	100p
LM393	45p
LM709DIL	30p
LM710	45p
LM723	40p
LM741DIL	18p
LM741MET	45p
LM747	55p
LM748	30p
LM1458	30p
LM1889	300p
LM3900	40p
LM3909	80p
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LM3914	160p
LM3915	160p
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M50786	500p
M50790	600p
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M51381P	200p
M51387P	900p
M51544	150p
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M54523P	200p
M54563P	200p
M58484	500p
M58655P	400p
M51516	260p
M51518	200p
MB3614	180p
MB3712	140p
MB3713	130p
MB3714	270p
MB3715	250p
MB3722	280p
MB3730	160p
MB3731	300p
MB3756	230p
MB3759	200p
MB8719	360p
MC1455	45p
MC1458	30p
MC1488	50p
MC1489	50p
MC1496	65p
MC3302	70p
MC3401	45p
MC3403	60p

NE555	20p
NE556	40p
NE565	110p
NE566	130p
NE567	115p
NE571	290p
NE592	85p
NE5532P	140p
SAS560	110p
SAA1006	300p
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STA404	290p
STA405A	280p
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STA435A	270p
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STA456C	240p
STA471	210p
STA901M	280p
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STK0050	440p
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STK0070	1100p
STK0080	580p
STK011	370p
STK015	490p
STK016	800p
STK025	700p
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STK436	490p
STK437	500p
STK439	550p
STK441	680p
STK443	740p
STK457	500p
STK459	560p
STK460	720p
STK461	620p
STK463	780p
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STK501	580p
STK561	550p
STK563	480p
STK583	600p
STK734B	510p
STK745	600p
STK760	600p
STK770	750p
STK772B	480p
STK780	650p
STK1039	500p
STK1040	700p
STK1049	800p
STK1050	750p
STK1060	760p
STK1070	940p
STK1080	990p
STK2025	700p
STK2028	560p
STK2029	480p
STK2038	900p
STK2048	950p
STK2110	680p
STK2120	820p
STK2125	650p
STK2129	610p
STK2139	800p
STK2155	950p
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STK2240	820p
STK2250	760p
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STK3042	425p
STK3044	525p
STK3062	600p
STK3082	700p
STK3083	550p
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STK3152II	990p
STK3156	560p
STK4017	450p
STK4019	600p
STK4021	425p
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STK4060	580p
STK4101	650p
STK4111	650p
STK4112	950p
STK4121	600p
STK4122	560p
STK4131	650p
STK4132II	750p
STK4141II	420p
STK4142	800p
STK4151	680p
STK4152	750p
STK4161	700p
STK4162	650p
STK4171	850p
STK4172II	800p
STK4181	820p

STK4182II	800p
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STK4192	800p
STK4231II	990p
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STK4311	800p
STK4332	410p
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STK4362	600p
STK4372	570p
STK4392	690p
STK4432	900p
STK4773	900p
STK4793	1100p
STK4803	720p
STK4813	950p
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STK4843	720p
STK4853	900p
STK4863	850p
STK4873	990p
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STK4913	1180p
STK5314	550p
STK5315	600p
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STK5324	520p
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STK5332	220p
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STK5335	450p
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STK6981B	850p
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STK7216	500p
STK7217	560p
STK7226	800p
STK7308	410p
STK7309	450p
STK7310	550p
STK7348	410p
STK7356	500p
STK7358	500p
STK7402	660p
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STK7408	880p
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STR381	450p
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STR441	440p
STR450	520p
STR541	350p
STR452	600p
STR453	600p
STR454	450p
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STR456	600p
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STR2005	500p
STR2012	500p
STR2013	400p
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STR3115	500p
STR3123	490p
STR3125	580p
STR3135	300p
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STR3214	330p
STR3215	330p
STR3315	330p
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STR16006	650p
STR20005	550p
STR20012	600p
STR20015	600p
STR30113	400p
STR30115	350p
STR30123	600p
STR30130	400p
STR30134	320p
STR40090	450p

STR41090	500p
STR44111	650p
STR44115	650p
STR45111	700p
STR50020	550p
STR50092	650p
STR50100	650p
STR50103A	300p
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STR50213	650p
STR53041	650p
STR53043	650p
STR54041	400p
STR55041	650p
STR58041	400p
STR59041	600p
STR60001	650p
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STR80145	700p
STRD1806	475p
STRD1816	475p
T2800D	52p
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TA7061	115p
TA7063	70p
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TA7137	83p
TA7140	130p
TA7157	140p
TA7176	200p
TA7193	320p
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TA7205	80p
TA7207	150p
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TA7220	220p
TA7222	120p
TA7223	210p
TA7225	300p
TA7226	290p
TA7227	190p
TA7229	300p
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TA7232	120p
TA7233	150p
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TA7241	190p
TA7242	250p
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TA7245	350p
TA7267	290p
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TA7280	250p
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TA7283	200p
TA7288	220p
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TA7315	200p
TA7317P	240p
TA7324	200p
TA7325	90p
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TA7335	110p
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TA7698	500p
TA7699	800p
TA7705	300p
TA7750	200p
TA7757	250p
TA7769	200p
TA7784	250p
TA8205	400p
TA8210	400p
TA8215	400p
TAA550	25p
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TBA530	120p
TBA540	100p
TBA560	120p
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TBA920	120p
TBA950	100p
TBA990	60p
TC5020	200p
TC5081AP	180p
TC9106	500p
TC9109	450p
TC9122P	430p
TC9125BP	410p
TC9132	400p
TC9134	750p
TC9142	320p
TC9143	300p
TC9145	150p
TC9148	200p
TC9149	225p
TC9150	425p
TC9152	425p
TC9153	300p
TC9156	300p
TC9163	375p
TC9164	400p
TC9172P	300p
TC9176P	500p
TCA740	130p
TCA940	100p
TCEP100	100p

TD62308AP	200p
TD62382	200p
TD62506	200p
TD62705	250p
TD6304AP	300p
TD6306P	350p
TD6350P	200p
TD6359P	300p
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TDA1013A	120p
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TDA1016	200p
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TDA1024	200p
TDA1025	320p
TDA1028	220p
TDA1029	250p
TDA1035	120p
TDA1037	190p
TDA1044	250p
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TDA1522	200p
TDA1524	350p
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TDA1675	250p
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TDA1870A	300p
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TDA1908A	90p
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TDA2005	90p
TDA2006	70p
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TDA2008	175p
TDA2009	160p
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TDA2040	200p
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TDA2532	120p
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TDA2541	120p
TDA2542	150p
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TDA2556	350p
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TDA2578A	200p
TDA2579	250p
TDA2582	200p
TDA2590	170p
TDA2593	150p
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TDA2595	300p
TDA2600	350p
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TDA2630	300p
TDA2640	220p
TDA2653A	250p
TDA2654	250p
TDA2670	150p
TDA2690	100p
TDA2730	250p
TDA2760	400p
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TDA2791	270p
TDA2795	250p
TDA2822M	60p
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TDA3048	150p
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TDA3083	250p
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TDA3506	300p
TDA3507	500p
TDA3540	300p
TDA3541	200p
TDA3560	260p
TDA3561	200p
TDA3561A	220p
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TDA3563	350p
TDA3565	300p
TDA3566	330p
TDA3580	500p
TDA3586	750p
TDA3590	320p
TDA3591	450p

LINEAR IC's — Cont.

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TDA3651	200p
TDA3652	500p
TDA3653	150p
TDA3654	150p
TDA3710	320p
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TDA3740	600p
TDA3750	400p
TDA3760	470p
TDA3771	460p
TDA3791	400p
TDA3800	350p
TDA3803A	500p
TDA3810	300p
TDA3950	300p
TDA4050	250p
TDA4180	400p
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TDA4200	380p
TDA4280	400p
TDA4282	400p
TDA4290	250p
TDA4400	350p
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TDA4421	400p
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TDA4431	200p
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TDA4555	600p
TDA4556	650p
TDA4560	450p
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TDA4601	160p
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TDA4660	480p
TDA4950	180p
TDA5330T	380p
TDA5600	450p
TDA5660P	260p
TDA5700	200p
TDA5708	560p
TDA5709	560p
TDA5800	600p
TDA5820	480p
TDA5850	225p
TDA7000	200p
TDA7010T	120p
TDA7050	200p
TDA7052	150p
TDA7211	150p
TDA7220	150p
TDA7240	300p
TDA7241	250p
TDA7250	600p
TDA7255	600p
TDA7273	100p
TDA7274	100p
TDA7275	75p
TDA7284	100p
TDA8115	300p
TDA8140	300p
TDA8145	150p
TDA8153	370p
TDA8160	150p
TDA8170	300p
TDA8173	325p
TDA8190	280p
TDA8191	425p
TDA8196	150p
TDA8440	380p
TDA8442	280p
TDA8443	400p
TDA8451	600p
TDA8452	280p
TDA9403	250p
TDA9503	200p
TDA9513	350p
TEA1002	650p
TL061	40p
TL064	80p
TL071	38p
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TL074	80p
TL081	40p
TL082	46p
TL083	55p
TL084	70p
ULN2002	70p
ULN2003	69p
ULN2068	270p
ULN2804	170p
UPC20C	220p
UPC554	130p
UPC555	60p
UPC556H	80p
UPC571	220p
UPC574	60p
UPC575C2	90p
UPC576	200p
UPC577	64p
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UPC592	95p
UPC595	190p
UPC596	190p
UPC1001	120p
UPC1018	170p
UPC1020	200p
UPC1023	60p
UPC1025	230p
UPC1026	95p
UPC1028	90p
UPC1031H	150p
UPC1032	60p
UPC1158H	70p
UPC1177H	250p
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UPC1183	200p
UPC1186	80p
UPC1187	150p
UPC1188H	350p
UPC1197	140p
UPC1198H	200p
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UPC1225H	220p
UPC1230	210p
UPC1238	120p
UPC1252H	220p
UPC1263	230p
UPC1270H	250p
UPC1274V	250p
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UPC1288V	230p
UPC1298V	320p
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UPC1335V	320p
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UPC1352	400p
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LINEAR ICs – Cont.

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UPC1370C	300p
UPC1373	85p
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UPC1384	425p
UPC1387C	250p
UPC1394	170p
UPC1397	350p
UPC-1403CA	650p
UPC-1420CA	450p
UPC-1421CA	650p
UPC-1423CA	550p
UPC1470	200p
UPC1504C	400p
UPC1505C	400p
UPC-1514CA	200p
UPC-1515CA	250p
UPC1520CA	250p
UPC1536C	550p
ZN423	100p
ZN424	100p
ZN425	320p
ZN426	260p
ZN427	560p
ZN429	215p
ZN435	340p
ZN448	510p
ZN459	190p
ZN1040	640p
ZNA134H	2150p
ZNA234E	1250p

JAPANESE TRANSISTORS

2SA473	35p
2SA490	60p
2SA505	120p
2SA509	120p
2SA550	150p
2SA562	50p
2SA603	100p
2SA606	300p
2SA608	15p
2SA634	50p
2SA636	50p
2SA640	60p
2SA673	20p
2SA684	60p
2SA699	100p
2SA708	300p
2SA715	60p
2SA720	20p
2SA725	80p
2SA726	25p
2SA733	30p
2SA747A	600p
2SA748	90p
2SA769	130p
2SA770	200p
2SA771	130p
2SA781	150p
2SA798	55p
2SA814	170p
2SA844	30p
2SA872	40p
2SA872A	50p
2SA886	90p
2SA899	60p
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2SC4023	325p
2SC4056	350p
2SC4106	200p
2SC4123	450p
2SC4124	250p
2SC4169	60p
2SC4236	550p
2SC4237	750p
2SC4242	200p
2SC4262	50p
2SC4301	550p
2SD198	180p
2SD199	280p
2SD200	210p
2SD201	260p
2SD257	195p
2SD313	40p
2SD315	75p
2SD325	45p
2SD330	110p
2SD348	460p
2SD357	40p
2SD358	40p
2SD371	240p
2SD380	650p
2SD381	80p
2SD388	170p
2SD389	90p
2SD400	20p
2SD401	50p
2SD402	120p
2SD415	120p
2SD424	400p
2SD426	150p
2SD427	350p
2SD438	45p
2SD467	60p
2SD468	25p
2SD471	75p
2SD525	70p
2SD526	70p
2SD545	60p
2SD549	120p
2SD551	400p
2SD555	500p
2SD560	150p
2SD571	80p
2SD575	530p
2SD600	80p
2SD601	40p
2SD602	60p
2SD612	100p
2SD613	70p
2SD636	30p
2SD637	40p
2SD638	60p
2SD639	60p
2SD640	350p
2SD642	50p
2SD655	60p
2SD661	60p
2SD666	70p
2SD667	70p
2SD668	120p
2SD669	40p
2SD673	350p
2SD676	250p
2SD716	115p
2SD717	180p
2SD718	100p
2SD722	240p
2SD725	350p
2SD734	60p
2SD-741	120p
2SD-743	130p
2SD-756	100p
2SD-757	120p
2SD-758	140p
2SD-762	140p
2SD-763	140p
2SD-768	180p
2SD-772	200p
2SD-773	40p
2SD-774	60p
2SD-777	400p
2SD-784	650p

2SD-786	100p
2SD-787	80p
2SD-788	100p
2SD-789	80p
2SD-792	400p
2SD-794	100p
2SD-795A	140p
2SD-811	450p
2SD-819	400p
2SD-820	450p
2SD-821	550p
2SD-822	400p
2SD-826	100p
2SD-836	150p
2SD-836A	200p
2SD-837	80p
2SD-838	400p
2SD-841	160p
2SD-844	200p
2SD-845	250p
2SD-850	260p
2SD-856	80p
2SD-858	250p
2SD-863	60p
2SD-864	200p
2SD-866	120p
2SD-866A	140p
2SD-868	450p
2SD-870	400p
2SD-871	450p
2SD-879	60p
2SD-880	40p
2SD-882	80p
2SD-892A	100p
2SD-894	120p
2SD-895	200p
2SD-896	200p
2SD-900	400p
2SD-905	450p
2SD-916	130p
2SD-917	300p
2SD-921	320p
2SD-923	360p
2SD-946	120p
2SD-947	100p
2SD-950	300p
2SD-951	350p
2SD-957A	520p
2SD-958	60p
2SD-965	100p
2SD-970	170p
2SD-973	60p
2SD-973A	70p
2SD-985	120p
2SD-986	120p
2SD-1012	60p
2SD-1020	40p
2SD-1021	120p
2SD-1022	400p
2SD-1024	130p
2SD-1030	75p
2SD-1031	130p
2SD-1037	750p
2SD-1046	200p
2SD-1047	225p
2SD-1051	130p
2SD-1060	130p
2SD-1062	150p
2SD-1063	200p
2SD-1064	250p
2SD-1065	200p
2SD-1069	150p
2SD-1071	450p
2SD-1073	350p
2SD-1088	150p
2SD-1094	520p
2SD-1110	225p
2SD-1111	60p
2SD-1113	225p
2SD-1128	200p
2SD-1133	100p
2SD-1135	150p
2SD-1138	80p
2SD-1140	40p
2SD-1142	350p
2SD-1148	175p
2SD-1151	50p
2SD-1159	90p
2SD-1160	150p
2SD-1163A	220p
2SD-1164	120p
2SD-1168	425p
2SD-1169	280p
2SD-1173	350p
2SD-1185	400p
2SD-1186	400p
2SD-1187	250p
2SD-1189	125p
2SD-1190	150p
2SD-1191	120p
2SD-1192	90p
2SD-1196	150p
2SD-1197	150p
2SD-1207	50p
2SD-1210	280p
2SD-1211	120p
2SD-1218	75p
2SD-1223	75p
2SD-1225	120p
2SD-1227	40p
2SD-1229	250p
2SD-1237	300p
2SD-1246	30p
2SD-1247	40p
2SD-1248	270p
2SD-1251	180p
2SD-1263	90p
2SD-1264	120p
2SD-1265	75p
2SD-1266	180p
2SD-1267	100p
2SD-1267A	125p
2SD-1271	200p
2SD-1271A	225p
2SD-1272	200p
2SD-1273	100p
2SD-1275	160p
2SD-1276	200p
2SD-1277	190p
2SD-1279	600p
2SD-1288	175p
2SD-1289	300p
2SD-1291	400p
2SD-1292	60p
2SD-1297	425p
2SD-1302	40p
2SD-1308	140p
2SD-1309	140p
2SD-1310	140p
2SD-1313	1000p
2SD-1326	200p
2SD-1328	60p
2SD-1347	70p
2SD-1348	85p
2SD-1350	150p
2SD-1376	125p
2SD-1379	100p
2SD-1380	100p
2SD-1383	100p
2SD-1384	50p
2SD-1389	200p
2SD-1390	350p
2SD-1391	450p
2SD-1392	150p
2SD-1395	150p
2SD-1396	240p
2SD-1397	175p
2SD-1398	130p
2SD-1399	300p

2SD-1400	280p
2SD-1402	280p
2SD-1404	125p
2SD-1406	80p
2SD-1407	160p
2SD-1408	125p
2SD-1409	170p
2SD-1412	100p
2SD-1413	175p
2SD-1414	700p
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2SD-1417	125p
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2SD-1879	275p
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2SD-1886	450p
2SD-1887	450p
2SD-1896	300p
2SD-1910	280p
2SD-1911	400p
2SD-1913	50p
2SD-1929	60p
2SD-1939	75p
2SD-1941	500p
2SD-1959	280p
2SD-1961	50p
2SD-1978	50p
2SD-1984	150p
2SD-2012	50p
2SD-2046	50p
2SJ-48	425p
2SJ-49	425p
2SJ-50	425p
2SJ-56	700p
2SJ-74	60p
2SJ-75	280p
2SJ-76	220p
2SJ-77	350p
2SJ-79	225p
2SJ-103	75p
2SJ-106	40p
2SJ-108	60p
2SJ-115	525p
2SJ-116	1000p
2SJ-117	550p
2SJ-118	600p
2SJ-119	700p
2SJ-122	800p
2SJ-161	650p
2SJ-162	680p
2SK-19	45p
2SK-40	50p
2SK-49	50p
2SK-55	100p
2SK-68	100p
2SK-73	75p
2SK-106	40p
2SK-107	40p
2SK-109	120p
2SK-118	50p
2SK-125	100p
2SK-133	650p
2SK-134	415p
2SK-135	415p
2SK-147	160p
2SK-150	150p
2SK-162	115p
2SK-163	40p
2SK-168	40p
2SK-176	800p
2SK-192	45p
2SK-195	150p
2SK-197	140p

2SK-214	170p
2SK-216	200p
2SK-217	35p
2SK-218	400p
2SK-240	140p
2SK-270	50p
2SK-294	350p
2SK-310	200p
2SK-312	750p
2SK-315	70p
2SK-320	120p
2SK-322	140p
2SK-323	130p
3SK-358	300p
2SK-370	40p
2SK-371	40p
2SK-386	600p
2SK-388	850p
2SK-405	450p
2SK-413	500p
2SK-414	500p
2SK-415	500p
2SK-429	180p
2SK-511	450p
2SK-513	325p
2SK-517	200p
2SK-531	350p
2SK-534	700p
2SK-537	900p
2SK-538	450p
2SK-539	1100p
2SK-555	400p
2SK-556	500p
2SK-557	400p
2SK-566	475p
2SK-695	550p
2SK-719	300p
2SK-724	600p
2SK-725	600p
2SK-727	1200p
2SK-735	600p
2SK-758	300p
2SK-787	1100p
2SK-794	500p
2SK-872	950p
2SK-903	500p
2SK-1057	600p
2SK-1058	800p
2SK-45	100p
2SK-51	100p
2SK-59	100p
2SK-73	60p
2SK-74	50p
2SK-77	50p
2SK-81	50p
2SK-85	160p
2SK-87	45p
2SK-88	70p
2SK-121	150p
2SK-129	175p
2SK-165	225p
2SK-166	300p

COMPUTER ICs

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
4164-10	100p
41256-15	80p
41256-12	100p
41256-10	110p
41464-12	150p
41464-10	200p
6116	80p
6264-15	160p
6264-12	200p
6264-10	210p
62256-12	300p
6502	300p
6502A	360p
65C02	930p
6522	280p
6551	380p
6800	210p
6802	220p
6803	500p
6808	500p
6809	500p
6810	150p
6818	380p
6840	290p
6845	200p
6850	90p
8080A	380p
8085A	300p
8086	500p
8088	480p
8156	300p
81LS96	130p
81LS97	130p
81LS98	130p
8224	240p
8226	240p
8243	250p
8250	750p
8251	200p
8253	160p
8255	160p
8256	700p
8257	220p
8271	3400p
8279	270p
8283	400p
8284	440p
8287	260p
8288	650p

8748	700p
8755	800p
Z80ACPU	100p
Z80BCPU	160p
Z80ADMA	200p
Z80APIO	150p
Z80BPIO	150p
Z80ACTC	140p
Z80BCTC	200p
Z80ASIO	210p
Z80ASIO-1	210p
Z80ASIO-2	210p
Z80ADART	260p
74S289	180p
74S387	200p
75107	65p
75110	75p
75113	100p
75122	110p
75150	95p
75154	100p
75162	700p
75182	95p
75183	95p
75188	55p
75189	55p
75195	185p
75451	40p
75454	65p
75492	55p
8T26	95p
8T28	110p

SIMMS

256Kx9-80	1000p
256Kx9-70	1100p
1MBx9-80	3000p
1MBx9-70	3200p

SIPS

256Kx9-80	1100p
256Kx9-70	1200p
1MBx9-80	3100p
1MBx9-70	3200p

OPTO COUPLERS

4N25	50p
4N26	50p
4N27	50p
4N28	50p
4N29	90p
4N30	90p
4N31	90p
4N32	100p
4N33	100p
4N36	58p
4N37	58p
4N38	68p

BRIDGE RECTIFIERS

W005 1A 50V	16p
W01 1A 100V	18p
W02 1A 200V	19p
W04 1A 400V	21p
W06 1A 600V	23p
W08 1A 800V	28p
BR81D 2A 100V	33p
BR82D 2A 200V	33p
BR84D 2A 400V	37p
BR86D 2A 600V	43p
BR88D 2A 800V	43p
BR32 3A 200V	43p
BR34 3A 400V	43p
BR36 3A 600V	44p
BR62 6A 200V	80p
BR64 6A 400V	72p
BR251 25A 100V	150p
BR252 25A 200V	165p
BR254 25A 400V	185p
BR256 25A 600V	200p
BR258 25A 800V	240p
BR351 35A 100V	185p
BR352 35A 200V	200p
BR354 35A 400V	220p
BR356 35A 600V	230p
BR358 35A 800V	260p
BY164 1.5A 100V	40p
BY179 1.5A 800V	40p

TRIACS

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

THYRISTORS

2N5061 0.8A 60V	20p
C106D 4A 400V	28p
TIC116C 8A 300V	59p
TIC116D 8A 400V	70p
TIC116M 8A 600V	79p
TIC126D 12A 400V	75p
TIC126M 12A 600V	90p
BR103	37p
BR303	85p
BT106	180p
BT116	80p
BT119	100p
TIC44	22p
17088	200p
17089	200p
17127	200p
15 80H	230p
15 85R	230p
SG264	550p
SG613	800p

SERVICE AIDS

SERVISOL PRODUCTS

VIDEO HEAD CLEANER	140p
SWITCH CLEANER	150p
SILICONE GREASE	170p
FREEZE IT	170p
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VS6/8/9 £30.00
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VT100 110 111 112/113/115/118/120/125/128/220/225/VT400/405/410/413/414/415/418/510/518/520/525/526/VTM625/626 £18.00
VT3000 £10.00
VT4000/4200/5000/500 £15.00
VT77/680 3000/6500/7000/8000/8030/8040/8100/8300/VT8500/8700/9000/9300/9500/9700/9900 £12.00
VT8/VT9/VT56/VT57 £34.00
VT65 £35.00
VT130/VT135/VT138/VT145/VT250/VT255/VT258/VT420/425/426/428/430 431/435/438/535/536
VTL301/VTM630/635/636 £29.50
VT52/61E/VT62E/VT63/VT64/VT640 £20.00
VT150 (4 HEAD) £27.00
VT530 £25.00

ITT

VR3605/3905/3935 3943/3954/3985/3993 £6.50
VR3833/VR3913/VR3914/VR3963/VR3975/VR3912 £6.50
VR3986 £20.00
VP3826/VR3906 3916 3926/3946/VR3948/6948 £15.75
VR3927 £17.00
VR3976 £24.50
VR3977 £31.00
VR3994 £23.00
VR3995 3997 £31.50
VR3917 £16.00

JVC 3HSS

HR2200/HR3300/HR3320/HR3330/HR3350/HR3360/HR3660/HR3750/HR3860/HR4100 £6.50
3292/8903 8900/8901 8902 8903 8906 8922 8928/3VO1 3V06/3V22 £6.50
HR3660/HR7600/HR7610/HR7650/HR7700/HRD110/HRD111/HRD120/HRD121/HRD220/HRD225/HRS100 £6.50

FERGUSON 3HSSL PIN

8904/8924/8941/8943/8944/3V16 3V23 3V24/3V31/3V35/3V36/3V38/3V39/3V49 £6.50
HRD140/HRD141/HRD143/HRD150/HRD157/HRD158/HRD160/HRD5101/HRS10 £15.50

FERGUSON

8947/8948 3V42/3V44 3V45/3V46 3V47 3V52 3V54/3V55 3V56/3V57 £15.50
8950/8951/3V64/FV10/FV11/3V65/FV20 £17.00
FV21/FV22/FV26 £24.50
3V48 £31.50
3V43/3V53 £7.50
8930/8940/3V29/3V30 £24.00
8945 £10.00
3V00 £22.00
FV31 £38.00
FV37

JVC

HRD170/171/210/211 £17.00
HRD565/566 £24.50
HRD725/HRD755 £31.50
BR7000E/BR7000S £30.00
HR7200/7300/7350/2650 £7.20
HRD455 £20.00
HRD520 £22.00
HRD300/HRD400/HRD600 £29.00
HR4100 £10.00
HRD750 £33.00
HRD250/257 £27.00

JVC & FERGUSON

3V32/8942/HR7655 £23.00
HRD180/230/3V59/FV12L/FV20B/FV22/26/30/32/33 £30.50
HRD370/3V58/FV13H/HRD430/HRD470 £27.00
HRD530/700/FV14T £33.50
GRC1/GRG2/3V41 £30.00

LOGIK

VR960 £16.00
VR950 £16.00

LOEWE

OC410/420/440 £24.00
OC50/OC55/OC60/OC65 £15.00

LUXOR

9225 £21.50

MATSUI

VX500E/VX600A/VX800A/VX810A/VX880A/VX770B/VX773B £13.50
VCRL3/VX730 £15.00
VX735/VX755 £16.00
VX735A/VX755A/VX765/VX850 £17.50

MITSUBISHI

HS303/HS304/HS320/HS700 £19.50
HS306/HS318/HS710 £20.00
HS307 £37.00
HS319 £37.00
HS330 £32.00
HS400 £29.00
HS349 £28.00
HS411 £32.00
HSE30 £28.00
HS338 £28.00
HSE11 £37.00
HS300/HS301 HS302/HS310 £18.50
HS200 £6.50
HS337/HS347 £22.00

NATIONAL PANASONIC 4HSS-3HSSN

NV300/NV300/NV7200/NV333/NV7500/NV7800/NV7850/NV322/NV332/NV340/NV390/NV2000/NV2010/NV7000/NV8170/NV8200/NV8400/NV8600/NV8610/NV8620 £6.25

NATIONAL

NV777/NV330 £17.00
NV430/AG1000 £11.00
NV280/NV460/470 480 £16.50
NV730/NV770 (4 HEAD) £18.50
NV366 £18.50
NV180/NVD48 £23.00
NV370/NV380/NV100/NV630 £8.50
NV788 £23.00
NV810/NV830 £30.00

NATIONAL Cont.

NV850/NV950 £35.00
NV870/NV890/NV970 £39.00
NVG33/NVG46/NVL23/NVL25/NVL28 £38.00
NVG30/NVG31/NVG40/NVG130/NVJ30/NVL20 £20.00
NVG10/NVG11/NVG12/NVG14/NVG16/NVG120/NV250/NV280/NV450/NV465 £16.50
NVG18 £25.00
NVG20/NVG21/NVG22/NVG25/NVG28/NVG200/NVD48 £25.00
NVG50/NVG300 £30.00
NVG45/NVG46 £30.00
NVH70 £50.00
NV688 £25.50
NV600 £23.00
AG-6800/6810 £39.00
AG-6100/6200/6300 £32.00
NVH65 £50.00
NVG7/NVG9/NV230 £18.00
NV780 £36.00
NVG15/NVG400 £48.00
NVM7/NVMC20/NVF70 £52.00

N.E.C.

N9011/N9012/N9013E/N9014E/N9014G/N9015/N9016/N901A/N902A/N9033/N9034/N9054/N9063/N9065/N9066/N906A £20.00
N911A/N915A/N916A/N917 £27.00
PCV754/PV2300/PV2400/PV760/PV794/PV770/PV774/PVC763E £18.00
N380/N381/N830/N831/N832/N833/N834/N835/N836 £7.00
82611AH1 (for model DX3000) £45.00
N895 £31.50

NORDMENDE

460/9/480/V100/V140/V200/V250/V304/V341/V450/V550 £7.00
V1001/V1005/V1015/V1025/V1035/V1041/V1055/V1065/V1105/V2005 £18.00
V110/V333 £20.00
V101/V102/V103/V112/V141/V142/V200/V300/V3005/V300/V301/V302/V350/V500 £7.00
V1205/V1215/V1235/V1245 £20.00
V1305 £33.50
V380 £27.00
V502/V503/V5005 £37.00

ORION

VH3/VH555/VH600/VH700/VH844/VH900 £13.00
VH1000 (ALL MODELS) £7.00
VH1/VH2A

PHILIPS

VR6460/VR6520/64/VR60/VR6420 £8.50
VR6711 4 HEAD £41.00
6920/VR6440 £58.00
VR6441/VR6540/VR6541/VR6640/VR6642 £14.00

RANK

BV6900AS £18.00
N830EA/RV300/RV310/RV320/RV330/RV340/RV350/RV380 £7.00

SAISHO

VR100/VR605/VR705/VR805/VR905/VR1000/VR1100/VR1200/VR1600 £12.50
VR3300X/VR3600X/VR3650/VR3800 £14.00
VR3200/VR3500 £15.00
VR2000/VR3300/VR3600 £15.00

SALORA

6500/6600 £21.50
SV7300/8200/8300/9200 £19.50
SV7400/8400 £23.00
SV8100 £13.50

SAMSUNG

SVX301/VB900/VB910/VVT510/VT320/VT5600/VX510/VX511/VX520/VX616/VX626/VX627/VX717/SV716/717/SVX303/305/VB510/520/610/616/617/619/620/626/627/629/710/971/VI520/616/621/626/900/810/VX617/619/629/710/712/VX720/730/970/971/972 £19.00
VB770/VI730/770/VK8220/VX750/770/8225 £21.00

SANYO

VTC5000/VTC5400/VTC6000/VTC6500/VPR5000/VTC1500/VTCM10/VTCM11/VTCM20/VTCM21/VTCM25/VTC2000/VTC5100/VTC5150/VTC5300/VTC5400/VTC5350/VTC5370/VTCNX10/VTCNX15/VTCNX20/VTCNX30/VPR5800 £18.50
VTC5500/VTC5550/VTC9100/VTC9300/VTC9350/VTC9355/VTC9455/VTC9500 £19.00
VHR1110/VHR1150/VHR1300/VHR1700/VHR2300 £16.00
VHR3200/VHR3270/VHR3100/VHR3150/VHR3300/VHR3400/VHR3310
VHRD500 £18.00
VHR1100/VHR1200 £18.00
VHR1500/VHR2500 £28.00
VHR2700 £24.50

SHARP

VC390/VC393/VC496 £30.00
VC488 £48.00
VC779 £20.00
VC789/VC790 £32.00
VC300/VC381/VC383/VC386/VC387/VC388/VC482/VC483/VC486/VC3300/VC8381/VC9100/VC9300/VC9500/VC9700/VC9400/VC9600/VC200/220/384/385/471/477/481 £13.00
VC582/VC583/VC651/VC681/VC750/VC780/VC781/VC683/VC684/402/500/571/573/581/584/585/600/682/685/693/VC700/772/7810/782/7822/783/8481 £13.00
VC6000/VC6200/VC6300/VC7300/VC7700/VC7750/VC8000/VC8300 £20.00
VC793 £36.00
VC473/785/786 £25.00
VC699/VCA501/VCA602 £29.00

SONY

DSR-19R (FOR SL-T-9ME) £39.00
DSR-21R (FOR SLC-8-C9) £30.00
DSR-35R (FOR C20/C30/C40/SLF1UB SLF1E) 2 PIN SLC24PS/SLC33E/SLC44PS/SLF30PF/SLF60PS/SLK85/SLT20ME/SLT30ME £15.00
DSR-43R (FOR SLC7 RANGE/SL5000/SL5100/SL3000) 1 PIN SLC6E/SL3EE/SL37E £13.00
SL3000/8000/8080/SLC5E/SLT7ME £16.00
SLV201/202 £29.50
SLK95/SLT50ME £29.00

TOSHIBA

V63 £18.00
V9680 £42.00
V8600/V8700 £38.00
V21/V31/V33/V50/V51/V53/V9600 £14.50
V55/V57 £7.00
V71/V73/V74/V75/V81/V82/V83/V84/V85/V86/V87/V80/V77 £14.00
V93/V80 £20.00
V5470/V5480 £18.00

TRIUMPH

VR9500/VR9501/VR9525 £13.00

THOMSON

TX8000/V309/316/320/321/323/326/4100/4200/4300/VK305T/306T/309BL/3301/312T/410T/411T £6.50
TX8500/V318/342/343/351/352/353/4210/4230/4260 £15.75

VCR PINCHROLLERS

AKAI

VS9300, VS9500, VS9700, VS9800, VP7100, VP77 £2.50
VS1, VS2, VS3, VS4, VS5, VS6, VS9, VS10, VS8, VS15 £2.50
VS105, VS112, VS115, VS116, VS126, VS244, VS245, VS247, VS248, VS515, VS516, VS205 £2.50
VS201, VS301, VS303, VS304, VS603, VS606, VS607, VP58-P82 £2.50
VS125, VS155, VS165, VS220, VS240, VS250, VS512, VSX9 £2.50

AMSTRAD

VCR4500, VCR4600, VCR4600, VCR6000, VCR6100, VCR9000 £2.50
VCR5200 £2.50
VCR7000 £2.50
TVR1 £2.50

AIWA

AV66, AV77 £2.50
G700, G900 £2.50

ALBA

VCR3000X, VCR4000 £2.50
VCR5000, VCR6000 £2.50

AUTHENTIC

N850 £2/50

BLAUPUNKT

RTV100, 200, 202, 222, 224, 301, 306, 307, RTV309, 311, 312, 315, 316, 317, 319, 320, 328, RTV404, 414, 434, 444, 478, 707, RTX100 £2.50
RTV211, 214, 321, 322, 348, RTX250, 260 £2.50
RTV324, 325 £2.50
RTV330, 454, 520, 530, 535, 560, 660, 670, RTV720, 730, 740, 800, 810, 900, 910, 920 £2.50

DECCA

VR8300 £2.50
VRH8495DK (Pressure Roller Assembly) £6.25

FERGUSON

3V00, 3V16, 3V22, 3V23, 3V24, 3292, 8900, 8901, 8902, 8903, 8904, 8906, 8909, 8912, 8922, 8923, 8924, 8925, 8929 £2.50
3V29, 3V30, 3V31, 3V32, 8930, 8931, 8940, 8941, 8942 £2.50
3V35, 3V36, 3V38, 3V39, 3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 3V58, 3V59, 3V64, 3V65, FV10, FV11, FV12, FV14, 3V49, 8943, 8944, 8945, 8947, 8948, 8950, 8951, FV13H, FV20B, FV21R, FV22L, FV26D, FV30B, FV32L, FV33H, FV39S, VC141L £2.50

FISHER

FVHP420, FVHP520, FVHP530 £2.50
FVHP615, FVHP710, FVHP715, FVHP716, FVHP722, FVHP725, FVHP830, FVH618, FVH620, FVH622, FVH622, FVH711, FVH720 FVH721, FVH722, FVH725, FVH730, FVH840 £2.50
FVHP905, FVHP970, FVHP980, FVHP990, FVHP5000, FVHP5005, FVHP5050, FVHP5075, FVHP5100, FVHP905, FVHP906, FVHP908, FVHP910, FVHP911, FVHP915, FVHP916, FVHP918, FVHP975 £2.50
VBR330, VBS3500, VBS7000, VBS7500, VBS7600, VBS9000, VBS9900 £2.50

FIDELITY

HQS200, VCR100, VCR600, VCR6100 £2.50
VTR1000 £2.50

FIJITSU

HS760, VX715, VX720D £2.50

FUNAI

V1, V2, VCR4000, VCR4500, VCR4530, VCR4600, VCR4800, VCR5200, VCR5400, VCR5840, VCR5843, VCR6000, VCR6600, VCR6800, VCR6803 £2.50
VIP1000, VIP1400, VIP3000 £2.50

GEC

V4004 £2.50

GRANADA

VHSAH1, VHSAH3, VHSVH4, VHSWH1, VHSXH1, VHSYH2 £2.50
VHSAN3, VHSBP1 £2.50
VHSAY3 £2.50
VHSBH1, VHSCH1, VHSFS1, VHSFS2, VHSEH2, VHSEH3 £2.50
VHSBY3, VHSCC1 £2.50
VHSDS2 £2.50
VHSDP1, VHSFP2
(Pressure Roller Assembly £6.25
VHSEY1 £2.50
VHSFG2, VHSFG4 £2.50
VHSFJ4, VHSYJ2 £2.50
VHSF63 £2.50
VHSTJ1, VHSTJ2, VHSTJ3 £2.50
VHSWJ1, VHSWJ3, VHSXJ3 £2.50

GRUNDIG

BARCELONA, MADRID, MVS500, MVS550, MVS600, MVS620, 660, SE5110, SE5140, SE6100, SE6160, TVR4500, VS500, VS505, VS510, VS520, VS521, VS530, VS540, VS550, VS600, VS610, VS620, VS630, VS640, VS660, VS680, VS5180, VS5480 £2.50
MVS400, MVS410, VS400, VS410, VS440, VS460 £2.50
VS120 £2.50
VS150 £2.50

GOLDSTAR

GHV1221, GHV1232, GHV1240, GHV1241, GHV1242, GHV1243, GHV1244, GHV1245, GHV1246, GHV51, GHV8210, GHV8215, GHVP1240, GHVP1241, GHVP1247, GHVP1248, GHVP1290, GHVP1291, GHVP1295, GHVP1296, VCP4100, GHV51, GHV8000, GHV8200, VCP4000, VCP4130, VCP4200, VCP4300, VCP4301, VCP4305, VCP4306, VCP4310, VCP4311, VCP4315, VCP4316, VCP4320, VCP4321, VCP4325, VCP4326 £2.50

HINARI

V20H, VXL10, VXL11, VXL19, VXL5, VXL6, VXL7, VXL8, VXL9, VXL90 £2.50
VXL2, VXL3 £2.50
VXL4, VXL20, VXL35 £2.50

HITACHI

VT11, VT14, VT16, VT17, VT19, VT33, VT330, VT34, VT35, VT38, VT39, VT52, VT6500, VT680, VT6800, VT7, VT7000, VT8000, VT8500, VT9700, VT9900 £2.50
VT61, VT62, VT63, VT64, VT65, VT86, VT88, VT110, VT122, VT120, VT128, VT130, VT135, VT138, VT150, VT168, VT220, VM200, VM500, VM600, VT100, VT111, VT113, VT115, VT118, VT125, VT145, VT175, VT225, VT250, VT255, VT258, VT260, VT400, VT405, VT410, VT413, VT414, VT415, VT418, VT420, VT425, VT426, VT428, VT430, VT431, VT435, VT438, VT450, VT498, CT510, VT518, VT520, VT525, VT526, VT530, VT535, VT536, VT540, VT545, VT546, VT548, VT570, VT575, VT576, VT580, VT588, VT640, VT8, VT85, VT86, VT88, VTL30, VTM625, VTM626, VTM630, VTM636, VTM640, VTM645, VTM646, VTS80, VTS85 £2.50
VT3,000, 5000, VT8000, VT9300, VT9500 £2.50

ITT

VR3605, VR3905, VR3935, VR3985, VR3986, VR3993, VR3994, VP3826, VR3906, VR3916, VR3926, VR3946, VR3948, VR3976, VR3995, VR3997, VR6948 £2.50
VR3913, VR3914, VR3943, VR3954, VR3963, VR3984 £2.50
VR3907 £2.50
VR3912 £2.50
VR3917, VR3833 £2.50
VR3929, VR3968
(PRESSURE ROLLER ASSEMBLY) £6.25

JVC

HR2000, HR3300, HR3330, HR3360, HR3660, HR4100, HR7700, HR7200, HR7300, HR7350, HR7600, HR7610, HR7650, HR7655 £2.50
HRD110, HRD111, HRD120, HRD121, HRD140, HRD150, HRD160, HRD225, HRD455, HRD565, HRD725, HRD157, HRD158, HRD170, HRD180, HRD210, HRD230, HRD250, HRD257, HRD300, HRD320, HRD370, HRD400, HRD430, HRD470, HRD530, HRD566, HRD700, HRD750, HRD755, HRD950, HRP50, HRS5000, HRS5500 £2.50

MATSUI

VX8[illegible] £2.50

MITSUBISHI

HS200, HS300, HS301, HS302, HS303, HS304, HS310, HS320, HS700, HS330 £2.50
HS306, HS307, HS337, HS338, HS349, HS400, HS411, HS412, HS421, HS710, HSB10, HSB20, HSB30, HSE10, HSE20, HSE30, HSE70 £2.50

NATIONAL

NV100, NV180, NV300, NV333, NV340, NV366, NV600, NV688, NV777, NV788, AG6010, AG6015, AG6100, AG6200, AG6400, AG6810, NV3321 £2.50
NV230, NV370, NV430, NV460, NV730, NV810, NV830, NV850, NV870, NV890, NV2000, NV2010, NV3000, NV7000, NV7200, NV7800, NV8600, NV8610, NV8620, NVG14, AG1000, AG1200, AG1500, AG2100, AG2100, AG2200, NV260, NV280, NV380, NV450, NV465, NV470, NV480, NV630, NV650, NV770, NV780, NV8050, NV8150, NV8200, NV8300, NV8400, NVG15, NVG30, NVG400, NVH70, NVG130 £2.50
NVG7, NVG19, NVG12, NVG18, NVG9, NVG10, NVG11, NVG120, NVG16 £2.50
NVG21, NVG25, NVH65, NVG33, NVG46, NVG50, NVG300, NVF65, NVF70, NVFS1, NVFS100, NVH75, NVJ30, NVL20, NVL23, NVL25, NVL28 £2.50
NVD48, NVD80, NVG21, NVG45 £2.50

NEC

N830, N831, N832, N833, N895 £2.50
PVC2300, PVC2400, PVC740, PVC744, PVC746, PVC760, PVC764, PVC766 £2.50

ORION

VH1, VH2 £2.50
VC150, VC180, VH1000, VH200, VH201, VH205, VH212, VH250, VH254, VH288, VH3, VH300, VH303, VH3030, VH312, VH33, VH3312, VH404, VH704, VH708, VH712, VH770, VH780, VR2948 £2.50
VH300, VH3050, VH2308, VH2400, VH2600, VH2700, VH4300, VXL20, VXL25, VXL30 Etc £2.50

PHILIPS

VR6460, VR6920 £2.50
VR2020, VR2021, VR2022, VR2023, VR2024 £3.20
VR6711 £2.50
VR6540 £2.50
DV856, VR6485, VR6585, VR6589, VR6880, VR6948 £2.50
VR445, VR6442, VR6542, VR6843, VR6943 £2.50
DV464, VR2324, VR2300, VR2334, VR2340, VR2350, VR2414, VR2480, VR2486, VR2489, VR2490, VR2498, VR6462, VR6463, VR64664, VR6560, VR6660, VR6860, VR6861, VR6862, VR6863 £2.50

Pressure Roller Assembly

DV186, DV190, DV286, DV486, DV471, DV582, DV571, DV761, VR6180, VR6182, VR6185, VR6285, VR6290, VR6291, VR6293, VR6362, VR6367, VR6390, VR6391, VR6393, VR6467, VR6468, VR6470, VR6561, VR6570, VR6581, VR6670, VR6676, VR6760, VR6761, VR6762, VR6870, VR6970, VR6975, VR86B1, 63SB7, 68SB4, 71SB4, 72SB8, 92SB31 £6.25

SANYO

VHR1100, VHR1300, VHR1500, VHR2300, VHR1150, VHR1200, VHR2100, VHR2500, VHR2700 £2.50
VTC5000, VTC5150, VTC5500, VTC9300, VTCM10, VTCM20, VTC5150, VTC5350, VTC5400, VTC6000, VTC6500, VTC9100, VPR5800, VTCM11, VTCM21, VTCM31, VTCM50 £2.50
VHR3100, VHR3300, VHR3310, VHR3700, VHRD500, VHRD700 £2.50
VTC3000 £2.50

SHARP

VC381, VC386, VC2300, VC3300, VC7300, VC7700, VC8300, VC9100, VC9300, VC9500, VC9700, VC200, VC2300, VC3300, VC384, VC385, VC388, VC390, VC393, VC6000, VC6200, VC7750, VC800 £2.50

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SONY FLYBACK TRANSFORMERS

Part No.	Models	Price
1-439-216-00	KV-2002E. 2010E. 2200E. 2015. 1820E. 2010SE. KV-2012ME. 2016ME. 2015ME. 2010ME	£14.00
1-439-256-11	KV-2704EC 2704UB 2704ET 2704E(A) 2704E	£40.00
1-439-286-21	KV-2215UB 2217UB 2215EI 2215FE 2212EX 2215ET	£30.50
1-439-289-21	KV-2705F 2705FE 2705UB 2705E 2706UB 2720EC	£40.00
1-439-303-00	KV-2064EC 20PS1 2082ME7 2056EC 2060SA KV-2062E(ESP)	£22.75
1-439-311-00	KV-1440AEC 1440AS MK2 CPS-14CD3 CPV-14CD2 KTX-1350NF KTX-1430UB	£22.00
1-439-332-21	KV-2756 2730EC 2730FE 2764EC 2752UB 2752F	£30.00
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BC-446	0.25	BC-109	0.09	AD-140	0.98	BC-397B	0.05	BC-450	0.25	BD-139	0.25	BD-436	0.26	BF-200	0.27	BF-594	0.50	BU-800	0.98	MJ-15025	5.72	TIP-127	0.32
BC-556B	0.19	BC-1-9A	0.11	AD-150	0.98	BC-308	0.23	BC-461	0.30	BD-140	0.19	BD-437	0.27	BF-224	0.14	BF-167	0.63	BU-806	0.67	MJ-2501	1.28	TIP-130	0.29
BC-2144	0.16	BC-109B	0.12	BC-173	0.40	BC-308A	0.05	BC-462	0.11	BD-144	1.13	BD-438	0.25	BF-240	0.10	BF-196	0.21	BU-806F	0.89	MJ-2955	0.79	TIP-131	0.52
BC-119	0.30	BC-114	0.09	BC-187	0.36	BC-308B	0.05	BC-463	0.09	BD-157	0.28	BD-442	0.33	BF-241	0.08	BF-421	0.30	BU-807	0.67	MJ-3001	1.28	TIP-132	0.37
BC-323	1.54	BC-120	0.08	BC-558B	0.05	BC-308C	0.05	BC-487	0.11	BD-166	0.38	BD-507	0.27	BF-244A	0.38	BF-258	0.28	BU-824	0.52	MJE-13003	0.56	TIP-136	0.33
BC-408	0.35	BC-125	0.09	BC-557B	0.08	BC-309	0.06	BC-517	0.11	BD-175	0.37	BD-508	0.78	BF-245A	0.23	BF-959	0.63	BU-826A	1.96	MJE-13004	0.57	TIP-137	0.39
BC-148B	0.18	BC-126	0.10	BC-635	0.17	BC-315B	0.11	BC-546A	0.05	BD-176	0.25	BD-510	0.63	BF-254	0.11	BDW-93C	0.36	BU-908	1.48	MJE-13005	0.67	TIP-140	0.93
BC-172	0.05	BC-136	0.09	BC-213C	0.09	BC-317	0.20	BC-547	0.05	BD-183	0.35	BD-517	0.56	BF-255	0.09	BFR-90A	0.50	BUT-11	0.60	MJE-13006	1.01	TIP-142	1.01
BC-2126	0.06	BC-138	0.08	BC-213L	0.10	BC-318B	0.08	BC-547A	0.03	BD-190	0.28	BD-520	0.80	BF-256A	0.14	BF-491	0.23	BUT-11A	0.85	MJE-13007A	0.90	TIP-147	0.99
BC-238B	0.05	BC-141	0.21	BC-184L	0.10	BC-319C	0.08	BC-547B	0.05	BD-199	0.67	BD-525	0.38	BF-257	0.26	BF-970	0.25	BUT-11AF	0.70	MJE-13009	1.41	TIP-29	0.30
BC-252	0.06	BC-142	0.18	BC-186	0.08	BC-320	0.05	BC-548	0.05	BD-201	0.32	BD-528	0.28	BF-259	0.29	BF-979	0.82	BUT-12A	0.92	MJE-2955	0.56	TIP-2955	0.67
BC-252B	0.06	BC-143	0.29	BC-204B	0.11	BC-322	0.10	BC-548A	0.14	BD-202	0.41	BD-530	0.85	BF-294	0.23	BFR-89	0.30	BUT-13	2.85	MJE 3055	0.42	TIP-29A	0.26
BC-140	0.28	BC-147	0.19	BC-205B	0.05	BC-327	0.05	BC-548B	0.07	BD-203	0.41	BD-534	0.38	BF-297	0.14	BFR-91	0.35	BUT-56A	0.81	MJE-340	0.32	TIP-29C	0.25
AC-188	0.23	BC-147B	0.05	BC-209	0.08	BC-328	0.06	BC-549	0.05	BD-204	0.46	BD-535	0.54	BF-324	0.10	BFY-50	0.28	BF-173	0.25	MPS-9634	0.15	TIP-29E	0.37
AC-138	0.20	BC-148	0.19	BC-212	0.05	BC-337	0.06	BC-549C	0.08	BD-232	0.33	BD-536	0.36	BF-337	0.30	BFY-52	0.28	BF-180	0.26	MPS-UO5	0.38	TIP-30	0.28
AC-151	0.25	BC-148A	0.21	BC-219	0.14	BC-338	0.05	BC-5508	0.07	BD-233	0.25	BD-537	0.32	BF-338	0.15	BFY-52	0.28	BF 451	0.40	MPSA-92	0.15	TIP-3055	0.51
AC-127	0.20	BC-148C	0.11	BC-237	0.05	BC-347	0.05	BC-556	0.08	BD-234	0.21	BD-578	0.60	BF-355	0.39	BFY-90	0.57	BU-508DF	1.42	R1038	1.65	TIP-30A	0.23
AC-128/01	0.25	BC-149	0.08	BC-237B	0.05	BC-348	0.08	BC-556A	0.11	BC-407B	0.35	BD-590	0.60	BF-392	0.15	BSX-20	0.24	BUT-76A	1.10	R2305	1.35	TIP-30B	0.27
AC-142	0.21	BC-149B	0.08	BC-237C	0.04	BC-349B	0.05	BC-557A	0.16	BC-185	0.25	BD-608	0.60	BF-393	0.14	BU-104	1.26	BF-493	0.14	R2323	0.83	TIP-30C	0.28
AC-186	0.28	BC-149C	0.10	BC-238	0.05	BC-350	0.14	BC-558A	0.05	BC-325	0.35	BD-651	0.41	BF-422	0.11	BU-105	0.98	BF-1322	0.10	R2354A	2.25	TIP-31A	0.28
AC-187	0.28	BC-157	0.21	BC-238C	0.06	BC-350A	0.11	BC 559	0.05	BC-486	0.32	BD-677	0.28	BF-423	0.10	BU 108	0.90	BF-336	0.30	R2540	1.76	TIP 31C	0.32
AC-188K	1.40	BC-157B	0.14	BC-239	0.05	BC-351B	0.07	BC-559A	0.06	BC-343	0.38	BD 678	0.45	BF-458	0.25	BU-108A	1.13	BF-460	1.69	RC-4136	0.67	TIP-32C	0.30
AC-05FSM	1.04	BC-158	0.21	BC-239C	0.05	BC-352B	0.05	BC-559B	0.06	MP5A42	0.12	BD-679	0.28	BF-459	0.23	BU-109	1.10	BUX-39	4.45	S-2000A	2.05	TIP-33C	0.65
AC-10FSM	1.38	BC-159	0.08	BC-250	0.05	BC-357	0.05	BC-560B	0.05	MP5A56	0.14	BD-680	0.33	BF 469	0.22	BU-126	1.12	BU-505F	1.39	S-2000A3	2.21	TIP-34C	0.72
AD 149	1.02	BC-159B	0.11	BC-251B	0.05	BC-365	0.08	BC 636	0.14	BP-177	0.79	BD-681	0.28	BF-470	0.23	BU-180	1.28	BUV-46	1.26	S-2000AF	1.54	TIP-35C	0.96
AD 161	0.84	BC-160	0.16	BC-252A	0.05	BC-368	0.08	BC-637	0.12	BD-169	0.88	BD-707	0.65	BF-472	0.28	BU-184	1.13	BU-505	1.19	S-2055A	2.05	TIP-41A	0.30
AD-162	0.78	BC-161	0.10	BC 258	0.12	BC 380	0.32	BC-538	0.12	BD-128	0.85	BD-711	0.50	BF-494	0.11	BU-204	1.13	BUV-48A	1.58	S-2055AF	2.89	TIP-41C	0.29
AD-2.62	0.60	BC-17-	0.05	BC-259	0.08	BC-369	0.11	BC 639	0.14	BD-437	0.37	BD-712	0.50	BF-495	0.08	BU-205	1.00	BUW-11	0.81	S-2530A	2.10	TIP 42	0.23
AF-121	0.35	BC-172B	0.08	BC-261A	0.05	BC-152	0.35	BC-640	0.12	BD-235	0.27	BD-809	0.46	BF-679	0.36	BU-206	1.50	BUW-12A	1.40	S-3786	8.74	TIP-42C	0.29
AF-124	0.63	BC-178A	0.40	BC-262A	0.09	BC 115	0.12	BC-875	0.24	BD-236	0.38	BD-810	0.46	BF-680	0.30	BU-208	0.84	BUW-13A	2.28	MN-650	2.80	TIP-47	0.42
AF-127	0.49	BC-181	0.08	BC-267B	0.23	BC 360	0.12	BC-879	0.32	BD 237	0.37	BD-647	0.98	BF-757	0.45	BU-208A	0.98	BUW-41B	0.68	BV-806A	0.65	TIP-48	0.49
AF-178	0.38	BC-182	0.06	BC-268	0.21	BC-182B	0.18	BC-880	0.30	BD-238	0.25	BD-518	1.84	BF-758	0.37	BU-208D	1.17	BUW-81A	1.79	MP-SA55	0.25	TIP-49	0.35
AF-179	0.38	BC-182L	0.05	BC-270	0.08	BC 682	0.68	BD-124	0.84	BD-241	0.27	BD-134	0.50	BF-759	0.42	BU-209	1.37	BUW-84	0.67	S-2060D	2.50	TIP-57	0.83
AF-180	0.38	BC-183L	0.10	BC-287	0.08	BC-385B	0.84	BD-124P	0.35	BD-241A	0.28	BD-145	0.98	BF-762	0.28	BU-225	1.62	BUX-80	1.62	T-9054V	4.98	TIP-640	0.90
AF-181	0.30	BC-137	0.45	BC-291	0.09	BC-304	0.98	BD-127	0.25	BD-242	0.27	BD-225	0.55	BF-788	0.45	BU-226	0.98	BUX-81	1.83	T-9051V	5.98	TIPL-761A	1.40
AF-239	0.38	BC-167	0.42	BC-297	0.06	BC 532	0.28	BD-131	0.40	BD-242C	0.28	BD-141	1.25	BF-858	0.30	BU-326A	1.30	BUX-84	0.53	T-6071V	2.38	TIPL-791A	1.12
BC-107	0.12	BC-182LB	0.08	BC-298	0.08	BC-546B	0.10	BD-132	0.25	BD-243A	0.35	BD 939F	2.25	BF-859	0.35	BU-406	0.56	BUX 85	0.63	T-6035V	2.95	TIC-126M	0.65
BC-108	0.11	BC-168	0.19	BC-300	0.39	BC-477	0.40	BD-135	0.21	BD-243C	0.49	BD-825	0.63	BF 869	0.21	BU-406D	0.84	BUX 86	0.27	TAA570	2.94	TIP-101	0.98
BC-108A	0.11	BC-151	0.35	BC-301	0.19	BC-413	0.06	BD-136	0.18	BD-244A	0.23	BF-11S	0.35	BF-869S	0.23	BU-407	0.53	BUY-18S	0.90	T-9038V	5.98	TIP 106	0.98
BC-108B	0.12	BC-171	0.16	BC-303	0.22	BC-413C	0.06	BD-137	0.28	BD-244C	0.20	BF-195	0.09	BF-870	0.23	BU-407D	0.79	BUZ-71A	0.53	T-9053V	4.98	TIP-112	0.42
										BD-245C	0.85	BF 450	0.10	BF-871	0.25	BU-408	0.25	BUZ-80	3.24	T-9035V	1.49	TIP-141	1.98
										BD-246	0.52	BD-826	0.23	BF-872	0.27	BU-408D	0.91	DTA-124EF	0.20	S-6192F	0.60	TIP-146	1.98
										BD-246C	0.43	BD-827	0.27	BF-900	0.52	BU-426A	0.84	DTA-144ES	0.20	SM6J45	2.46	TIP-31B	0.20
										BD-249	1.11	BD-839	0.42	BF-960	0.23	BU-426E	0.88	DTC-124ES	0.20	T-9064V	1.05	TIP-32A	0.29
										BD-249C	0.95	BD-901	0.57	BF-645	0.98	BU-500	1.38	DTC-144EF	0.20	TAA-550	0.28	TIP-33	1.50
										BD-250	0.76	BD 902	0.42	BDW-83C	1.09	BU-506	1.37	F-1035	0.30	TIC-106D	0.49	TIP-34	0.72
										BD-250C	0.93	BD-911	0.57	BDW-84C	1.14	BU-506DF	1.37	FT-5753M	2.51	TIC-206D	0.57	TIP-33A	1.50
										BD-253	0.90	BD-912	0.62	BD-441	0.28	BU-508A	0.98	FT-5754M	2.90	TIC-225	0.69	TIP-33B	1.25
										BD-253A	0.98	BDW-93B	0.40	BD-519	0.85	BU-508AF	0.98	FT-5763M	2.25	TIC-226	0.71	TIP-32B	0.98
										BD-278A	0.38	BDW-94	0.41	BD-529	0.99	BU-508D	1.19	FT-5764M	2.18	TIP-110	0.23	TIP-42A	0.98
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										BD-318	1.83	BF-126	0.06	BD-150	3.08	BU-526	1.26	KSR-1004	0.08	TIP-115	0.36		
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COVER PHOTO
This month's cover photograph shows a prime focus dish with polar mount being installed – see article on pages 24-32.

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Technological Leads

There was much talk earlier this year of an exiting new type of consumer electronics product, the computer-based multimedia device. The idea is to combine computer and communications or other relevant technology to produce innovative new offerings. Apple was at the time taking a leading role. It announced forthcoming digital consumer products at last January's Las Vagas Consumer Electronics Show. This was followed by a prototype, the Apple Newton, described as a "digital personal assistant", at May's Chicago Consumer Electronics Show. It was said that Newton would have communications capability though its exact specification was left rather vague.

More recently an international consortium that includes the US telecommunications company AT&T and Matsushita has announced the development of the "personal communicator", a combined pocket telephone and personal computer. It is to be the first of a family of portable communicators - AT&T has shown mock-ups of the NotePhone and FlipPhone - that combine voice telephony, electronic mail, fax and wordprocessing with the ability to accept handwritten input. The consortium claims that development work is complete and hints that marketing plans for the first devices will be announced in the near future. It's suggested that the devices will retail at around £600, though a sharp fall is expected when large-scale production commences. According to Alain Rossman, chief executive of the Californian computer design company EO, a member of the consortium, "personal communicators integrate telephony, messaging and computing to create a compelling new device that will have as much impact on person-to-person communications as the telephone did in the early 1900s". The consortium is seeking a European partner to assist with marketing.

It all sounds very intriguing. But one wonders exactly how such devices would be integrated with people's everyday lives, despite being described as consumer products. Clearly they don't have entertainment value unless possibly as games machines. Is there scope for a vast increase in person-to-person communications, and is it logical to combine this with computing ability? Maybe, but more likely as a business tool.

In fact it seems that Apple, which made the initial running, is now having second thoughts. Apple's chairman and chief executive John Sculley is reported to have told a recent industry conference in California that his company is "less and less convinced that there is a market for these things in the near term in the consumer field". He is now stressing the business applications of Newton - as a handheld electronic notepad. Despite early suggestions that Newton might sell as a consumer product at around £300 or so, it now seems that Newton will have to be priced at a level well above that acceptable as a mass-market product, certainly to start with. But conflicting comments are coming from Apple. According to Ken Wert, the Apple PIE division's marketing manager, "our perception of the market has not changed".

Well, we shall have to see. But it does seem doubtful whether some of these technology combinations would result in really useful, practical consumer products. Meanwhile at a more down-to-earth level Amstrad has postponed plans to launch its low-cost videophone. The company is trying to get production costs down. But BT intends to go ahead in the near future and hopes to be able to sell GEC-Marconi produced videophones at under £400. The phone will have a 4in. screen and transmit the video signal at a data rate of 9kbits/sec. GEC-Marconi has also received an order for its videophones from a US telephone operator, MCI Communications. It will be interesting to see how consumers respond to the prospect of these small, low-definition pictures.

Should the anticipated increase in person-to-person communications occur, will it be via cable rather than radiotelephony? At the British Association meeting in August a panel of specialists in opto-electronics reported on significant developments in their field. The data capacity of fibre-optic cabling seems to be almost infinite. A great advance came with the erbium-doped fibre amplifier, which enables light signals to be amplified automatically without conversion to electronic form and back again. According to Professor David Payne of Southampton University the bulk of international telecommunications traffic will shift from satellites to undersea fibre routes. Videocommunications will be much cheaper and more realistic than with today's videoconferencing systems. Professor Peter Cochrane of BT Laboratories, Martlesham predicted that early next century optical-fibre networks will extend to every home and business in the UK, and that radio and microwave systems will be reserved for mobile communications. Where will all this leave us? Linked to the cable but with receivers of some sort that will presumably still go wrong from time to time!

Service Briefs – Philips

The following notes on TV fault-finding and modifications are based on items included in the Philips publication *Service Link*. Further notes relating to satellite TV receivers, video equipment and CD players will appear in a later issue.

2A chassis: Failure of the TDA3653AQ/TDA3654Q (90°/110° models respectively) field output chip IC7570 is often caused by C2571 (100µF, 25V) going low in value. The 390pF, 100V ceramic plate capacitor C2565 on the print side of the panel can also be responsible for failure of IC7570. If this i.c. has to be replaced these two capacitors should also be renewed.

2B chassis: The following modification can be carried out where playback of copy-protected VHS tapes is affected by the anti-copy signals present during the sync period: change C2544 from 47nF to 22nF; add a 3·3µF capacitor in parallel with C2545 on the print side of the panel; change R3544 from 1·8kΩ to 3·6kΩ. For optimum results the value of C2544 may have to be slightly less or higher than 22nF.

Radiation from Nicam decoder panel 1110 can cause interference to Band II f.m. radio reception in areas where reception conditions are poor. Where this problem is experienced the following modification should be carried out: (1) Cut the print between pin 40 of IC7450 and coil L9494. (2) Disconnect and discard the tubular 47pF capacitor from the print side of the panel. (3) Reconnect the 10µH coil L9494 between pin 40 of IC7450 and its original position, i.e. across the print cut, ensuring that the lead between the coil and the i.c. is as short as practicable. (4) Solder a link wire in position 9454. (5) Solder a 47pF chip capacitor (code no. 4822 122 31772) between pins 2 and 3 of edge connector S10 – don't use the discarded tubular capacitor as small physical size is essential here.

2B, CP90, CP110, G90 and G110 chassis: The teletext microcomputer chip was changed to type MAB8461P/W196 (code no. 4822 209 62479) to prevent continuous page header display under certain conditions in the subtitle mode.

3A chassis: To avoid spurious fuse blowing in sets with Nicam and PIP the rating of fuse F1642 in the 7V supply was increased from 800mAT to 1·25AT.

CP110 chassis: In later production the colour decoder chip IC7260 was changed from type TDA3562/N5 to type TDA3566/N5. At the same time R3292, R3293 and Tr7267 were deleted (these components are not shown in any of the circuits we have – editor). If the PAL phase coil L5270 can't be set up for optimum results when this change is carried out as a service replacement change L5271 to 15µH (code no. 4822 157 52842).

To give improved protection to the BUT11AF chopper transistor Tr7665 a 39Ω resistor (code no. 4822 050 23909) was added in parallel with coil L5656 in its base drive circuit.

An overmains circuit was added in later production to reduce the possibility of mains-borne spikes causing failure of the TEA1039 chopper control chip IC7669. It's linked to IC7669's supply pin (pin 9).

D16-III chassis: Slight patterning (several straight or random wavy vertical lines) may be noticed when a video signal is fed in via the external 2 scart socket. The following modification will provide an improvement: (1) Remove link wire 9297 and chip link 4219 to isolate a section of printed track. (2) Connect the inner conductor of a suitable length of coaxial cable between the print from pin 20 of PL06 (external 2 scart socket) and pin 5 of IC7265 (S-VHS switch chip). Connect the braid between pin 21 of PL06 and pin 6 of IC7265. The coaxial cable link must be positioned along the rear edge of the panel on the print side.

FL1·0 and FL1·1 chassis: Slight interference from the I2C bus may be audible from the left-hand speaker under very quiet conditions when the treble control is at or near its minimum or maximum setting. The effect is not present with the treble control at mid-position. It can be minimised by carrying out the following modification: (1) Cut the print track to pin 14 of the TDA8425 audio processing chip IC7680. (2) Solder a wire-ended 4·7nF, 63V ceramic plate capacitor (code no. 4822 122 31125) between pin 14 of IC7680 and the earthy end of C2694. Keep the extra capacitor's leads as short as possible.

G90 chassis: When there has been a power supply fault it's advisable to check visually that the chip diodes are all adequately soldered at both ends.

G90 and G110 chassis: When the chopper transistor has failed the CNX83A feedback optocoupler (code no. 4822 130 82034) should also be replaced.

G90, G110 and GR1-AX chassis: Later production sets have an ST24C02CP instead of an X2402 EEPROM chip. In most sets no other changes are required when fitting an ST24C02CP. Where a PCD8582P EEPROM was used in the G90B/G110 chassis however a chip jumper (code no. 4822 051 10008) must replace C2724 and R3729 must be deleted. With the GR1-AX chassis the ST24C02CP chip comes with a metal shield (under code no. 4822 310 31886) which must be placed over the EEPROM and soldered in place of jumper link 9020: also the 5V supply must be modified as described in the GR1-AX chassis section later. Note that when a new EEPROM is fitted there will be no tuned programmes and the customer control settings will all be at minimum. This may give the impression that a fault is present. Complete reprogramming is required when a new EEPROM is fitted.

G90AE chassis: To reduce vertical striations at the left-hand side of the screen a choke with a series-connected RC network in parallel were added in series with the 95V feed to the line output transformer (pin 5). The 82µH choke is code no. 4822 158 10563, the 33Ω resistor (on the input side) code no. 4822 116 52094 and the 10nF capacitor code no. 4822 122 31414. To add these components in earlier sets proceed as follows: (1) Fit the choke in pace of link 9547. (2) Connect the resistor and capacitor in series then fit the network in place of link 9548, with the capacitor to pin 5 of the transformer. (3) Connect a wire link between the positive terminal of C2631 (47µF) and link 9609.

In later production sets a 400mAT fuse (F1670) was added between the anode of standby thyristor Ty6670 and pin 15 of the chopper transformer T5625. It's mounted on a small PCB together with Ty6670.

G90AE-Sat chassis (Pye Model 52KV2529): A buzz on sound may be heard on some satellite channel recordings made via phono sockets BU8/9. This effect can be cured by adding a 1,000μF electrolytic capacitor (code no. 4822 124 20786) across the 13V supply on the satellite sound module. Fit the capacitor on the component side of the panel between link 9112 (positive terminal) and the coil end of link 9113 (negative terminal). Where link 9113 is not fitted use the hole in the PCB near coil L5212 for the negative terminal connection.

G90B chassis: This chassis uses a TDA8153 RGB output chip (IC7380) which is mounted on the tube base panel. If a replacement has to be fitted additional flashover protection is recommended. Add a 4·7μF, 250V electrolytic capacitor (code no. 4822 124 21157) between pins 4 and 8 of the chip, negative terminal to pin 8.

G90B and G110 chassis: Later production sets are fitted with a colour decoder chip type TDA8390/N4 instead of type TDA8390/N3. These i.c.s are not interchangeable. The following changes must be made when fitting the N4 version: G90B chassis delete R3313, R3340, R3341 and D6336; change C2352 to 15pF (4822 122 32504), R3336 to 3·9kΩ (4822 111 90571) and R3338 to 6·8kΩ (4822 111 90544). G110 chassis delete R3340, R3341 and D6336; change R3371 to 1·2MΩ (4822 111 90409) and R3372 to 680kΩ (4822 111 90368).

Also in later production the timebase generator chip was changed from type TDA2579 version N6 or N7 to type TDA2579A/N8. Although minor component value changes were made none are necessary when fitting the later type as a replacement. The change was made to eliminate jitter at the start of the field scan.

With some Nicam sets a ticking noise may be heard in the background when in the external AV mode. The effect can be reduced by carrying out the following modification to the Nicam panel: (1) Remove chip resistors R3044/5 then cut the print between pins 14 and 15 of IC7040. (2) Use 100mm lengths of screened cable to connect pin 12 of IC7150 to pin 14 of IC7040 and pin 11 of IC7150 to pin 15 of IC7040. Earth the cable screening at pins 1/2/3 of IC7040. (3) Connect a 4·7nF capacitor between pins 5 and 18 of IC7150 and another 4·7nF capacitor between pins 5 and 20, keeping the leads as short as possible (capacitor code no. 4822 122 30128).

G110 chassis: Extra protection for the BUT18AF chopper transistor Tr7625 was incorporated in later production sets by adding two series-connected BYD73B diodes (code no. 4822 130 60778) between its base and emitter (chassis), with the anodes to the base side. Make sure that the opto-coupler driver transistor Tr7654 is type BC817, not type BC847.

On some sets, mostly those fitted with the ·4 version of the tube base panel, vertical striations on the left-hand side of the screen may be noticed under certain picture conditions. Removing wire link 9302, which is adjacent to connection 19G on the tube base panel, will cure or greatly alleviate the symptom. The ·4 version of the panel can be identified by the figure 4 that follows the code no. 3113 253 3072 on the component side. With Nicam sets, soldering links 9011 and 9126 to the chassis print on the component side of the main PCB will provide a further slight improvement.

In the event of a complaint about low teletext contrast, D6813 on the print side of the teletext panel can be deleted. This increases the contrast range in the teletext mode.

If a red flash is seen when changing channels, with VCR playback in the still or search modes or at edit points in own recordings, reduce the value of chip capacitors C2434/5 from 0·1μF to 2·2nF (code no. 4822 122 32999). These capacitors are on the main PCB adjacent to IC7425.

GR1-AX chassis: In the event of failure of R3616, R3680 (both 1Ω), D6610 (BZY79C10) or the MOSFET chopper transistor Tr7610 all four items should be replaced. The two resistors are in series with Tr7610. When fault finding don't apply a probe to Tr7610's gate to check voltages or waveforms – this will damage or destroy it.

Note that the series chopper circuit provides a 95V h.t. output at 33W. Thus a 60W, 240V bulb can't be used as a load when fault finding. If a bulb rated at more than 15W is used as a load the power supply, because of the bulb's low resistance when cold, won't start up. A working power supply will operate without a load however (lift coil L5660) – the h.t. will be approximately 97V under these conditions.

Note that there's an error in the circuit and the main PCB layout diagram in the service manual. The 160V rectifier circuit should be shown connected between pins 1 and 6 of the line output transformer, not pins 1 and 5 – pin 6 is the 95V h.t. feed to the transformer's primary windings.

Transistor Tr7705 (type PH2369, code no. 4822 130 41594) can be responsible for tuning problems (stations appearing to the right of the normal position, higher channels not available).

For added safety in the event of a short across the 9V line the value of R3100 was increased to 1·5Ω (code no. 4822 116 80691), an 0·47μF capacitor (code no. 4822 121 51252) was added in parallel with it and transistor Tr7100 (BC558, code no. 4822 130 40941) and resistor R3646 (150Ω, code no. 4822 116 52211) were added (see Fig. 1). Tr7100 senses the voltage across R3100, firing the over-voltage protection thyristor Ty6641 to remove the 95V h.t. supply in the event

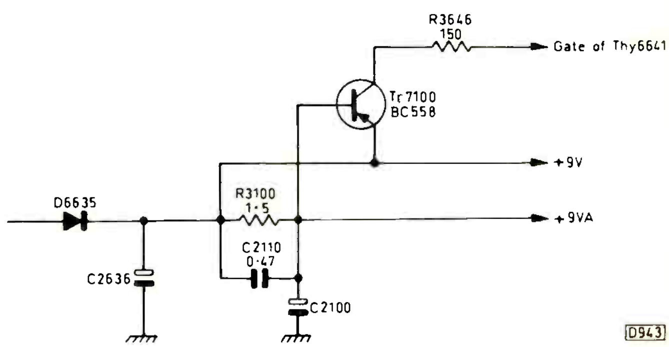

Fig. 1: Modification for added protection in the 9V supply, GR1-AX chassis.

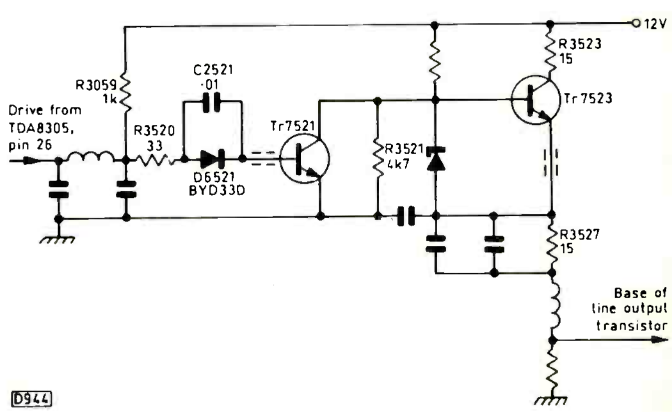

Fig. 2: Line drive circuit modification, GR1-AX chassis.

of a short.

Several changes were made to improve the operation of the unusual line drive circuit. The modified circuit is shown in Fig. 2.

A modification was introduced to prevent sets coming on from standby in the hotel/store lock mode, when stored control/programme settings can't be altered. The memory chip IC7785 was changed to type ST24C02CP (code no. 4822 209 62098). Its 5V supply is taken from R3797 instead of the junction of R3770/R3767, via L5786 which is connected to a different pad.

When colour dropout is experienced with poor quality prerecorded video tapes an improvement can be obtained by increasing the value of C2322 from 0·22μF to 1μF (code no. 4822 124 40242).

The anti-copy signal recorded during the sync period can affect the playback of copy-protected tapes. The following modifications provide a significant improvement. Change C2050 to 47nF (code no. 4822 121 42491), C2322 to 1μF (4822 124 40242), R3050 to 75kΩ (4822 116 52301) and R3051 to 1·5kΩ (4822 116 52243).

GR2·1 chassis: If with Nicam versions of this chassis the sound and vision mute for a few seconds maybe several times whilst viewing, remove C2721. The serial number of receivers affected is preceded by QG06: the sets are fitted with a memory protection panel in place of R3771.

To eliminate possible hum in the standby mode R3673 was changed to 4·64kΩ (code no. 4822 051 54642) and R3674 to 1·05kΩ (4822 051 51052).

The following modifications were introduced to avoid failure of the power supply to start up from standby: R3663 was changed to 5·6kΩ (code no. 4822 051 10562), R3674 to 1kΩ (4822 050 11002), D6670 to type TAGE0102AA (4822 130 20272) and IC7624 to a selected version of the CNR50 (4822 209 30992).

KT4 and K40 chassis: Failure of the TDA3650 field timebase chip IC7110 is often due to C2107 (100μF, 50V) going low in value. Intermittent field collapse, sometimes with field cramping at the top of the screen, can be caused by D6107 (BAX18). If it's necessary to replace IC7110, C2107 and D6107 should also be renewed. Use type BYD33D (code no. 4822 130 42488) in the D6107 position. C2107 is code no. 4822 124 40712. At the same time the line output transformer's pins should all be resoldered – dry-joints can cause intermittent field faults.

Tuners: Later CP90, CP110, G90AE, GR1-AX and Anubis A sets are fitted with tuner type U943 in place of the earlier U743. In some chassis components have to be added if the earlier type of tuner is used as a replacement. GR90AE add C2006, R3006 (chip type) and link 9701; GR1-AX add C2004, link 9087 and link or coil 9510/L5000; Anubis A add R3003 and R3004 (chip resistors).

The U341 tuner used in the K30 and K35 chassis is no longer available from Philips who supply the U342LO tuner as a replacement. When fitting this the aerial input connection has to be modified as follows: (1) Remove the side covers from the U341 tuner then desolder the aerial connection tag from the PCB. (2) Remove the side covers from the new tuner and desolder pin 1 (aerial input). (3) Solder the aerial input tag from the U341 tuner in the same position in the U342LO tuner, then fit the replacement unit in the receiver. When working on the tuner don't disturb any of the coils or Lecher lines. Confine soldering to the immediate area of the aerial input connection and ensure that the covers are refitted in the correct position.

Camcorner

Reports from Steve Beeching, T. Eng., David C. Woodnott and Nick Beer

Panasonic NVMC5

This little machine has a JVC style mechanism. It came in with a no playback fault. Recording was o.k., with fine results from playback via another machine. This eliminated the heads and most of the head switching circuitry. The culprit turned out to be an open-circuit coil in the head amplifier circuit – the coil that feeds the PB 5V supply to the M51459FP head amplifier chip. As usual with faults in this area, diagnosis was easier than gaining access to the PCB, mounted as it is within its own screening can. **D.C.W.**

Panasonic NVMS2

The problem here was intermittent closure of the iris. As the symptom could sometimes be brought on by tapping the case a dry-joint was suspected. When the case was removed and the fault area was located we found not one faulty joint but many: connector P001 on the camera operation PCB had never been soldered in! **D.C.W.**

JVC GRC2

There were no functions apart from fast forward/rewind at about half the normal speed. No E-E pictures or any other results were obtained, except that the emergency mode was entered within a few seconds of pressing the fast forward or rewind button. CP3 was replaced, as suggested by the emergency-mode display. This restored all the deck functions, but there was still no camera picture though YC signals from the YC separator could be recorded. Playback was o.k.

The supplies to the camera head were correct but there wasn't a glimmer of an output. At this point fate gave a helping hand. When the camera head was removed from the case a large screw dropped out – it was one of the deck securing screws. To cut the story short, the offending screw had caused extensive damage to the SSG circuitry. The SSG chip IC3, the blanking chip IC4 and the regulator and switching chip IC1 all had to be replaced, also Q6 (in the 5V supply of IC3) which was open-circuit. One screw did all this – and an estimate had been requested. Estimating can be a nightmare with camcorders! **D.C.W.**

Sony CCD330

This one had been "looked at" by a large service centre that had charged for a no-fault found repair! According to the customer the problem was occasional tape crinkling. Apparently the camera would sometimes behave itself while on other occasions it would chew the tape immediately, causing the mechanism to jam with the inevitable eventual shutdown. The customer was then left to retrieve what was left of his tape as best he could.

On removing the case and watching the tape load and run it was obvious that all was not well with the tape transport system. The tape was being dragged up the pinch roller and, if left, would eventually jam against the guide. We also noticed that the travel of the tape tension arm was being restricted – in fact it was jamming against guide two (TG2) on the tape supply side of the mechanism. All this was caused by nothing more than misadjustment downwards of TG2. How it had come to be so far away from its correct position, and why this wasn't spotted by the previous repairer, will never be known! **D.C.W.**

JVC GFS1000

The symptom was intermittent spots that covered the whole screen in playback. They could have been caused by a capstan servo fault but were actually too random and instantaneous for this diagnosis to apply. In fact the cause was that one of the heads wasn't being switched on. The fault persisted, though with less regularity, after replacing the TA8609P playback f.m. processing and head switching chip IC701. Closer inspection of the r.f. switching signal then showed that it skipped a beat every so often, staying high instead of going low. This signal is derived from the drum PG pulses by the servo chips IC401 and IC403, so checks were carried out in this area. The r.f. switching output at pin 16 of the main servo chip IC401 was first compared with the preamplifier's f.m. output, using the scope's two beams. Nothing conclusive resulted from this and other checks and the problem was getting more difficult as the fault was now more intermittent. Replacing IC401 made no difference so I moved on to the next chip down the line, the drum PG pulse amplifier IC403. This turned out to be the cause of the fault. **S.B.**

Sanyo VMD3P

A cassette was jammed in this camcorder. Checks showed that there was no loading or capstan motor drive as F4001 (type ICP-F10) on PCB SV1 had blown. This fuse feeds the 2SB1205 5V regulator transistor Q4006. There were no readable shorts but over 1A was being drawn through F4001 which is a 400mA device. Disconnecting the loading and capstan circuits in turn suggested that the fault was in the former, but we couldn't find anything amiss here. When an external 5V supply was used instead of the regulator circuit the peak current demand was 150mA. Q4006 was faulty. **N.B.**

Panasonic NVM10

This machine, which belonged to a local school, had been dropped. The smashed case was easily replaced, as was the buckled cassette carriage. We then found that there was no play or record as the drum had seized. This is not uncommon when one of these machines has been dropped – the hifi stator jams the drum either because the stator centralising has been knocked off or the supporting bracket has been bent. The latter was the case this time. Next the machine wouldn't record as the record prevent switch was broken. When this had been attended to we put the machine on soak test where it ran well for some days. It then wouldn't switch on.

After checking the power supply I established that the fault was in the power switching logic rather than the supply itself. There was pull-up on the switch line and the switch operated correctly, taking the line low. This takes the common cathode connection of two diodes low. Conditions were correct here. However the common anode connection of the following pair of diodes remained high. Yes, would you believe it, a break in the print?! **N.B**

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viewfinder, a digital image stabiliser, a x36 digital zoom, LP and hi-fi stereo sound. The suggested retail price is £1,000. The NVMS4B at £1,400 is a full-sized S-VHS model with a stereo zoom microphone, x12 zoom, VITC generator and digital picture effects. Model NVS6 is a replacement for the NVS5.

Sanyo has launched two VCRs which feature a Video Plus timer and ASO (active sideband optimum) picture enhancement. The VHR251E has a suggested retail price of £330 while the VHR291E, at £400, also has a Nicam decoder.

Sony's CCD-TR805 camcorder at £1,099 features the SteadyShot anti-shake system described by Steve Beeching last month. There are also two new Sony VHS VCRs featuring the dual-mode shuttle system which has the main controls on a rotary dial. The SLV225 at £300 has NTSC playback, LCD programmable remote control and index search. The SLV425 at £380 adds trick-play features, long play and an on-screen menu system. Sony's CCD-FX500 camcorder at £800 weighs only 850g: its features include a digital superimposition and fader facility, a choice of aperture or shutter priority for creative effects, Sony's quick inner focus system and an innovative one-touch connection system to provide easy playback of recordings with just one lead connected to the camcorder.

Sharp has introduced the VLM4H 8mm palmcorder at only £600 despite a long list of features.

Fuji has introduced two 8mm camcorders with a compact x12 optical zoom lens system that has a wide-angle setting of 4·5mm. The FF120SW has a suggested price of £700 while the FG122SW, which includes a colour viewfinder, is priced at £850.

Letters

INSURANCE WORK

We try to be fair to our customers and the insurers when it comes to claims and estimates for repair, but I can find no rules for such things as damaged print on a power supply panel. Are we allowed to repair the panel with tinned copper wire or must it be replaced? It seems rather an extreme course to change a panel costing say £80 for the sake of a few inches of wire. In the case of an Amstrad VCR that came in recently the print was stripped from the panel around the mains fuse. Something had been spilt into the machine and the board was scorched. As the damage was in the mains area I decided to replace the panel. But it isn't available as a spare part, so the machine had to be written off.

We had a severe bout of storms not long since, with a lot of electrical damage to TV sets, VCRs, stereo systems, microwave ovens and cordless phones. Print loss and blown semiconductor devices were common and we had to issue a large number of estimates. I hope we were fair to all concerned and kept within the law. But what happens if we say, in good faith, that a panel needs to be replaced and the machine is then considered to be a write-off because the panel isn't available, then the insurer has the machine checked by another dealer who considers it to be o.k. for repair by over-wiring and cutting out the scorched parts? The insurer could accuse the owner of making a fraudulent claim, abetted by ourselves. Can anyone clarify the position? I've asked many people in the trade, but no one seems to be sure.

It would be very unfair if a small firm were to be prosecuted for something for which they've not even been paid.

Chris Watton,
Boston, Lincs.

CHANNEL 5

My thanks to Keith Cummins for expanding on my piece about Channel 5 reception. He's not the only one to have been shaken by the details I provided – a local broadcaster has expressed similar apprehension.

Certainly the retuners will earn their £1·50 a visit in this area. Our channels for the present services are 55, 59, 62 and 65. To find out what would be involved I added a second VCR to my home outfit. After two hours spent fiddling about I still couldn't find for the two VCRs a combination of tuning points that, taken together, rid me of patterns on the two lower channels 55 and 59. So "ten minutes a visit" is a little optimistic.

Harold Peters,
Lowestoft, Suffolk.

In previous letters (January and May) I outlined some of the problems that I feared would accompany the introduction of Channel 5. Harold Peters' well researched and highly informative article (July) made me aware of further difficulties.

The "city TV" idea as proposed simply won't work in South Yorkshire. It has long been a source of irritation in this area that our main city, Sheffield, is not a centre for regional TV. BBC and ITV regional services come from Leeds, a city that's remote both culturally and geographically. Sheffield, Rotherham, Doncaster and the surrounding small towns form a densely populated area with a distinct regional identity. So on the face of it the proposal to make Sheffield a regional centre for Channel 5 is very welcome. Unfortunately the technical problems will defeat the intention.

Harold Peters tells us that the Sheffield service is to be transmitted from Crosspool on channel 67 with an e.r.p. of 2·5kW. The existing co-sited transmitters use group A channels, have an e.r.p. of 5kW and serve only a small part of South Yorkshire – mainly Sheffield city centre and some outlying districts. Most viewers in South Yorkshire receive their signals from Emley Moor, not Crosspool. Transmissions on channel 67 will be inherently more susceptible to screening effects than the current group A ones from Crosspool. This fact together with the lower e.r.p. will reduce the Sheffield Channel 5 coverage still further. Very many people in the city and the vast majority of those in South Yorkshire as a whole won't be able to receive the correct, local version of Channel 5. Instead they will have to receive the Leeds version, transmitted from Emley Moor at 870kW e.r.p. Under these circumstances I can't see anyone running the Sheffield City TV franchise successfully.

Harold Peters tells us that the Sutton Coldfield Channel 5 transmissions will be on channel 37 and that this is a "typical n + 9 interference problem because BBC-1 is on channel 46". The ITC's answer to this is in part to transmit Channel 5 with the opposite polarisation. But this won't help at all, because at virtually every receiving site the Channel 5 aerial's output will be combined with the existing services – once the signals are on the same cable the polarisation of the signal is of course irrelevant. I'm astonished that the ITC is seriously proposing to transmit a signal spaced nine channels away from an existing service at the same site, completely disregarding one of the fundamental rules of TV broadcast planning. Does it think that people are going to stand up, walk across the room and change from one aerial to another every time they zap through the channels? Does it suppose that we are going to duplicate every existing communal system, with termination at an aerial switch in every household?

When the Channel 5 transmissions start they will of course interfere with any VCR or satellite TV receiver whose output is on the same or an adjacent channel. Most customers will regard this as being a fault in their equipment and will expect a free service call, even when the equipment is out of guarantee. Because of this a little defensive forward planning is required. When I install a satellite TV receiver I make sure that its output is well away from the channel 35-38 region. In our area this usually means channel 30, the only vacant group A channel. N + 5 and n + 9 then preclude the use of channels 35 and 39 for the VCR. Due to local transmissions channels 34 and below and 40 and above are often not usable. So the VCR's output usually ends up on channels 36, 37 or 38. What happens to the VCR picture when Channel 5 comes into operation? That's not my problem!

Bill Wright, Wright's Aerials,
Rotherham, South Yorkshire.

FAIR CHARGES

In your September issue John Edwards raised the question of fair charges. There are two basic problems. First, too many engineers chasing too few jobs. Thus the temptation is always present to try to attract extra business in one way or another. Secondly, because of the complexity of modern TV sets the true repair cost is often out of all proportion to the value of the set. Gone are the days when you could charge what a job was worth: it's now more a question of what the customer is prepared to pay.

As far as estimates are concerned, I find that the best course is to glean as much information as possible over the phone and give a rough verbal estimate. This at least gives you some idea of how much the customer is prepared to spend. If the set is brought in I'll have a quick look and do the same.

There must be far more self-employed and unemployed TV engineers in the Bromley area, where John Edwards lives and where I once lived, than here in rural Dorset. But the problems are the same, with the additional one of the high mileage that has to be covered to take in a large enough area to make a living. In the twenty two years that I've been here several other TV businesses have started up and failed. We are only just surviving, mainly I think because of the length of time we've been here and the fact that I try to give good service.

I was speaking recently, via ham radio, to an ex-TV engineer in the States. He was in his thirties and was retraining for a job in industry because, as he said, "when you can buy a new TV set for less than $200 people don't want them repaired". That cheered me up no end!

Peter Nutkins, G0HET,
Charmouth, Dorset.

With regard to fair charges, the crux of the matter seems to be how to charge for estimates etc. when your colleagues/competitors don't do so. The following situation is common enough. You're trying to do a fair estimate in someone's home, say for a stereo with umpteen screws etc. to remove before you get inside. The customer is reclining nearby with his second can of lager, watching TV. He knows that you know you're probably the fifth or sixth engineer to have taken the thing apart. As soon as the cover is off he asks "how much? – and just show me exactly what the fault is".

I've had to adopt the 'no-speak, ignorant' approach: I inspect the equipment and talk about anything but the job. As I put it back together, or reach a suitable point, I just say "the price will be £42 (or whatever) and I'll need to take it to the workshop for a day or so". The customer then usually says "well what exactly is wrong with it?" I give him a vague reply, such as "the amplifier's faulty", and add "if you need a report I charge £15 which is deductible from the bill". This doesn't overcome the problem, but it does educate the customer into realising that not everything is free, especially technical advice so that he can get his mates to fix the gear for him.

Mark Thomason,
Manchester.

Satellite TV Installation Guide

Derek J. Stephenson, B.A., I.Eng., FIEIE

This article is intended as a basic, non-mathematical installation guide for those new to the subject. Although most of the work done in the UK consists of installing Astra dishes there's growing interest in the offerings provided by other satellites, particularly the new Eutelsat II and Intelsat VI series craft. For reception from such satellites a small, motorised polar-mount dish is required. To free the reader from tedious mathematical calculations this article provides tables that give the look angles for seventeen satellites of interest at over fifty locations in the UK. We'll start with a brief summary of the basics.

Satellite Reception Basics

TV satellites offering a 24-hour service are in orbit above the equator at 35,786km (22,225 miles) above mean sea level – see Fig. 1. At this altitude the orbital speed of the satellites and the Earth's rotation are such that the satellites appear to an Earth-based observer to be stationary. The spacecraft are said to be in geosynchronous orbit. They are positioned at intervals around the equator in locations known as orbital slots. Each slot is specified by the longitude of the equatorial point directly beneath it. This is called the sub-satellite point. If a satellite is quoted as being at 16°E, this is the sub-satellite point longitude. Occasionally all orbital slots are quoted as degrees east, for example 347°E instead of 13°W.

Any point on the Earth's surface can be specified by a pair of latitude and longitude co-ordinates. Latitude 0° is at the equator, steadily rising to a maximum of 90° at each pole. Northern hemisphere latitudes are said to be north and southern hemisphere latitudes south. All latitudes are parallel to the equator. Longitudes are convenient lines drawn between the north and south poles, crossing the equator at right angles. The Greenwich meridian, passing through Greenwich, England, is taken as longitude 0°. Longitudes extend from 0° to 180° east and west of this meridian.

Satellite Look Angles

At any point on the Earth's surface only a limited number of the geosynchronous satellites are visible, see Fig. 2. They are located in a geo-arc whose apex is due south and is lower in the sky the farther north your location. In the southern hemisphere the geo-arc apex is due north.

You can aim at any satellite in the geo-arc by setting your aerial at specific elevation and azimuth angles that are collectively known as "look angles". Elevation angles can range from 0° to 90°, but reception from a satellite whose elevation is lower than about 10° is usually poor because ground noise enters the dish as a result of diffraction at the rim. Azimuth angles are measured from 0° to 360° (both being due north), and for the northern hemisphere can lie only between 90° and 270°, the range becoming progressively narrower as the latitude of the receiving site increases. Due south is 180° azimuth, but some installers prefer to quote azimuth as either east of south or west of south (as in Fig. 2). This calls for mental arithmetic, and can lead to mistakes when using a sighting compass (dial graduated from 0° to 360°).

The look angles depend on your latitude and the longitude difference between the receiving site and the satellite. Actual calculations involve the use of trigonometry, but there's no need for this here as Table 1 gives the look angles for most Ku band satellites at a variety of towns and cities around the UK.

There are many ways of establishing the azimuth setting, ranging from placing a stick in the ground and noting the shadow direction at certain times of the day to using a compass. The former approach is not quite as ridiculous as it might seem to be: in fact it's one of the most accurate methods, but is worthwhile only when installing a very large polar mount structure that takes several days to erect.

Magnetic Variation

Depending on geographical location a compass's north indication can vary considerably from true north. This effect is known as magnetic variation and is said to be east if the direction of magnetic variation lies to the east of true north and west if it lies to the west. Points of equal variation are jointed by contours known as isogonal lines (see Fig. 3). Where the true and magnetic norths are identical the contour is called the agonic line.

Where the magnetic variation is to the west of true north it's said to be negative: so the compensation to be applied to the compass reading is positive, i.e. the correction has to be added to the azimuth value to obtain the correct bearing. Conversely where the magnetic variation is to the east of true north it's positive and has to be subtracted. Fig. 3 shows the magnetic variation values for Europe. In the UK the correction has to be added to the true azimuth to obtain the correct compass bearing, for example add 5° in the London area.

Prime and Offset Focus Aerials

Several aerial arrangements can be used. The most common however are the simple prime focus and offset focus parabolic dish configurations, see Fig. 4. Prime focus types are set up for the satellite's elevation angle: with an offset focus type a correction angle, usually in the region of

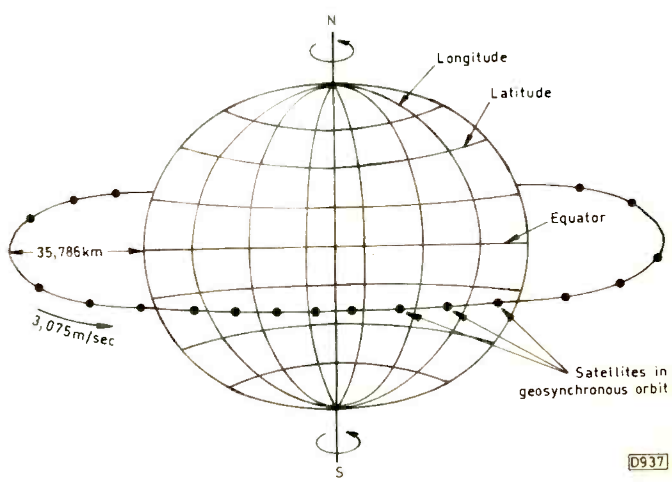


Fig. 1: Satellite orbital slots.

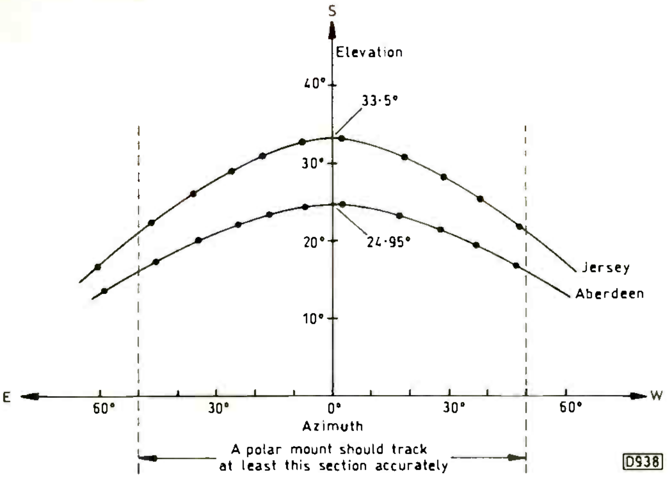


Fig. 2: The geosynchronous satellite arc seen from two different latitudes – Jersey and Aberdeen.

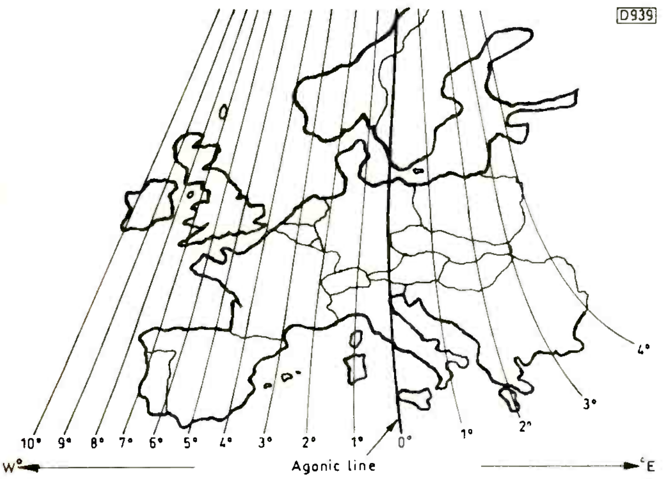


Fig. 3: Magnetic variation for Europe, 1992 estimation.

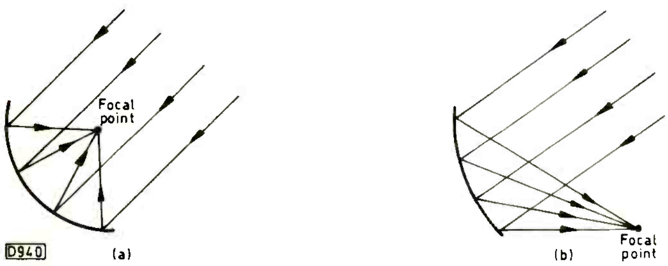


Fig. 4: The two basic parabolic dish arrangements, (a) prime focus, (b) offset focus.

19° to 24° depending on design factors, has to be subtracted from the "true" elevation angle to obtain the correct rim or boom elevation. This correction value is normally provided in the manufacturer's literature, and may be similar to that shown in Fig. 5.

The Head End

The head-end assembly that's mounted at the focus of a parabolic dish normally consists of a feedhorn and short length of waveguide, a polariser and a low-noise block (LNB). These items come preassembled or with assembly instructions so we won't go into this here. Polarisers were treated in detail in the September issue (pages 794-7).

In Europe, Ku band broadcasts are in the frequency range 11·7-12·5GHz. The main function of the LNB is to down-convert (frequency change) this received block of frequencies to what is known as the first i.f. (intermediate

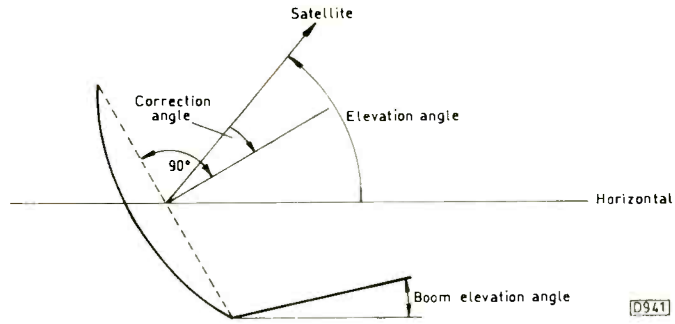


Fig. 5: A correction angle supplied by the manufacturer is required to set the elevation of an offset focus dish. The correct elevation setting is the elevation angle minus the correction angle. Note that the boom setting may have a different correction angle to the dish.

frequency) band. This is 950-1,750MHz. Signals at this lower frequency suffer far less attenuation when fed via a coaxial cable to the main satellite receiver.

Basically then at the head end the dish concentrates the incoming microwave signals from the satellite, bringing them to a focal point at the feedhorn. After polarisation selection the signals are passed via a section of waveguide to the LNB, where they are converted to a form suitable for the conventional channel selection (tuning) techniques used in the satellite TV receiver. Conversion from microwave radiation to a small electrical signal is done by a probe that's precisely positioned in the throat of the LNB. The overall gain provided by the LNB is in the order of 50-60dB, after which the law of diminishing returns applies.

Prime focus dishes are usually equipped with a scalar feedhorn, which often has adjustable rings, while offset focus dishes usually have a fluted circular feedhorn. More efficient dielectric lens feeds, the Marconi polyrod for example, have been developed in more recent times and matched to each type of dish.

Dish Mounts

There are three basic types of satellite dish mounts, the simple fixed az/el mount, the polar mount which includes the so-called horizon-to-horizon variants, and finally mounts with dual motor control of both azimuth and elevation. We'll not deal with this last type since they are both rare and expensive.

The first type, which includes the common Astra variety, can receive signals from only a single satellite or a cluster of satellites that occupy a single orbital slot. A number of gagets that claim to give reception from two separately located but closely spaced satellites via the same dish have recently appeared on the market. They use a pair of accurately positioned head units mounted on a common boom. Although this approach is o.k. for retrofit use, it's not worthwhile with a new installation since polar mount equipment can be obtained at a similar cost.

With a polar mount the polar axis angle is set to the latitude of the receiving site and a "declination offset angle" is then introduced to lower the aerial on to the geosynchronous satellite arc (see Fig. 6). Thus when the dish is rotated around its polar axis any position in the visible geosynchronous satellite arc can be accurately selected. A low-cost linear actuator arm or jack whose movement corresponds to about 50° east or west of south is normally used to provide dish rotation. The horizon-to-horizon types employ a single geared motor to obtain a greater range of dish movement. With both arrangements control is effected by a positioner that acts on position information supplied by a transducer

Table 1: Look angles

Town/city	*PAS-1* *45°W*		*Marcopolo, Hispasat* *31°W*		*Intelsat VI F1* *27.5°W*		*TV-SAT 2* *19.2°W*		*TDF1/2* *19°W*	
	El	Az	El	Az	El	Az	El	Az	El	Az
Aberdeen	14.99	227.91	20.16	213.34	21.21	209.51	23.22	200.15	23.25	199.92
Aberystwyth	19.23	227.56	25.07	212.65	26.23	208.66	28.43	198.82	28.47	198.58
Bath	19.11	229.68	25.36	214.94	26.63	210.98	29.08	201.17	29.13	200.92
Belfast	18.48	224.90	23.70	209.87	24.71	205.89	26.56	196.16	26.59	195.92
Birmingham	18.16	229.71	24.24	215.05	25.48	211.12	27.89	201.42	27.93	201.18
Blackpool	17.75	228.07	23.44	213.31	24.59	209.39	26.77	199.73	26.81	199.49
Bournemouth	19.33	230.40	25.76	215.72	27.08	211.76	29.64	201.92	29.69	201.68
Brighton	18.20	232.34	24.83	217.92	26.22	214.03	28.98	204.35	29.03	204.11
Bristol	19.18	229.44	25.38	214.68	26.64	210.71	29.07	200.89	29.12	200.64
Cambridge	17.30	231.81	23.67	217.39	24.99	213.52	27.62	203.94	27.67	203.70
Cardiff	19.47	228.79	25.59	213.96	26.83	209.97	29.18	200.11	29.23	199.86
Chester	18.12	228.45	23.95	213.70	25.13	209.76	27.38	200.06	27.42	199.82
Derby	17.64	229.96	23.69	215.36	24.93	211.46	27.33	201.82	27.38	201.59
Douglas	18.17	226.53	23.63	211.63	24.71	207.68	26.74	197.97	26.77	197.74
Dover	17.38	233.36	24.09	219.09	25.51	215.24	28.34	205.67	28.40	205.43
Dundee	15.86	227.24	21.07	212.57	22.11	208.70	24.09	199.25	24.13	199.02
Edinburgh	16.33	227.16	21.61	212.45	22.66	208.57	24.66	199.07	24.70	198.84
Exeter	20.15	228.80	26.38	213.90	27.64	209.89	30.03	199.94	30.08	199.69
Fort William	16.49	224.96	21.40	210.10	22.36	206.20	24.13	196.69	24.16	196.45
Glasgow	16.82	226.14	21.99	211.33	23.02	207.43	24.93	197.88	24.96	197.64
Gloucester	18.71	229.62	24.87	214.91	26.13	210.96	28.55	201.20	28.60	200.95
Grimsby	16.52	231.09	22.59	216.66	23.85	212.81	26.33	203.30	26.38	203.07
Harwich	16.89	233.02	23.42	218.74	24.80	214.90	27.56	205.38	27.62	205.14
Holyhead	18.84	226.67	24.44	211.72	25.55	207.74	27.62	197.95	27.66	197.71
Inverness	15.68	225.63	20.57	210.88	21.54	207.01	23.34	197.58	23.37	197.35
Jersey	20.45	230.75	27.14	216.01	28.52	212.00	31.18	202.02	31.23	201.77
Kirkwall	14.06	226.45	18.82	211.85	19.77	208.04	21.56	198.76	21.60	198.54
Lands End	21.73	226.84	27.81	211.62	29.00	207.51	31.21	197.35	31.25	197.10
Leicester	17.64	230.46	23.78	215.90	25.05	212.01	27.52	202.37	27.57	202.14
Lerwick	12.54	227.92	17.27	213.49	18.23	209.73	20.08	200.59	20.11	200.37
Liverpool	17.98	228.36	23.76	213.60	24.93	209.67	27.16	199.99	27.20	199.75
London	17.92	231.79	24.39	217.33	25.74	213.44	28.40	203.79	28.46	203.55
Londonderry	18.78	223.31	23.75	208.15	24.69	204.15	26.37	194.39	26.40	194.15
Manchester	17.63	229.00	23.48	214.32	24.67	210.41	26.96	200.77	27.01	200.53
Middlesborough	16.40	229.61	22.15	215.06	23.33	211.20	25.61	201.70	25.66	201.46
Newcastle	18.75	228.54	24.70	213.74	25.91	209.78	28.20	200.01	28.24	199.77
Northampton	17.81	230.79	24.06	216.25	25.35	212.35	27.87	202.70	27.92	202.46
Norwich	16.45	232.78	22.85	218.50	24.20	214.67	26.89	205.19	26.95	204.96
Nottingham	17.45	230.26	23.52	215.69	24.77	211.80	27.21	202.19	27.25	201.95
Oban	16.94	224.71	21.88	209.81	22.84	205.89	24.60	196.33	24.63	196.10
Oxford	18.30	230.63	24.59	216.04	25.89	212.12	28.42	202.41	28.47	202.17
Plymouth	20.71	228.29	26.93	213.29	28.17	209.25	30.52	199.22	30.57	198.97
Portsmouth	18.85	231.17	25.36	216.59	26.71	212.66	29.34	202.89	29.39	202.65
Reading	18.36	231.01	24.75	216.45	26.07	212.53	28.65	202.82	28.70	202.58
Southampton	18.95	230.80	25.39	216.18	26.72	212.24	29.31	202.45	29.36	202.21
Stoke on Trent	17.91	229.26	23.86	214.58	25.08	210.66	27.41	200.99	27.46	200.75
Stornaway	15.95	223.22	20.48	208.33	21.34	204.44	22.91	194.99	22.94	194.75
Sunderland	16.24	229.34	21.91	214.79	23.07	210.93	25.31	201.44	25.36	201.21
Swansea	19.72	228.00	25.73	213.07	26.93	209.07	29.20	199.17	29.24	198.93
Swindon	18.71	230.19	24.99	215.53	26.28	211.59	28.77	201.83	28.82	201.59
Telford	18.29	229.08	24.27	214.36	25.48	210.43	27.82	200.71	27.86	200.47
Wick	14.51	226.48	19.35	211.86	20.32	208.03	22.14	198.71	22.18	198.49
York	16.74	229.97	22.63	215.43	23.84	211.56	26.19	202.03	26.24	201.79

Add correction for local magnetic variation to azimuth values.

attached to the drive mechanism. The transducer may consist of a Hall-effect element, a reed relay or an optical counter. Safeguards are built in to prevent the dish being driven beyond preset limits.

Anyone dealing with polar mounts needs to know the associated jargon. Four angles are of relevance, as follows. The polar axis angle is the latitude of the receiving site. The polar elevation angle is 90° minus the polar axis angle. The Apex declination angle is the polar axis angle plus the declination offset angle. The apex elevation angle is 90° minus the apex declination angle. These angles are illustrated in Fig. 6.

Refinements have been adopted to improve the arc tracking accuracy with Ku band satellites that operate in the 11/12GHz bands. The result is the "modified polar mount", which differs slightly from the basic arrangement descibed above in that the polar axis is tilted forwards very slightly, i.e. the polar axis angle is increased, and a corresponding reduction is made to the declination offset angle. As a result the apex declination remains the same when the dish is in

for Ku band satellites.

Olympus		Telecom 2A		Telecom 2B		Intelsat VA F12		Tele-X		Eutelsat II F4	
18.8°W		8°W		5°W		1°W		5°E		7°E	
El	Az	El	Az	El	Az	El	Az	El	Az	El	Az
23.29	199.69	24.74	187.05	24.90	183.49	24.94	178.73	24.65	171.61	24.46	169.25
28.51	198.34	29.95	184.94	30.05	181.16	29.99	176.11	29.46	168.59	29.17	166.12
29.18	200.68	30.94	187.20	31.13	183.37	31.17	178.25	30.77	170.60	30.52	168.08
26.62	195.68	27.69	182.56	27.71	178.88	27.56	173.97	26.93	166.69	26.62	164.28
27.98	200.94	29.74	187.65	29.94	183.89	30.00	178.84	29.66	171.30	29.43	168.81
26.85	199.26	28.36	186.12	28.50	182.41	28.50	177.46	28.08	170.06	27.84	167.62
29.74	201.43	31.62	187.86	31.83	184.00	31.90	178.84	31.54	171.11	31.29	168.56
29.09	203.87	31.27	190.44	31.57	186.61	31.77	181.46	31.59	173.73	31.41	171.17
29.16	200.40	30.89	186.91	31.06	183.09	31.09	177.98	30.68	170.34	30.42	167.82
27.72	203.46	29.79	190.25	30.08	186.48	30.27	181.43	30.10	173.85	29.93	171.34
29.28	199.62	30.90	186.10	31.05	182.28	31.03	177.17	30.57	169.54	30.29	167.03
27.46	199.58	29.03	186.36	29.18	182.62	29.19	177.63	28.77	170.17	28.53	167.70
27.43	201.35	29.22	188.15	29.43	184.41	29.52	179.39	29.22	171.89	29.01	169.41
26.81	197.50	28.10	184.36	28.19	180.66	28.11	175.73	27.58	168.38	27.30	165.95
28.46	205.19	30.79	191.90	31.15	188.09	31.41	182.97	31.35	175.27	31.21	172.72
24.17	198.79	25.54	186.03	25.67	182.44	25.67	177.64	25.31	170.47	25.09	168.10
24.74	198.60	26.11	185.77	26.23	182.15	26.22	177.33	25.83	170.11	25.60	167.73
30.13	199.44	31.75	185.78	31.89	181.92	31.86	176.75	31.34	169.05	31.05	166.51
24.19	196.22	25.27	183.44	25.32	179.86	25.22	175.08	24.70	167.97	24.44	165.61
25.00	197.41	26.23	184.53	26.32	180.91	26.26	176.08	25.78	168.87	25.53	166.49
28.64	200.71	30.39	187.31	30.58	183.51	30.63	178.43	30.25	170.84	30.01	168.33
26.43	202.83	28.36	189.80	28.63	186.10	28.79	181.14	28.62	173.69	28.45	171.22
27.67	204.91	29.93	191.73	30.27	187.96	30.53	182.90	30.46	175.28	30.32	172.76
27.70	197.47	29.01	184.20	29.09	180.46	28.99	175.47	28.44	168.05	28.15	165.60
23.40	197.11	24.56	184.45	24.64	180.89	24.58	176.15	24.14	169.06	23.90	166.72
31.29	201.52	33.22	187.68	33.44	183.74	33.49	178.46	33.08	170.58	32.82	167.98
21.63	198.31	22.87	185.87	22.99	182.37	22.99	177.71	22.66	170.73	22.46	168.41
31.29	196.84	32.59	182.96	32.63	179.04	32.45	173.84	31.72	166.11	31.36	163.58
27.62	201.90	29.48	188.68	29.71	184.92	29.82	179.90	29.56	172.36	29.36	169.87
20.15	200.15	21.53	187.89	21.70	184.44	21.77	179.83	21.57	172.92	21.42	170.62
27.25	199.51	28.80	186.32	28.95	182.59	28.95	177.61	28.54	170.18	28.30	167.72
28.51	203.31	30.59	189.97	30.88	186.17	31.05	181.06	30.85	173.41	30.67	170.87
26.43	193.91	27.29	180.81	27.25	177.15	27.03	172.28	26.30	165.05	25.96	162.67
27.05	200.30	28.69	187.14	28.87	183.42	28.91	178.44	28.56	171.00	28.33	168.54
25.70	201.23	27.42	188.28	27.63	184.62	27.72	179.71	27.46	172.37	27.27	169.93
28.28	199.53	29.87	186.17	30.02	182.40	30.01	177.35	29.57	169.82	29.31	167.33
27.97	202.22	29.89	188.95	30.14	185.18	30.26	180.13	30.00	172.55	29.80	170.04
27.00	204.72	29.21	191.64	29.54	187.91	29.79	182.89	29.73	175.35	29.59	172.84
27.30	201.71	29.13	188.54	29.36	184.80	29.46	179.79	29.19	172.29	28.99	169.81
24.66	195.86	25.71	183.02	25.75	179.42	25.63	174.62	25.07	167.48	24.79	165.12
28.52	201.93	30.43	188.57	30.66	184.77	30.76	179.68	30.47	172.06	30.26	169.54
30.61	198.72	32.15	184.97	32.26	181.08	32.19	175.89	31.61	168.17	31.30	165.63
29.45	202.40	31.44	188.90	31.70	185.05	31.81	179.89	31.53	172.17	31.31	169.61
28.76	202.34	30.72	188.94	30.97	185.13	31.09	180.02	30.82	172.37	30.61	169.84
29.42	201.96	31.35	188.46	31.59	184.61	31.69	179.46	31.37	171.76	31.14	169.21
27.50	200.51	29.19	187.29	29.37	183.55	29.42	178.54	29.06	171.05	28.83	168.58
22.97	194.52	23.83	181.90	23.84	178.37	23.68	173.67	23.11	166.67	22.82	164.36
25.40	200.97	27.07	188.07	27.28	184.42	27.36	179.53	27.09	172.22	26.90	169.79
29.28	198.68	30.79	185.16	30.90	181.34	30.84	176.24	30.31	168.64	30.02	166.14
28.87	201.35	30.71	187.92	30.92	184.10	30.99	179.00	30.65	171.36	30.42	168.84
27.91	200.23	29.57	186.95	29.74	183.18	29.77	178.16	29.39	170.64	29.15	168.16
22.21	198.26	23.46	185.75	23.58	182.23	23.57	177.54	23.22	170.52	23.02	168.19
26.28	201.56	28.06	188.53	28.28	184.84	28.38	179.90	28.13	172.49	27.94	170.04

Continued on page 29.

the "apex position", i.e. pointing due south. Table 2 lists these modified angles for major UK towns and cities.

Site Surveying

The purpose of a site survey is to establish the best position for the dish. Installation of a fixed, single satellite system is similar to that of a standard terrestrial TV aerial. Thus the survey and installation are carried out at the same time. As there's a little more money in the job when a polar mount is being installed a more detailed survey may be undertaken. This involves line-of-sight checks with a number of satellites. You may find that trees or other obstructions or buildings restrict the number of satellites that can be received.

To carry out a full site survey you need a list of the look angles for all the required satellites, see Table 1. Use a compass to check azimuth angles and a sighting bar, e.g. a large spirit level, in conjunction with an inclinometer (an angle measuring device) to check the elevation angles. Mark

Table 2: UK polar mount angles.

Town/city	*Polar Elevation*	*Apex Elevation*
Aberdeen	32.23	24.95
Aberystwyth	36.95	30.06
Bath	37.97	31.18
Belfast	34.79	27.72
Birmingham	36.90	30.01
Blackpool	35.54	28.53
Bournemouth	38.64	31.90
Brighton	38.52	31.78
Bristol	37.91	31.11
Cambridge	37.14	30.28
Cardiff	37.87	31.07
Chester	36.17	29.21
Derby	36.45	29.52
Douglas	35.22	28.19
Dover	38.22	31.45
Dundee	32.93	25.70
Edinburgh	33.44	26.25
Exeter	38.64	31.90
Fort William	32.58	25.32
Glasgow	33.50	26.32
Gloucester	37.48	30.64
Grimsby	35.79	28.80
Harwich	37.41	30.57
Holyhead	36.05	29.09
Inverness	31.95	24.65
Jersey	40.10	33.50
Kirkwall	30.43	23.01
Lands End	39.30	32.63
Leicester	36.73	29.83
Lerwick	29.28	21.77
Liverpool	35.95	28.98
London	37.86	31.05
Londonderry	34.40	27.29
Manchester	35.90	28.92
Middlesborough	34.79	27.72
Newcastle	36.93	30.04
Northampton	37.13	30.26
Norwich	36.73	29.83
Nottingham	36.40	29.46
Oban	32.98	25.75
Oxford	37.59	30.76
Plymouth	38.97	32.27
Portsmouth	38.55	31.81
Reading	37.89	31.09
Southampton	38.44	31.69
Stoke on Trent	36.37	29.43
Stornaway	31.21	23.85
Sunderland	34.46	27.36
Swansea	37.72	30.91
Swindon	37.81	31.00
Telford	36.70	29.79
Wick	30.98	23.60
York	35.41	28.39

the chosen site with chalk or a stick. Then make a list of the tools and equipment that will be needed.

Points to Watch

Trees, hills, buildings and overhanging eaves attenuate microwave signals. So check that the dish won't be shadowed by any of these and, before carrying out the installation, tell the customer about any satellites from which reception may be blocked. Unless this is unavoidable for technical reasons, choose a position where the dish will be unobtrusive. Avoid positions where the dish will be seen against the sky.

To overcome line-of-sight obstruction by overhanging eaves specify a T and K bracket and pole, or an equivalent arrangement, to lift the dish out and above the eaves. Remember that some dishes can't be pole-mounted without modification.

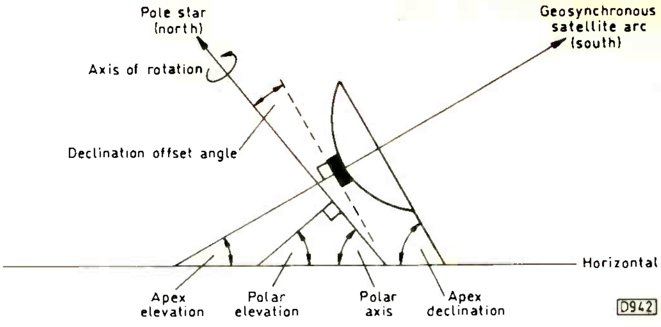


Fig. 6: Polar mount settings.

If the siting is particularly critical a compass may not be sufficiently accurate. So carry out a live test by connecting a battery-powered signal-strength meter to the hand-held outdoor assembly to check the signal amplitude.

If the dish is to be installed close to licenced premises mount it at least two drunks high to reduce the risk of vandalism. This should suffice unless a delinquent circus troup passes by.

Customers occasionally ask about distribution amplifiers, remote control extenders, etc. Don't underestimate the time that it will take to set this lot up. It can take literally hours to get a whole system working without intermodulation patterning. Make sure that your quote is high enough for the job!

Dish Alignment Equipment

Although it's possible to align a fixed, single-satellite dish by trial and error, adding a sighting compass, an inclinometer, a long spirit level and a signal-strength meter to the toolbox will save much time and energy.

Ideally the compass should have a mirror, sighting lines and 360° bearing graduations. Inclinometers vary from a rotating dial to sophisticated moire-pattern types with vernier scales. A spirit level of sufficient length to exceed the diameter of most popular sized dishes is ideal. It can also be used for setting mounting poles vertically, marking out drill holes and as a sighting bar in survey work.

Signal-strength Meters

The signal-strength meter is used to monitor the LNB's output. This can usually be done without connecting the polariser.

The cheapest signal-strength meters are the simple wide-

Table 3: Volex Radex cables.

Type	*Polariser wires*	*Attenuation(dB)/ 100m at 1,750MHz*
CT100	0	28·3
CT125	0	23·6
SAT100	0	28·6
SAT1001	1	28·3
SAT1002	2	28·3
SAT1003	3	28·3

Impedance of all types is 75Ω.

Table 1 – continued.

Eutelsat II F2		*Eutelsat II F1*		*Eutelsat II F3*		*Astra 1A-D*		*DFS-1*		*Intelsat VI F4*	
10°E		*13°E*		*16°E*		*19·2°E*		*23·5°E*		*60°E*	
El	Az	El	Az	El	Az	El	Az	El	Az	El	Az
24.08	165.73	23.60	162.24	23.03	158.78	22.30	155.15	21.17	150.34	6.06	114.01
28.64	162.43	27.98	158.80	27.22	155.23	26.28	151.50	24.83	146.61	6.82	111.06
30.04	164.33	29.43	160.62	28.70	156.98	27.79	153.17	26.38	148.18	8.21	112.25
26.06	160.71	25.39	157.19	24.62	153.73	23.69	150.09	22.27	145.32	5.01	110.01
28.99	165.10	28.42	161.43	27.73	157.82	26.88	154.03	25.54	149.07	8.05	112.93
27.37	163.98	26.79	160.39	26.10	156.84	25.24	153.13	23.91	148.25	6.87	112.32
30.82	164.77	30.21	161.03	29.48	157.35	28.57	153.50	27.15	148.47	8.75	112.45
31.03	167.36	30.52	163.58	29.87	159.87	29.05	155.97	27.74	150.87	9.91	114.23
29.93	164.07	29.31	160.37	28.57	156.74	27.66	152.93	26.24	147.96	8.06	112.08
29.57	167.59	29.08	163.88	28.47	160.22	27.69	156.38	26.44	151.34	9.33	114.64
29.77	163.29	29.13	159.61	28.37	155.99	27.43	152.20	25.98	147.25	7.67	111.55
28.05	164.04	27.46	160.42	26.76	156.85	25.89	153.11	24.54	148.20	7.20	112.28
28.59	165.71	28.05	162.06	27.39	158.45	26.56	154.67	25.27	149.71	8.12	113.43
26.79	162.34	26.16	158.78	25.42	155.28	24.53	151.60	23.15	146.77	5.97	111.17
30.88	168.90	30.42	165.13	29.83	161.40	29.07	157.49	27.84	152.36	10.48	115.35
24.67	164.56	24.15	161.06	23.52	157.59	22.75	153.95	21.55	149.15	5.89	113.04
25.16	164.17	24.62	160.66	23.97	157.18	23.18	153.53	21.94	148.72	5.96	112.70
30.51	162.75	29.83	159.04	29.04	155.40	28.06	151.59	26.56	146.62	7.78	111.09
23.95	162.11	23.36	158.65	22.68	155.23	21.85	151.63	20.57	146.90	4.64	111.22
25.05	162.95	24.47	159.44	23.79	155.98	22.96	152.35	21.68	147.56	5.44	111.77
29.54	164.59	28.95	160.91	28.23	157.28	27.35	153.48	25.97	148.51	8.10	112.50
28.10	167.54	27.62	163.89	27.03	160.29	26.28	156.50	25.09	151.52	8.62	114.85
30.01	168.98	29.56	165.25	28.99	161.55	28.25	157.68	27.05	152.59	10.10	115.57
27.61	161.97	26.95	158.38	26.19	154.85	25.26	151.15	23.84	146.31	6.18	110.82
23.45	163.23	22.91	159.78	22.27	156.36	21.48	152.77	20.28	148.03	4.85	112.13
32.30	164.11	31.65	160.31	30.87	156.58	29.90	152.69	28.39	147.61	9.15	111.80
22.08	164.96	21.61	161.54	21.05	158.15	20.35	154.57	19.26	149.85	4.87	113.62
30.70	159.82	29.92	156.14	29.02	152.53	27.93	148.77	26.28	143.87	6.66	109.07
28.95	166.15	28.42	162.48	27.77	158.86	26.95	155.06	25.66	150.07	8.46	113.70
21.12	167.20	20.72	163.79	20.24	160.41	19.63	156.85	18.66	152.12	5.23	115.54
27.83	164.06	27.24	160.45	26.54	156.89	25.68	153.16	24.34	148.26	7.11	112.32
30.28	167.09	29.77	163.36	29.13	159.67	28.31	155.81	27.02	150.75	9.46	114.17
25.36	159.14	24.65	155.65	23.84	152.22	22.88	148.63	21.42	143.91	4.10	108.88
27.89	164.88	27.33	161.26	26.66	157.69	25.82	153.94	24.51	149.02	7.46	112.92
26.89	166.30	26.39	162.71	25.78	159.16	25.01	155.43	23.80	150.52	7.57	114.10
28.81	163.64	28.20	159.99	27.46	156.40	26.56	152.64	25.16	147.72	7.38	111.91
29.40	166.31	28.86	162.62	28.21	158.98	27.39	155.16	26.09	150.15	8.73	113.75
29.28	169.10	28.85	165.40	28.29	161.73	27.57	157.88	26.40	152.82	9.81	115.79
28.59	166.11	28.06	162.45	27.41	158.84	26.60	155.06	25.32	150.09	8.28	113.72
24.29	161.61	23.68	158.14	22.97	154.71	22.12	151.12	20.81	146.38	4.60	110.80
29.83	165.79	29.27	162.08	28.60	158.43	27.75	154.61	26.41	149.59	8.72	113.31
30.72	161.86	30.01	158.15	29.18	154.51	28.16	150.71	26.61	145.76	7.51	110.45
30.87	165.81	30.30	162.06	29.61	158.37	28.74	154.50	27.36	149.44	9.21	113.18
30.19	166.07	29.64	162.34	28.96	158.67	28.11	154.83	26.78	149.79	8.99	113.46
30.69	165.42	30.11	161.68	29.41	157.99	28.52	154.14	27.14	149.10	8.96	112.92
28.39	164.89	27.82	161.25	27.14	157.66	26.29	153.90	24.97	148.96	7.70	112.86
22.32	160.92	21.73	157.51	21.04	154.15	20.22	150.61	18.96	145.94	3.50	110.39
26.52	166.18	26.02	162.60	25.41	159.06	24.65	155.35	23.45	150.45	7.35	114.06
29.47	162.42	28.80	158.76	28.02	155.16	27.06	151.40	25.58	146.47	7.19	110.97
29.97	165.08	29.38	161.38	28.68	157.73	27.80	153.91	26.43	148.90	8.49	112.79
28.68	164.46	28.10	160.81	27.40	157.22	26.53	153.45	25.17	148.51	7.66	112.51
22.63	164.72	22.14	161.29	21.56	157.88	20.84	154.30	19.72	149.56	5.03	113.38
27.55	166.38	27.05	162.76	26.43	159.19	25.65	155.44	24.42	150.50	7.91	114.07

Add correction for local magnetic variation to azimuth values.

band peaking types that monitor signal activity across the entire LNB output band. This type of meter is connected in series with the LNB and the receiver, deriving its power from the LNB feed. Meters of this type are cheap, rugged and reliable, but need continual resetting as full-scale deflection is reached. There are other shortcomings. Such meters don't give a comparative reading of signal strength, and the display may vary rather erratically with signal content. Alignment cannot start until the equipment has been installed, and there's a risk of receiver damage by shorting the inner and outer coaxial cable conductors. Unless you are within sight of a TV set these meters are the cheapest solution for one-off DIY use.

Battery-powered meters are a considerable improvement. The batteries power the LNB, eliminating the risk of receiver damage. Switched attenuators are included to set the sensitivity, and the display is much smoother. The final attenuator position and the meter reading together give a comparative indication of received signal strength. Automatic shutdown of the battery supply in the event of a short-circuit is usual. This type of meter is ideal for aligning polar mount aerials since there's no need to alter the tuning for different satellites. The disadvantage is that the batteries may go flat on the job!

Tuned signal-strength meters tune to each down-converted channel individually, giving an accurate signal-strength reading. In addition some models include C/N ratio measurement for each channel, direct channel or frequency selection input, composite video output, an audio output via a built-in speaker and microcomputer control. But watch out for models that, designed for the US market, have an h.f. range extending to only 1·45GHz instead of 1·75GHz.

Aligning a Fixed Az/El Dish

Alignment of a fixed az/el mount using a battery-powered signal-strength meter is a trivial task that takes only a few minutes. The procedure is as follows.

(1) Obtain the azimuth and elevation angles for the required satellite at the receiving site from Table 1.

(2) Tighten the adjuster bolts to take up slack but not so tightly that the dish can't be moved with moderate effort.

(3) Connect a short length of coaxial cable between the LNB and the meter.

(4) Set the LNB power switch to on.

(5) Set the attenuator switch to a low value until signals are detected.

(6) Set the elevation angle, using an inclinometer or the stamped graduations provided on some mounting brackets. With an offset focus dish there's usually a special measuring point for elevation setting. This is normally on the boom or the rim of the dish. In such cases a fixed correction angle supplied by the manufacturer is subtracted from the true elevation angle.

(7) Swing the dish to the relevant azimuth compass bearing, corrected for magnetic variation.

(8) Carry out fine setting of the azimuth and elevation adjusters while viewing the signal-strength reading. Increase the attenuator setting as appropriate until a maximum signal reading is obtained.

(9) Set the polarisation offset by twisting the LNB in its holder. Watch for a null in the received signal strength, then rotate through 90°.

(10) Apply grease to all adjuster bolts to reduce corrosion.

(11) Check reception and waterproof all outside connections.

Aligning a Polar Mount

Polar mounts are a little more tricky and are set up in the apex position to start with, i.e. the highest point of the visible satellite arc. In the northern hemisphere this is due south. When in this position the dish can be driven by equal amounts to the east and west. Successful alignment depends on the following two points: (1) adjust the polar elevation angle for peak signal strength from satellites at or near the apex of the satellite arc; (2) rotate the whole mount assembly around its mast or pillar when peaking signals from satellites far from the apex of the arc, i.e. when trimming the north/south orientation to the apex of the arc.

The basic steps in a well-established procedure that takes fifteen minutes or so to perform are as follows:

(1) Look up the modified polar mount angles for the receiving site – see Table 2.

(2) Find, from Table 1 or by calculation, the elevation angle of a convenient satellite that corresponds to an azimuth 30° or so from due south. Call this SAT 1.

(3) Ensure that the mounting pole is vertical then set the dish to its apex position, facing as near due south as possible.

(4) Set the polar elevation or polar axis angle, whichever is the easiest to measure.

(5) Set the apex elevation or apex declination angle. The declination offset angle is set automatically. With an offset focus dish the manufacturer usually specifies a measurement point and elevation correction angle for the particular model.

(6) Connect a wideband signal-strength meter to the LNB.

(7) While monitoring the resultant elevation (actual elevation) of the dish, rotate it around the polar axis until the measured elevation matches the elevation of SAT 1. Hold this position by any means at your disposal. Then slowly rotate the whole assembly around the mast until maximum signal strength is obtained from SAT 1. Temporarily tighten the adjuster bolts. This in effect trims the aerial's north/south orientation by making use of the station-keeping accuracy of SAT 1. It may at this stage be convenient to optimise the focal length setting of the feedhorn.

(8) Move the dish back around the polar axis until signals from a satellite close to the apex of the satellite arc are detected. Call this SAT 2. Fine trim the polar elevation or polar axis for maximum signal strength from SAT 2.

(9) Drive the dish back to SAT 1 and trim further for maximum signal strength by slightly rotating the whole assembly around the mast.

(10) Repeat steps (7) to (9) as often as you need to do to obtain consistently peaked signals from both satellites. It may be necessary at each stage to tighten the adjuster bolts temporarily. If difficulty is experienced, start again.

(11) Check the picture quality and tracking with several satellites. When satisfied, fully tighten and grease the adjuster bolts. Recheck the picture/sound quality in case final tightening has put the alignment out slightly. If so repeat steps (7) to (9).

Cables

The first i.f. band (950-1,750MHz) is rather higher than that used for terrestrial TV transmissions so, except for very short runs, a fatter, double-screened cable is required. The important parameter is the attenuation figure in dB per 100m at the frequencies used. Cables with low attenuation per 100m tend to be of large diameter and can thus be expensive. Clearly a compromise between acceptable diameter cable and reasonable cost is needed for the domestic market.

If there's often a grainy picture with cable runs of greater than 30m the use of a line amplifier should provide an improvement. Line amplifiers are powered by the LNB supply that's fed along the coaxial cable. Note that it would be pointless to fit one where sparklies are experienced since no improvement in the carrier-to-noise ratio would be obtained. The only cure for this problem is to use a larger dish or perhaps a lower-noise LNB.

Table 3 gives details of a range of cables manufactured by Volex Radex. Where incorporated the polariser conductors are bonded to the coaxial cable in a separately insulated outer sheath.

Double-screened coaxial cable is used with the V/H switch type of polariser, where control of the polariser is by switching the LNB supply between 13V and 17V. Combination cable, with an extra polariser conductor, is used with 0 and 80mA electromagnetic polarisers – the outer coaxial braid is used for the return current. Combination cable with two polariser conductors is used with +40mA and –40mA electromagnetic polarisers. Cable with three polariser conductors is used with mechanical polarisers, the connections being +5V, earth and pulse for motor control. Cable connections at the receiver end are usually marked. When carrying out any sort of cabling it's vital that the equipment is switched off: check for shorts between the connections before switching on.

The cabling requirements with polar mount installations are a little more complex, but special all-in-one ribbon cables are available for the purpose. They consist of the following: (1) Double-screened coaxial cable for feeding the down-converted signals to the receiver. The 15-24V LNB supply is fed via this cable. (2) Three polariser conductors as detailed above. Any unused conductors can be snipped off. (3) An actuator cable for the dish drive. This consists of two larger-diameter conductors for the actuator motor supply and three smaller-diameter cables for the position sensor (5V, position sensor pulses and earth). It's important to wire these three connections correctly: mistakes are costly!

Most manufacturers produce cables with a choice of PVC or PE (polyethylene) sheathing. PE cables can be buried directly but it's not advisable to use PVC for underground cables in any situation. Volex Radex has a special cable sheath called RBS (Raydex Bonded Shield) for use in underground ducting: it has a waterproof, bonded outer jacket that's both impact and abrasion resistant and also has good slip characteristics.

Installing Cables

Agree with the customer the the shortest cable route that's consistent with aesthetic considerations. Try to make it as unobtrusive as possible by following the natural lines of a building, e.g. eaves, window frames and brick courses. Avoid tacking cables close to building entrances as children may tug at them. Dogs are a problem with low tacked cables, particularly where the cable enters the building – add a few extra cable clips.

As a general rule don't bend a coaxial cable less than ten times its diameter, otherwise attenuation may be introduced, and don't allow the cable to scuff against sharp edges. The clips used shouldn't deform the cable in any way. Avoid perfectly regular tacking distances. The recommended distances are less than 750mm for vertical runs and less than 230mm for horizontal runs. For cable extensions use appropriate impedance line connectors overwrapped with self-amalgamating tape. Leave a sufficient length of cable to form a drip loop at the head end, so that water is forced to drain away from connections.

An overhead cable span may be used to bridge a walkway or concreted area. Support the cable with a galvanised, stranded steel wire attached to rigid eyelet wall fixings: use plastic cable ties to link the support wire and the cable. The overall sag at the centre should be between 1·5 and 2·5 per cent of the span length.

Cable entry holes should be a millimetre or two larger than the cable diameter to prevent cable scuffing and distortion. Drill the hole from the inside out, with a downward tilt to prevent rainwater entering from outside. Large multi-sheath ribbon cables for polar mounts can be rolled up to feed through the appropriate hole. Form a drip loop and seal the hole on the outside with a waterproof sealer. It's best to feed a multisheath cable through the wall. Single coaxial cables can be fed through a window frame where this is convenient and the frame is made of wood.

Connectors

Most LNB outputs are of the F connector type but receivers may have either an F or a Belling and Lee type socket depending on make and model. F connectors can be either crimped with a special tool or simply twisted on to a pre-stripped cable. The twist-on type is more versatile. Connections to mechanical and electromagnetic polarisers are best made with grease-filled scotch-locks: each unstripped polariser exit lead is pushed into a connector along with its feed wire and crimped with a pair of pliers. Receivers usually have screw terminals for the polariser connections but some have plugs and sockets.

Weatherproofing

There are three ways of weatherproofing outdoor connections. The first is to use a weatherproof rubber boot, the second to use a sealing compound and the third to overwrap with self-amalgamating tape. Long-term trials have shown that self-amalgamating tape – the easily moulded variety –

works best. Rubber boots tend to crack and perish in a relatively short time. Bath sealing compounds that contain acetic acid can cause corrosion and failure of the LNB. New compounds have recently been developed specifically for the purpose and should be o.k.

Most service calls to satellite equipment because of complaints about sparklies occur when rainwater has got between the LNB/polariser/feedhorn flanges or through the periphery of a feedhorn cap. This can be prevented by overwrapping with self-amalgamating tape.

Preset Controls and Tuning

Tuning problems associated with the satellite receiver, the TV set and the VCR comprise the most time-consuming part of an installation. In view of the profusion of tuning arrangements in use this is no trivial task. The basic method however is as follows:

(1) Tune a spare TV set and VCR channel to the satellite receiver's r.f. output.

(2) Tune in the satellite receiver – most now come pretuned.

(3) Optimise the polarisation. With models that use a magnetic or mechanical polariser check that each channel is set for optimum polarisation at the receiving site. Again this is normally preset to a certain extent. If poor pictures are obtained with an electromagnetic polariser try switching the control leads over. With a V/H switched type of polariser check that the correct polarisation sense is programmed for each channel.

Trouble-shooting

It's surprising how often Murphy's Law comes into operation when carrying out an installation, so here's a simple fault guide to the problems likely to be encountered. Generally a multimeter with an audible continuity test and a signal-strength meter will suffice. An oscilloscope may also be useful for monitoring position count pulses from a polar mount actuator or the pulse drive to a mechanical polariser.

The first step is to isolate the unit that's causing the trouble.

Start by using the signal-strength meter to check the LNB's output. If a good reading is obtained the LNB is probably o.k. If in doubt about the gain or noise level fit a replacement. Next check that the LNB's supply voltage, which is typically in the range 15-24V, is present at the receiver's LNB input socket. It's possible when installing equipment to short a coaxial cable's inner conductor to its outer braiding accidentally, sometimes blowing a fuse or safety resistor in the receiver.

Check the polariser circuit. If signals are missing or weak or only one polarisation sense can be resolved a fault in the polarisation section is likely. With V/H switched polarisers check that the LNB supply's voltage level shift alternates between 13V and 17V with the V and H polarised channels respectively. If these voltages are present but channels of only one polarisation sense can be received suspect the LNB. Electromagnetic polariser currents can be checked by connecting a multimeter switched to its 100mA range in series with one of the polariser feeds. The currents should be +40mA and –40mA depending on the polarisation of the received signal or, with some designs, 0 and 80mA. If no current reading is obtained check the d.c. resistance of the polariser windings. The resistance should be about 70Ω. If this is o.k., suspect the control circuit. If a high resistance reading is obtained check the outdoor connections. With a mechanical polariser check the 5V supply and that motor drive pulses are present when the skew control is operated.

If a dish with a polar mount fails to move check that the motor supply (36V) is present when the dish should be being driven. Check that the position sensor is correctly wired both at the indoor unit and at the actuator jack. Incorrect wiring can damage the position sensor.

Use the multimeter to check for cable breaks. This can be done by using another length of cable. To check that a length of coaxial cable is sound, use a jumper lead to short the inner conductor to the outer braid at one end, then check for zero resistance across both conductors at the other end. High-resistance readings indicate that the cable is broken at some point along its length – the break is usually within a few centimetres of a connection.

RF Patterning

A separate satellite receiver, VCR and TV set are often interconnected at r.f. Patterning, often intermittent, can be a problem in some areas. In fact it may be impossible to set the r.f. modulators in the VCR and satellite receiver so that interference is not present at some point. The patterning may be noticed on a normal TV channel far removed from the narrow tuning band of the r.f. modulators, and may be particularly bad in areas where many terrestrial stations can be received in the same band. Experience shows that most of the trouble is caused by radiation from interconnected r.f. cables. The solution is to use double-screened cables throughout rather than the "bits of string" supplied by VCR and satellite receiver manufacturers. If Channel 5 ever does start up this problem will clearly become a nightmare!

AFC Offset Adjustment

The down-converted first i.f. band can vary slightly from one LNB to another. Normally this doesn't cause too much trouble, but sparklies may appear because of slight frequency mismatching between the LNB's output and the receiver. This may be noticed with certain weaker transponders or after replacing a faulty LNB.

The adjustment to correct this is called a.f.c. offset. It can be set either from the remote control unit or by means of an internal preset in the receiver. If a preset resistor is used, the adjustment must be carried out very slowly in discrete steps, as there's a small time delay before the a.f.c. locks on each time. Low cost V/H switched head ends are particularly prone to this effect.

Basic Equations

The basic equations for elevation and azimuth are as follows:

$$El^\circ = \arctan \{[6{\cdot}61 \times \cos A \times \cos B - 1]/[6{\cdot}61 \sqrt{(1 - \cos^2 A \times \cos^2 B)}]\}.$$

$$Az^\circ = 180 + \arctan(\tan B/\tan A).$$

where A is the receiving site latitude (+ in the northern hemisphere, – in the southern hemisphere) and B is the receiving site longitude minus the satellite longitude (expressed in degrees E). The term 180 in the azimuth equation is dropped in the southern hemisphere. The term 6·61 is the ratio of the radius of the geosynchronous orbit to the Earth's equatorial radius.

CD Player Notebook

Reports from Mike Leach, P.J. Roberts and Chris Hawkins.

NordMende CP3500

This machine wouldn't work at all after a new laser had been fitted. There was no TOC reading and although the turntable rotated it didn't do so at the correct speed. Going through the setting up procedure made no difference, and all the supplies were o.k. A check on the r.f. eye pattern showed that it was very poor and distorted and lasted for only a few seconds before the machine shut down in the stop mode. The cause of the trouble was dry-joints on the main panel – lots of them! I could see that most of the transistors required attention, and after a good solder up I was able to set up the machine. All was then o.k. One to watch out for. **M.L.**

Akai ACM370L

This was a bit of a silly one really, but it caused some difficulties before we got to the bottom of the problem. A new laser had been fitted to this midi system, which was working all right. After using it for about a week however the customer brought it back with the complaint that "the tray was sticking and there was a crunching noise". When we ran it in the workshop it performed perfectly and quietly. Now as with all CD midi systems this machine is not easy to strip down. But we did so in order to check whether there was anything amiss in the tray mechanism. There wasn't.

The customer insisted that the tray would stick and sent us some discs to prove the point. This they did: the tray stuck because the hole in one of the discs was too small. When the open/close button was pressed to eject the offending disc the clamp stuck, making the crunching sound complained about. I felt like charging him a second time for all the hassle he'd caused but I'm too nice for that. I just smiled politely and sent him on his way. **M.L.**

Test Disc

In previous CD player fault notes I've mentioned a test disc. Readers may be interested in details of this helpful item. The one I use is manufactured by Panasonic, the part number being SZZP1054C. Tracks 1, 2, 16 and 17 are for reference purposes and don't have any defects. Tracks 3-8 have an information layer break that increases in width from 0·4mm (track 3) to 0·9mm (track 8). On the readout side of tracks 9-15 there's a black dot whose size increases from 0·3mm to 0·9mm. Tracks 1 and 2 have a 1kHz sinewave (L + R) at 0dB while tracks 3-17 have a 400Hz sinewave at –10dB. **P.J.R.**

Saba DAD9772TM/Telefunken CD300

A problem we've had is that the disc eject system fails to lift and eject the disc after playing two or three discs. Before you examine the mechanism check for dry-joints around the two voltage regulators IP05 (7805) and IP10 (LM317). They are mounted close to the mains transformer. **C.H.**

TV Fault Finding

Reports from Philip Blundell, AMIEIE, Michael Dranfield, J. Olijnyk, Brian Storm, Stephen Leatherbarrow and K.E.Fellingham

Philips G90 Chassis

The complaint was of a "frilly picture". When I tried the set I found that the picture was too large and had corrugated verticals. So I switched off quickly. On inspecting the main panel I saw that resistor R3668 and transistor Tr7652 in the chopper feedback circuit had burnt up. Replacing these items and fitting a new CNX83 optocoupler returned the 95V h.t. supply to normal, but the corrugated verticals were still present. Replacing the 47µF h.t. reservoir capacitor C2630 cured that. **P.B.**

Ferguson TX100 Chassis

For intermittent low contrast check whether the tube's heaters are going out. The solid-cored wires can break where they go into the plug connector by the line output transformer. **P.B.**

Philips K40 Chassis

This set had very weak sound. The signal was present at the output of the i.f. strip and then passed through all the switching chips but went missing at the audio output module. A new TDA1524 tone-volume control chip was required. **P.B.**

Sharp C1421

The fault note said "stuck in standby". When I switched the set on the e.h.t. rustled up for a second then the set went into the standby mode. As the e.h.t. rustle seemed to be rather violent I tried the set with a 110V mains supply. It then came on, but if the mains supply was raised the 115V supply to the line output stage rose as well. The STR40090 chip was faulty. **P.B.**

Philips GR1-AX Chassis

This set had an odd fault: the volume control couldn't be turned down with the remote control unit and no stations could be tuned in. As with most modern sets these functions are carried out by a microcontroller chip, but experience has taught us that failure of the associated RAM chip is much more common. So we replaced the ST24C02CP chip IC7785, which is also the cheaper of the two devices. This time we were wrong however. The microcontroller chip IC7700 was the cause of the trouble. The original one was type TMP47C434N-3559 but the replacement supplied by Willow Vale was type TMP47C434N-3537, i.e. it had a different mask. In addition it came with a small tin shield. It's presumably a new, improved type. **M.Dr.**

Triumph TC1670/Hitachi NP8CQ Chassis

We didn't realise that this Triumph badged set was fitted with an Hitachi chassis until we removed the back. The complaint was of a very dark picture, and a check on the first anode voltage showed that it was very low at around 200V. Further investigation revealed that the first anode supply's 0·068µF, 1kV reservoir capacitor C714 was open-circuit. It's the very large capacitor mounted on the small vertical subpanel behind the line output transistor's heatsink. **M.Dr.**

Matsui 1455

The complaint with this 14in. portable was that the sound and vision would sometimes disappear, leaving a blank white screen. A check showed that when this happened it had gone into the AV mode. But when the on-screen display was called up the channel number appeared. A check on the voltage at pin 6 of the microcontroller chip IC401 showed that this was correct, i.e. low for TV and high for AV. Our next checks were on the AV panel at the rear of the set where we found that the AV switching transistor Q1103 was without its 12V collector supply. On tracing the source of this supply we came to R121 which had voltage at both sides. The only thing between R121 and Q1103 was the print, which turned out to have a hairline crack. **M.Dr.**

Amstrad CTV2000

This set came in because of field collapse, but on further investigation we found that there was no sound and the channel LEDS didn't light up. A start was made at the TDA3652 field output chip IC801. Pin 9 had the correct 28V but there was no field drive at pins 1 and 3. This took us back to the LA7800 timebase generator chip which has two supplies, one at pin 15 for the line generator and one at pin 12 for the field generator. There was no voltage at pin 12 because R840 (10Ω, 2W) was open-circuit.

Replacing this resistor restored the set to life. While it was on soak test next day however R840 again failed. This time a short-circuit could be measured to chassis. Several electrolytics were checked to no avail, then the short disappeared. Until next day that is, when R840 once again went open-circuit. This time the cause of the mystery short was found amongst the spaghetti of wires that make this set so difficult to work on. A 2A, 20mm fuse was found wedged between some components in the corner of the chassis. I can only assume that a previous repairer had dropped it and been unable to find it. The fault showed up after the set had been disturbed whilst moving house. **M.Dr.**

Sony BE1 Chassis

This set came in with the complaint that the height was excessive. We noticed that it began to fluctuate as the set warmed up. After ruling out the possibility of a noisy height control we turned attention to the JC501Q transistor (Q501) that's connected across it. This transistor is used to provide height compensation with beam current changes, receiving an input from pin 7 of the line output transformer. Although it tested o.k. a replacement cured the fault. A 2SC1815 worked fine – we didn't have this oddly numbered transistor in stock. **M.Dr.**

Finlux 51590

Both fuses in the power supply had blown, the BU208 chopper transistor was short-circuit and the 270kΩ resistor connected to pin 4 of the TDA4600 chopper control chip was open-circuit. It's worth emphasising that whenever you find the chopper transistor in a power supply of this type short-circuit the value of the resistor(s) connected to pin 4 of the chip should be checked. Yes, I know that this point has been made before, but people still get caught out! **J.O.**

Panasonic TX21M1T (Z4 Chassis)

No sound and only half a picture was the complaint. Sure enough the line scanning was locked but the start was shifted about half way across the screen. Checks around IC601, where the video and line outputs are obtained, failed to reveal anything amiss. Eventually the culprit turned out to be the 0·01µF capacitor C503 across the line shift control – it was leaky. Replacement restored the sound and the complete picture. **B.S.**

Panasonic TX21T1 (Alpha 2 Chassis)

This set operated perfectly for an hour or so. Then the sound would mute and no controls would work. There didn't seem to be any problems around the main microcomputer chip IC1203 and the DAC chip IC171. The data and clock signals fluctuated normally – usually the data freezes if one of these chips is faulty. Eventually, after much hair tearing, it transpired that the PCD8582P memory chip IC1202 was faulty. **B.S.**

Panasonic TX15M1T9 (Z4 Chassis)

This set permanently displayed a letter C towards the left, centre of the screen. In these sets the on-screen graphics are generated by the main microcomputer chip IC1213. A similar system is used in the Alpha 3 chassis. Here, if anything strange happens you can reset the microcomputer chip by entering a test mode. This is initiated by set's volume down button while depressing the timer button on the remote control unit. The set then displays a column of o.k.s and resets to normal operation. Fortunately this also applies with the Z4 chassis, though there's nothing to say so in the manual. **B.S.**

Osaki 142

This set tripped at switch on. Heating the TA7869 chip, which contains the line and field generator and the luminance and chroma processing circuits, stopped the tripping and the set then worked all right. But this wasn't the cause of the fault: the actual cause turned out to be the STR50103 power supply chip. **K.E.F.**

Sharp C1431H

The power supply was working, with the h.t. correct at 115V, but there was no drive to the line output stage. We had to check back to IC801, which contains the timebase generators. It has two supplies, one to get things going at start up. This comes via D619 and Q610, which is turned on by R679 (100kΩ). A check showed that this resistor, which is connected to the 115V supply, was open-circuit. **K.E.F.**

Ferguson TX10 Chassis

This oldie had a fault I'd not seen before. There was a half-inch wide black line across the picture, with field instability. The picture was of the correct size and was locked in the right place. A replacement TDA2576A timebase generator chip cleared the fault. **K.E.F.**

Philips CP110 Mk II Chassis

Later sets in this series have an additional overvoltage trip on a subpanel. When it works the 1·6A Wickman fuse F1653 goes open-circuit, the result being a dead set. This always seems to happen after an hour or three. I've found that replacing the CNX62 optocoupler provides a cure. **K.E.F.**

Amstrad SRD400 Satellite TV Receiver

This seems to be a very reliable receiver. One problem we've had concerns the child-lock function – customers seems to forget their numbers. Unfortunately of late we've had a few sets that can't be cleared using the reset method with a 1kΩ resistor: we've had to replace the SDA2516 chip. **K.E.F.**

Nikkai TLG99/Solavox 141

These sets always seem to come in dead. Here are various faults we've had. R109 (180Ω, 0·5W) goes open-circuit. This resistor's body colouring makes it look as though the value is 1·8kΩ – I've even had a faulty one measure 1·8kΩ! Q117 (2SC1573A) often goes open-circuit. It's an npn transistor rated like a video output device. Another regular failure is the remote standby transformer whose primary winding goes open-circuit. The 12V supply filter resistor R104 (5Ω, 1W) can and does go high in value. This usually results in a dead set though in one case the symptom was persistent field collapse because the low 12V supply upset the TDA4503 chip, removing the field drive. **S.L.**

ITT CVC1200 Series Chassis

I've never been completely at home with discrete component chopper power supply circuits. In my experience they either work normally or self-destruct. This case fell into the latter category. At switch on the BU508A chopper transistor would go short-circuit, blowing fuse Si651 (F1A). By using a variac I was able to prove that the filter capacitor C701 (4·7µF, 350V) was faulty. Nothing unusual about that, I hear you say. But it took rather longer that it should have done because a replacement had only recently been fitted.

The set worked when C701 and the chopper transistor had been replaced but the output voltages were low. We cured this by replacing the various small electrolytics and the ZPD8·2 zener diode D721 in the control section on the isolated side of the circuit. After setting up the 117V rail we were rewarded with normal pictures and sound. This lasted for only half an hour, after which T712 (BC328) in the chopper driver stage went short-circuit. It had presumably been weakened by the earlier problems with the BU508A chopper transistor. **S.L.**

Philips 2A Chassis

If you come across one of these sets with the 2AT mains fuse 1651 blown don't immediately go for the chopper transistor. It's quite common to find that the chopper transformer's tuning capacitor C2664 (1·5nF, 1kV) has gone short-circuit.

A totally blank raster with no sound but with the e.h.t., focus, first anode and l.t. supplies present may have you fooled, but not for long. Replace the back-up battery, reset the analogue controls and the panic will be over. **S.L.**

The DCC Audio Format

George Cole

Philips and Matsushita have now launched in the UK their Digital Compact Cassette (DCC) format, which is a digital version of the conventional audio cassette. The companies hope that it will become a new home audio recording standard.

Background

Philips introduced the analogue compact cassette (ACC) in 1963. It was originally intended as a low-fi system for dictation, with a tape speed of 4·75cm/sec and a tape width of 3·8mm. There were no restrictions on tape type or grade. Sound quality was vastly improved with the development of new types of tape, e.g. metal, new head technology and Dolby noise reduction systems. As a result, ACC became the world's largest selling audio format. In 1990 ACC sales included 1,600m blank tapes and one billion prerecorded cassettes. In comparison, CD and vinyl LP record sales during the same period were 780m and 260m respectively. Around 180m recorders are sold each year. But cassette sales are declining, and the consumer electronics and musical industries believe that consumers are becoming tired of the ACC and that increasing sales of CDs have resulted in a demand for a digital tape system.

Analogue recording systems can produce high-quality sound. But the recording process has to be carefully controlled. An h.f. bias signal is required to improve the recording characteristic, bias and equalisation have to be matched to tape type, the recording level has to be set correctly to avoid distortion and a stable tape transport system is required to avoid wow and flutter. A digital system records the sound in digital form: there's no need to worry about bias, equalisation or recording levels.

When the CD was launched in 1982 it was inevitable that a home digital tape system would be developed. JVC came up with a system that recorded the sound as pulse code modulation (PCM) on a conventional cassette. It used metal tape that ran at 1·5 times the normal speed, with a fixed multi-track head that recorded eight tracks along the tape linearly. But the shorter playing time, limited frequency response (to 15kHz) and problems with producing the thin-film heads led to it being abandoned.

A number of companies joined forces to develop a new tape system known as DAT – Digital Audio Tape. Full details were given in the February 1991 issue of *Television.* The version that was eventually adopted used helical scanning of the tape. The 30mm drum had two heads spaced 180° apart. It rotated at 2,000 r.p.m., giving a tape writing speed of 3·13m/sec – the linear tape speed was 8·15mm/sec. High-density, high-coercivity metal-powder tape was used, enabling a tiny DAT cassette to store up to two hours of sound (or four hours with half-speed recording). A sub-code system provided a number of features such as search and track programming.

DAT was an elegant technical solution, but was not a success commercially. There were several reasons for this: the tape and the players were expensive; the launch was delayed because of music industry lobbying; there was a shortage of software; the cassettes were small and fiddly; and the system was incompatible with all other audio systems.

Enter the DCC

The solution was the digital compact cassette, which was announced by Philips in 1991. Matsushita was officially credited as having been the co-developer the following summer. Like DAT, the DCC format stores CD-quality sound on a cassette. But the DCC uses conventional audio cassette technology. Thus the decks are cheaper and easier to produce, while tapes can be duplicated at 64 times normal speed – with the DAT system tapes have to be copied in real time. But the system's developers claim that its winning feature is its backwards compatibility with existing ACCs – DCC machines can play both digital and analogue cassettes. DCC decks cannot make analogue recordings however, nor can ACC machines use DCC tapes.

DCC Basics

DCC uses a stationary multi-track head to record and play back sixteen parallel audio tracks along the tape. It's a two-channel stereo system with a frequency range of 5-22,000Hz and a dynamic range of over 105dB. The format was made possible by a new coding system that has a data rate of just 384kbits/sec (this compares with the 1·54Mbits/sec for DAT). The track width is 185μm and the maximum recording time two hours.

The coding system is known as Precision Adaptive Sub-

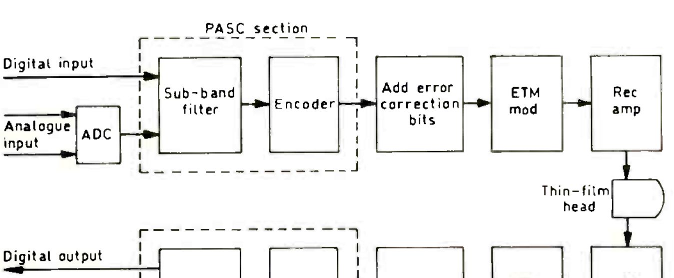


Fig. 1: DCC record and playback processing.

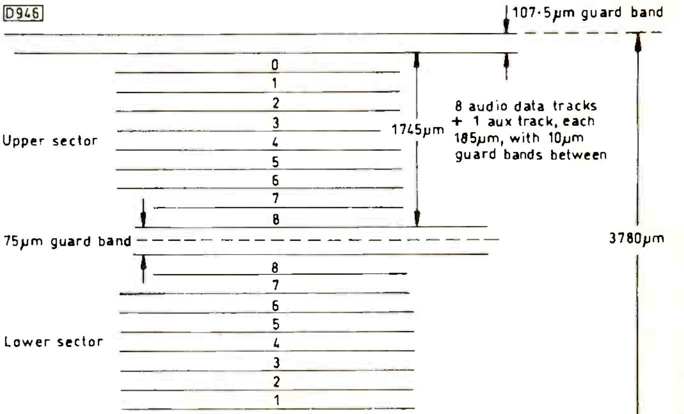


Fig. 2: DCC track layout.

band Coding (PASC), which is four times more efficient than the PCM coding used by the CD and DAT. It makes use of two characteristics of human hearing, the threshold of hearing and signal masking. Sounds that are below the threshold of hearing are ignored. Masking occurs when a weaker sound is pushed below the threshold of hearing by a stronger one at a similar frequency. PASC also ignores these masked signals. As a result, PASC needs to code only 25 per cent of the available audio data.

PASC also uses an adaptive bit allocation system to make more efficient use of the bits available. Basically, more bits are allocated to stronger signals than weaker ones – the range of bits that can be allocated in this way varies from 2 with a weak sound to 15, this allocation being in addition to a basic allocation of 6 bits. This is referred to as the scale factor: the bits cover a range of –118dB to +6dB in 2dB steps. The scale factor indicates the signal's scale within the dynamic range. As a result PASC provides a dynamic range that's equal to 19-bit coding.

Player Block Diagram

Fig. 1 shows in simplified block diagram form the DCC recording and playback processes. The player will accept either an analogue or digital sound input. Analogue signals first undergo AD conversion. The signal is then filtered into 32 sub-bands: the PASC system uses real-time processing to calculate each sub-band's threshold level and the number of bits to be allocated to it. The sub-bands are next multiplexed for recording on eight parallel tracks, and error-correction bits are added. Reed-Solomon error correction is used to reduce the effects of random and burst errors: dropouts of up to 1·45mm diameter and damage extending to one and a half tracks can be corrected. After eight-to-ten modulation the signal is ready for recording on the tape.

A ninth, auxiliary track on the tape is used for sub-code and control bits. This track has a data rate of 12kbits/sec.

Head and Track Layout

Fig. 2 shows the track layout. The tape is divided into upper and lower sectors that correspond with the two "sides" of an ACC tape. The head reads all nine tracks – eight audio and the auxiliary track – in one sector simultaneously. At the end of the tape an auto-reverse system rotates the head so that it reads the other sector. Track width is 185μm and there's a 10μm gap between tracks. The playback head reads a track width of only 70μm however. This makes DCC tolerant of mistracking and azimuth errors.

The thin-film head is made using a similar method to the lithographic process employed in LSI chip manufacturing. There's no erase head as data is overwritten. The head provides for digital recording, digital playback and analogue playback. At present there's no provision for analogue recording as this would complicate head construction and require additional circuitry, an erase head etc., but Philips says that DCC/ACC double decks are a possibility. The DCC head has nine integrated elements for digital recording, nine magneto-resistive elements for digital playback and two magneto-resistive elements for analogue playback. With the magneto-resistive system the varying magnetic field from the tape alters the element's resistance.

Tape and Cassettes

As the shortest recorded wavelength is 0·99μm the DCC system can use low-coercivity tape. Chrome- or cobalt-doped ferric oxide tape with a coercivity of 700 Oersteds is used. The magnetic layer is 3-4μm thick, the total tape thickness being 12μm. Tape width is the same as with an ACC.

The DC cassette is basically the same size as the ACC but is styled differently and has a uniform thickness of 9·6mm. Its top looks like a CD case and has the artist's name and a photograph. The tape is protected by a metal slider, a system borrowed from computer floppy discs. To reduce the risk of tangling or jamming, the tape reels are locked until the cassette is played. Blank DCC tapes have a slider that can be used to prevent accidental over-recording. A series of ID holes tell the machine the total tape playing time: this information is used to calculate and display the remaining tape recording time.

A couple of features improve the tape tracking. Two azimuth locking pins (ALPs) increase the wrap-round angle of the tape against the head while a fixed azimuth tape guide (FATG) system consisting of slots at the top and bottom of the head assembly improves the tape alignment. This system is not only effective, it's also cheaper and easier to produce than the pilot-tone tracking system used with DAT.

DCC playing times vary from 45 to 120 minutes (types D45, D90 etc.), though there's provision for longer-playing tapes. Tape speed is the same as with the ACC, i.e. 4·75cm/sec. There's no half-speed system because Philips wants any DCC tape to play on any DCC machine: the company doesn't however rule out the possibility of the standard being extended to include LP recording at a later date.

DCC Coding

The data is arranged as a series of frames. Each consists of 12,288 bytes of information, excluding sync data. There are 8,192 bytes of PASC data, 3,968 bytes are used for error detection and correction and there are 128 bytes for system information – this includes text mode data and other information such as copyright details.

The text mode display system enables a DCC deck to show various types of information, such as artist details, lyrics, song titles etc. Up to 255 different items can be included on a tape and, with an eye to international markets, the text can be encoded in up to seven different languages. Around 400 characters per second of text data can be stored and displayed. There are several types of text display as follows: one line of 12 characters, for example the artist's name; two lines of forty characters, for song titles and other information; 21 lines of 40 characters, for biographical information, lyrics etc. The text mode is optional, and the coding system used is such that text data cannot be transferred when a tape is copied. Philips hopes that this will deter people from copying prerecorded tapes.

DCC Recorders

All DCC recorders will be able to handle three digital sampling rates, 32kHz for digital broadcasts, 44·1kHz for CD signals and 48kHz for DAT. The latter two rates provide CD-quality sound. A sampling rate of 44·1kHz is used when recording analogue signals, e.g. from LP records.

Inaudible ID markers buried in the auxiliary track enable the machines to offer features such as direct track access, fast search, track programming etc. The DCC format's auto-reverse system makes track search faster than with an ordinary tape deck, but it will still be much slower than with CDs and DAT.

A serial copy management system prevents the user from making multiple recordings from a digital copy.

Long-distance Television

Roger Bunney

August was a relatively poor month for Sporadic E reception. Although there were several days when activity was high, most days were indifferent. Conditions did improve somewhat towards the end of the month however. The Perseids meteor shower didn't produce much either, and the only slight tropospheric lifts were on the 12th, 15th and 21st. The following SpE log shows that there were four good openings, on the 10th, 11th, 28th and 30th.:

5/8/92	RAI (Italy) ch. IA; TVA (Italy) Ch. IA; HTV/JRT(Yugoslavia) ch. E3.
6/8/92	TVE (Spain) chs. E2, 3.
9/8/92	SVT (Sweden) E3; NRK (Norway) E2; TVE E2.
10/8/92	TVE E2, 4; RAI IA, B; C+ (France) L2, 3; ARD (Germany) E2; CST (Czechoslovakia) R1, 2; TVR (Romania) R1;HTV E3; +PTT (Switzerland) E4; TVP (Poland) R1; ORF(Austria) E2a, 4; SVT E3; NRK E2, 3; CSI (Russia) R1-4; DR (Denmark) E3; RUV (Iceland) E3, 4.
11/8/92	TVE E2-4; TVE-2 E2; RTP (Portugal) E3; RAI IA, B; +PTT E2, 3; TVR R2; MTV (Hungary) R1; RSTH (Albania) IC.
12/8/92	TVE E3; DR E3; YLE (Finland) E4.
13/8/92	RTT (Tunisia) E4 (received by Tim Anderson).
15/8/92	DR E3.
16/8/92	TVE E2; SVT E2.
18/8/92	TVE E2; RAI IA; DR E3.
19/8/92	TVE E2; DR E3.
22/8/92	+PTT E2; ARD E3; DR E3.
23/8/92	TVE E2-4.
25/8/92	CST R1; TVE E2. Reports indicate that there was a good SpE opening this day.
28/8/92	RAI IA, B; TVE E2; +PTT E2; DR E3; NRK E2; ARD E2; HTV E3; C+ L2, 3.
29/8/92	TVE E2, 3; +PTT E2; DR E3.
30/8/92	NRK E2-4; SVT E2-4; YLE E4; CSI/OK1 R1, 2.

My thanks to Roger Fussell (Torpoint), Iain Menzies (Aberdeen), Tim Anderson (St. Leonards), Peter Schubert (Rainham), Brian Williams (Penarth) and Simon Hamer (Powys) for sending in reception reports.

Some years ago Ian Beckett designed a wideband Band I array consisting of a reflector and a three-element dipole assembly. It was featured in this column at the time and is shown in the TV-DXer's Handbook. Brian Williams has been experimenting with this system recently and suggests that improved results are obtained by connecting the feeder to the longest of the elements in the dipole cluster, i.e. the one nearest the reflector, also that gamma matching enhances the performance. More details next month.

Tim Anderson and Dave Shirley have just completed programming two computer discs on DXing. One, for Band I TV-DXers, provides worldwide channel allocations and transmitter lists. The other, entitled "Amiscan", is described as a confidential scanner frequency list with a difference! They are available on 3·5in. discs for Amiga/IBM PCs – 5·5in. to order. The TV-DX disc costs £8 and the Amiscan £7·50, both including post and packing. For further details write to Tim/Dave at 2 Burry Road, St. Leonards, E. Sussex TN37 6QX including an s.a.e. Again I hope to be able to provide further details next month.

News Items

France: Jean Louis Dubler tells us that several privately owned u.h.f. transmitters which were previously used for the La Cinq network are now relaying the Canal J and Canal Jimmy satellite linked programmes. These are being picked up and carried on at least twenty two Swiss cable networks. Canal Plus is not amused and may soon scramble the satellite feeds, probably with Nagravision coding.

CIS: The BDXC has sent us a list of current u.h.f. stations in the western part of the CIS. The high-powered transmitters are listed below, with e.r.p. where known. LTU = Lithuania; LVA = Latvia; BYL = Byelorussia; RUS = Western Russia:

R21	Juragiai 800kW LTU; Vyborg RUS; Dededovici RUS.
R22	Bubiai 500kW LTU.
R23	Kirisi RUS.
R27	Koeru EST; Taurage 600kW LTU.
R28	Tallinn 600kW EST; Juragiai 800kW LTU; Luga RUS.
R29	Kohtla-Nome EST; Klaipeda 700kW LTU; Heraneny BYL.
R30	Vavgjarve 400kW EST; Visaginas 50kW LTU; Brest BYL.
R31	Vilnius 800kW LTU; Kingisepp RUS.
R32	Viesintos 700kW LTU.
R33	Visaginas 125kW LTU.
R34	Bubiai 500kW LTU.
R35	Visaginas 125kW LTU.
R37	Kingisepp RUS.
R38	Vilnius 700kW LTU; Volchov RUS.
R39	Koeru EST; Taurage LTU.

Germany: Tele 5 will become a sports programme called Deutches Sports Fernsehen from January 1st. The Hoebeck transmitter now carries ORB-3 on ch. E51 at 100kW e.r.p.

Thailand: The government has given permission for five new privately-owned TV networks to be established.

Vanuatu: This island group in the south west Pacific (formerly the New Hebrides) now has a TV service. The first transmitter is at Port Vila, Efate.

Kuwait: A cable network is being set up in Kuwait City. Programmes will be censored and it's thought that satellite TV dishes could be banned. Some 400 independent TV stations have been refused licences though 150 have refused to close down.

50MHz Amateur Band: Eighty Spanish amateurs are to be allowed to use the 50MHz band on an experimental basis for a year, operating at up to 30W e.r.p. with SSB and CW.

Satellite TV

Steve Birkill was the first to monitor the Russian ZSSRD-2 satellite at 16°W carrying downlink data from the MIRS space station at 11·375GHz (RHCP) and TV pictures in clear SECAM from the same source at 10·835GHz – unfortunately this is outside the coverage of most tuners, which cut off at 10·9GHz or so. For several months I'd noticed "flashing" effects at about 16°W. Quite coincidentally I've recently been involved in some modifications to the Echosphere SR50 manual receiver, including a change that allows the tuning head to cover well below the usual 10·95GHz limit. During the late evening of August 21st I first found the data downlink then, tuning l.f., weak pictures appeared. Adjustment of the i.f. bandwidth control lifted the signal above the noise to reveal three spacemen sat together! The locked off camera shot showed only these men moving and talking within their living quarters. I found the signals at 2300: the carrier ceased abruptly at 2307 BST. Despite careful monitoring for several days afterwards no further pictures were seen, though the data feed is operational for much of the time. It seems that the TV transmissions are random: Steve reports that when he last received them they lasted for 30-45 minutes. My reception was with a 1·5m dish. Obviously a much larger dish is required for satisfactory reception. With my system there's a 3dB loss through using linear instead of RHCP.

I noticed a gradual fall off in signal quality here over several weeks. The cause was eventually traced to a build up of water behind the feed tube cap on the prime-focus head due to condensation. I'd orignally fitted the polythene cap to prevent spiders etc. getting in, a previous cause of signal fall off. Seems you can't win!

The Australian Optus B1 satellite has been successfully launched. It will replace an earlier AUSSAT craft when operational next year.

Ian Waller (Lincoln Satellite) reports that ARABSAT 1B has drifted east because of fuel shortage but has been halted at 33°E. Earlier this year the ARABSAT 1A craft drifted to 31°E. The Dubai downlink is now at 3·96GHz (LHCP). According to Cairo Radio the Egyptian Space Channel that's downlinked from ARABSAT will in the near future use Intelsat and Eutelsat transponders as well.

The equipment that will be required for the DirectTV 150-channel DBS service in the USA starting in 1994 will comprise a receiver-decoder and a 46cm dish, costing around $700. Two Hughes HS601 satellites will be used for the service. First launch is due in December 1993.

The BBC World TV service is to be relayed to Africa via the Intelsat 601 craft at 27·5°W. There will be nine hours of programmes daily.

Intelsat K at 21·5°W is now up and running. At the time of writing this two Starbird transponders are relaying the US Open tennis championships to Europe, one in 625-line PAL and the other in 525-line NTSC. Interesting to listen to the audio subcarriers with the NTSC signal – from time to time one features a Boston radio station's output! The satellite has sixteen 54MHz bandwidth transponders, giving a capacity of 32 channels in the half-transponder mode, all in the Ku band.

WTN has bought British Aerospace's 50 per cent stake in Starbird. SISLink is to provide SNG facilities for five regional ITV companies starting next January. From early autumn the Continental TV transmissions are to move to transponder 20 on Eutelsat II F1 at 13°E. The SAVE encryption is to change to smart-card driven Cryptovision next spring.

Anti Ghost Techniques

Japan inaugurated an ED-TV (extended definition TV) programme in 1989. Effort has gone into better camera resolution, digital signal processing and an overall improvement of the NTSC system. The research programme also included ways of reducing the damage caused by ghost signals – signal reflection from high buildings causes severe ghosting in some urban areas in Japan.

The research has shown that ghost delays of up to 42·5µsec are not uncommon. Measurements in Tokyo and Osaka recorded delays of up to 26µsec in 92 per cent of cases checked.

Some years ago NHK marketed a system that reduced the effects of ghosting electronically, though technical details were never released. The process was thought to involve phase shifting/cancellation, being external to the receiver.

More recently the Shibasoku Company, a firm involved in the design and manufacture of professional test equipment, video monitors etc., has introduced a ghost cancellation system that, though intended for laboratory work, could well have implications for domestic TV. The system works by integrating direct and reflected signals to produce a cancellation signal that leaves the original signal free from interference.

To achieve this result Shibasoku inserts a GCR (ghost cancellation reference) signal on lines 18 and 281 of the odd/even fields in the field blanking period, just after the vertical interval test signal. A repeating eight-field sequence is used to capture ghosts with a long time delay – in practice a 30dB reduction in ghost impairment can be achieved within five seconds of a ghost first being detected. These figures have been confirmed during field tests in Tokyo and Osaka. The GCR signals are now being included in broadcast transmissions throughout Japan, on a full 24-hour basis.

Shibasoku manufactures the full system – the GCR signal insert generator, ghost simulation equipment and ghost detecting/rejection equipment. When a ghost-degraded signal is detected phase-shift circuitry is switched into operation: shifts from 0-360° can be achieved with delay times of not more than a single line. Under laboratory conditions up to ten ghosts can be attenuated by 55dB.

NHK has carried out research into what is perhaps a more fundamental approach to the problem of ghosts – to clad offending buildings with a ferromagnetic material that absorbs instead of reflecting v.h.f. signals. Already three major Tokyo buildings have been built with the material used in tile form as vertically mounted strips.

VHS Tape Path Alignment

Joe Cieszynski

Tracking correction by moving the V blocks with which the guide rollers engage seems to be a common practice nowadays, though totally wrong. I've recently come across a number of engineers who did it as a matter of course without realising the damage they were inflicting on the machines. In some cases they were acting on the instructions of others who told them that it was an accepted cure for tracking problems. It isn't. In fact the practice can be more destructive to a machine than pouring the mains supply down low-voltage lines: at least you can repair all the damage done by the mains.

Back to Basics

I'm concerned mainly with full-size M-wrap decks – see Fig. 1 – though the theory applies to other formats as well. To start off we should examine why it's imperative for the V blocks to be left in their factory preset positions. To do this we must look at the way in which the helical tracks are laid down on the tape and how this is done.

Fig. 2 shows the standard VHS track layout. The critical factor that governs tape tracking is angle a, which for VHS is 5·963°. If, because of mechanical misalignment, the video heads scan the tape at a slightly different angle the machine will replay its own recordings correctly but tracking problems will be evident with prerecorded tapes. There will also be poor tracking or complete mistracking when the machine's tapes are played via another machine.

Tolerances

This precise angle of 5·963° is well enough known, but how often do we recall the strict tolerances to which the threading mechanism is manufactured? The tape is wrapped around the drum by something in the order of 185-188° (more on this in a minute); the drum diameter is precisely 62mm, so that when it rotates at 1,500 r.p.m. the head velocity is 4·87m/sec; the drum is tilted at a precise angle with respect to the tape path; tape speed is a constant 23·39mm/sec; and finally the tape height is set at the entry and exit points, then tilted by the slant poles, so that the tape contacts the drum surface correctly. All these factors ensure that the two 49μm thick heads travel across the tape at the correct angle so that the 0·3μm head gaps, set at a 12° offset angle with respect to each other, retrieve the recorded information. If any one of these parameters is changed by even the smallest amount you no longer have the exact VHS format. It's for this reason that the V block settings are so critical: if either block is misaligned, the wrap angle changes and so does the tracking angle.

At deck assembly plants, where the original alignment is carried out, manufacturers work to tolerances of the order of 1μm. The plants are built on firm rock foundations to reduce the effects of vibration produced by traffic, aircraft etc. The Thomson VCR factory at Yishun, Singapore provides an interesting illustration of the lengths to which manufacturers go to ensure precision production: the head drum facility has a suspended floor to prevent any vibrations that would otherwise upset the production tolerances. If the manufacturers find it necessary to go to such lengths to ensure correct alignment, how can anyone hope to do as well with a Phillips screwdriver, a pair of pliers and the machine on a wooden bench?

Mechanical Reference

The two V blocks form a reference for the alignment of the rest of the deck. Moving the blocks may appear to fix a machine that's mistracking, but in fact what's being done is to introduce an error to compensate for the original fault.

Some might argue that since the drum wrap can be anything between 185° and 188° moving the blocks is in order. This is not so. The wrap has to be in excess of 180° to accommodate the playback head switching, the most popular wrap being 186°. But it's the manufacturer who decides on the wrap. He then sets the angle of the slant poles to suit. So the argument for leaving the V blocks alone stands.

The blocks are generally firmly secured to the chassis or subchassis by means of screws that are often fixed with locking compound. It follows that if the tracking is poor the cause of this must lie elsewhere.

When I made further enquiries about the effectiveness of the practice of moving the V blocks amongst those who do this some admitted to a comeback rate in excess of thirty per cent. They couldn't understand why, as the machines appeared to be fine when they left the workshop. Clearly in some cases the original fault may have altered slightly. In

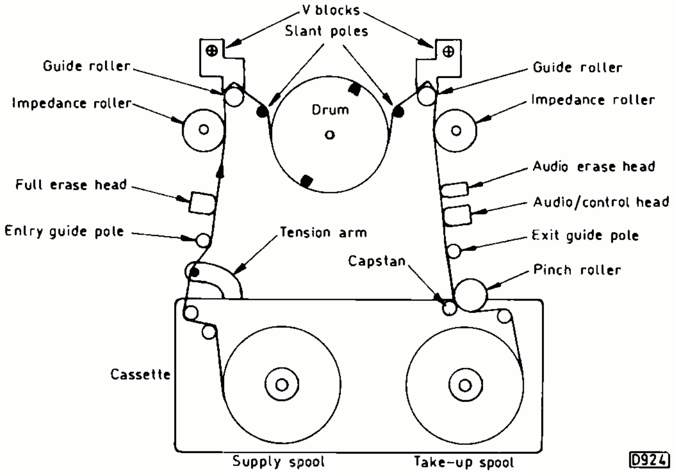


Fig. 1: Basic VHS deck layout with M-format tape wrap, indicating the positions of the main mechanical items. In practice some variations occur: one or both of the impedance rollers, which are included to prevent tape flutter at the entry and exit points, may be omitted; the entry guide pole may simply be a pin; an audio erase head is generally included only with models that have editing facilities.

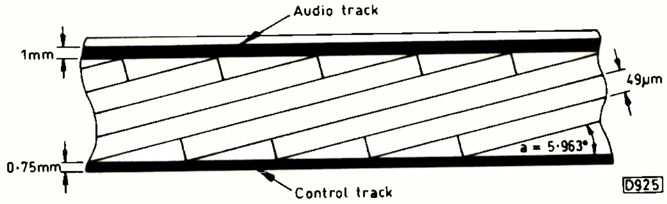
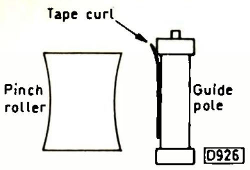


Fig. 2: Way in which the signals are laid down on the tape (standard VHS format).



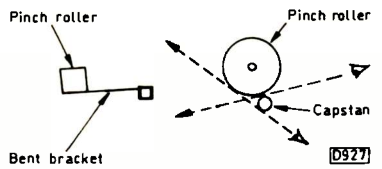


Fig. 3 (left): A concave pinch roller can cause creasing at the top or bottom edge of the tape. A hardened pinch roller can have the same effect.

Fig. 4 (right): Check for correct vertical alignment if the pinch roller is mounted on a soft metal bracket. A distorted bracket can cause tape edge creasing. Check for both zenith and azimuth distortion.

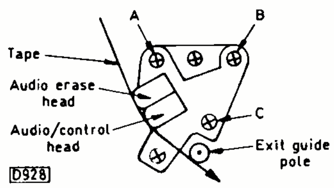


Fig. 5: Typical arrangement of the height, azimuth and zenith adjustment screws for an audio/control head assembly. Adjust screws A, B and C for the correct height, screws A and C for the correct azimuth setting and screw B for the correct zenith setting.

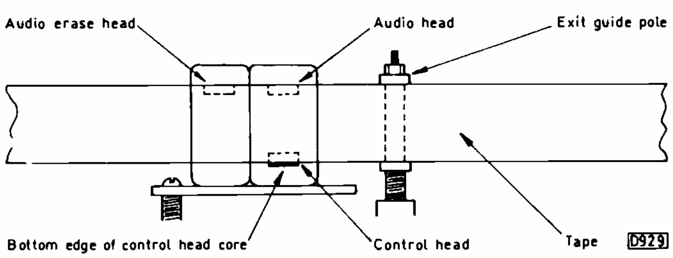


Fig. 6: Correct height conditions for the audio/control head.

others the machine may be able to cope with good quality tapes but will struggle to track correctly with tapes that are a little worn but still within specification, e.g. some hired tapes or old recordings.

How to Deal with Mistracking

Having made the point that you don't move the V blocks to correct tape path problems we'll next consider how mistracking should be tackled. There are several approaches to VHS deck servicing: each engineer adopts his/her own method. The procedure I'm about to describe is presented for the benefit of those still gaining experience. It's not the only way to go about it, but it is a logical approach that will in most cases get you to the root of the trouble.

After carrying out a quick visual check to see whether there are any obvious faults such as foreign bodies, pieces of the mechanism broken off etc., the first thing to do is to inspect the pinch roller.

Defective Pinch Roller

When the roller is worn the tape will ride up or down the capstan because of the uneven pressure (see Fig. 3). This in turn causes tape curling at the exit guide. One or more of the following symptoms will be present: (1) tape edge creasing, with permanent damage; (2) loss of the CTL pulses, the result being intermittent noise bars; (3) poor h.f. audio response because of poor head/tape contact.

The tape curl shown in Fig. 3 is best observed by looking at the tape from directly above: if there's no curl the tape should be almost invisible as you are viewing it edge on. Even the slightest curl should be evident when the tape is viewed in this way, but you must carry out the check under good light conditions. I should perhaps point out that when training engineers in this skill I've found that some are unable to see very slight curls that have been introduced artificially though others have no difficulty at all. The danger is that if you don't notice what's happening you'll start to look for the cause of the trouble elsewhere. This check must be carried out carefully.

The way in which the roller deteriorates depends on the composition of the rubber. This varies with different manufacturers. The wear illustrated in Fig. 3 is easy to detect by checking the pinch roller against a straight edge. Roller replacement is not a major job. Alternatively the rubber may become hard – often shiny – the result being poor tape transport. You can get the same symptoms as with a concave roller.

The roller is sometimes mounted on a soft metal bracket which may have bent, see Fig. 4. This usually happens when someone has applied excessive pressure while replacing the roller. As shown in Fig. 4, the capstan provides a convenient line against which to site the roller.

Back Tension

Back tension is the next thing to check. Incorrect back tension can cause misalignment anywhere along the tape path. The only correct method of checking the back tension is to use an appropriate gauge – a back-tension cassette, tentelometer or spring gauge. Too many service engineers are under the impression that back tension can be set without the use of a gauge. This is not the case. All video workshops should not only have a gauge, they should use it. Nick Beer's articles in the August 1988 and January 1990 issues of *Television* provide further information on back-tension problems.

The Audio/control Head

Having checked the pinch roller and back tension you know with certainty that the conditions are correct at the tape entry and exit points. In most cases the tracking will now be correct. If it isn't, proceed as follows.

Check the alignment of the audio/control head. Incorrect alignment can produce the same symptoms as a defective pinch roller. In addition the tape may be displaced at the exit guide roller, giving the impression that this roller is misaligned. It's in such circumstances that a VCR deck can end up in a state of complete misalignment.

If the screws that secure the audio/control head are still locked with the manufacturer's locking compound you can be fairly certain that the head alignment is correct. If the compound is broken the alignment must be checked.

In their manuals manufacturers usually tell you what to look for when carrying out head alignment, but they seldom tell you how to do it. The following procedure generally works well. The best alignment order is: height, zenith and finally azimuth.

First set the head so that it's roughly perpendicular, using all the setting screws – see Fig. 5. This gives you a good starting point. Now set the height. This can be done with a jig, but most manufacturers recommend that the height is set up while playing a tape, looking for the conditions shown in Fig. 6: the top of the audio head core is just covered and a fraction of the control head core shows beneath the tape. When adjusting the height rotate each screw in turn by the

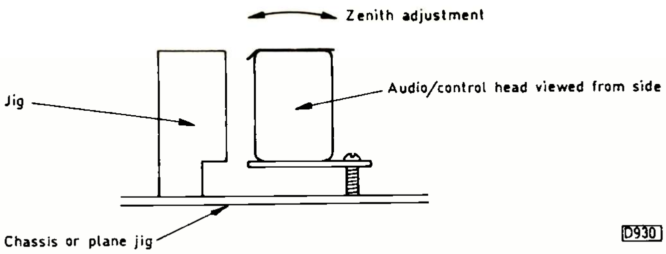


Fig. 7: Zenith adjustment using a vertical jig. I use the reel disc height jig from the old Ferguson 3V00 VCR service kit but any suitable straight edge will generally do.

same amount, e.g. by 90° increments, so that the head remains vertical with respect to chassis.

Once the height has been set correctly, carry out the zenith adjustment. Check this by placing a vertical edge – a piece of stiff card will do if nothing else is available – about 1mm from the front face of the head and looking at the gap, see Fig. 7. Any tilt in the zenith plane will be clearly visible. When tilt is evident it's not always easy to know which adjustment screw (where there are two screws), front or rear, should be adjusted. To avoid putting the height adjustment too far out I suggest that each screw is adjusted equally to correct the zenith error.

The correct azimuth alignment method requires the use of an alignment tape. This is not an essential item of test equipment for domestic machines however: tolerances are generally such that a known good test recording can be used. It's not sufficient to set the azimuth for optimum h.f. audio response: scope the control track output as well. It's possible to have good audio with very attenuated control pulses.

To ensure correct adjustment, check the height, zenith and azimuth settings once more.

The lateral (lip sync) adjustment is necessary only when it has been misadjusted by someone else or a new audio/control head has been fitted.

The Guide Rollers

If there are signs that the guide rollers have been adjusted previously, i.e. they are chewed up, full alignment with a scope is recommended. As a general rule I always replace chewed guide rollers because there's no way of telling whether they have become fractionally distorted – even fractional distortion will affect the machine's tracking ability. Guide rollers get chewed because people don't slacken off the locking screws before attempting adjustment.

Other Possibilities

There are many occasions when the symptoms displayed on the screen suggest that a guide roller is misaligned but there's no evidence that the machine has received previous attention. Why might the guide(s) have gone out of alignment when they are still locked tight? In all probability the guides are not the cause of the problem: several other things can give the impression that a guide roller is misaligned.

The head drum may have been replaced at an earlier stage in the machine's life. In theory the guide rollers should be reset when a new drum is fitted, but in practice this is rarely done. In most cases this doesn't matter. Sometimes however the f.m. output is compromised slightly when a new head is fitted and, as the drum wears, the entry/exit angles shift farther, resulting in a noticeable loss of f.m. output.

Another possibility is a worn slant pole. The wear may be almost invisible yet a check on the f.m. output shows serious entry/exit misalignment. Replacement of the offending slant pole is often the only way of confirming this.

A worn lower drum can give the same symptoms.

Adjustment of the guide rollers will sometimes compensate for any of these possibilities. If it proves difficult to adjust a guide roller however the worn item must be replaced – you will otherwise waste many long hours trying, without success, to get the machine to perform correctly. I cannot stress sufficiently the fine tolerances to which we have to work. Too often engineers who happily replace electronic components are reluctant to replace slant poles, guide rollers, the lower drum etc. Admittedly some of these items can be expensive, but the sort of wear we are considering only occurs with older machines for which spares from scrap machines are usually readily available.

Back to the V Blocks

This brings us back to the subject of the V blocks. A machine with a poor f.m. output at the entry or exit point may be in this condition because someone has moved the blocks. It's easy to see how this arises. The machine has say a worn slant pole but the engineer fails to diagnose this. Having heard that V block adjustment is an accepted cure he goes ahead and adjusts them.

The question that now arises is what can you do about the problem? A precise alignment jig would have been used to set the blocks at the factory, but such jigs are simply not available to the service engineer. Even if they were they would be very expensive. One thing is for sure: unless the blocks are reset full interchangeability performance will never be attained.

You must first confirm that the blocks have been moved. This is usually simple – the screwheads will show signs of wear. They are sometimes secured with locking compound and this seal will have been broken. If the blocks have been moved, you must accept that precise alignment will be impossible without a jig. The tolerances are just too fine. The best that you can hope for is to get them close enough to the correct positions to be able to set the guide rollers for an acceptable though not perfect f.m. output.

If there are marks in the surrounding dust to give an indication of the original settings, use these as a guide. Then set the guide rollers. After doing this the entry point, which is the most critical factor, can be tweaked using the head-switching procedure.

Check first that the head switching controls haven't been got at, i.e. that they are set at approximately their mid positions. Insert the tape that you use for head switching adjustment (this should be an alignment tape) and set up your scope. With the VHS system head switching should occur 6·5 lines before the field sync. This will be the case if the entry V block is set correctly. If the block is offset slightly the tape wrap will result in noise during the field blanking period. Move the block fractionally to reduce this noise, resetting the guide roller as you do so. You can eventually reach a point where slight movement of the block appears to shift the head switching point – in fact you are moving the tape in relation to the head switching time. Adjust the block so that head switching occurs exactly 6·5 lines before the field sync.

The results with machines that I've dealt with in this way have been varied. Some appear to have been restored to correct operation. Others display a slight amount of interlace flicker. This is why at the outset I commented than moving the V blocks can be more destructive than mains down the supply rail. At least in the latter case the equipment and spares are available to carry out a proper repair.

In Conclusion

Repairing video mechanisms has never been more difficult. Multi-function motors that drive complex gear trains, mode switches that tie the deck to an even greater extent to the microcontroller chip, and layered deck construction all contribute to the problems encountered by the service engineer.

Then there are the tiny mechanisms used in VHS-C and 8mm format camcorders.

The video deck is a piece of precision engineering that must be treated with respect. Mistakes will be made and accidents do happen during servicing. But I personally was disappointed to find that fundamental errors which were being made fifteen years ago are still common today, even in some of the larger workshops. This bodge does nothing for the service industry in terms of customer relations and makes things much more difficult for those who try to do the job properly.

Satellite Notebook

Nick Beer

Back in August I mentioned the duplication of MTV via Astra 1B and put forward a suggestion for this. That was before official information was released. My guesswork was wrong: the reason for the duplication is to give greater coverage over the Iberian peninsula. My thanks to those who contacted me when they heard the official news.

While on the subject of matters previously raised, there's now an official line from Ferguson on the modified VideoCrypt decoder connector (see letter from Bernie Hinton last month). The modified connector is now supplied when the original part number is ordered. I still feel that Ferguson took an unduly long time to deal with the matter satisfactorily and fell down in their dealings with the service trade.

Problems with a Connexions Receiver

I had to deal with a dead Connexions CX8520R receiver recently. It's not a model or a manufacturer we've dealt with before, but I've seen a fair number of these receivers in customers' homes – a local aerial rigger sold quite a lot of them as part of a motorised system. He had one himself and frequently extolled its virtues.

An unfortunate accident had occurred with this particular receiver: the 18V supply to the LNB had been shorted out because the F connectors at the receiver and LNB hadn't been crimped. The crimp rings were missing and the plugs had simply been pushed on to the coaxial cable... It wasn't one of the aforementioned rigger's installations, a local "repair centre" having been responsible. I've had to sort out their attempted repairs more than a few times before.

Anyway the customer reported that smoke had come from the unit. This was a bad sign and in fact you could still smell the smoke inside the receiver. As I'd no circuit diagram I had to feel my way cautiously. The 7818 18V regulator was a molten mass though its number could still be discerned. I replaced it along with the two 1N4007 rectifiers that preceded it (they were simply four legs sticking out of the PCB! – I assumed that they were of the same type as in the 5V and 12V rectifier circuits), also for good measure the 2,200µF reservoir capacitor. When I switched the receiver on I was rewarded with a dead unit that after ten or so seconds would have served admirably as a single-plate hob. The mains transformer, a massive affair that's bolted to the case, was getting very hot.

Disconnecting the secondary plug proved that the load wasn't the cause of the transformer's distress. Cold checks then showed that the 18V supply secondary winding was short-circuit. So a new transformer was required, and I was left wondering where the protection was? There were no obvious fuses or other protective devices in the 18V supply and the transformer didn't seem to have a thermal fuse. So the mayhem experienced was bound to happen in the event of a short across the supply to the LNB, something quite likely to occur. I may have missed something but I didn't and still don't have a circuit diagram. Why? Read on.

Spares

Our storeman phoned Connexions for a transformer and a service manual. He was told that he could order a manual on a pro-forma basis but would have to obtain spares from another source. So he forwarded an order and cheque to Connexions then contacted the spares agent. On asking the price of the transformer he was told "about thirty quid". "Does that include VAT, post and packing etc.?" "Spose so"!

A cheque for about thirty quid was sent off and ten days later a transformer arrived. The manual didn't but the transformer was fitted in the hope that this would be the end of the story. It was an easy job – the secondary windings are connected to a non-reversible six-pin plug. When I powered the receiver I was greeted by a clicking from various relays and a standby dot in the larger-than-life display across the front. Then at switch-on "ASTRA. . . . " appeared across the display and the picture and sound came up. The picture was marred by 100Hz hum bars however, then after about two minutes the receiver went to standby and almost immediately came back on. It continued to do this, which was worrying after the previous burn up. What damage could have been done to the microcontroller circuitry etc.?

Being an optimist and concluding that the faults were connected I decided to tackle the hum first. It was on the 12V supply, which was low at 8V. Why? Because the input was only 10V. The rectifiers read o.k., as did the reservoir capacitor, but I replaced them as they were in very close proximity to the previous damage. A check on the 12V regulator showed that there was a very slight leak from its output to chassis, so a new 7812 was also fitted. But the symptoms remained as before.

For want of something better to do I decided to check the d.c. conditions around the 5V regulator, which is at the other end of the heatsink. There was a nice 5V output but what was this? – the input was 27·5V! The penny then dropped: the secondaries were wired back-to-front in comparison with the original transformer. A.C. checks confirmed this. Rewiring the plug (non-reversible, so it wasn't me fitting it back-to-front!) finally cured everything.

Polarisers and the Luxor 9570

Recent letters from K.D. Bunting and Philip Lane (August and September) have commented on interfacing the Luxor 9570 receiver with a polariser purchased from Sendz and a Connexions polariser respectively. I'm a little suspicious about this. Philip Lane is clearly talking about driving a servo-motor polariser, which is what the 9570 is designed to do, but feels that the 5V supply provides insufficient current for the purpose. He may well be right, but a tight motor or one with shorted turns could be responsible for the problem.

In this set-up there are three connections to the polariser, which is simply a motor that turns the waveguide/probe through 90° to select the polarisation required. It's a system that's become largely obsolete due to its unreliability, energy consumption and greater signal loss than an electronic/electromagnetic type. The motor has 5V and chassis connections, the third connection being a squarewave drive that switches the 5V through the motor to chassis: the idea is to obtain an accurate 90° shift by varying the width of the squarewave drive. There are two potentiometers, which are accessible through holes in the bottom of the case, to set the pulse width limits.

K.D. Bunting appears to be talking about the use of an electromagnetic polariser which he says requires 5V at 80mA for switching to receive the horizontal channels. If this assumption is correct, the situation is not quite so simple. The fact that the vertical channels were obtained with no supply to the polariser could be pure chance, i.e. the polariser/LNB is aligned for this. Such a polariser requires a variable current at 5V, not a switching voltage. The easiest way in which to achieve this with the 9570 is to fit a servo motor to electromagnetic polariser interface – such items are available at modest cost, certainly cheaper than it would cost to build one! It enables the current through the polariser coil to be controlled by the width of the polariser drive pulses.

With certain receivers, for example the B and O Beosat RX which was also designed to drive a servo-motor polariser, the 5V supply is switched off when the required polarisation has been obtained. This switch-off would have to be overridden when an interface is present, otherwise the polariser would revert to its null state after a few seconds.

Mr. Bunting's idea works for him because his LNB is set for one polarisation with no current flowing through the polariser: with full polariser current flowing, by simply switching a 5V supply, the other polarisation is obtained. This could cause problems since it would not work with different polariser/LNB orientation or a polariser with a different drive coil impedance. It's for this reason that we need to be able to adjust the current flowing through the polariser: with an interface fitted, you can still use the previously mentioned potentiometers (PA03 and PA04) for this purpose.

Like everything else, if it works to your satisfaction then fine. Provided it's safe don't worry. I mention these points in case other readers experience problems when trying to do the same sort of thing.

All about Ceramic Resonators

Ray Porter, M.Sc., C. Eng. MIEE

System clock oscillators are now commonplace in TV, video and telecoms equipment because of the use of digital, in particular microcomputer-based, control and processing systems. Simple oscillators to provide a system clock can be made using an RC network, but when good stability, accuracy and freedom from the need for production-line setting-up are required a piezoelectric (PZT) element is generally used in the oscillator circuit. The traditional PZT material is crystalline quartz, but ceramic elements can exhibit similar properties and are smaller, cheaper and sufficiently stable for many oscillator applications, perhaps the best known being their use in TV/video remote control handsets.

Oscillator Characteristics

Basically an oscillator consists of an amplifier with positive feedback to sustain oscillation. Its frequency is set by the filter (LC, RC, quartz crystal or ceramic resonator) used in the feedback circuit. The basic characteristics of the various types of filters are as follows:

LC: Initial frequency tolerance ±2%; long-term stability fair; inexpensive; large size; set-up adjustment required.

RC: Initial frequency tolerance ±2%; long-term stability fair; inexpensive; small size; set-up adjustment required.

Quartz crystal: Initial frequency tolerance ±0·001%; long-term stability excellent; expensive; large size; no adjustment required.

Ceramic resonator: Initial frequency tolerance ±0·5%; long-term stability excellent; inexpensive; small size; no adjustment required.

Piezoelectric Effect

Although the voltage generated by the piezoelectric effect is well known to practising engineers, the important factor with a ceramic resonator (or a quartz crystal) is how the PZT effect influences circuit impedance. This is often less well known.

The application of a voltage across a piece of PZT material alters its dimensions. Conversely compressing or expanding a piece of PZT material generates a voltage across its faces. Thus a sinusoidally varying voltage results in a sinusoidally varying dimensional change. This generates its own e.m.f. which opposes the applied voltage, creating an impedance to current flow through the PZT material. The opposite of what we require, you might think. At some applied voltage frequencies however the dimen-

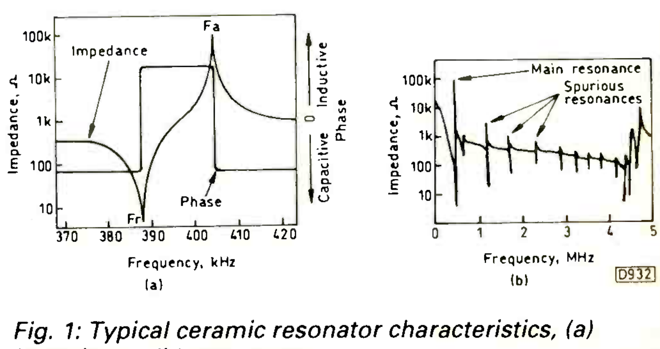


Fig. 1: Typical ceramic resonator characteristics, (a) impedance, (b) resonance.

sional changes are sympathetic with modes of mechanical resonance in the material. The resonance amplitude is large at one particular frequency, the other resonances being less significant. When mechanical resonance occurs, the amplitude and phase of the internal e.m.f. also change. As a result the electrical impedance alters, in the same way that an LC circuit's impedance changes at resonance. Fig. 1 shows measurements of the impedance of a typical ceramic resonator.

Equivalent Circuit

Fig. 2 shows the equivalent circuit that produces the same impedance/frequency characteristics as those shown in Fig. 1. R1 represents the energy loss in the ceramic structure; C1 and L1 are the delay and energy storage elements within the PZT material; Co represents the physical capacitance of the terminations and leadout wires (parallel stray capacitance).

As Fig. 1 shows, there are two frequencies of resonance Fr and Fa. Fr is the series resonant frequency of L1 and C1. Fa is called the anti-resonant frequency: it occurs when the series combination of C1 and Co resonates with L1. The significant differences in the electrical characteristics of a 4MHz ceramic resonator and quartz crystal are as follows:

Ceramic resonator: L1 385μH, C1 4·4pF, Co 36·3pF, R1 8·7Ω. The Q is 1,134 while the frequency difference between Fr and Fa is 228kHz.

Quartz crystal: L1 210mH, C1 0·007pF, Co 2·39pF, R1 22·1Ω. The Q is 240,986 and the Fr-Fa frequency difference 6kHz.

It follows that a quartz crystal will provide an oscillator with better accuracy and stability. But, when using CMOS gates, an oscillator with a ceramic resonator starts up in 100μsec compared to 10msec for a quartz crystal.

Oscillator Fundamentals

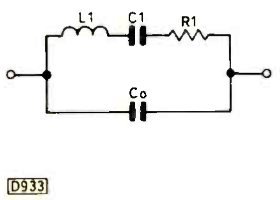
As we've stated an oscillator is basically a positive feedback amplifier. The most common use for ceramic resonators is in the feedback path of such amplifiers, the amplification being required to make up the energy lost during each cycle of PZT oscillation. Such a stage oscillates only when the gain from the input through to the output and back through the feedback network is at least 0dB and the phase change is either 0° or 360°. To ensure that oscillation occurs at only one frequency the feedback is frequency selective, with gain and phase characteristics that, when added to the amplifier's gain and phase characteristics, give the required conditions. A ceramic resonator provides the frequency-selective gain and phase characteristics in the feedback loops of the circuits described below.

Fig. 3 shows a series resonant oscillator: the ceramic resonator contributes a 0° phase shift in the feedback path because each inverter stage contributes a 180° phase shift, giving 360° overall. This condition occurs at Fr, when the PZT element is series resonant. This type of oscillator tends to start more slowly and consume more current than the alternative parallel type.

Parallel resonant oscillators (see Fig. 4) use one inverter to contribute a 180° phase shift. The PZT device is used at a frequency at which it has an inductive impedance that, together with additional capacitors (C1 and C2), contributes a further 180° phase shift. Sometimes the additional capacitors are incorporated within the resonator package. In the circuit shown in Fig. 4 Rf has a value of typically several MΩ: it biases the CMOS inverter to a point where the gain is sufficient for the oscillator to start up readily. Rd limits the drive to the resonator and suppresses operation at the spurious higher-frequency modes (see Fig. 1). The one-transistor equivalent circuit is shown in Fig. 5.

The parallel resonant circuit is basically a Colpitts type oscillator in which the resonator behaves as the inductor, oscillating at a frequency between Fr and Fa in conjunction with C1 and C2. These capacitors and the resonator form a pi filter: when the series combination of C1 and C2 resonates with the inductive reactance of the ceramic resonator the phase shift is 180° and the attenuation is low. The actual frequency of oscillation is sometimes adjustable by means of a trimmer connected in parallel with the resonator.

Ceramic resonators for parallel oscillator circuits are manufactured to suit a specified value of C1/2: this should be borne in mind when a replacement is fitted. A ceramic resonator intended for use in a series oscillator can be used in a parallel circuit by adding a trimmer in series with it.



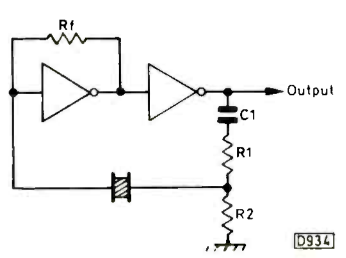
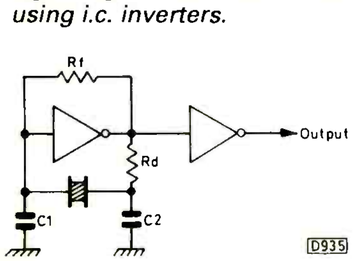


Fig. 2 (left): Ceramic resonator equivalent circuit.
Fig. 3 (right): Basic series resonant oscillator circuit using i.c. inverters.



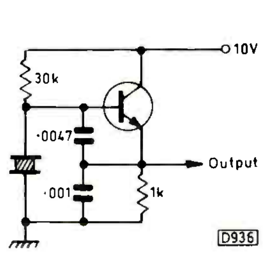


Fig. 4 (left): Basic parallel resonant oscillator circuit.

Fig. 5 (right): Single transistor equivalent of the circuit shown in Fig. 4.

Fault Finding

Since the number of components used in these circuits is small, fault finding by substitution of the passive components is straightforward.

You may want to check whether a surface-mounted LSI chip using such a circuit is really faulty before changing it. This can be done by connecting a 100kΩ resistor to one side of the resonator and, while measuring the d.c. voltage at the other side of the resonator, alternately applying 0V and the supply line voltage to this resistor. If no voltage swing is detected, move the resistor to the other side of the resonator – you may have been attempting to drive the inverter's output. If there's still no voltage change there may be a PCB track failure or the chip may indeed be faulty. Move the resistor right to the chip and repeat the test to be sure.

Acknowledgement

My thanks to Murata and Fuji for providing details of their ceramic resonator products.

VCR Clinic

Reports from Philip Blundell AMIEIE, Michael Dranfield, Brian Storm, Ed. Rowland, Alan Smith, Eugene Trundle and Chris Watton.

Philips DMP Series Decks

A lift guide repair kit for the Charlie range of decks is now available from Konig, the part number being VID1534. Damage to the lift guides previously meant either a replacement chassis or a bodge with Araldite, but this kit enables a satisfactory and neat repair to be carried out in only a few minutes. **P.B.**

Philips VR6185

With this one the keyboard and the syscon didn't talk to one another! The machine would take in a cassette and would change channel in the E-E mode, but there was no sound. When a deck function was tried the display showed that the command had been received but nothing happened. If the operation board was pressed in the right place the fault cleared. On inspecting the print we noticed that there was a crack by the side of the infra-red receiver can. **P.B.**

Mitsubishi HS347

The customer complained that rewind was poor and that the machine didn't always carry out a timer recording. At first I couldn't see a connection, but the faults did have a common cause. The reel idler was so worn that it could hardly wind forward either. Thus if a tape was inserted with the start leader showing the idler tried to move it along but couldn't. When play or a timer recording was then tried it wasn't carried out. A new gum idler unit was required. **P.B.**

Philips VR502

In the event of intermittent remote control operation check for dry-joints on the infra-red receiver chip IC121. **P.B.**

Grundig VS520

For no teletext check the voltage at pin 12 of the SAA5231 chip. If it's between 10-11V you'll probably find that R574 (10Ω safety type) is open-circuit. **P.B.**

Mitsubishi HSB32

This machine played all right but there was no forward wind or rewind as the brakes stayed on. They should be held off by an electromagnetically-controlled plastic lever. The magnet was energised but the lever didn't latch on the brake cam correctly. As the lever is plastic and the brake cam metal it seemed reasonable to assume that the plastic item would wear first, so it was replaced. This made no difference. A replacement brake cam put things right. It's called brake cam C, part no. 591b554010. **P.B.**

Akai VS25

This machine came from another dealer with a ticket that simply said "won't play". When we tested it there wasn't a no play fault initially but we did notice a slight drum servo twitch. The cause of this couldn't be pinned down as the symptom quickly disappeared. Later, on soak test, the machine intermittently switched to standby, leaving the tape threaded up. Extensive power supply checks failed to reveal anything amiss here, so we left a meter connected to pin 61 (function off) of the main microcontroller chip IC506. This proved that the chip was intermittently issuing the off command. On test next day another symptom appeared: the head switching point wandered up and down the picture.

This was the last straw, so we referred the problem to Akai Technical. A very nice man suggested that as the machine went into standby only when the tape was playing it would be a good idea to check the continuity of the drum PG pulse feed – the machine will go to standby if these pulses are missing. A scope left connected to pin 7 of the BU2735AS digital servo chip IC503 showed that the drum PG pulses were o.k. here, but the story was very different when the scope was connected to pin 9. The mark-space ratio of the 25Hz head switching squarewave varied intermittently then, a bit later, the waveform started to disappear completely from time to time, the result being that the machine switched to standby. A new BU2735AS chip cured all the faults. Phew! **M.Dr.**

Logik VR960

The complaint was of buzzing on sound due to a faulty aerial socket. Strange, I thought, but on test this proved to be the case. When the aerial input socket on the modulator was pulled down the E-E sound disappeared, leaving a loud buzzing noise. A scope check on the audio input to the modulator showed that the signal was still present when the fault occurred. No dry-joints could be seen when the modulator was removed but after going over all the connections with a fine-tipped iron the fault had cleared. **M.Dr.**

Sony SLC9

The fault with this machine was no clock display due to a faulty d.c.-d.c. converter on the rear-mounted power supply PCB. Unfortunately the cost of a replacement unit is over £20 trade. By the time that labour had been added the charge would have been outside the customer's budget. So we decided to open up the old unit to see if it could be repaired. The only difficult job was unsoldering the tin can that surrounds the PCB inside. We did this by applying heat from a miniature blow-torch powered by lighter fuel. Once we'd got inside we found that a 2SD789 transistor had an open-circuit emitter terminal. A 2SD774 made an excellent substitute as we didn't have a 2SD789 in stock. For good measure we replaced the four electrolytics (10μF, 16V; 10μF, 50V; 10μF, 50V; 330μF, 16V) as tests showed that they were well down and possibly the cause of the transistor failure. After reassembling the case we refitted the converter and gave the VCR a two-day soak test. The results were excellent and our charge was within the customer's £50 limit. **M.Dr.**

Samsung SI1240

In the April issue E.T. mentioned the problem of failure of the KA8301 loading motor drive chip. The latest Samsung technical information book (vol. 3) contains details of a modification to overcome this. **M.Dr.**

Panasonic NVF75

This all-singing and dancing machine worked perfectly unless you took notice of the function display – the usual display was pause, with no counter display in any mode. Our first checks were on the serial data and clock lines between the syscon chip IC6001 and the timer and display chip IC7501. As data signals go, they appeared to be all right. To eliminate the front panel timer and display circuits the front panel PCB from a nearby NVF70 was borrowed. This showed the same errors, so back to the syscon circuitry.

Comparative checks with the NVF70 showed that identical data left the syscon chip. Only an inverter circuit centred on transistor QR6017 was left to check. It was working as well as I could tell but the culprit turned out to be C6011 at the base of QR6017. It's a tiny surface-mounted type capacitor and was open-circuit, thus apparently corrupting the data signals to IC7501. **B.S.**

Saisho VR1200

This machine would accept a cassette but no functions, including eject, worked. When the bottom cover was removed we found that the main drive belt was broken. A replacement restored normal operation. **E.R.**

Panasonic NVG40

This machine made a real mess of tapes by damaging their bottom edge. The cause of the problem was a faulty pinch roller. It was quite an expensive repair as the pinch roller can't be detached from its drive assembly – the whole thing has to be purchased as a unit. **E.R.**

Saisho VR3600X

This machine blew the 1·6AT fuse F502 at switch on. Fortunately the first component we checked, D504, was found to be short-circuit. A replacement cured the fault. **E.R.**

Samsung SI1260

This machine recorded the sound but not the video – there was just snow. Playback of prerecorded tapes was correct. Scope checks showed that there was low record f.m. in the vicinity of C3203, which when checked read 68Ω. Strangely, its value is 68pF. We subsequently had the same fault on two other machines. **A.S.**

Hitachi VTF770

When power on was pressed the machine powered down almost immediately. Checks showed that the 18V supply was missing. The cause was a crack around one of the mains transformer's pins. Some fresh solder restored normal operation. **A.S.**

Philips DMP Series Decks

We've had two cases where the cassette would be ejected whatever deck function was requested. In both machines the capstan motor had seized due to a build-up of sticky gunge on the capstan shaft in the upper bearing. Dismantling and cleaning provides a cure.

Some older DMP/IDM series decks are developing cracks in the top rails of the plastic racks that guide the cassette lift on its way in and out of the machine. If they actually break you have to fit a very expensive half-chassis subassembly (but see note elsewhere on the Konig repair kit – Ed.). To guard against having to do this we run a layer of hot-melt glue along the top surface of any cracked racks we find, forcing it tight into the angle between the rack moulding and the metal wall to which it's fixed. **E.T.**

Tatung TVR6151

The problem was a buzz on the hi-fi sound, present only when the machine had warmed up. A tiny gap could be seen in the f.m. sound playback envelope waveform at the start of the helical scan, the cause being misadjustment of the head switching-point preset VR2 on the top rear PCB. Adjust for zero envelope gap at TP4501, with the scope triggered by the flip-flop waveform at TP2. It seems that this is a batch problem – two machines with similar serial numbers came in with the same symptom, cause and cure. **E.T.**

Akai VSF200

If one of these machines comes in with the no-go symptom you may well find that fusible resistor FR1 is open-circuit. If so, check zener diodes D13 and D16 in the motor supply stabiliser circuit for leakage or being short-circuit. D13 is a 16V type and D16 a 10V device. **E.T.**

JVC HRD700

This machine suffered from a rare intermittent fault: about once a week the spool motor would fail to rewind the tape into the cassette when entering the stop mode. The result was tape looping and crushing. A replacement mode switch solved the problem – the original one seemed to be putting hash and noise into the microcomputer control chip whenever the loading motor was on the move. **E.T.**

Mitsubishi HS318/Luxor 9253-97

After about half an hour in the play mode the speed of the capstan motor would fluctuate wildly, sometimes coming to a complete stop so that the machine entered the stop mode. Whenever this happened however the capstan motor would never fail to perk up and run backwards to drive the take-up spool! The cause of the fault was traced to a hairline crack in the top PCB, between the capstan motor driver chip IC5A2 and the pull-up resistor R5C6. **E.T.**

JVC HRD530

On rare occasions this machine would stop in the middle of play or record. Luckily we were watching the deck when it had a spasm and saw that the take-up reel stopped. We subsequently found that when the fault occurred the voltage applied to the reel motor dropped but the current through it increased. In fact the motor was going short-circuit intermittently and had to be replaced. To be on the safe side we also replaced the drive chip in case it had been damaged by the increased current flows – more than an amp. **E.T.**

ITT VR3918

The cassette would be ejected when this machine was set to record. At last a simple one! The erase prevention switch had become disconnected from the frame of the deck. As it didn't open, it didn't tell the control chip that the tab had been removed. I refitted the switch with a tiny spot of glue so that it couldn't fall off again. **C.W.**

What a Life!

Donald Bullock

Les Piercy dropped in the other day. I wonder how many of you remember him? After being in the radio and TV business in the London area he was, when I first came to know him, a Radiospares rep. He later went into partnership with Harry Reddin, running their own spares business RSP Supplies. Though he retired several years ago he retains a considerable knowledge of our trade. We spent a pleasant hour recalling the early days.

Some Memories

We agreed that though there was never much money in the servicing trade there was, at one time, some status. People, especially country folk, would often be waiting on their doorsteps for our call and we often came away with gifts of produce from their gardens and perhaps a few eggs. Les recalled the time when, on an outside service visit in Sussex, he was given a bottle of home-made wine. He stowed it away carefully behind his seat and went on his way, first to Horsham and then towards Surrey. It was there, in a leafy glade, that the wine exploded, covering himself and his vanful of sets with the sticky wine. "I though my end had come" he added.

A frequent job in those days was to remove the implosion screen and clean it and the tube's face. They used to attract a film of greasy dust that fogged the picture. "It wasn't at all unusual," Les commented, "for the customer to complain that his picture had become liney after we'd carried out a cleaning job."

Les recalled a small boy who arrived at the shop daily for a 1A fuse. Hearing that the set was a Pye VT4 he suggested that the PZ30 h.t. rectifier probably had an intermittent heater-cathode short and offered to change it. But the visits continued, until one Saturday when the Cup Final was imminent. Les was asked to call round and change the valve, which he did along with the fuse. Whilst at it he cleaned the screen and tube face. Then he accepted a cup of tea and left.

The bills he sent were ignored until, when finally pressed, the customer paid for the valve and fuse but not the call. "We don't pay people to sit in our home and drink tea" he was told.

One day Les was called to service a vacuum cleaner that wasn't sucking the dust up efficiently. He asked the owner when she last emptied the dust bag. "What dust bag?" she replied, "surely all the dust goes into the mains?" Another lady said her Electrolux had failed after being cleaned. "How did you do it?" Les asked. "By sucking soapy water through it of course" was the reply.

In those days most of the sets were of the t.r.f. type and we were plagued by faulty crimson EF50s. Rotary tuners later came on the scene. Some had a full complement of coils but others were fitted with only those required in the locality. Les was asked to change a set of coils in a huge Ferguson console set with castellated knobs. He had difficulty getting them off to release the chassis and get at the tuner. The tuner knob was eventually freed but to remove the volume control knob he had to use a piece of rope and tug at it with his knee against the set. It came away suddenly of course, along with the volume control shaft, propelling Les backwards. The result was a considerable shambles – and Les then found that he'd got the wrong coils. The customer was not amused.

Les then recalled the time when one of those screen magnifiers, which were full of paraffin oil, fell into the fire. "Boy did they have a cheering fire for a while!" He also recalled the "magic screens" that were advertised in the papers and claimed to be able to convert a monochrome set into a colour one. Those who sent off for one received a screen-sized sheet of plastic that was tinted blue at the top, pink in the centre and green at the bottom. "Not bad with a country scene" said Les, "but a full-face close-up produced a bizarre effect.

It seemed that there was never a dull moment in those days.

A Ferguson 3V36

As Les left, Mr. Moggie came in with a Ferguson 3V36 VCR. "He's dead and flashing, but you can see only bits of the clock. It blew a fuse a fortnight ago. Was all right with a new fuse then it went like this."

I removed the cover and looked at the power panel carefully. Pin 1 of socket CN4 was sitting in a little circle of ash. It had clearly been a dry-joint that had carbonised. I cleaned and resoldered it then tried out the machine, which now worked well. What a relief!

Mr. Ng's TX100

My next customer was Mr. Ng, who had with him a Ferguson Model 20A1 – a 20in. set fitted with the TX100 chassis. He laughed as he announced that it was "completely dead", then hurriedly departed. On investigation I found that two of the mains bridge rectifier diodes, D6 and D8, were short-circuit while the mains fuse and the surge limiter resistor R106 were open-circuit. After replacing these items the set was still dead. So I disconnected the 119V and 20V outputs from the chopper circuit and connected a 60W bulb across the 119V supply's smoothing capacitor C129. It didn't light up. This meant that the cause of the trouble was in the chopper circuit.

I soon found that the TICP106D thyristor SCR1 in the start-up supply for the TDA4600-2 chopper control chip IC7 was open-circuit. But fitting a replacement made no difference. Nor did a new TDA4600-2 chip. Although the 330kΩ resistor R115 connected to pin 4 of the chip seemed to be o.k. I decided to replace it, also the 0·39Ω resistor R114 connected to pin 7, but the set still failed to come to life. I eventually found that C115 (8·2nF) was short-circuit, removing the feedback to the chip. A replacement restored the e.h.t.

When Mr. Ng came back he was still laughing happily. He stopped laughing when I told him that the charge would be nearly £40.

As he left the phone rang.

A Question

"D'you handle backs?"

"Beg your pardon?" I said.

"D'you sell backs?"

"Backs of what?"

"Tellies."

"No sir."

A Philips KT4 Set

I continued with my work. The next set was an old-timer, a Philips 20CT4626/05T (these Philips numbers!). It was cracking and banging. I opened it up and found that there was a dry-joint on one of the line output transformer's pins. Resoldering it cured the cracking, but there were no programmes. When I tuned them all in the picture had a green cast. So I set up the grey scale. This produced excellent results.

An Amstrad TVR2

Mrs. Scratcher then bowled in with her Amstrad TVR2. "It ain't much Mr. Butcher" she said, "it works a treat until you press the record button, then it ejects the cassette."

I took the machine apart, which is quite a feat in itself, and studied the deck. It worked all right in the play mode. When the record button was pressed however the pinch wheel shuddered but didn't move towards the capstan, the drum didn't rotate then the cassette was ejected. I replaced IC400 (14DN244C) on the deck panel, then IC200 (BA7751ALS), but this made no difference. I then noticed that the four-pin plug that mates with the socket on the left-hand side of the cassette carriage wasn't properly seated. A casting pimple made it sit askew. I filed this off and tried again. All was now well, but the fault occurred again when the set had been put back together.

I took it all apart once more and looked again at the plug and socket. The socket pin nearest to where the pimple had been was lower than the others. I pulled it up with a pair of sharp-nosed pliers, reassembled the machine and tried again. It finally worked as it should have done.

Test Case 359

The chilly winds of autumn are blowing around the Test Case workshop. Holidays are all over, there's no sign of an up-turn in trading conditions and morale is low. Television Ted's got the grots, Sage dreams of being miles away, Service Manager *is* miles away and Dylan's got a Sanyo VHR3300 VCR that's troubling him.

The Sanyo VCR's fault seemed to be straightforward enough – no play. No record either in fact. In both modes the tape would lace up, run for a second or so then unlace as the machine went into the stop mode. Fast forward and rewind worked all right, as did the cassette front-loading system. This sort of thing is common enough with domestic VHS machines and usually means that the system control microcomputer chip is not satisfied that tape loading has been completed.

Dylan fitted a new loading belt, but this did no good at all. He found that the supply to the loading motor was cut off on completion of loading, which indicated that the mode switch was correctly phased from the mechanical point of view and being driven to the correct point. Or was it? Well, there was a bagful of mode switches in the stores, and they wouldn't be there if they didn't give trouble, would they? So a new mode switch was fitted and, you guessed it, the symptom remained exactly as before. Maybe the cause of the fault was outside the tape-loading loop?

The control system will put the machine in the stop mode if it thinks that the take-up reel has stopped. Rotation is monitored by the reel sensor, which must supply a constant pulse train to keep the control system happy. But not in the pause mode! Dylan let the machine lace up and, a split second after completion, he hit the pause key. The machine unlaced as before, so reel-sensor problems were discounted.

Another essential feedback signal is the PG pulse train, which provides the control system with evidence that the head drum is rotating. Dylan finally got to work with his oscilloscope and checked out the PG pulse feed from the drum motor to pin 15 of amplifier chip IC4002. The pulses were present and there was a nice 25Hz squarewave output at pin 14. This was in turn reaching the servo chip IC4001. Maybe the FG section was in trouble? In the few moments available during each play cycle Dylan established that the FG signal also reached the servo chip. Further evidence that everything was o.k. in this area was provided by the fact that the drum rotated at what seemed to be the correct speed, not fast, during its brief periods of operation. Anyway, the syscon didn't require drum FG feedback in this machine.

Recalling a memorable tussle with a Philips VCR that didn't want to play, Dylan next checked out the capstan FG. Feedback was present and correct at the servo chip and the capstan started up each time play was selected. Dylan finally began to suspect the syscon microcomputer chip.

There wasn't an HD404418SM01 in the stores. Another Sanyo VCR was discovered on the scrap pile, but it had an entirely different control chip. Maybe it was as well that there wasn't a spare chip of the correct type to hand, because fitting it would have been a waste of time: the cause of the trouble lay elsewhere. A scope probe applied to just the right point would have quickly revealed the true cause. Which of Dylan's many lines of investigation should have been pursued farther? For the answer and another item in the test case series, see next month's issue.

ANSWER TO TEST CASE 358
– page 891 last month –

Who hasn't been confronted by a situation like that described last month – a horrible case of intermittent mains fuse blowing that continued despite three separate attempts at repair? The set concerned was an Hitachi CPT1456. You have to wait several days for this type of fault to put in an appearance, and when it does there are just a few milliseconds during which a diagnosis can be made!

Sage's 'trap' idea worked very well, providing the solution to this particular conundrum. When the failure occurred, the up-rated 3·15A mains fuse blew while the temporarily wired-in lower-rated fuses in the d.c. feeds held. This proved that the fault current didn't flow via the chopper chip IC901, still less the rest of the set. In fact it was caused by a faulty posistor (TH901) in the degaussing circuit.

When the posistor was cracked open its element was seen to be blackened and spark damaged. It had plainly been flashing over intermittently, generally at switch on, connecting the full mains supply to the degaussing coils. Fortunately this treatment hadn't damaged the coils themselves and a new posistor provided a permanent cure. You get the same trouble sometimes with Tatung and other TV sets.

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TA7303	£1.10
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TA7312	£1.75
TA7313	£0.90
TA7313AP	£1.40
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TA7325	£2.00
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TA7335	£1.50
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TDA1908A	£1.75
TDA1940	£1.80
TDA1950	£2.50
TDA2002	£1.40
TDA2003	£1.30
TDA2004	£1.70
TDA2005	£1.70
TDA2005S	£2.95
TDA2006V	£1.95
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TDA2030	£1.10
TDA2030H	£2.00
TDA2030V	£1.75
TDA2040	£2.00
TDA2151	£3.00
TDA2161	£1.75
TDA2170	£3.00
TDA2270	£2.20
TDA2320	£0.90
TDA2510	£4.30
TDA2521/3	£9.75
TDA2522Q	£10.75
TDA2530Q	£4.25
TDA2532	£3.00
TDA2532Q	£3.00
TDA2540	£2.75
TDA2541	£2.00
TDA2543	£5.25
TDA2560	£3.75
TDA2600	£6.80
TDA2576A	£6.00
TDA2578	£3.00
TDA2578A	£2.80
TDA2579	£3.50
TDA2581Q	£2.50
TDA2581	£2.40
TDA2582	£2.55
TDA2590	£2.00
TDA2591	£2.70
TDA2593	£1.50
TDA2594	£3.00
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TDA2653A	£2.75
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TDA3330	£5.50
TDA3540	£4.00
TDA3541	£2.25
TDA3560	£3.40
TDA3561A	£5.00

TDA3562A	£5.00
TDA3565	£3.00
TDA3571BQ	£5.50
TDA3590	£3.00
TDA3651	£3.00
TDA3651AQ	£6.50
TDA3653	£4.00
TDA3654	£2.80
TDA3810	£2.90
TDA3950	£3.00
TDA440	£2.00
TDA4420	£2.45
TDA4422	£3.95
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TDA4501	£4.00
TDA4503	£4.50
TDA4505	£6.75
TDA4510	£4.40
TDA4600	£2.60
TDA4600-2	£2.60
TDA4601	£2.10
TDA4610	£4.50
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TDA8190	£3.80
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TEA1014	£2.00
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TMS1956	£2.30
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UPC1363	£1.90
UPC1365	£3.50
UPC1377C	£2.20
UPC1378H	£2.00
UPC1379	£2.20

UPC1382	£1.50
UPC1394	£1.70
UPC1420A	£7.00
UPC1458	£1.95
UPC1513HA	£2.00
UPC1520CA	£2.48
UPC339C	£0.70
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2SA1124	£0.35
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2SB1016	£1.50
2SB772	£0.40
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2SB819	£0.55
2SB965	£2.30
2SC1413A	£2.50
2SC1826	£1.80
2SC1942	£2.10
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2SC2003	£0.25
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2SC2570	£0.55
2SC2577	£1.50
2SC2592	£0.95
2SC2621	£1.25
2SC2631	£0.30
2SC2632	£0.30
2SC2655	£0.60
2SC2958	£2.50
2SC2979	£3.00
2SC3153	£3.40
2SC3402	£0.40
2SC3519	£4.60
2SC3678	£2.70
2SC3715	£4.80
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2SC789	£2.50
2SD1047	£2.75
2SD1051	£0.85
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2SD1138	£0.85
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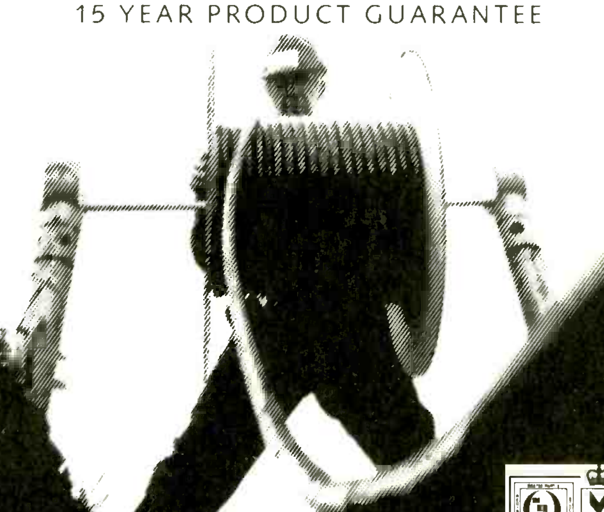

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2SD1453	£1.60	2SD895	£2.00
2SD1455/2SD1730	£3.10	2SD898	£2.75
2SD1496	£4.00	2SD898B	£2.75
2SD1497	£2.60	2SD900B	£4.00
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2SD1497-06	£5.95	BC108	£0.10
2SD1650	£3.50	BC108B	£0.10
2SD1877	£2.30	BC115	£0.16
2SD639	£0.35	BC118	£0.12
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2SD725	£3.70	BC159	£0.09
2SD787E	£0.30	BC171	£0.09
2SD811	£2.95	BC172	£0.09
2SD836	£1.10	BC172C	£0.07
2SD837	£0.80	BC182L	£0.09
		BC183	£0.09

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		BF422	£0.15
BC184	£0.09	BF458	£0.22
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BC214A	£0.07		£0.25
BC214B	£0.07	BF471	£0.25
BC214L	£0.09	BF472	£0.25
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BC238	£0.07		£0.25
BC307	£0.12	BU108	£0.75
BC308B	£0.07	BU126	£0.70
BC327-25	£0.07	BU208	£1.00
BC328-40	£0.05	BU208A	£1.00
BC337	£0.07	BU208D	£1.15
BC372	£0.95	BU208T	£1.00
BC392	£1.50	BU326A	£1.00
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BC461	£0.25	BU406D	£1.50
BC547	£0.07	BU407	£0.50
BC548	£0.07	BU426A	£1.00
BC549	£0.07	BU500	£1.00
BC557	£0.30	BU508A	£1.00
BC559B	£0.07	BU508AF	£1.70
BC639	£0.18	BU508D	£1.00
BC640	£0.30	BU806	£0.75
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BD244C	£0.30	TIP112	£0.45
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BD434	£0.80	TIP30	£0.45
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BF196	£0.15	TIP41	£0.27
BF197	£0.15	TIP42C	£0.40
BF198	£0.07	TIP47	£0.98
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BR100	£0.20	IN4001	£0.06
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BR303	£1.50	IN4005	£0.10
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BT129P	£4.50	IN5408	£0.25
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BY126	£0.20	OA91	£0.20
BY127	£0.08	OT112	£2.20
BY133	£0.20	RGP15G	£0.45
BY164	£0.90	RGP15J	£0.55
BY164/SKB2/02	£0.90	RGP15K	£0.35
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BY179/SK2/08	£1.10	RHI	£1.30
BY184	£0.65	RM11C	£0.45
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BY190	£2.00	SG613	£12.00
BY223	£2.00	SKB/02	£0.60
BY206 (BYB96R)	£0.55	SKB/08	£1.20
BY210/800/BYV96		SKB2/02	£0.90
	£0.55	SKB2/08	£1.10
BY227	£0.20	SKE1/02	£0.60
BY228	£0.50	SKE1M15	£0.65
BY229	£1.15	SKE2G2/02	£0.75
BY299	£0.50	SKE2G3/04	£1.30
BY96D	£0.30	SKE4F1/04	£0.45
BYV96D	£0.55	SKE4F1/06	£0.45
BYW56	£0.50	SKE5F3/10	£2.20
BYW96E	£0.50	SR2M	£0.75
BYX10	£0.50	T9053V	£1.40
BYX55/600	£0.55	T9064V	£2.28

ASK FOR SEMICONDUCTORS NOT LISTED

VIDEO HEADS

AMSTRAD
3HSSR-VCR7000 (Saisho/Orion) £16.00
PSF1-VCR4500.5200.9000 £15.00
PSF2-VCR4600.4700 £14.00
PSF3-VCR6000 £17.00

FERGUSON
3HSSV-2 Head universal £7.50
3HSSVA-3V42.44.45.46 etc £20.00
3HSS4VB-3V32/HR7655 £25.00
3HSS4VC-3V48/HRD565 £26.00
3V48.58.59.65.FV10.11.12.13.14.20.21.26
And most other Fergusons POA

HITACHI
3HSSHA-VT8000.9000 series £15.00
3HSSHB-VT11.33 etc £15.00
10082-VT120.220 £22.00
10081-VT130.135 £25.00

PANASONIC
3HSSN-2 Head universal £7.50
3HSSU1N-NV100.370.380/Philips VR6460 £9.00
3HSSU2N-NV230.470.480.G9.10.11.15PX £17.80

VIDEO HEADS Continued

3HSSU3N-NV430.460 £14.70
3HSS3N-NV777.330 £18.50
3HSS4NB-NV730 £19.00
3HSS4NA-NV366 £24.00
NVG30.33.40.45.46.130. & most other Panasonics POA

SANYO
3HSSSY-VHR1100.1110.1300 £18.00
3HSS3SY-VHR1500 £32.00

SHARP
3HSSSP-VC9300.9500.9700.381.481.482.483.486 etc £15.50
3HSSSPB-VC581.583.651.670 etc £14.50
VC7000.8000 series (Brass) £42.00

OTHER MAKES
Alba 4000. Goldstar 8000. Sentra 8000. Solavox 1000 £16.50
Fisher FVHP510.520.530.615.710 etc £18.00
Fisher VBS7000.9000 etc £25.00
Hinari VXL2.4.3.20.25 £16.00
Hinari VXL5.6.20H £15.00
Mitsubishi HS306.710 £23.90
Orion VC150.180.VH1.2.3 etc £16.00
Saisho VR100.605.705.805.905 £16.00
Samsung Universal 2 Head £18.50
Toshiba V71.73.74.75.81.82.83.84.85.87 £20.00
Toshiba V93 £19.00

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

BELT KITS

A range of belt kits in stock from 60p to £2.40. Makes for most models available including: Alba, Akai, Amstrad, Ferguson/JVC, Fisher, Funai, GEC, Goldstar, Granada, Grundig, Hinari, Hitachi, Mitsubishi, NEC, Orion, Panasonic, Philips, Saisho, Samsung, Sanyo, Schneider, Sharp, Sony, Tensai, etc – Please state model and make.

CLUTCH BASE

Hitachi 520 at £4.50

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LOPT Hitachi CPT2276 etc £19.00
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ITT CVC253032 9.50
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ITT 1109F 14.00
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ITT CVC80013 21.50
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ITT CVC11501175 20.00
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ITT 3546 18.50
ITT 12001 20.00

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Fidelity all models up to 20" ZX3000 15.50
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Fidelity 22" ZX3000 18.50
Hinari CT45 & TVA1 17.50
Philips KT3 12.95
Thorn TX100 Green Spot 110 14.50
Ferguson TX90 LOPT specify sizescreen 17.75
Ferguson 3V3536 Mains Transformer 23.00
Ferguson 3V444445 Mains Transformer 18.85
Sony – Please state model for price

TRIPLERS

Universal Tripler 4.75
Universal Tripler with focus unit 9.50
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Ferguson 9000 triplers at £4.50
Thorn TX10 Focus Unit Kit 10.00
Trip Grundig CUC2401 etc £17.00
OTHER GRUNDIG TRIPLERS IN STOCK

Hitachi and Matsui LOPTs in stock

VIDEO MOTORS

A range of **Reel Motors** made by Ferguson, Hitachi, Sanyo, Sharp & Panasonic are available, please state model and make.
We stock **capston motors**, makes include Ferguson/JVC, Hitachi and Sharp.
Also available are Ferguson **Mode Control Motors**, please state make, model
Mode Motor Assembly 3V35-49 at £12.50

Sharp Reel Motor Pulley only £1.20

Replacement of plastic pulley on a number of Sharp Reel Motors with the above metal pulley gives better rewind/FF performance.

IDLER ASSEMBLIES

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3V29/30 Take up Clutch £2.85
3V29/30 Reel Idler £3.00
3V35 Reel Idler £3.00
3V35.36.38.39 Take up Clutch £2.85
3V58.59.64.65.FV10.11.12.13.14
Idler Arm £1.80
Clutch Assembly 3V44.45.48.49.52.53.54.55 £11.50
Clutch Assembly 3V42.43 £14.00

FISHER
FVHP615.905.910. Idler Assembly Original £5.00
FVHP615 Gear Idler Assembly £4.35
FVHP905.910 Gear Idler Assembly £5.00
FVHP520.530 Idler £3.00
FVHP520.530 Pulley £0.70

HITACHI
VT11.33 etc. Original Idler Arm £2.50
VT11.33 etc. Idler Replacement £1.75
VT9300.9500 etc. Play Idler £3.65
VT9300.9500 etc. F/F Idler £2.95
VT9300.9500 etc. Idler £2.95
VT8000.8500 etc. F/F Rew Idler £2.95
VT800.8500 etc. Play Idler Assembly £3.00
VT8000.8500 etc. FF/Rew Pulley £0.70
VT11.33 etc. Clutch Assembly £8.00
VT400.500. series clutch/base complete £3.50

PHILIPS
VR6460.6920 Idler Arm (Original) £3.00
DV464.6462.6463.650 etc. Idler Mod. Kit (Original) £6.75
VR6542.6843 Reel Idler £6.50
VR6542 Reel Drive Pulley £7.75
VR6843 Reel Drive Pulley £9.00

PANASONIC (All Original)
NV370 Idler Arm Unit VXP0521 Gen. £3.00
NV8600.8610 Play Idler VXP0243 £0.95
NV332.777.788 Idler Unit VXP0463 £3.00
NV600.688 Idler VXP0515 £3.00
NV333.366 Idler Arm 2 Unit VXL0997 £10.50
NV8400.8600.8610 etc. VXP0245 £0.95
NV333.366 etc. Idler VXP0401-NV700.7200.7800 Idler VXP0344 £0.90
NV2000.3000 Play Idler VXP0331-
NV2000.3000 Idler Unit VXP0329 £1.10
G Mech. Play Gear VXL1490 £1.90
Back Tension Bands From £1.50
All Panasonic Maintenance Kits POA

QUOTE PANASONIC PART No. FOR PARTS NOT LISTED

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Idler VHR1100.1300.1500 £5.50
Idler VHR2100.2300.2500.2700 £5.50
Reel Drive Pulley Unit
VTC5000.5150.6500 £5.00
Idler Roller Assembly
VTC5000.5150.6500 £2.25

SHARP
Idler VC9300.9500 etc £1.75
Idler VC481.581 etc. £1.95
Idler (original) VC9300.481.581 etc. £3.50
Idler Assembly (original)
VC651.681.685 £6.50
Idler Assembly (original) VC780.781.785.787.793.VC772 £6.50

AMSTRAD
4500.4600 MOD KIT INCLUDES PINCH ROLLER AND IDLER CLUTCH £5.00

Limiter Post Assembly £1.75
Makes & Models: Hinari VXL4, Matsui VX730,735,735A,755, 770,800A,810,820,880,990. Saisho VR1100,1200,1200HQ. 1600,2500,3200,3300,3300X,3500, 3600,3700

IDLERS FOR AKAI, SAMSUNG, MITSUBISHI, NEC, ETC. IN STOCK

REMOTE CONTROLS

Bush, Ferguson, Grundig, ITT, Philips, Pye, Sony, Hitachi, Matsui, Logik, Panasonic, Saisho, Salora, Samsung, Tashiko, Tatung, Toshiba. Various models TV & Video From £10.00

MANY HITACHI TV REMOTE CONTROLS NOW IN STOCK.

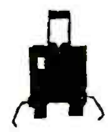
SONY REMOTE CONTROL RUBBER PADS.
STATE MODEL FOR PRICE.

Universal Remote Control £25.00

TV ON/OFF SWITCHES

ITT, Philips, Decca, Thorn, Fidelity, Grundig, Sony and Hitachi. State model for price.

SONY PUSH SWITCH 70p



MAINTENANCE KITS

Available for Alba, Amstrad, Ferguson, Fisher, Goldstar, Goodmans, Granada, Hinari, Hitachi, JVC, Matsui, Mitsubishi, Nikkai, Panasonic, Philips, Saisho, Salora, Schneider, Sentra, Sharp, Sony, Tashiko, Toshiba

PINCH ROLLERS

A range of Pinch Rollers is in stock, most of them @ £2.80. Makes include Akai, Amstrad, Ferguson, Fisher, Funai, GEC, Goldstar, Grundig, Hinari, Hitachi, ITT, JVC, Marantz, Mitsubishi, NEC, Nordmende, Orion, Panasonic, Philips, Samsung, Sanyo, chneider, Sharp, Sony, Tensai, Thomson, Toshiba etc. Please state model and make.

Philips Pinch Roller for models VR6180, 6185, 6285, 6362, 6367, 6467, 6468, 6470, 6561, 6670, 6760, 6761, 6870 £5.00
Panasonic G Mech. ass. complete £9.00

BACK-UP BATTERIES

Philips 1.2V Back up Battery £1.75
Philips 2.4V Back up Battery £2.80
Ferguson TX10 £2.00

Wider Range Available

OTHER SPARES

Universal Video Copying Kit £4.25
Universal Copying Kit (Scart) £5.20
Universal Camcorder Kit £6.90
Video Cassette Lamps from £0.50
CRT Anode Caps £0.60
Video Tape Splicing Kit £6.95
Hitachi TV Frame Module HM6251 £8.00
Hitachi TV Frame Module HM6232 £5.50
Cassette Housing Assembly Ferguson 3V35.36.38.39.42.43.44 £25.25
Cassette Loading Roller Assembly 3V23. 3V31. 3V32 £3.50
5.5V Back Up Cap £1.85
Degaussing Positor Blue £4.00
Degaussing Positor White £1.30
Cassette Housing Assembly Hitachi VT11 £19.50
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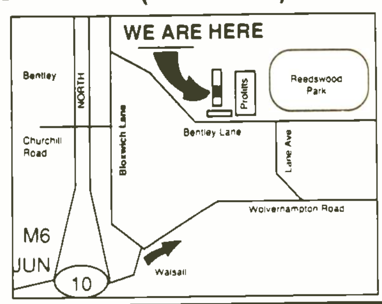

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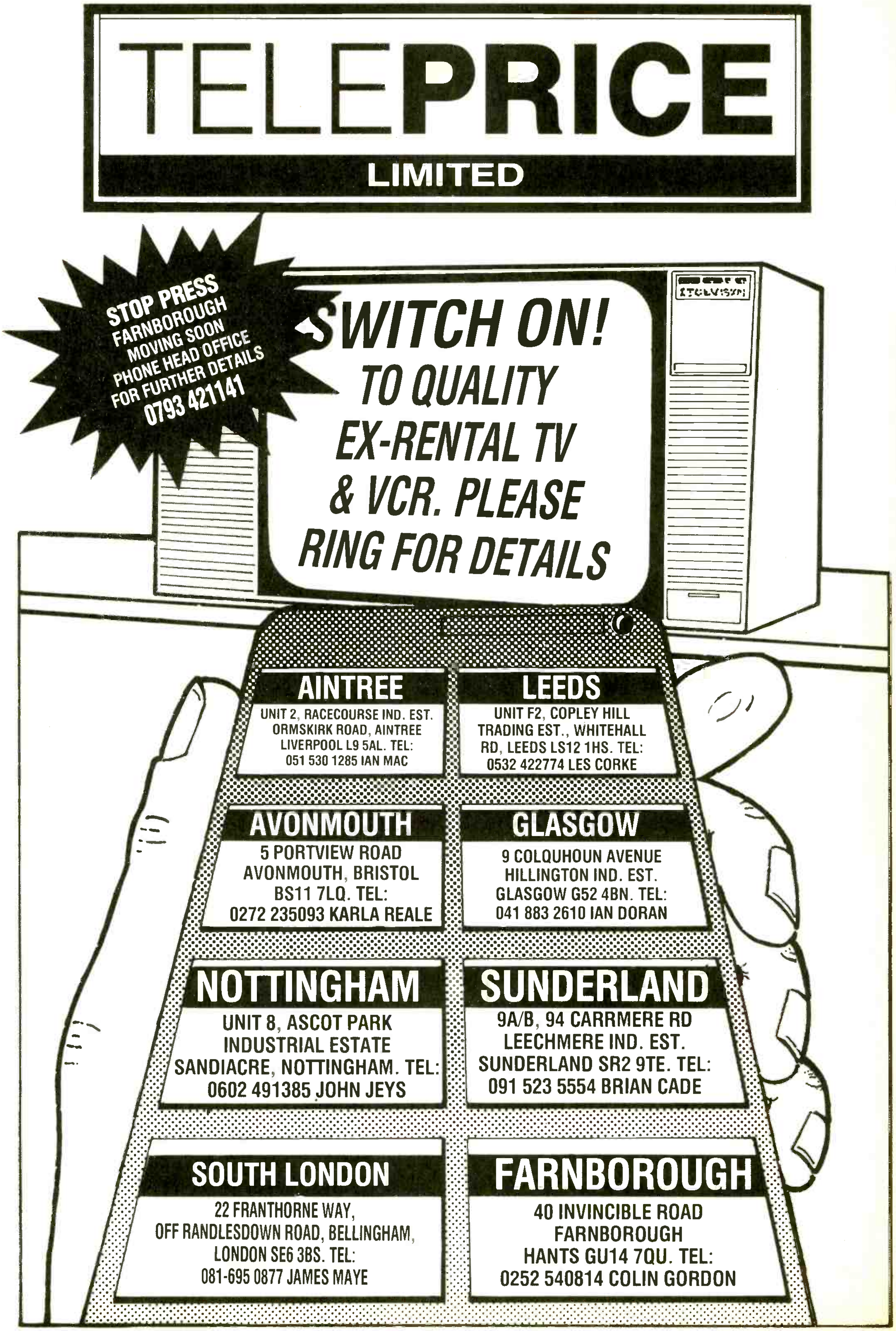
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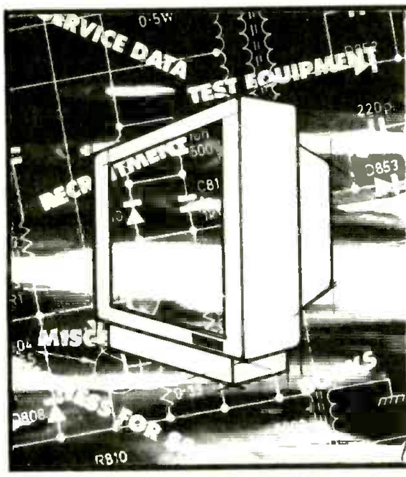

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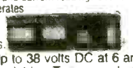

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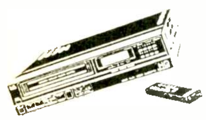

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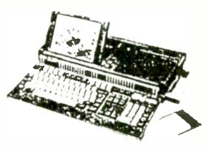

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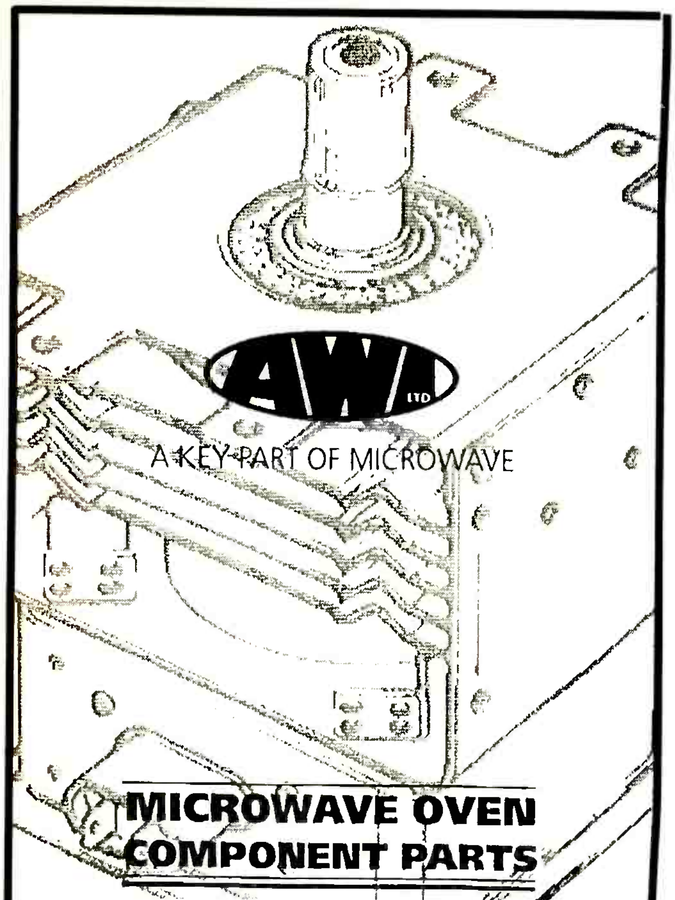

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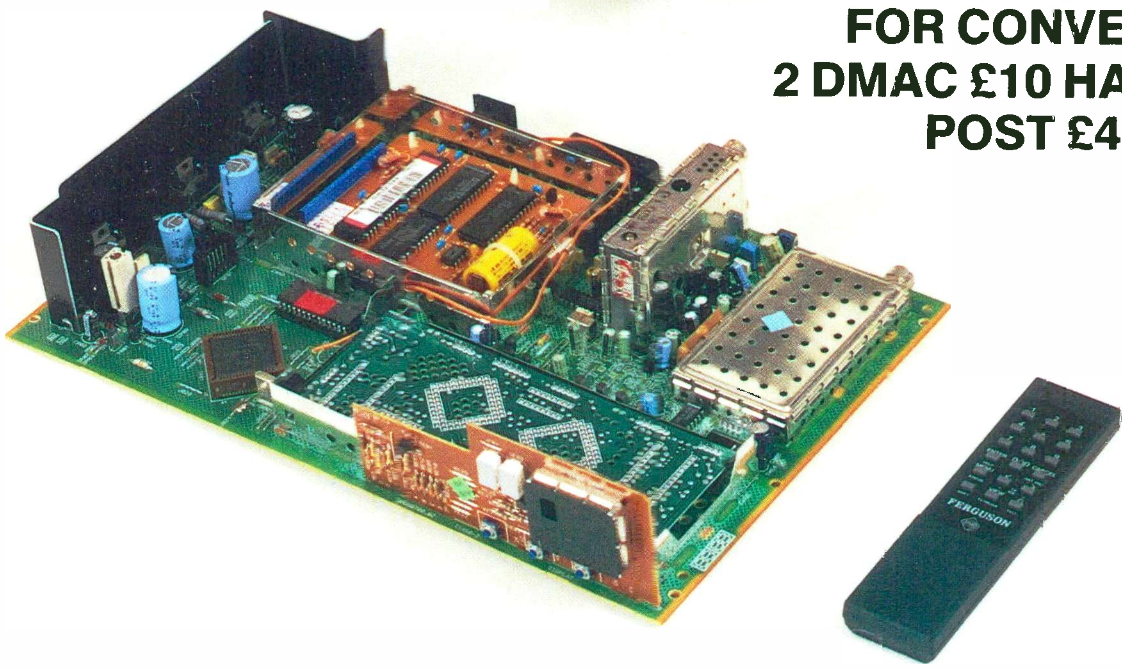

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