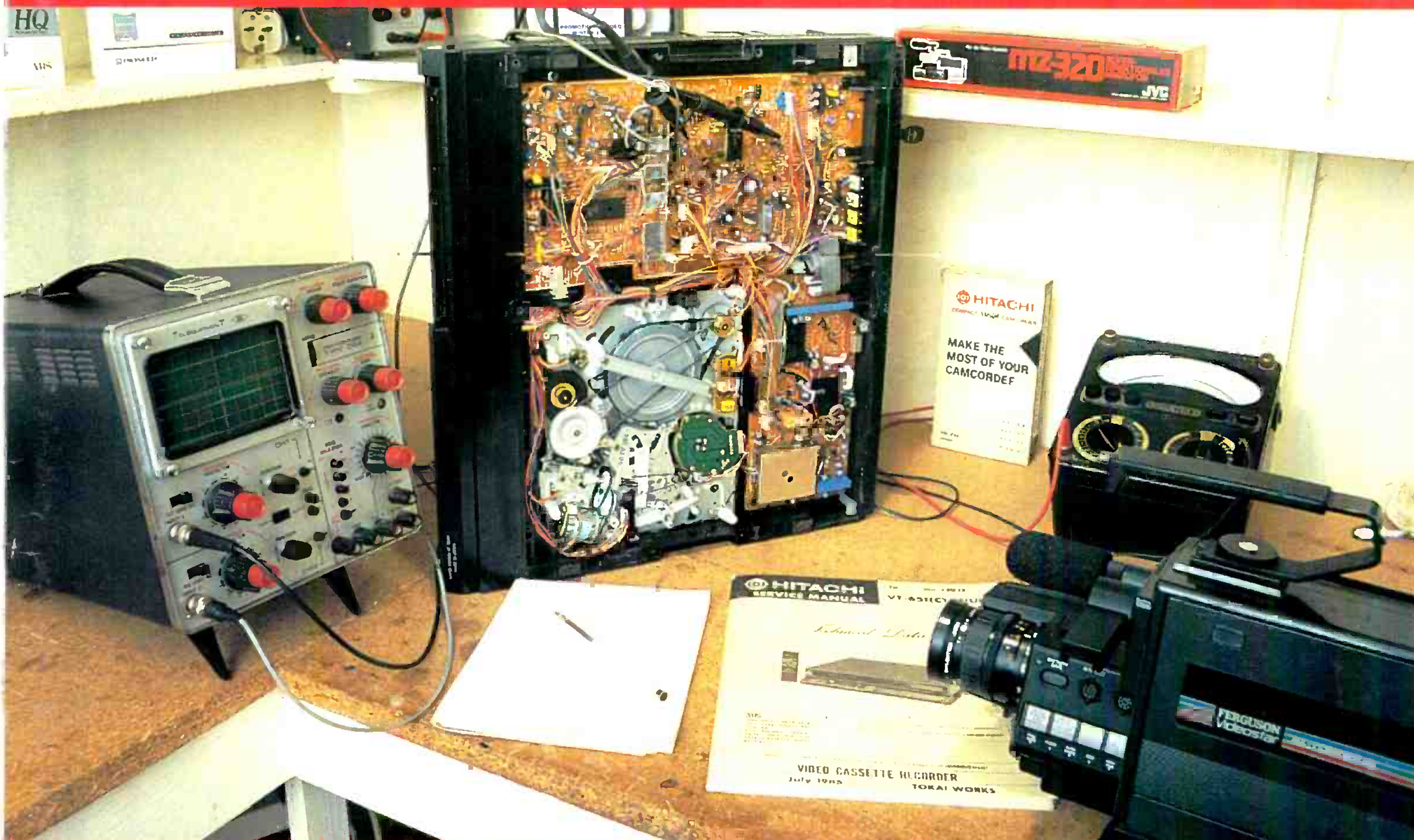
MAY 1993 £2.20

TELEVISION

SERVICING·VIDEO·SATELLITE·DEVELOPMENTS



A Video Monitoring Test Jig

The Philips Double-scan Technique

Setting up a Polar Mount · DX-TV

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The Philips Scopemeter Reviewed

VCR Clinic · TV Fault Finding

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TELEVISION

MAY 1993

Vol. 43, No.7
Issue 511

On sale April 21st.

CORRESPONDENCE
All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.Editorial correspondence should be addressed to "Television" Editorial Department, Reed Business Publishing, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

INDEXES AND BINDERS
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OUR NEXT ISSUE DATED JUNE WILL BE PUBLISHED ON MAY 19th.

BC107	8p
BC108	8p
BC109	8p
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
BC178	14p
BC179	14p
BC182	7p
BC182L	7p
BC183	7p
BC183L	7p
BC184	7p
BC184L	7p
BC212	7p
BC212L	7p
BC213	7p
BC213L	7p
BC214	7p
BC214L	7p
BC237	7p
BC238	7p
BC239	7p
BC300	20p
BC301	20p
BC302	20p
BC303	20p
BC304	25p
BC327	7p
BC328	7p
BC337	7p
BC338	7p
BC441	28p
BC446	8p
BC449	15p
BC461	28p
BC477	18p
BC478	18p
BC516	22p
BC537	25p
BC546	8p
BC547	8p
BC548	8p
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BC550	8p
BC556	8p
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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
BD136	20p
BD137	20p
BD138	20p
BD139	20p
BD140	20p
BD144	90p
BD157	38p
BD166	30p
BD175	30p
BD177	30p
BD179	32p
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BD201	33p
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BD241A	40p
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BD244	50p
BD245	50p
BD246A	50p
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BD441	40p
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BD643	50p
BD645	50p
BD647	50p
BD649	50p
BD675	40p
BD676	40p
BD677	38p
BD678	40p
BD679	40p
BD680	40p
BD681	45p
BD682	45p
BD705	50p
BD707	50p
BD709	50p
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
BF181	18p
BF183	20p
BF195	7p
BF199	8p
BF200	16p
BF225	30p
BF240	16p
BF245	25p
BF254	15p
BF255	12p
BF256	18p
BF257	18p
BF258	18p
BF259	18p
BF262	25p
BF263	25p
BF270	18p
BF273	15p
BF311	21p
BF336	20p
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
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BU104	80p
BU105	80p
BU108	100p
BU109	80p
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BU184	100p
BU204	75p
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BU208D	80p
BU209	140p
BU225	190p
BU226	190p
BU312	120p
BU325	55p
BU326	75p
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BU406D	85p
BU407	55p
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BU408	75p
BU408D	85p
BU409	95p
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BU508D	80p
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BU626	150p
BU636	150p
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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
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MJ15001	325p
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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
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TIP29C	25p
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TIP30C	30p
TIP31A	22p
TIP31C	30p
TIP32	24p
TIP32A	21p
TIP32C	28p
TIP33	50p
TIP33C	60p
TIP34	50p
TIP34C	60p
TIP35C	65p
TIP36C	65p
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TIP42A	20p
TIP42C	22p
TIP47	40p
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TIP51	120p
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TIP151	90p
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TIP3054	45p
TIP3055	42p
TIS44	40p
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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
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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
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2N3019	28p
2N3053	18p
2N3054	40p
2N3055	38p
2N3055H	50p
2N3440	58p
2N3442	85p
2N3585	120p
2N3702	9p
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2N3704	9p
2N3705	9p
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2N3707	9p
2N3708	9p
2N3710	12p
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2N4036	25p
2N4062	12p
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2N4443	76p
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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
IN914	2p
IN4001	3p
IN4002	3p
IN4003	3p
IN4004	3p
IN4005	3p
IN4006	3p
IN4007	4p
IN4148	2p
IN5400	9p
IN5401	8p
IN5402	8p
IN5403	8p
IN5404	8p
IN5405	11p
IN5406	12p
IN5407	12p
IN5408	12p
RGP15	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	60p
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	150p
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
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AN6320	300p
AN6328	400p
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AN6337	420p
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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	360p
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	150p
HA1377	160p
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HA11221	180p
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HA11251	240p
HA11423	210p
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ICM75556	80p
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KA2102	150p
KA2130	150p
KA2206	150p
KA2209	125p
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KA2212	80p
KA2213	130p
KA2214	150p
KA2261	100p
KA2263	100p
KA2264	100p
KA2401	150p
KA2412	350p
KA2912	125p
KA2914A	320p
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
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LA4032	140p
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LA4120	270p
LA4125	200p
LA4126	240p
LA4137	180p
LA4140	60p
LA4160	100p
LA4180	300p
LA4182	180p
LA4190	300p
LA4192	140p
LA4200	130p
LA4201	120p
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LA4260	230p
LA4261	300p
LA4270	300p
LA4420	140p
LA4422	130p
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
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LINEAR ICs — Cont.

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JAPANESE TRANSISTORS

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2SC3950	120p
2SC3953	120p
2SC3954	150p
2SC3973	275p
2SC3975	275p
2SC3987	100p
2SC3996	1200p
2SC4006	100p
2SC4020	280p
2SC4023	325p
2SC4056	350p
2SC4106	200p
2SC4123	450p
2SC4124	250p
2SC4169	60p
2SC4236	750p
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	400p
2SD424	400p
2SD426	150p
2SD427	350p
2SD438	45p
2SD467	60p
2SD468	25p
2SD471	25p
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	50p
2SD637	40p
2SD638	60p
2SD639	60p
2SD640	350p
2SD642	50p
2SD655	50p
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
2SD741	120p
2SD743	130p
2SD751	100p
2SD756	120p
2SD757	140p
2SD762	140p
2SD763	140p
2SD768	180p
2SD772	200p
2SD773	40p
2SD774	60p
2SD777	400p
2SD784	650p

2SD786	100p
2SD787	80p
2SD788	100p
2SD789	80p
2SD792	400p
2SD794	100p
2SD795A	140p
2SD811	450p
2SD819	400p
2SD820	450p
2SD821	550p
2SD822	400p
2SD826	100p
2SD836	150p
2SD836A	200p
2SD837	80p
2SD838	400p
2SD841	160p
2SD844	200p
2SD845	250p
2SD850	260p
2SD856	80p
2SD858	250p
2SD863	60p
2SD864	200p
2SD866	120p
2SD866A	140p
2SD868	450p
2SD869	400p
2SD870	450p
2SD871	450p
2SD879	60p
2SD880	40p
2SD882	80p
2SD892A	100p
2SD894	120p
2SD895	200p
2SD896	200p
2SD900	400p
2SD905	450p
2SD916	130p
2SD917	300p
2SD921	320p
2SD922	360p
2SD946	120p
2SD947	100p
2SD950	300p
2SD951	350p
2SD957A	520p
2SD958	60p
2SD965	100p
2SD970	170p
2SD971	60p
2SD973A	70p
2SD985	120p
2SD986	120p
2SD1012	60p
2SD1020	40p
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2SD1037	750p
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2SD1055	130p
2SD1060	130p
2SD1062	130p
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2SD1064	250p
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2SD1088	150p
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2SD1111	60p
2SD1112	225p
2SD1128	200p
2SD1133	100p
2SD1135	150p
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2SD1157	50p
2SD1159	90p
2SD1161	150p
2SD1163A	220p
2SD1164	120p
2SD1168	425p
2SD1169	280p
2SD1173	350p
2SD1184	400p
2SD1186	400p
2SD1187	250p
2SD1189	125p
2SD1190	150p
2SD1191	150p
2SD1192	90p
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2SD1196	150p
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2SD1265	75p
2SD1266	180p
2SD1267	100p
2SD1267A	125p
2SD1271	200p
2SD1271A	225p
2SD1272	200p
2SD1273	100p
2SD1274	160p
2SD1276	200p
2SD1277	190p
2SD1279	600p
2SD1288	175p
2SD1289	300p
2SD1291	400p
2SD1292	60p
2SD1297	425p
2SD1302	40p
2SD1308	140p
2SD1309	140p
2SD1310	140p
2SD1311	1000p
2SD1326	60p
2SD1341	70p
2SD1348	85p
2SD1350	150p
2SD1376	125p
2SD1379	100p
2SD1380	100p
2SD1383	100p
2SD1386	130p
2SD1389	200p
2SD1390	350p
2SD1391	450p
2SD1392	150p
2SD1395	150p
2SD1396	240p
2SD1397	175p
2SD1398	130p
2SD1399	300p

2SD1400	280p
2SD1402	280p
2SD1404	125p
2SD1406	80p
2SD1407	160p
2SD1408	125p
2SD1409	170p
2SD1412	100p
2SD1413	175p
2SD1414	700p
2SD1415	190p
2SD1417	125p
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2SD1427	380p
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2SD1556	700p
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2SD1565	75p
2SD1571	200p
2SD1572	100p
2SD1576	450p
2SD1577	480p
2SD1579	120p
2SD1589	100p
2SD1590	100p
2SD1591	310p
2SD1593	125p
2SD1595	160p
2SD1604	200p
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2SD1783	100p
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2SD1877	250p
2SD1878	300p
2SD1879	275p
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2SD1887	450p
2SD1896	300p
2SD1910	280p
2SD1911	400p
2SD1913	50p
2SD1929	60p
2SD1939	75p
2SD1941	500p
2SD1959	280p
2SD1961	50p
2SD1978	50p
2SD1984	150p
2SD2012	50p
2SD2046	50p
2SJ48	425p
2SJ49	425p
2SJ50	425p
2SJ56	700p
2SJ74	60p
2SJ75	280p
2SJ76	220p
2SJ77	350p
2SJ79	225p
2SJ103	75p
2SJ106	40p
2SJ108	60p
2SJ115	525p
2SJ116	1000p
2SJ117	550p
2SJ118	600p
2SJ119	700p
2SJ122	80p
2SJ161	650p
2SJ162	680p
2SK19	45p
2SK30	50p
2SK40	50p
2SK49	50p
2SK55	100p
2SK68	100p
2SK70	75p
2SK103	40p
2SK106	40p
2SK107	40p
2SK109	120p
2SK118	50p
2SK125	100p
2SK133	650p
2SK134	415p
2SK135	415p
2SK147	160p
2SK150	150p
2SK162	115p
2SK163	40p
2SK168	40p
2SK176	800p
2SK192	45p
2SK195	150p
2SK197	140p

2SK214	170p
2SK216	200p
2SK217	35p
2SK218	400p
2SK240	140p
2SK270	50p
2SK294	350p
2SK310	200p
2SK312	750p
2SK315	70p
2SK320	120p
2SK322	140p
2SK323	130p
2SK358	300p
2SK370	40p
2SK371	40p
2SK386	600p
2SK388	850p
2SK405	450p
2SK413	500p
2SK414	500p
2SK415	500p
2SK429	180p
2SK511	450p
2SK513	325p
2SK517	200p
2SK531	350p
2SK534	700p
2SK537	900p
2SK538	450p
2SK539	1100p
2SK555	400p
2SK556	500p
2SK557	400p
2SK566	475p
2SK695	550p
2SK719	300p
2SK724	600p
2SK725	600p
2SK727	1200p
2SK735	600p
2SK758	300p
2SK787	1100p
2SK794	500p
2SK872	950p
2SK903	500p
2SK1057	600p
2SK1058	800p
2SK45	100p
2SK51	100p
2SK59	100p
2SK73	60p
2SK74	50p
2SK77	50p
2SK85	160p
2SK87	45p
2SK88	70p
2SK121	150p
2SK129	175p
2SK165	225p
2SK168	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
BY176 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	56p

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	27p
17088	200p
17089	200p
17127	200p
5 80H	230p
5 9SR	230p
SG264	550p
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8947 8948 3V42 3V44 3V45 3V46 3V47 3V52 3V54 3V55 3V56 3V57 £15.50
8950 8951 3V64 FV10 FV11 3V65 FV20 FV21 FV22 FV26 £17.00
3V48 £24.50
3V43 3V53 £31.50
8930 8940 3V29 3V30 £7.50
8945 £24.00
3V00 £10.00
FV31 £22.00
FV37 £38.00

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
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JVC & FERGUSON
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HRD180 230 3V59 FV13H HRD430 HRD470 £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
NV3000 NV300 NV7200 NV333 NV7500 NV7800 NV7850 NV322 NV332 NV340 NV390 NV2000 NV2010 NV7000 NV8170 NV8200 NV8400 NV8600 NV8610 NV8620 £6.25

NATIONAL
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NV430 AG1000 £11.00
NV280 NV460 470 480 £16.50
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NV366 £18.50
NV180 NVD48 £23.00
NV370 NV380 NV100 NV630 £8.50
NV788 £36.00
NV810 NV830 £30.00

NATIONAL Cont.
NV850 NV950 £35.00
NV870 NV890 NV970 £39.00
NVG33 NVG46 NVL23 NVL25 NVL28 NVG30 NVG31 NVG40 NVG130 £38.00
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.
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N906A £20.00
N911A N915A N916A N917 £27.00
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N380 N381 N830 N831 N832 N833 N834 N835 N836 £7.00
82611AH1 (for model DX3000) £45.00
N895 £31.50

NORDMENDE
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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 VH1000 (ALL MODELS) £13.00
VH1 VH2A £7.00

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

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N830EA RV300 RV310 RV320 RV330 RV340 RV350 RV380 £7.00

SAISHO
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VR3300X VR3600X VR3650 VR3800 £14.00
VR3200 VR3500 £15.00
VR2000 VR3300 VR3600 £15.00

SALORA
6500 6600 £21.50
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SV7400 8400 £23.00
SV8100 £13.50

SAMSUNG
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VB770 VI730 770 VK8220 VX750 770 8225 £21.00

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VTC5500 VTC5550 VTC9100 VTC9300 VTC9350 VTC9355 VTC9455 VTC9500 £19.00
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VHR3200 VHR3270 VHR3100 VHR3150 VHR3300 VHR3400 VHR3310
VHRD500 £18.00
VHR1100 VHR1200 £18.00
VHR1500 VHR2500 £28.00
VHR2700 £24.50

SHARP
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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
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VC6000 VC6200 VC6300 VC7300 VC7700 VC7750 VC8000 VC8300 £20.00
VC793 £36.00
VC473 785 786 £25.00
VC699 VCA501 VCA602 £29.00

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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
SL366ES SL37E £13.00
SL3000 8000 8080 SLC5E SLT7ME £16.00
SLV201 202 £29.50
SLK95 SLT50ME £29.00

TOSHIBA
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V9680 £42.00
V8600 V8700 £38.00
V21 V31 V33 V50 V51 V53 V9600 £14.50
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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 £15.76

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AMSTRAD
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VCR5200 £2.50
VCR7000 £2.50
TVR1 £2.50

AIWA
AV66, AV77 £2.50
G700, G900 £2.50

ALBA
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VCR5000 VCR6000 £2.50

AUTHENTIC
N850 £2/50

BLAUPUNKT
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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
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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

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VBR330 VBS3500, VBS7000, VBS7500, VBS7600 VBS9000, VBS9900 £2.50

FIDELITY
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VTR1000 £2.50

FIJITSU
HS760, VX715, VX720D £2.50

FUNAI
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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, MVS440, VS400, VS410, VS440, VS460 £2.50
VS120 £2.50
VS150 £2.50

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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
VX850 £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
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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
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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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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 2066EC 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
1-439-333-00	KV-1882EC 1882UB 1882F 1882CH 1882AEB 1882AM	
	KV-1882ME3 1882HK 1882AS 16TR1 882EC(PS) 1770R	£21.50
1-439-363-21	KV-19H11A 19FX1MT 18G2 1602M7 1602GE ADM-16B	
	KV-2092UB 2096UB	£22.00

FLYBACK TRANSFORMERS

FERGUSON		
00D-4208-001	TX9	£14.00
00D-4-208-002	TX9	£14.00
00D-4-235-002-01G	TX90	£14.00
00D-4-247-001	TX90	£14.00
00D-4-247-001 HT1	TX90	£14.00
06D-3-093-001	TX100	£14.00
(110) 06D-3-087-001	TX100	£14.00
(110) 06D-3-084-001	TX100	£14.00
06D-3-088-001	TX100	£14.00
GRUNDIG		
29201-019-05		£8.00
29201-024-11		£14.00
29201-024-04		£14.00
PHILIPS		
PS 140-17112	G11	£14.00
PS 140-10306	G90AE	£11.50
PS 140-10353	G90B	£15.50
PS 140-10151	K12	£15.00
PS 140-10283	K30 K30111	£15.00
PS 140-10246	K40	£13.00
PS 140-10247	KT4	£14.00
PS 140-10149	K12	£9.00
PS 140-10161	KT3	£9.00
PS 140-17033	G8	£10.00
PS 140-17089	G9	£10.00
PS 140-10328	NC3	£14.00
ITT		
	CVC20	£11.50
	CVC25	£11.50
	CVC30	£11.50
HITACHI		
2432981	CPT 1444	£15.00
2434274	CPT 2174 CPT2176	£18.00
	CPT 2178	
OUTPUT TV MODULE	HM6251 (REF 2370551)	£5.50
	HM6232	£5.50

IDLERS & PULLEYS REPLACEMENTS

AKAI			
VS1-2 VS4-5 VS15	FF-REW IDLER	M1327773	£4.50
VS3 6 12 56 58 59			
VS1-2 VS4-5 VS15	T-UP IDLER	BV327815	£6.00
VS3 6 12 58 59			
V9700	IDLER	BV321979	£6.00
VS125 126 155	IDLER ASSY	MZ366960J2	£11.00
VS165 240 244 245 247 248 250 512 515 516			
VS22 38 105 112 115 116 205 220			
VP7100 VS9300	T-UP IDLER	PU47752	£4.50
VS9500 VS9800			
VP7100 VS9300	UNLOADING IDLER	PU46381	£4.00
VS9500 VS9800			
VP7100 VS9300	REW IDLER	PU46380	£6.00
VS9500 VS9800			
VP77 VS10	REEL IDLER	BV327815	£3.00
VP88	IDLER	BV336067	£5.00
VS1 3 4 9 12	REEL TABLE	BR347731	£5.50
VS15 56			
VS23 35 37 53 55	CLUTCH	ML373043	£13.00
VS66 75 VSA77			
VS9700	FF IDLER	BV321761	£3.20
VS9700	REW IDLER	VV321762	£4.25
AMSTRAD			
VCR7000	IDLER	150280	£1.50
TVR1 VCR4500	CLUTCH	150873	£3.75
VCR4600 VC5200 VCR9000			
TVR1 VCR4500	GEAR HOLDER	151284	£3.50
VCR4600 VCR5200 VCR9000			
TVR1 VCR4600	REF CLUTCH		£3.50
VCR5200			
VCR6000 VCR6100	CLUTCH	153202	£3.80
VCR4500 VCR9000	CLUTCH		£4.00
VCR4500 VCR4600	MOD KIT	(TAPE CREASING)	£4.50
VCR4700			
MOD KIT TAPE CREASING FOR AMSTRAD			
VCR4500 4600 4700			£4.50
FERGUSON			
3V00 3V01 3V16	T-UP IDLER	PU47752	£4.50
3V22 3292 8900 8901 8904 8906			
3V16 3V22 8902	T-UP IDLER	PU49280	£5.50
8903 8909 8912 8922			
3V23 3V29 3V30	REEL IDLER	PU48967	£2.50
3V31 3V32 3V35 8923 8924 8929 8930 8931 8940 8941 8942			
3V23 3V31	ROLLER ASSY	PU49042A	£4.00
3V29 3V30 3V31	T-UP IDLER	51402	£1.25
3V32 3V35 3V36 3V38 3V39 3V49 8930 8931 8940 8941 8942			
3V29 3V30 3V31	T-UP CLUTCH	PU51380	£2.25
3V32 8930 8931 8940 8941 8942			
3V35 3V36 3V38	REEL IDLER	PU55374	£2.85
3V39 3V49 8943 8944			
3V35 3V36 3V38	T-UP CLUTCH	PU55373	£2.00
3V39 3V49 8943 8944			
3V58 3V59 3V64	IDLER ARM	PU58645	£2.25
3V65 FV10 FV11 FV12 FV13 FV14 FV20 FV21 FV22 FV26			
FV30 FV32 FV33 8950 VC141L			
3V42 3V43	CLUTCH ASSY	PU55822	£13.50
3V42 3V44 3V45	CLUTCH ASSY	PU57658	£11.50
3V48 3V53 3V54 3V55 3V57 8947 8948			
3V42 3V43 3V44	T-UP CLUTCH	PU56043-1-4	£2.80
3V45 3V48 3V53 3V54 3V55 3V56 3V57 8947 8948			
3V42 3V43 3V44	SUPPORT CLUTCH	PU56044-1-5	£2.80
3V45 3V48 3V53 3V54 3V55 3V56 3V57 8947 8948			
3V00 3V01 3V16	LOADING IDLER	PU43681	£4.00
3V22 3292 8900 8901 8902 8903 8904 8906 8909			
8912 8922			
3V00 3V01 3V16	REW IDLER	PU46308	£6.00
3292 8900 8901 8904 8906			
3V16 3V22 8902	IDLER	PU49281	£1.70
8909 8912 8922			
3V16 3V22 8902	IDLER	PU49283	£1.00
8909 8912 8922			
FISHER			
FVHP420 520 530	FF-REW PULLEY	HI638531	£1.00
FVHP615 618 620	COMP IDLER ASSY	FI1430420400300	£3.30
FVHP622 710 711 FVHP720 721 722 FVHP725 730 830			
FVHP840 905 906 FVHP908 910 911 FVHP915 916 918			
FVHP615 618 620	GEAR IDLER ASSY	FI1430490400900	£4.50
FVHP622 710 711 FVHP720 721 722			
FVHP725 730 830 FVHP840			
FVHP615 618 620	REEL T-UP ASSY	FI1430410400900	£5.50
FVHP622 710 711 FVHP720 721 722			
FVHP725 730 830 FVHP840			
FVHP905 906 908	GEAR IDLER ASSY	FI1430490402400	£4.00
FVHP910 911 915 FVHP916 918			
FVHP975 980 990	IDLER	FI1430420400700	£4.50
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FVHP5050 5075 5100			
FVH040 55 140	REEL DRIVE ROLLER		£6.00
FVHP1 10 20			
FVHP975 980 990	GEAR		£3.00
FVHP975 980 990	CLUTCH	FI1430510404200	£9.50
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FVHP420 520 530	TAKE UP IDLER		£3.60
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GHV1221 1232 1240	CLUTCH GEAR	435038A	£2.50
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GHV8200 8210 8215 GHVP51 VCP4100 4130			
GHV1221 1232 1240	IDLER		£1.70
GHV1241 1242 1243 GHV1244 1245 1246 GHV1247 1248 8000			
GHV8200 8210 8215 GHVP51 VCP4100 4130			
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VXL2	IDLER		£1.50
VXL4 VXL35	IDLER		£2.75
VXL4 VXL35	CLUTCH		£6.50
VXL4 VXL12 VXL25	LIMITER POST		£1.30
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VXL5 VXL6	CLUTCH		£3.75
VXL5 VXL6	GEAR HOLDER		£3.50
VXL7 VXL8 VXL9	CLUTCH		£3.80
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62 65 85 330 640 VT16S			
VT120-220 100 110	CLUTCH ASSY	6886824	£7.50
111 113 115 118 120		6886972	
125 128 130 135 138 145 150 175 225 250			
255 258 260 VTL30			
VT8000-8300 7000	FF-REW IDLER	6413663	£2.80
VT8500-8700			
VT8000-8300 7000	PLAY IDLER	6414221	£3.60
VT8500-8700			
VT8000-8300 7000	FF-REW PULLEY	6383531	£0.80
VT8500-8700			
VT9300-9500 6500	FF-REW IDLER	8681471	£3.30
VT680 6800 9700 9900			
VT9300-9500 6500	PLAY IDLER	6861482	£3.20
VT680 6800 9700		6861481	
VT9900			
VT9300-9500 9700	IDLER	681505	£3.00
VT9900 6500 680 6800			
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VT100 110 111 113	FF-REW ARM	6886792	£2.75
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VT400 405 410 413	FF-REW ARM	6897094	£1.30
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VT400 405 410 413	CLUTCH BASE	6896951	£3.25
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VT438 450 498 510 518 520 525 526 530 535			
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HR7655 7300 7350 7610			
HR7200 7300 7350	REEL IDLER	PU48967	£2.50
HR7600 7610 7650 7655 7700			
HR7600 7610 7650	ROLLER ASSY	PU49042A	£4.00
HR7655 7700			
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HR7200 7600 7650	T-UP IDLER	PU51402A	£1.25
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HRD110 HRD120-121	T-UP CLUTCH	PU55373	£2.00
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HRD110 HRD120-121	IDLER ARM	PU55374-3-8	£2.85
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HRD170 180 210 230	IDLER ARM	PU58465	£2.25
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HR3300 HR3330	REW IDLER	PU46380	£6.00
HR3660 HR4100			
HRD140 150 157 158	TAKE UP CLUTCH	PU56043-1-4	£2.80
HRD160 250 257 455 565 566 725 755 HRP50			
HRD140 150 157 158	TAKE UP CLUTCH	PU56044-1-5	£2.80
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VX730 735 750 755	CLUTCH	850A00005	£6.50
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HS306 307 318 319	GEAR WHEEL	641071001	£1.50
HS400 410 710			
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N9510 9520 9530 9610			
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NV300 NV333 NV340	IDLER ARM	VXL0997	£3.60
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NV300 NV330 NV333	IDLER UNIT	VXP0401	£0.75
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NV300 NV330 NV333	PLAY IDLER	VXP0433	£2.75
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NV230 NV250 NV260	IDLER ARM	VXP0521	£1.70
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AG2200 NVH65 NVH70			
NV370 NV430 NV870	CAM GEAR	VDG0200	£1.20
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NV465 NV630 NV650 NV777 NV780 NV788 NV810 NV830 NV850			
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NVG14 NVG15 NVG18 NVG30 NVG120 NVG130 NVG400 NVH70 AG1000			
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VR605 VR800 VR900	CLUTCH	850A20000	£6.50
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VR1100 1200 1600 2500 3200 3300 3500 3600 3700			
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VTC9100 VTC9300	IDLER	143-0-551T-01400	£1.20
VTC9300	FF ROLLER ASSY	143-0-547T-00200	£2.20
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VHR2100 2300 2500	IDLER	6130374899	£5.00
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VTC5000 5150 6000	PULLEY	143-0-662T-01201	£5.20
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DX2000	3400P
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VM1560, VN1561	2200P
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VHR7900	3600P
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VC585, VC685	2300P
VC90ET	3900P
VFH815	2800P
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V660	2350P
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VHS65, VHS90 (capstan motor)	3100P

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M491BB1	500P
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TIP112H	50P
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2020, 2114, 2321, 2514	1000P
DECCA	
RC70	850P
FISHER	
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UNIVERSAL, 79500C, 986700	850P
SATELLITE	1000P
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MK4A TEXT, 70375C	850P
95288E	1000P
94490D	1000P
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TP590-600	1050P
TP390, TP610	1050P
TP621	1050P
TP630, TP650	1000P
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390C9500	1000P
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EUR51200	900P
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CARVEL, CONCORDE, MERCURY	1000P
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TC10	1000P
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RC5002, 5154	900P
KT3 NON TEXT	900P
69117032	1050P
69117194	1050P
RC5991 UNIV	850P
RC3B	900P
KT3 TEXT	900P
RC5352	900P
RC5375	900P
RC5 STANDARD	900P
RC5901	900P
RC5903	900P
SABA	
T6772	1000P
TC319-320	1050P
TC356	1050P
TC358	1050P
TC360	1000P
TC355	1000P
SALORA	
SERIES L	1000P
86173	1000P
SANYO	
RC218, RC222, RC228, RC238	900P
JXGE	1000P
JXDE	1000P
VHR2300	1000P
RC628	1000P
SHARP	
G0121CESA, 123CESA, 204, 251	900P
SIEMENS	
FC616	1000P
FC631	1000P
FC742	1000P
SONY	
RM604, RM605, RM606	900P
32 CHANNEL	900P
RM613	900P
RM632, RM636	900P
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FXA	1000P
RC70	900P
FX70 FASTTEXT	850P
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FB632	1000P
FB639	1000P
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3V35-42	900P
3V31-32	900P
3V57-58	1050P
TX10 TEXT	850P
TX10 STEREO TEXT	850P
TX9-90-100	850P
3V55, FV11	1050P
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BLAUPUNKT 210	1600P	LOT08
GRUNDIG 2922010	1600P	LOT09
ITT CVC800/1/3	1500P	LOT10
ITTD218/37 EQ	1600P	LOT11
NORMENDE 5255	1600P	LOT12
SABA 81000 200	1600P	LOT13
SALORA T236 EQ	1650P	LOT14
SABA 811-50-24	1600P	LOT15
SABA 770223500	1600P	LOT16
TELEFUNKEN AT1	1450P	LOT17
TELEFUNKEN EQ	1400P	LOT18
SALORA FM0218B	1600P	LOT19
NORMENDE 5255	1600P	LOT20
ITT CVC 1150/1	1500P	LOT21
ITT COMPACT 80	1500P	LOT22
FE TX100 GREEN	1450P	LOT23
HINARI CT4/5 5113	1500P	LOT24
SELECO 6320410	1600P	LOT25
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TELEVISION

Electronics UK 1993

The recent history of the UK's electronics industry has been curious to say the least. With the possible exception of GEC there are virtually no indigenous UK electronics companies with international status. You might be forgiven for suspecting that electronics long ago ceased to be a major industrial activity in the UK. Yet the UK has the fourth largest electronics industry in the world, after the USA, Japan and Germany. So where is it and what is it doing? The fact of course is that electronics in the UK has been kept alive through inward investment by overseas companies. This is particularly the case with the TV/video industry, in which all the major Japanese and Korean manufacturers have plants in the UK. As a result the UK's consumer electronics industry, though almost entirely foreign owned, has been quite a success story over the last decade. The trade deficit in consumer electronics is now only a quarter of the £1·1bn reached in 1983. On the purely TV front the trade balance has been positive for some time – a quarter of the large-screen TV sets produced in Western Europe are made in the UK. Overall the electronics industry was responsible for about fifteen per cent of the UK's visible exports in 1992. There remained an overall trade deficit of around £1·4bn in 1992, but this was half the gap ten years previously. Manufacture of computer equipment in the UK has been another success story, largely through subcontracting.

Two questions present themselves: how is it that foreign firms have succeeded in the UK where our own manufacturers have failed, and does it matter that a successful industry is almost entirely foreign owned? The first question has been addressed on many occasions, not least on this page. It's not easy to pinpoint any particular major failings that provide a sound explanation. The change to foreign ownership and subcontracting has been going on for several decades, under different economic conditions You could put some of the blame on stop/go economic policies and high interest rates due to inflation. Such things certainly haven't helped. But neither has an insular management approach with a lack of commitment to long-term development. In the past the UK has been a world leader in television (both consumer and professional equipment), radar, telecommunications and medical electronics. We have singularly failed to build on any of these.

It seems that the management of large-scale manufacturing is a particular weakness in the UK. But other countries have had their problems in this respect, and it's interesting to note the way in which the approach to manufacturing has had to evolve over the years. With a new market the ability to get product out at a competitive price is all important. This has been called the Fordist approach, after Henry Ford's famous dictum that you can have his cars "in any colour so long as it's black". Once a market becomes saturated the all-important thing becomes product differentiation – persuading customers that a particular brand really is best and worth buying, through reputation and added value. This calls for product quality, variety and short runs. The Japanese have been particularly good at this. But you can go too far: the point arises where consumers become confused about rival claims and go on a buyers' strike. They get annoyed about unnecessarily complex products that are superseded at too rapid a rate. This seems to have been a Japanese failing in recent times. Getting it right is not easy of course – nor is it the complete answer where excess production capacity is a problem, as in recent times.

Whether it matters that most of the UK's electronics industry is foreign owned is also a question that can be debated at length. One suspects that education is a key element here. If we can produce good engineers and technicians in adequate numbers development work as well as manufacturing will thrive in the UK. Otherwise the future is likely to be as an off-shore assembly centre, which is hardly good enough.

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COVER PHOTO
This month's cover photograph shows Eugene Trundle's video monitoring test jig. See article on pages 483-5.

REED BUSINESS PUBLISHING

The Television Index and Directory

Peter Marlow, B.Sc., C.Eng.

Television now has a computerised index. The Television Index and Directory runs on IBM and compatible personal computers and covers Volumes 38 to 42 (November 1988 to October 1992). It contains some 3,500 references to TV/VCR fault reports, articles, leaders, letters and features. Synopses are provided for articles. The Index also includes an advertisers list, a TV/VCR spares guide and a directory of Trade and Professional Organisations. A reprint service for articles back to 1986 is also offered.

Why put the Television Index on to a PC? A computer is particularly good at searching quickly through large quantities of data. Applied to an index it can save a lot of time that would otherwise be spent looking through issues for articles, fault reports and company details: having information available in this way often saves one having to "re-invent the wheel". PCs are now commonplace in the workplace and at home, so it seems the right time to produce a 'soft' index for Television.

The minimum requirement for the soft index is an IBM or compatible personal computer that runs a version of DOS 3·0 or higher and has 512K of RAM, a hard disk with 1Mbyte available and a floppy disk drive – either 5·25in. (360K) or 3·5in. (720K). The program runs under DOS and supports mouse operation. It can also be run in Windows.

Features

The soft index is easy to use, with plenty of on-screen help. Finding information is a two-stage process: first you select a subject from the Table of Contents then you examine the subject index. The subject index is like a card file. An index is displayed on one side of the screen while information relating to a chosen index item appears on the other side.

Many useful features have been built into the software. They are accessible by using function keys and menus. Rapid searches of the data relating to one or more words are possible. The computer ignores hyphens, making it easy to look up model and chassis numbers. The memo function enables you to add comments to the index data. A blank subject index is provided for your own notes etc. Treat the Television index and directory like a book. A purchased copy should be run on only one machine at any one time. A copy may be taken as a backup.

Now for a look at the main features of the software. Full instructions for use are contained in the manual that comes with the disk.

The Television Index and Directory is supplied on either a 3·5 or 5·25in. floppy disc in 'archived' form. A simple installation procedure results in the program and data being 'expanded' and copied to the directory TV on drive C, taking up just under 1Mbyte: other directory names and drives can be used. To run the program, type TV followed by Enter.

Table of Contents

After a short pause the Table of Contents display appears – see Fig. 1. A list of subjects appears on the left-hand side of the screen. Most of the titles will be familiar to you: TV Fault Reports, CD Player Casebook, Teletopics etc. The Information section provides details about the reprints service, magazine subscriptions, licensing details, etc. 'Notes' is, as the name suggests, for your own notes, information, contacts etc.

To gain access to a subject index, the highlight bar is moved to that subject by using the ↑ or ↓ key and the page up and down keys. The Enter key is then pressed. A faster way of positioning the highlight bar is to type the first letter of the desired subject. If one is attached, a mouse can be

```
[■]                  TELEVISION Index and Directory

 Advertisers Index                   Welcome to the first issue of
 CD Player Casebook                  the TELEVISION Index and Directory
 CD Player Servicing                 on disk.  It spans five years of
 DX-TV                               TELEVISION magazine from volume 38
 Information                         1988 to volume 42 1992 and contains
 Leaders                             over 3500 entries.
 Letters
 Microcomputers                      Help can be obtained at any time
 Miscellaneous                       by pressing the F1 key.  Fuller
 Notes                               instructions for use are contained
 Projects                            in the MANUAL file on the disk or
 Reviews                             in the May 1993 issue of TELEVISION
 Satellite Notebook
 Satellite TV                        Your attention is drawn to the
 Service Bureau                      licence, limited warranty and
 TV/VCR Spares Guide: Distributors   disclaimer in the INFORMATION
                    : Manufacturers  section.
                    : Misc Suppliers
 TV Fault Reports                    This is a scratchpad area for your
 TV Servicing                        notes whilst using the index.

 F1-Help  F2-Search                  F10-Exit     ↑↓→     6/28
```

Fig. 1: Table of Contents display.

```
[■] + -  2                    TV Servicing                                 R

 B & O 39XX Series Chassis                 FERGUSON ICC5 CHASSIS
 B & O L/LX2500/L800 Chassis               John LeJeune
 CCTV Faults
 Coincidence Detection                     July 1989, p676 (E)
 Data on TV Servicing
 Decca 120 and 130 Chassis                 "Inside the Ferguson ICC5 Chassis".
 Decca 80 and 100 Chassis                  The Thomson designed ICC5 chassis
 EHT Arcing, How to deal with              has been customised to meet
 Electronic Stethoscope Testing            reception requirements in the UK.
 Ferguson Service Briefs                   This new chassis from Ferguson top-
►Ferguson ICC5 Chassis                     of-the-range model features
 Ferguson ICC5 Chassis, More on            microprocessor control via four
 Ferguson TX10 Chassis                     busses, some ICs have not been
 Ferguson TX100 Chassis Servicing          seen before in a UK chassis and a
►Ferguson TX80 Chassis                     novel thyristor field output stage
 Ferguson TX90 Chassis Servicing           which uses the line output
 Ferguson TX98 Chassis                     transformer as its load.
 Ferguson/Thorn Rental TV Chassis
 Field Faults on Modern CTV Sets           See also February 1990, p295.
 Finlux 1000 Chassis Servicing

 F1-Help  F2-Search  F3-Memo  F4-Edit  F5-Other  F10-Exit   ↑↓→   15/68
```

Fig. 2: Typical subject index display.

used to click on a subject to select it.

A 'progress bar' is present on the far left-hand side of the screen. It shows you where you are relative to the rest of the file. The little arrows at the top and bottom of the bar are for scrolling up and down with a mouse, which can be clicked on any part of the bar to go to different parts of the Table of Contents.

The 'help line' at the bottom of the screen shows the various functions available. Pressing the F1 key brings up a page of more detailed help information.

The search function is perhaps the most useful feature. Pressing F2 starts a word search of either the individual subject indexes (very fast) or of all the data. Hyphens are ignored, making it easy to look up model or chassis numbers.

A 'welcome message' is present on the right-hand side of the screen. It's in fact a scratchpad area for your notes and can be modified or edited by pressing the → key. Text can be typed anywhere in the box. Press Esc to exit.

The current line number and the total number of lines of the Table of Contents are displayed at the bottom right-hand side of the screen.

To exit the program, press F10 or click the mouse on the small square at the top left-hand side of the screen.

Subject Index

The subject index shown in Fig. 2 belongs to the TV Servicing section. The screen display has two halves: an index on the left-hand side and information on the right-hand side. Moving the highlight bar to a different index entry automatically brings up the relevant information on the right-hand side. It's just like a card file. A rapid way of positioning the highlight bar is to spell the relevant item on the keyboard. As before, the help line at the bottom of the screen identifies the various functions available. Pressing F1 brings up a page of more detailed help information. Each subject index has an 'information' entry.

F2 is the search function, which is more extensive than in the Table of Contents display. It allows searches with up to five words, either together (AND) or individually (OR). Entries can also be marked with an arrow for quick access later. Information at the top left-hand side of the screen indicates, in our example, that two items are currently marked: use the + and – keys to switch between the marks.

An R symbol at the top right-hand side of the display shows that the file is 'read only': as the information is fixed, it cannot be edited. By using the Memo function F3 however a note can be added in the bottom line of the data. In the 'Notes' subject index data can be added or altered by using the edit function key F4.

The 'other' function, key F5, gives printing. Individual records can also be stored in an ASCII text file for incorporation into word-processed documents. This is particularly useful for company names and addresses.

The symbol (E) next to the reference date and page number in the example shown in Fig. 2 is the reprint price code. All unmarked references are price code A. The Information section contains a price list.

Press F10 or Esc, or click the mouse on the small square at the top left-hand side, to return to the Table of Contents. The computer remembers where you are for the next time.

Availability

Most readers should find the Television index and Directory very useful. We hope that readers will make suggestions about the content, presentation and software operation. The intention is to publish a new issue of the disk annually.

The Television Index and Directory is available at £30 from Video Interface Products Limited, 1 Vineries Close, Cheltenham, Gloucestershire GL53 0NU. Cheques should be made payable to Video Interface Products Limited – not Television or Reed Business Publishing Ltd. – and please state the disk format required (5·25 or 3·5in.). The price includes VAT and UK postage: add extra postage for overseas orders. Allow up to 28 days for delivery.

An article reprint service is also offered by Video Interface Products, as mentioned above. There's an order form on the disk: further details can be obtained from Video Interface Products.

Each disk is scanned before despatch with the current version of Dr. Solomon's Anti-Virus Toolkit (V6·03)

TV Fault

Reports from Philip Blundell, A.M.I.E.I.E. John Edwards, Richard Newman, Mark Ward, Michael Dranfield, Graham Richards, Chris Watton, Denis Foley, K.E Fellingham and Nick Beer

Philips CP110 Chassis

This fault applies only to later versions of the chassis that have transistor Tr7672 in the power supply. The symptoms are as follows. No picture when the set is first switched on but after a few minutes a low-contrast picture begins to appear, gradually improving until, after half an our, the contrast is back to normal. Tr7672 was conducting when the fault was present. It was being turned on because of excessive ripple on the 140V line. C2670 and C2621 had dried up. **P.B.**

Grundig ST63460

There was no picture, just a dim blank raster with reduced height. Tests around the RGB module were inconclusive, though the waveform on the SSB line (beam limiter) did seem to be rather large considering that there was no picture information. A rather long wild-goose chase around the RGB and c.r.t. base modules followed, to no avail. What's common to the RGB and field timebase departments? Ripple on a supply maybe? No ripple could be seen, but to be sure I replaced smoothing capacitors one by one. Still no improvement. As desperation was beginning to set in I had a chat with the nice man at Grundig Technical. He suggested that a fault in the i.f./sync module was affecting the sand-castle pulses, and that the diodes associated with the field oscillator should in particular be checked. True to form D2334 (TD190) was found to have a 200kΩ reverse leak. A replacement restored the picture. **P.B.**

Philips CP90 Chassis

The complaint was that the set would "go dead". We put it on soak test and discovered that it would run for up to three hours, after which it would shut down as though switched off. If the set was then switched off and on again it would work for another few hours. We removed the main panel and heated it with the trusty hairdryer. When the set failed the main h.t. rail voltage had fallen to about 20V, suggesting that the set was in the standby condition though the standby LED was not alight. Checks showed that pin 14 of the microcontroller chip had indeed gone low, and that if the voltage at the reset pin 33 was momentarily reduced the set would start up again. A replacement microcontroller chip restored normal operation. What had fooled me initially was the fact that the standby LED did not light up. This was because the standby command hadn't been given by the remote control unit. Thus the latch within the microcontroller hadn't turned the LED on. **R.N.**

Philips 2B Chassis

This Nicam set was stuck in standby and the power supply was tripping. If the programme button on the front panel was held in the set would try to start but the LED display would do strange things. As the power supply proved to be o.k. I disconnected D6734 to disable the standby command. The set then started up but the display was haywire and none of the front controls did what it was supposed to do.

Scope checks showed that there was a lot of noise on the microcontroller's data lines. This disappeared when the EEPROM X2402 was removed. Fortunate that – it was the only one of the three chips in the control system I had in stock! Fitting the replacement cured all the problems. These sets require the correct option code to be programmed in – 26 for a Nicam set, 18 for a non-Nicam version. When the set had been retuned and the correct option had been programmed in everything was back to normal. **R.N.**

Philips G90AE

The power supply had shut down but the set would work when the mains input was reduced to about 90V. This was not due to the protection circuit operating. I found that the supply to the optocoupler rose quite high as the mains input was increased. The only path is via D6653, which is normally reverse biased – it's forward biased in standby. A check showed that it was leaky, a replacement restoring normal operation. **R.N.**

Sanyo CBP3011-15

For a dead set check R320 and R321. They are both 120kΩ and you will probably find that one or both of them have changed value. But beware: the main smoothing block electrolytic will still be charged – it bites! **M.Dr.**

Huanyu 37C-3

This set seems to be a Chinese copy of an Hitachi model with which we are familiar. It suffered from the same stock fault. Someone who claimed to have an electronics background brought it in, saying that he didn't have the time to do the repair. After we'd removed a 2N3055 and fitted the correct 2SD898B line output transistor we replaced the 2·7V zener diode ZD907 in the power supply. All was then well. **M.Dr.**

Hinari CT5

For intermittent field bounce replace the 2·2μF, 35V tantalum capacitor C901 in the field feedback circuit. This capacitor can also be the cause of other field faults such as cramping or a ragged picture. **M.Dr.**

Dansai CTV1477

The only sign of life with this set was a faint whistling noise that came from the power supply. When we checked around in the power supply we found that there was a pinhole in the small blue disc capacitor C617. A replacement obtained from a scrap chassis cured the fault. Incidentally this set appears to be the same as the Binatone one in which the CF82 line output transformer regularly burns up. **M.Dr.**

Saisho CM159TX

The chassis in this set seemed to be the same as that in the Bush 2020, and we were in fact able to use the Bush service sheet to repair it. When we switched it on the power supply screamed very loudly. After cleaning up the PCB around the electrolytics on the secondary side of the power supply the set still continued to scream. Disconnecting the line output transistor's collector restored some life, but we couldn't find anything wrong in the line output stage. A check on the h.t. line then gave us a clue: it was high, at 175V instead of 125V, and the voltage couldn't be reduced by adjusting VR801. Checks on the primary side of the circuit brought us to C818 (1μF, 50V) which provides the negative bias for the TDA4600 chopper control chip. It had dried out. Fitting a replacement enabled the h.t. to be set at 125V, but the set still didn't work.

We found that the supply to the TDA2579 timebase generator chip was low at only 5V, which brought us to R409. This was very discoloured but was in fact all right. So back to the power supply. The penny then dropped: what we had initially thought to have been a spillage was actually electrolyte leaking from C806 (1,000μF, 16V). The excessive voltages had caused this capacitor to burst open. C808 (1,000μF, 25V) was also faulty. Replacing these two capacitors restored normal operation. This situation could of course arise with any set that uses a Siemens TDA4600 type chopper power supply. **M.Dr.**

Sharp C1410HW

This set was dead though voltages were present in the area of the chopper transformer. We didn't have the circuit diagram but noted that the circuitry was very similar to that in the Sharp Model C3705 for which we did have a circuit diagram. This enabled us to establish that the h.t. voltage was missing at pin 4 of the line output transformer. When this pin was disconnected the h.t. voltage returned to its normal level. A check on the various items between the chopper and line output transformers showed that they were all o.k. So out came the line output transformer checker which declared that the transformer was faulty. A new one from Willow Vale got the set running again. **J.E.**

Solavox 16R19 (ITT Pico S2 Chassis)

This set was dead with no display and no relay click when the on/off switch was pressed. The cause of the fault was that the standby mains transformer's primary winding was open-circuit. A new one restored normal operation. **J.E.**

Alba CTV711

You sometimes get one of these sets in dead with the 1·6A fuse blown, R801 (2·7Ω, 4W) open-circuit and the BU508A chopper transistor Q800 short-circuit. In this event a check on R809 (270kΩ) will show that it has gone high in value or open-circuit. In addition two of the bridge rectifier diodes may have gone short-circuit. Replacing these parts is usually all that's required to bring the set back into service. **J.E.**

Toshiba 140E4B

An arcing noise would come from within this set intermittently, accompanied by a loud buzz from the loudspeaker. At the same time the picture would reduce in height and width, what was left of the display being best described as a combination of line tearing and field foldover. We found that every pin of the line output transformer was dry-jointed and that there were several suspect joints in the power supply circuitry. A blanket resoldering job in these areas put matters right. The line output transformer pin that had actually caused the symptoms was pin 3: when we desoldered and cleaned it we found that there were signs of burning around the hole in the PCB. We had to scrape this clean prior to resoldering. **J.E.**

Fidelity CTV2001

The 220kΩ preset field hold control PR9 in this set tends to go open-circuit, the symptoms being continuous field roll with the control having no effect. Another cause of this trouble is R25 (470kΩ) going high in value. **J.E.**

Murphy M22S01 (Fidelity ZX4200 Chassis)

Although this set was dead a faint ticking could be heard, indicating that the power supply was tripping. The cause of the fault was that D21 (BY229P) was short-circuit. When this was replaced the set sprang to life and the line output transformer put on a grand firework display for us. Fortunately a new transformer restored normal operation. **J.E.**

Finlux 3029V (3000 Chassis)

One of these sets gave me quite a bit of trouble. The complaint was of dark bars across the top of the picture. Now this is not an uncommon fault with the 3000 chassis, so I went straight to Ck8 (0·1μF) which goes open-circuit. It wasn't this time however and in fact the symptom was rather different: the dark bar was about a quarter of the way down the picture. I decided to check the supply at pin 9 of the TDA3654 field output chip ICk1. It was low at 20V instead of 26·5V. This took me to the line output stage which is the source of the supply. The resistors, rectifier diode and reservoir capacitor were all o.k. So why the low voltage? The line output stage also produces a 200V supply for the RGB output stages. A check on this showed that it was at only 155V. This was all very strange as the width and brightness were o.k. The power supply was also producing the correct 140V output.

A check on the h.t. at pin 3 of the line output transformer produced a reading of only 120V however. Between the power supply and pin 3 of the LOPT there's a filter module, RR300. It was dropping about 20V instead of 2V. A scope check at pin 3 of the LOPT showed that instead of d.c. there was a huge waveform present. Replacing Cz14 (4·7μF, 250V) restored normal operation.

The line output stage hadn't been operating properly because of the squegging h.t. supply. It all goes to prove that whatever appears on the screen the basics – correct voltage conditions – should be checked first. I was really fooled by the correct brightness, focus and width. But one scope check revealed the nature of the fault in seconds.

I subsequently had the same thing on another of these sets, only this time the symptoms were dark bands across the top of the screen plus cramping. Once again the set worked perfectly apart from the slight field fault. **C.W.**

Loewe MS56C8001

Only the standby light was on. A quick check showed that the power supply was operating normally. After some further checks I found that the line driver transistor T534 had no supply because its 3·3Ω feed resistor R534 was open-circuit. A replacement restored normal operation – but only for a few minutes, after which R534 went open-circuit again. This time I replaced the transistor and C534 (47μF) as well as the resistor. The set then worked correctly during a soak test. **C.W.**

Finlux 2000 Chassis

The teletext section was at fault. At first glance the text screen appeared to be full of characters, but on a closer look they were all either @ or ?. Replacing the SAA5240 chip restored normal teletext. **C.W.**

Bush 2321T

No picture or intermittent loss of the picture is becoming quite common with these sets now, due to poor soldering on the teletext module. There are a number of through-the-board links: these need to be resoldered. On a couple of sets however the same symptom has been caused by the crystal being dry-jointed. **C.W.**

Pye T183

These monochrome portables are rare visitors to our shop! This one was dead though the 270V supply was present. Time for some up-to-the-minute fault-finding methods. Checks on the wire-wounds soon showed that R602 (27kΩ) was open-circuit. **C.W.**

Amstrad SRX200

We had a tricky fault with one of these satellite TV receivers recently. The unswitched 5V A line was oscillating. After a lot of searching the cause was traced to C504 (220μF, 10V) which was leaky. It's a nasty little fault that now seems so obvious, but when most of the problems with this receiver are things like R532 it's all to easy to be put out by this one. **M.W.**

Sony KVM14TU

The symptoms with this set were as follows: the search tuning didn't stop at stations, there was no sound and the picture came only when the 'preset' button was pressed.

The microcontroller chip IC001 needs a 7V line-frequency pulse at pin 51, a 6V sync pulse at pin 36 and an a.f.t. 'dip' at pin 35. We found that the sync pulses were missing because the sync generator transistor Q071 was short-circuit base-to-collector.

When the set is working correctly the voltage at the a.f.t. pin 35 is about 2-3V. If you find that it's 0V C012 (0·01μF) is probably short-circuit. **D.F.**

Sony KVM14TU

The reds flared, giving the impression that the tube was soft. Checks at the tube base showed that the first anode (G2) voltage was low at only 190V. D852 was short-circuit and R852 (680Ω) burnt out. Replacing these items restored the first anode voltage to 880V, producing a normal picture. **D.F.**

Salora K Chassis (Granada C59DZ6)

Parts of the picture would blank out suddenly then return. Putting the set in the text mode proved that it was a luminance fault. Checks on the voltages at the pins of the TDA3562A colour decoder chip showed that the voltage at pin 9 was varying between 0·23V and 1·86V, triggering the chip's internal text switches randomly. We traced the source of the voltage back to the BC547 text blanking transistor T9. Remembering that I'd had this sort of thing before I confidently fitted a new BC547 – but this made no difference. Tracing back farther brought me to an SN74LS74AN chip, also on the text PCB. Voltage checks here indicated that it was the culprit. To prove the point an SN74LS74AN was borrowed temporarily from another set. Fitting this cleared the fault. **G.R.**

M/A/I Basic Four Computer Monitor

The symptom was no raster. After removing the tube to get at the power supply and line scan sections (!) we found that the 110V rail was low at 40V while the 15V rail read 5·5V. R502, a 100kΩ resistor, was badly discoloured but read o.k. C508 (0·22μF, 100V) however had apparently suffered from being in a hot spot. Replacing it brought all the supplies back to the correct levels. Just as well in view of the time spent on dismanlting and reassembling the set – and we didn't have a manual. **G.R.**

Mitsubishi CT25M1TX

The symptoms were horizontal lines on the picture accompanied by a whistling from the power supply. The cure was to replace C956 (2,200μF, 16V). **K.E.F.**

Samsung CI5012/5013

The fault with this set was no sound. After much time had been wasted ordering and fitting a replacement chip in the IC101 position only to find that the fault was still present we finally discovered that C605 (22nF), which is connected to pin 13 of IC101, was leaky at around 25Ω! It's a disc ceramic capacitor. **K.E.F.**

Grundig CUC50 Chassis

The customer insisted that the picture expanded at the top and contracted at the bottom when the set was warm, or was it the other way round? Anyway it ran perfectly for days, so I removed the back and got to work with the hairdryer and freezer. When the end of the TDA2655 field output chip was heated expansion and rolling occurred. It could be cleared by cooling the chip. This wasn't how the customer had described the fault! I replaced the chip but when setting up the field output stage I found the real cause of the problem – as soon as the linearity potentiometer R2766 was touched the fault occurred. The potentiometer was noisy. **N.B.**

Toshiba 2500TB

This was a nasty one. There was chroma patterning from cold: the deeper the saturation the worse the patterning, which also varied tremendously with the setting of the colour level. It was most prevalent in red and blue, and was present with video as well as r.f. inputs. As the set warmed up the fault cleared. There were black lines in the chroma, and diagonal swathes of white bars ran through it all.

As the set was only a couple of months old I contacted Toshiba to check on whether there were any known problems. Indeed there were – the fault can be caused by pick-up from the teletext oscillator, and there's a modification involving replacement of ICF01 and fitting two diodes on the text PCB. But when I looked this had already been done!

Scope checks showed that there was noise on the d.c. colour control line, i.e. at pin 7 of the do-everything chip IC501. The decoupling capacitor C515 (22μF) was found to be very low in value when cold, a replacement curing the fault. **N.B.**

Motorising a Fixed Dish

Ian Martin

Since making the comparison tests on Astra dishes described last month I've been using an 80cm dish and have found that it gives a useful degree of signal improvement here in Gwent. This inspired me to greater things, so I decided to install the 98cm dish I'd also briefly tested and at the same time to motorise it. Fortunately dish manufacturer Lenson Heath makes a polar mount that's designed to fit directly on to the 98cm dish – it can be used with the 80cm dish by adding an adaptor plate. The mount comes complete with pole and actuator brackets.

Dry Run

As I'd not previously installed a polar mount I decided to do a 'dry run' at ground level. I already had some TV aerial mast material welded together to make a simple vertical stand, so this was placed on the flattest part of the patio. It was then checked with a spirit level to ensure that it was vertical. I found that it was slightly out of true – but a copy of *What Satellite?* was just the right thickness to place under one of the legs as a shim. Concrete blocks were used to ensure that the stand didn't move.

At this point I decided to take an unusual course of action – to read the instructions! This was because of my concern about the number of adjustments that might have to be made. Only three are actually required: mount elevation, dish declination angle and dish azimuth. The instructions include tables for all these for latitudes between 28° and 66°N, also an outline map of Europe showing latitude and local magnetic variation. An exploded view of the assembly is provided so that you can see what the finished unit should look like – see Fig. 1.

As the mount itself is already assembled putting the components together is not difficult. It's probably best to start with the pole bracket. This is of the same type as the one supplied with Lenson Heath's latest fixed dishes and is clamped to the pole in the same way. One point worth noting is that this clamp has sufficiently large jaws to fix on to a 1·25 or a 2in. mast. The latter is definitely recommended, as the mount and bracket weigh 4·8kg, excluding the dish. The polar mount can then be offered up to the pole bracket and the two bolted together.

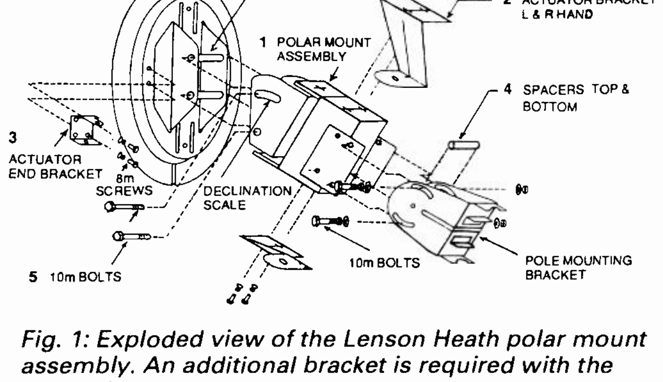


Fig. 1: Exploded view of the Lenson Heath polar mount assembly. An additional bracket is required with the 80cm dish.

At this stage it should be possible, before tightening the bolts, to set the approximate elevation angle. There's a scale embossed on the bracket. At my location the angle is 38°, but a further 15° must be added to take into account the pole mount. This is described in the assembly instructions. The dish and preassembled backing ring (required with the 98cm dish) can then be fitted to the front of the mount and the declination angle set, again by using the tables provided. This leaves only the LNB boom and the actuator brackets to be fitted.

The boom simply slides up and into the backing plate, being held in place by two bolts. The actuator mounting brackets can be assembled in either left- or right-hand configuration, to take into account situations where a wall might obstruct the actuator jack in one or the other position. The moving end of the jack is then attached to the dish backing plate.

Actuator

I used a 12in. Superjack actuator from Supervision. This provides approximately 45° of dish rotation either side of the apex position. As my sample mount has mechanical stops at approximately ±50° this was considered to be adequate. Slightly wider dish movement would be nicer, but there are few satellites that far out and probably few locations where one could see that amount of sky without obstruction.

In setting up the system on the ground I connected the jack to my positioner, a low-cost, unbranded model from Sendz, using heavy-gauge, two-core wire for the motor and two-core, lower-duty cable for the built-in reed sensor. I then retracked the jack fully and clamped it in position lightly before extending it fully and checking the maximum position. The sliding clamp on the body of the jack was tightened to the mount when its mid-position corresponded to the dish's apex position. Quick checks were made to ensure that nothing that should be loose was too tight and vice versa. The jack's maximum and minimum electrical limits were then stored in the positioner's memory.

Dish Alignment

In order to make the final job up the ladder easier I decided to align the dish as best I could on the ground. Although the elevation and declination had been set in accordance with the data sheet, it seemed prudent to confirm this and also to give myself a chance to play with the set-up. I decided that it would be sufficient to check with three satellites, one to the far east, one nearly overhead and one to the far west. Given the limits imposed by the mount and the LNB and feedhorn available this meant Kopernikus at 23·5°E, Intelsat VA F12 at 1°W and Intelsat VI F1 at 27·5°W. I used a Maspro Ku band LNB and a Racal combined feedhorn and polariser.

Fortunately the sun came out just before noon, so it was possible to find true south by centralising the shadow of the LNB on the dish (I still don't have a decent compass). I then drove the dish westwards and quickly found Astra and several Eutelsat craft on my monitoring TV set. By the time that I reached Kopernikus I found that the Arte signal was a little weaker than expected, though it could be improved by increasing the dish elevation very slightly. Similarly the TV Norge signal from Intelsat VA F12 was quite weak until the elevation was increased. This seems to be a reasonable situation as the elevation graduations on the pole mount are a little coarse.

When I was finally happy with the alignment I tightened up all the bolts and positioned the dish at 1°W. I then removed the whole assembly from the patio stand by releasing the pole mount clamps. In theory all the adjustments would remain correct: all that I would have to do on the wall mount would be to realign the azimuth. This turned out to be true.

On the Wall

Getting the mount up on the wall is definitely a two-man job, due to the sheer weight of the assembly, dangling wires and Murphy's Law of gravity and spring washers. Removal of the dish and boom from the backing plate made the job easier – this didn't affect the adjustments. The lengthiest part of the job was to fit the wall bracket securely and ensure that it was truly vertical, then to confirm the alignment and peak the signal, using a carrier-to-noise ratio meter. Sealing all the connections and routing the cables down the wall and into the house came a close second.

In Conclusion

Since I first installed the system I've added a Telecom band LNB, using an orthomode transducer to split the signal. This has proved very successful, as the Telecom signals come in loud and clear albeit in SECAM. Not being able to move the dish by more than ±45° doesn't seem to be a big disadvantage as it spends most of its time directed at Astra, the nearby Eutelsat craft and Telecom 2B. Anyway Lenson Heath tell me that their latest mounts don't have this limitation and will, with an 18in. actuator, cover the whole sky from horizon to horizon.

No doubt professional installers would manage the installation with greater ease. It seems however that with a little planning and a methodical approach the job can be done by anyone in the industry, even if only for their own personal use.

Camcorner

Reports from Ian Bowden, Brian Storm and David C. Woodnott

Panasonic NVG101

This camcorder was reported to be dead. When it was switched on or eject was pressed nothing happened. The cause of the problem was soon traced to the fact that the reset at pin 20 of the system control chip IC6007 was low at 1·5V instead of momentarily dropping to zero then rising to 5V. We suspected the small reset generator chip IC6003 and confirmed that the fault was in this area by removing it from the PCB then, shortly after connecting the battery, connecting pin 20 of IC6007 to the 5V line via a suitable resistor. The machine then attempted to work, but as the PCBs weren't connected to the mechanism it just flashed the power on LED as a warning signal.

A new reset generator chip was fitted but the fault was still present. A check on the resistance between the reset line and chassis produced a reading of 1·5kΩ. When pin 20 of IC6007 was disconnected from the PCB the resistance reading remained the same. The only other component connected to this point is the 0·1μF capacitor C6017 which had developed a leak. With this capacitor loading it down the reset chip couldn't pull the line high enough. **I.B.**

Sony CCDV8

The fault with this machine was loss of playback ATF servo action: the picture would appear then disappear into noise cyclically. A check at output pin 25 of the ATF servo chip IC106 showed a movement of only 200mV from the nominal d.c. level of 2·6V. When we checked around the input and low-pass filter areas of this chip we found that an h.f. signal was present up to pin 8, which appears to be an input to an amplifier stage. But there was only a very low output at pin 12, which feeds the two bandpass filters. An identical signal to that at pin 8 was present at pin 9, which is connected to chassis via the 6·8μF surface-mounted tantalum capacitor C200. This capacitor was open-circuit, a replacement restoring normal operation with a 40mV peak-to-peak input signal at pin 8 of the chip and a 2V peak-to-peak output at pin 12. **I.B.**

Panasonic NVMS4

This was my first glimpse of the new all-singing, all-dancing full-size Panasonic Super VHS camcorder, an imposing beast. But it appeared to have dirty heads. In my experience the cause of a fault like this with a new camcorder is always a duff direct-drive motor assembly. Nevertheless I did try to clean the heads, but to no avail. I also tried replacing the heads, then placed on order a VEG0889 DD motor while I played with all the new and exciting buttons on the camera section! **B.S.**

JVC GR323E

This camcorder had been dropped and wasn't the better for it. The reported fault was 'no functions with a scraping noise'. The cause of the scraping noise could be seen when the case had been removed: the impedance roller/guide assembly was in contact with the upper drum. Once this had been sorted out all functions seemed to work correctly. After the usual checks we reboxed the camcorder and put it on soak test.

All was fine until stop was selected whilst in the play mode: the mechanism then decided to shut down. After several attempts to resume operation had failed, the casing was once more removed. Then, at switch on, all functions had been restored! We noticed that there was a slight nick in the ribbon cable that connects the lower drum to the main PCB. Only one connection was damaged – drum motor Hall effect to the motor drive amplifier. If this connection goes open-circuit whilst in the play mode there is no effect, but when stop is then selected it's impossible to return to the play mode because the drum motor won't rotate. The nick in the ribbon cable had been caused by the fact that the impedance roller assembly tension spring had become detached and had punctured it. To avoid the cost of a replacement lower drum and all the extra work involved the cable was repaired. **D.C.W.**

Sony CCDV88E

The report with this one said that it played and recorded all right but would go into the caution mode after rewinding a tape to its end. All functions remained available if the tape was only partially rewound. Now the caution mode is effectively a shut-down situation, with the caution LED flashing and no user functions available. To restore the functions to the previous state the camcorder has to be switched off then on.

The cause of the problem was an open-circuit cassette LED, D991, which is normally required only for tape-end detection. The fact that it's open-circuit won't be evident until the missing tape-end signal is detected. This differs from the effect that a similar failure would produce in a mains operated machine. **D.C.W.**

Mitsubishi HSC40B

This C format machine has a full-sized drum, with results to match. The fault report was of wow on sound. Sure enough a wow was discernible when we played the relevant JVC test-tape section. A scope check on the audio signal showed that the problem was more of a random change than a regular change of frequency. As a first step we removed and inspected the capstan motor: everything seemed to be in order here – the bearings were o.k. and no sticking or slack-ness was discernible. After refitting this we cleaned the tape path as a precaution and checked the tape path tensions. It was immediately clear that something was wrong in the back-tension department – in fact there wasn't any back tension at all! The tension adjusting screw had become slack, causing the rather unusual symptom. Resetting it to provide the correct tension completely cleared the trouble. We locked the screw with a suitable sealant. **D.C.W.**

Sony CCDTR55E

Playback was fine but there were no camera pictures. This was because the iris return spring had become detached and the vanes were stuck in the closed position. Dismantling the lens unit is quite straightforward, and cleaning and refitting the iris parts is not too time consuming. There are only two vanes to refit: this makes it rather easier than with the three-vane variety whose washers and retaining plate always seem to move out of place at the slightest touch. **D.C.W.**

A Video Monitoring Test Jig

Eugene Trundle

The brown goods servicing business is not getting any easier as time goes by! When a fault is permanently present its cause can usually be located quite quickly using conventional diagnostic techniques, difficult though this can be with complex products – especially those with which you are not familiar.

Intermittent Faults

Many faults are intermittent however, making diagnosis more difficult and less certain. Various methods are used in tackling them. These include bashing the PCBs and components with the handle of a screwdriver, heating and cooling suspect parts cruelly, running the gear on test with diagnostic equipment permanently connected, replacing complete modules, assemblies or PCBs, and various 'political' solutions in which the repair is not actually carried out! Most intermittent faults are eventually resolved in one way or another, though seldom with much profit for the repairer.

The widespread use of system control and protection circuits in consumer electronics products has made tracing the cause of an intermittent fault that much more difficult: we now have the 'beat you to it' factor. A VCR for example will go into the stop mode within seconds of anything untoward happening on the deck or when a sensor hiccups; a TV set will go into the standby mode at the drop of a hat or the passage of a single spark; the screen or loudspeaker will be muted during mistracking or a momentary corruption of the signal or control information; and so on. The classic situation is where a fault crops up once a day, once a week or once a month, and when it does you've got anything from a few milliseconds to four whole seconds to make a diagnosis, after which the symptom is automatically removed, perhaps not to reappear for another two days when you've got another split-second diagnostic window.

Similar frustrations occur with some other types of fault – the TV set whose screen flashes blue for a second at rare intervals, the VCR whose capstan speed throws a wobbly once a day, and the set with a little crackle from the loudspeaker now and again, whose sound has been booming from the set uninterruptedly for a week, shattering the concentration and composure of a whole roomful of technicians.

You can't sit watching or listening to these rogues all day, every day, waiting to pounce with your little meter or beady eye. Experience, guesswork and trial-and-error are the order of the day, except sometimes with those wonderful machines that have built-in, latching self-diagnostic systems to give a readout of whodunnit, or at least who might have dunnit.

Enter the Camera

Over the years we've devised various electronic traps and gizmos to help in tracking down the causes of such faults, with varying degrees of success. Currently we are using a TV camera and VCR that watch the equipment under test, recording for as many hours (or days) as necessary. We can then play back the recorded pictures, and sound where relevant, and obtain an action replay of the transient event.

The camera usually looks at test equipment (a meter, oscilloscope or whatever) as well as the screen of the TV set, see Fig. 1, or the deck of the catch-you-napping VCR, see Fig. 2. The basic idea is that you record not only the momentary fault symptom but also readings of the circuit conditions, control line state or whatever at the instant of, or just prior to, the occurrence of the fault. In many cases the tests are progressive, narrowing down the field of search with each new recording and test set-up.

Some Case Histories

Here are some recent workshop examples. A VCR came to us after having been to two other repairers. The problem was that the deck would stop running on random occasions: sometimes it would run for weeks without any trouble. The reel motor and a couple of chips had been replaced. We trained the camera on the deck from above and were able to record the fact that the tape, both spools, the drum and the capstan all kept moving right up to the moment when the machine unlaced to stop. An oscilloscope was next connected to the microcomputer control chip's reel sensor and drum flip-flop inputs: this time the camera was used to

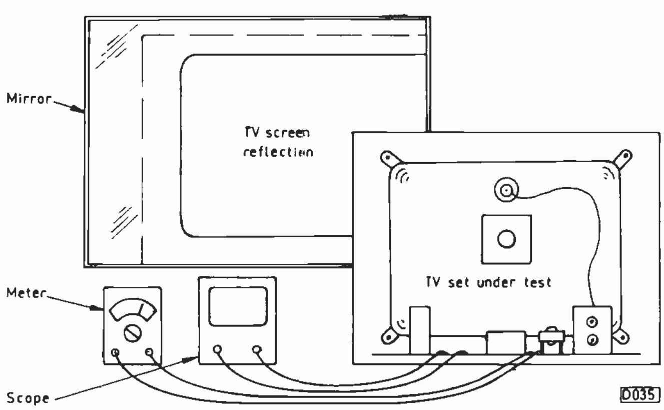


Fig. 1: Test set-up for surveillance of intermittent TV faults. With the TV set facing the same way as the camera, test connections are easily made and changed. For best definition of the scope's screen and the meter's scale, zoom in to get the test gear and part of the mirror image in the frame.

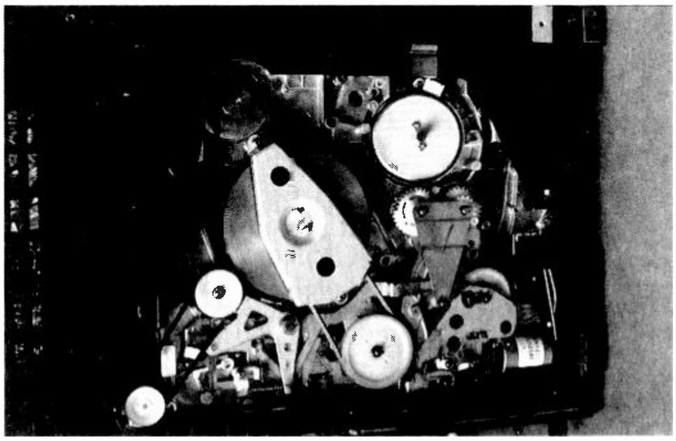


Fig. 2: Camera-eye view of the mechanics of a VCR deck, showing all the rotating items.

monitor the deck and the screen of the oscilloscope. Just before the auto-stop action the reel pulses were seen to jitter, get up and lie down. We d.c.-coupled the scope to monitor the supply to the Hall sensor under the spool. This showed that the supply failed intermittently. The scope's second trace showed that the voltage at the main PCB remained steady. The cause of the problem was then soon traced to a badly crimped wire in a socket. Similar symptoms and start points in other VCRs have led us with certainty to faulty mode switches, motors, chips etc.

A TV set's field scan would occasionally collapse for a second or two: we were unable to instigate the fault by employing the usual means. Two or three progressive tests with the camera and an oscilloscope showed that one of the field output transistors was going open-circuit base-to-emitter to cause the fault.

Another TV set went into the standby mode at rare and random intervals, accompanied by a 'snick' noise that could well have been a spark. But where? In the tube itself? On the chassis, the tube base or at the focus potentiometer? The camera was used to take a broad view of the back of the TV set whilst it was working in low ambient light. Three hours later there was a little click and the set shut down. We rewound the tape and played it, with three technicians as observers. Sure enough a spark could be clearly seen in the action replay. It left from the casing of the dioe-split line output transformer to the adjacent metal frame. In went a new transformer, with an assurance to the customer that there would be no further trouble. The observation set-up had notched up another stripe!

A satellite TV receiver had a funny turn now and again, producing heavy sparklies on some channels only then reverting to normal operation almost before you could blink. Assaults with heat and freezer and screwdriver handles didn't have the slightest effect. Ordinarily we might have replaced the very expensive tuner/demodulator module and carried on testing. Camera recordings however showed that the trouble was in the power supply section, where the LNB polarising/d.c. supply voltage would dip monentarily. A regulator chip was the cause of the problem. Fig. 3 shows a typical test set-up for checking an intermittent TV tuner.

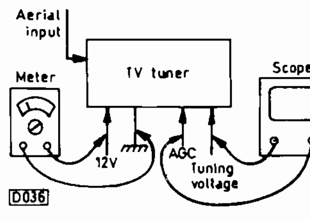
There are many other examples I could quote to show how effective the system is: those quoted above indicate its usefulness in several quite different situations.

Fig. 4 shows how voltage and current can be monitored simultaneously. Fig. 5 shows a simple 60dB attenuator for feeding TV sound into the microphone socket of a camcorder for continuous (and quiet) checks on TV sound systems.

Camcorders sometimes develop intermittent faults in their lens and lens-drive systems. A simple arrangement for continuous testing of camera optical functions is suggested in Fig. 6. W. Heath Robinson would have liked this one!

What You Need

You wouldn't of course want to spend the best part of a thousand pounds on a posh camcorder for this application – though it works very well if you do! The types of camera you can press into service for this application are many and various – and necessarily cheap. For example CCTV security/surveillance cameras bought from liquidation sales of bankrupt retail shops etc.; commercial VHS or Video-8 camcorders that have been damaged or written off because of deck faults, upper drum failure or whatever; bad debt and uncollected camcorder repair jobs; cameras/camcorders that have been traded in by customers who are updating their gear; or secondhand video cameras/camcorders bought for



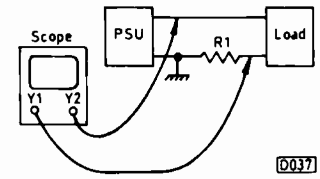


Fig. 3 (left): Test gear arrangement for a TV set whose signals disappear spasmodically. The scope must be d.c.-coupled and the surveillance camera needs a simultaneous view of the TV set's screen.

Fig. 4 (right): By breaking the earth-return circuit and inserting an 0·5 or 1Ω resistor, the current and voltage can be monitored simultaneously using the two traces of a d.c.-coupled scope. This set-up can be used to establish whether the cause of a picture-size fault is in the power supply or the line output stage for example. The load could be a VCR motor and the PSU its drive circuit; or various other arrangements can be used as circumstances demand. The voltage at the scope's Y1 input is proportional to the current in the load: with R1 0·5Ω the proportion is 500mV per Amp.

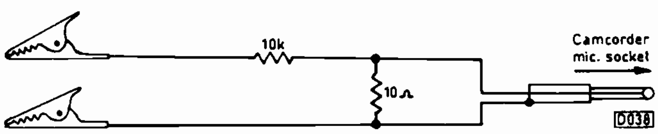


Fig. 5 : An easy to make resistor attenuator to match the loudspeaker feed of a TV set to the external microphone socket of a camcorder or camera. Long, flexible leads with crocodile clips are connected to the set's speaker tags.

the purpose – many are advertised in the classified for sale columns of *What Video?* magazine each month. Nor does the picture have to be a colour one. For most applications, including all the examples previously described, a black-and-white system is perfectly adequate. Indeed unless you need colour, for instance when checking certain TV picture faults, it's best to turn the colour off so as not to muddy the results. Cheap monochrome TV surveillance systems can thus be used, also outdated tube-type consumer TV cameras that are worn to the point where they produce sickly, useless colour but perfectly acceptable monochrome pictures.

Even when the camera is part of a fully-operational camcorder it's probably best to use a separate home-deck type VCR to record the pictures. Camcorders have limited playing time, with small cassettes, and the mechanics might not be up to recording all day, every day. Other disadvantages can be poor search and replay still-frame images, and often a relatively long rewind time. So keep the camcorder in the E-E mode, even if it means carrying out a modification to defeat the time-out feature on some models.

The VCR used for soak test recordings can be any old sort, from a redundant 3V23 to a reliable Beta-format banger (the video heads on the Sanyo 5000 series machines seem to be immune from wear!) or a bad-looking second-hand stock machine with a duff tuner. Use a three-hour tape and, unless you need especially sharp pictures and good sound, consider using the LP mode if the machine has this. Features worth looking for are fast picture search (cue/review), good trick-play operation and a clear freeze-frame picture – the latter two usually go hand-in-hand, and many old-time machines are suitable in this respect. Ingenious technicians may find a way of modifying some models to obtain continuous record/playback cycling until the machine is manually interrupted by use of the stop key.

As we've seen, in most cases the camera will monitor test readings as well as the equipment being checked. The meter used doesn't have to be super-accurate or sensitive to register such things as the cessation of motor current or the rise in a supply-line voltage when a picture expands. Similarly you don't need a 50MHz dual-trace scope to monitor a drum FG signal or a video waveform. That old analogue meter with the cracked glass, the narrowband scope with a low-emission tube and the Avo 7 with which you started your servicing career can all be dusted off and pressed into service. Bear in mind however that the quickest-acting voltmeter is a d.c.-coupled scope. Depending on the application and circumstances, you might find that the digits of a digital meter are still flickering when it's all over – even the pointer of an analogue meter takes a second or so to settle down. That's twenty five or more crucial TV frames if your surveillance recorder has a still-frame advance facility. . .

Setting Up

Unless you have very little space it's best to leave the camera, recorder and monitor permanently set up on a spare bench or corner ready for whatever VCR or TV set may need the facility. Use of an ordinary floor-standing tripod for the camera virtually guarantees that it will get knocked over sooner or later, so use a clamp or sucker-mount to fix it to a wall or shelf – several types are available from video accessory shops. You need the type that enables the camera to be panned, tilted and clamped in any position.

The surveillance bench needs to be large enough to take big TV sets. When recording off-tape pictures you'll need a small-screen TV set to act as a monitor in addition to the one in the test rig. Once again neither need be new, good-looking or sophisticated models, nor does it matter if their screens are scratched, their tubes down a bit or the cabinets tatty!

A high lighting level is seldom required, especially when a scope is being used as part of the televised set up. Normal room lighting is usually adequate unless you need a large depth of focus to cover for example a tape deck, a monitor and a couple of pieces of test equipment all at once. Always exhaust all the possibilities of camera position and lens setting before turning the lighting up to a high level. A small fluorescent or tungsten bench lamp in an Anglepoise-type holder or goose-neck stem is normally adequate for this application.

Some of the rotating parts of a VCR are virtually plain discs whose motion can be difficult to discern during play-

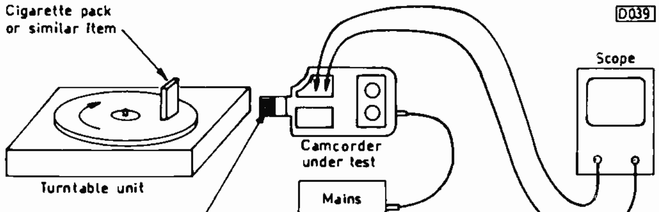


Fig. 6: An old phono deck pressed into service to rotate a cigarette packet or whatever (use the slowest possible speed) to activate the auto-focus system of a camcorder continuously while a scope monitors the lens motor drive and sensor output. By using a white card whose rear surface is matt black the same jig can be used to monitor at length the operation of the auto-iris servo loop. It may be necessary to modify the turntable drive system to get a sufficiently slow speed.

back of the camera's pictures. Make it visible by dabbing the disc, flywheel, clutch or whatever with a marker pen or a paper sticker. For easy sighting use a cassette whose reels have 'flags' on them.

Many tests involve monitoring the conditions at an i.c. pin, often one of a microcontroller chip's pins. To make a reliable test point, solder a short stub of thin (22 gauge) solder direct to the i.c.'s pin – beware of static discharge – and connect the test probe to this stub.

Now that we've ventured into the realms of microcontrollers, another useful feature of the camera-watching approach can be mentioned. You can use the technique to monitor data, control and remote-control preamplifier output lines continuously – where the causes and effects of noise or momentary errors can turn you grey! For serial control lines like an I2C bus you need only a double-beam scope. For parallel data lines a multi-trace generator such as the one featured on the May 1986 cover of *Television* must be used.

Interpreting Symptoms

As I hope I've by now made clear the system as described is a very powerful tool in dealing with most types of intermittent fault. Even so it doesn't itself provide the diagnosis, any more than a doctor's stethoscope or a test meter does. Basically what it does is to take out the waiting and watching period, presenting the symptoms and readings in a clear, repeatable and unambiguous form. The clever bit is to interpret the results you see and to change the tests or the camera viewpoint progressively to narrow down the field of search and pursue the trail to a cast-iron conclusion. In doing this some simulation tests on the equipment will provide useful clues: noting how many seconds the syscon of a VCR takes to initiate shutdown after a pulse feed vanishes: whether disconnecting one data line or one mode switch wire gives the same effect that you saw in the surveillance replay; and determining which of two near-simultaneous events is the cause and which the effect for example.

With the symptom, effect and test readings frozen in time on a TV screen you don't get the suck-it-and-see element possible with a permanent live fault, so your interpretation of the results has to be logical. Maybe we shall one day be sending wish-you-were-here video cassettes to those poor souls at setmakers' technical liaison offices, with instructions to hit the pause button at 2 hours, 23 minutes 14 seconds or whatever! I can remember when the majority of intermittent TV faults could be cured by cleaning the tuner contacts or squirting jungle juice into all the valveholder sockets.

Toil and Trouble

At first sight the whole idea might seem rather like overkill, and a few years ago it would have been in terms of its expense and relatively rare application. Now however, with the ready availability of video camera gear and VCRs and the increasing incidence of horrible intermittent faults in all types of electronic equipment, it's my belief that setting up a video monitoring jig is well worthwhile in a busy workshop that has a high throughput and a good name to maintain. It doesn't have to cost a fortune, and there is tremendous satisfaction in being able to diagnose with certainty the causes of faults in equipment that might otherwise take root on soak-test benches, and then have to be returned to the customer with crossed fingers and big question marks over the set, the bill – and your reputation!

Teletopics

BT LAUNCHES VIDEOPHONE

British Telecom launched the UK's first home videophone, the Relate 2000, at the recent Ideal Home Exhibition. The unit works like a normal phone and plugs into a standard telephone socket, the differences being the inclusion of a small video camera and a three-inch colour LCD screen to enable users to see each other. The sound and picture are transmitted simultaneously, calls being charged at the normal rates. GEC Marconi designed and manufacture the units, which use the company's M-VTS technology. This converts the picture to digital form then compresses the digitised video to enable it to be sent via standard analogue telephone circuits. There are two modem rates, 14·4kbits/sec giving a frame of ten per second and 9·6kbits/sec for displaying a still image. With the low frame rate some blurring is inevitable when movement is present, and the image can lag the speech by up to about a tenth of a second.

A self-view facility enables users to check their appearance, and there's a picture-in-picture facility. The user can switch off the video part of the unit. Although there's at present no international standard for videophones that use analogue networks, BT says that by the end of the year it will be possible to make video calls to the USA, Japan, Hong Kong and Singapore. The Relate 2000 is being sold in BT phone shops and Dixons stores at £399 a unit or £749 for a pair.

While GEC Marconi videotelephones are being distributed in the USA there is also a non-compatible system developed by AT&T in use there.

AMSTRAD'S PEN PAD

Amstrad has launched the world's first Personal Digital Assistant, a held-held electronic organiser that has a pen-driven interface. The Pen Pad weighs less than a pound and is to sell for £300 including VAT. It includes 128Kbytes of memory, which can be expanded to 2Mbytes by using a standard memory card. A three-chip processing system is used. The Pen Pal was designed by Amstrad and is being manufactured by the company in China. It comes with built-in applications such as a diary, address/telephone book and calculator. Use involves menus and writing on a pressure-sensitive pad – the user has to train the Pen Pal to recognise his separately written letters (cursive handwriting is not recognised).

NARM

A number of new DCC products were shown at the National Association of Record Merchandisers (NARM) convention in Orlando, Florida, early March. Philips unveiled its first DCC personal stereo, Model DCC130. Its features include a twelve-character illuminated LCD screen with scrolling facility, a three-position dynamic bass boost (DBB) system and an optical digital output socket. Power is from the mains or rechargeable Nicad batteries that provide a playing time of up to two hours. Price is $549 (about £390). Panasonic showed its RQDP7 portable DCC player that includes wired remote control, Dolby B for analogue tapes and has the same price tag. Philips also demonstrated its DCC Slide Show system which stores large amounts of information in the sub-code track. It's designed to present text on a TV screen – up to 250 pages of text (each comprising 21 lines of 40 characters) can be stored. The display looks like teletext and can consist of track and time information, lyrics and details of the artist. For the demonstration Philips fed digital signals from a DCC deck to an external adaptor, but future DCC machines will have a built-in adaptor and a video output socket.

Sony showed its first table-top Mini Disc player/recorder, Model ZSM1, whose features include an a.m./f.m. tuner with 24 presets and remote control. Price, when it goes on sale in the USA this summer, will be around $900 (£640). Sony has started to sell a five-chip Mini Disc set to enable other manufacturers to produce recorder/players.

Sharp showed two Mini Disc personal stereo players, Models MDD10 and MDS10. Both have a scrolling LCD display and an X-bass booster system. The Nicad battery provides a playback time of about 100 minutes. Prices are $549 (£390) and $599 (£430) respectively – the S10 has a headphone lead with a remote control unit attached to it.

No UK launch dates have been announced for any of these products.

CD-I UPDATE

According to Philips around 100,000 CD-I players have been sold worldwide to date, 50,000 in the USA, 40,000 in Europe and 10,000 in the rest of the world. The company expects the figure to double this year and treble in 1994, giving a base figure of 600,000 machines. During May-December 1992 some 10-12,000 decks were sold in the UK along with 120,000 discs.

Philips has also announced that full-motion video (FMV) cartridges will be available in September/October. They will incorporate in addition a memory chipset to enhance CD-I player performance. Price is expected to be around £200. Philips intends to launch five FMV interactive movies this autumn.

SEGA'S CD-ROM

Sega has launched a CD-ROM add-on for its MegaDrive 16-bit games system. Known as Mega CD the add-on unit contains a Motorola 68000 processor that operates at a clock rate of 12·5MHz. The MegaDrive games console plugs into the CD-ROM unit, playing games and music CDs. Sega says that 36 CD-ROM games will be launched in the UK this year. Mega CD gosts £270.

SATELLITE TV

Five transponders on the Astra 1C satellite have been leased so far. Services include Discovery Channel Europe, Filmnet and an expanded Children's Channel. RTL 2 is now transmitting a general entertainment service via Eutelsat II F1's superbeam transponder 21 (11·095GHz, horizontal): the satellite now has 14 TV and ten radio channels.

Pace Micro Technology, Europe's largest satellite TV manufacturer, is at present producing some 80,000 receivers a month. The company has announced a pre-tax profit of £5·8m for the six months to the end of February on turnover of £40m.

CABLE MUSIC SYSTEM REACHES EUROPE

The American company International Cablecasting Technologies has announced that its Digital Music Express (DMX) music cable service is to be extended to Europe. DMX is a non-stop, 24-hour service that offers the user thirty channels of CD-quality music. There are no adverts, jingles or announcements. A large remote control handset called a DMX-DJ is used for channel selection: it has an LCD screen that displays the artist's name, the title and record label information. Over 300 cable systems carry DMX in the USA, the system being available in some ten million homes. The channels offer a wide range of music including pop, classical, jazz and country. Cable franchise operator Telewest and BSkyB will be the first British companies to offer DMX. Subscription is expected to cost around £10 a month.

IN BRIEF

The UK's mains voltage will be reduced to 230V from 1995 as part of a move to a common supply voltage throughout the European Community.

Antex (Electronics) Ltd., 2 Westbridge Industrial Estate, Tavistock, Devon PL19 8DE (0822 613 565) has introduced a range of three new desoldering pumps. The Conductive is for use where static protection is essential; the Pro, with a large suction volume and a conductive tip, is for standard production rework; the low-cost Mini is intended for low volume or hobbyist use.

HS Publications, 7 Epping Close, Derby DE3 4HR (0332 513 399) has published a new catalogue listing DX-TV equipment and technical publications, including video cassettes on vintage TV subjects. Send three first class stamps or three IRCs for a copy. Also just published is the third edition of *This is BBC-TV – The First 30 Years of Television Graphics*. Price is £4.95 plus 85p post and packing in the UK (£1.20 world-wide air mail).

Our thanks to advertisers Teleprice and Besco who donated prizes for Red Nose charity draws: Teleprice donated a portable TV set as first prize, Besco a VCR as second prize.

EXHIBITIONS

The 1993 Berlin Radio show will be held on August 27th-September 5th: display space has been increased to 100,000 square metres.

The National Vintage Communications Fair 1993 will be held at the National Exhibition Centre (Pavilions Hall), Birmingham on Sunday May 16th. Admission is £3 and the fair will be open from 10.30 a.m. to 5 p.m. For further details contact Jonathan Hill, 2-4 Brook Street, Bampton, Devon EX16 9LY (0398 331 532).

Letters

TECHNICAL ADVICE

I have just phoned the Sony Technical Enquiries line for assistance in solving a sticky problem with a Sony colour TV set only to be told that as I'm not a Sony account holder they cannot provide any technical advice of any nature. I find this most unsatisfactory and think that it's a very high-handed attitude.

In the past the servicing trade was always one in which there was a sort of comradeship between fellow service technicians. Those employed by manufacturers were only too glad to discuss any problem, however trivial, encountered with their firms' products. They had a certain pride in being able to pass on any useful tips that might help to get a repair satisfactorily completed. It also helped to uphold brand image if products could be speedily and efficiently repaired by local service shops. Indeed Sony was and remains a brand that's held in high esteem by many of my customers.

Sadly it seems that in this day and age of the multicorporation all this counts for nothing. I was told to take the offending TV set to the nearest Sony agent: it was implied that because I'm not an approved Sony technician I cannot be given information or be qualified to carry out a repair. I find this offensive, having been in the trade all my working life and gained all the relevant servicing qualifications.

So Sony agents and their engineers are something very special. They must be, because the prices our local Sony agent charges are way over the top. That's what the average customer comes to me!

In addition to servicing I run a small retail shop. Ironically, I do sell various Sony products which I buy through a local wholesaler. I am now wondering what I should do if one of these products presents a technical problem in the future. It's going to look very bad if I can't offer my customers an efficient service.

Grundig operate a similar policy of non-cooperation with smaller dealers. Just how many multicorporations are going down this road? Perhaps we small TV shops are a nuisance to these corporations. After all we frequently repair examples of their products that they would consider long past their 'use by' date, thus reducing the sale of new goods.

Oh for the friendly voice of the man at Thorn who always knew the answer and always said "it was a pleasure to be of assistance". Sadly no more!

Peter Murchison,
Salisbury, Wilts.

TRANSFORMER THERMAL FUSES

In view of the extensive coverage of electrical safety in your pages I was concerned to read in VCR Clinic (March, under the heading Ferguson 3V35/JVC HRD120) about how a thermal fuse internal to the transformer structure had been bypassed in order to "save the cost of a new transformer". Mains transformers are normally designated safety components, which means that they should be replaced with only the correct original type, also that they shouldn't be altered or modified in any way.

For a fuse to be reliable with transformer-input equipment, or any similar inductive load, it must be a time-delay type – in order to absorb the in-rush current associated with this kind of load. If a 'straight' fuse is used it will fail before long due to fuse-wire metal fatigue, caused by the bending that occurs at switch on.

In addition to the need to use a T-rated fuse it's important to realise that the long-term rupture current of such a fuse can be typically ten times the rated 'instantaneous' rupture current – which in the case of a time-delay fuse isn't instantaneous anyway. Even with a straight fuse the long-term rupture current is several times the rated value.

This means that in the event of an overload on the secondary side of the transformer, possibly as a result of shorted turns within it, a primary current of potentially some 2·5A could flow before the 250mA external fuse fitted would blow. It's in fact more likely that core saturation of the transformer would take over before this, limiting the current to well under what the fuse requires to blow it.

Even assuming that 1A could flow, this still represents 240W dissipation in the transformer (not strictly true because of out-of-phase components, but near enough to be alarming). Protection against such an eventuality is the whole purpose of using a thermal fuse.

I had a real case on the day that I read of the 'fix' – it was this that prompted me to write. In my case there was an external fuse on the secondary side of the transformer. The item concerned was a cordless telephone that was dead because of an open-circuit thermal fuse in series with the mains transformer's primary winding. A new transformer was fitted and the phone was repowered. As life was not restored further investigation was required. In the short time that the equipment had been on – no more than about 45 seconds – the transformer's core had already reached a temperature noticeably higher than normal. A quick current check after the phone had cooled down revealed a secondary current flow in excess of 1·5A. The secondary fuse, a straight type rated at 1A, stood up to this quite happily. But of course the thermal fuse in the transformer didn't.

In a case like this if the parts required are either not available or prohibitively expensive the equipment really must be committed to the scrap pile.

Geoff R. Darby, Proprietor, Monitech,
Earls Barton, Northampton.

NIKKAI BABY 10

On page 351 of the March issue Chris Avis suggests the use of an RS device to replace the '12V regulator' IC402 in the Nikkai Baby 10. I too had several of these sets awaiting delivery of the AL2411 regulator. Measurements carried out with a working set showed that the output from this hybrid device is in fact 10·4V, not 12V. The suggested modification could result in R127, R207, R208, R362, R411 and the line output stage being overloaded. The genuine part is now available from HRS.

L. Mackenzie, T.Eng.,
Edinburgh.

BACK INJURY

We now know of more than a dozen engineers who, like us, are suing for compensation for back injuries caused by lifting heavy TV sets. Anyone thinking of doing this can get in touch with us for advice. In doing so please state the company you worked for when the injury was sustained, whether the accident/incident was entered in an accident book, whether the problem was mentioned to management, whether you are a member of the EEPTU and whether there are lifting aids at your place of work. If you want something done, help us to help you.

Harry and Pam Todd,
37 Northdene, Chigwell, Essex IG7 5JS.
Telephone 081 500 1433.

AM RADIO RECEIVERS

There were one or two errors in the circuit diagrams that accompanied Part 2 of the article on repairing LED clock radios (April). In Fig. 8 the MW pole of the aerial wavechange switch should be connected to chassis. In Fig. 9 the stator of the oscillator tuning capacitor and the items connected to it should be connected to chassis while VR1 and VR2 should be VC1 and VC2.

Aerial 'padders' CT1 and CT2 should properly be called trimmers. Padding needed to ensure that the aerial and oscillator tuned circuits, with their different frequency ranges, track is provided by the 150pF capacitor.

Standard alignment practice is to set the signal generator to 600kHz, adjust the oscillator dust core and aerial coil for maximum output, then reset the signal generator to 1,500kHz and adjust the MW oscillator and aerial trimmers for maximum output, repeating both operations for optimum results.

No padding adjustment is provided on LW operation. So the signal generator is set to 150kHz and the aerial coil is adjusted for maximum output. The signal generator is then set to 300kHz and the LW oscillator and aerial trimmers are peaked. Repeat the process for optimum results. Sets that don't have the luxury of LW trimmers should have the LW aerial coil adjusted at 220kHz.

I intend to cover radio alignment more extensively in my Browsing with Bruce feature in a future issue of *The Radiophile*.

Bruce Adams,
Halesowen, West Midlands.

AMSTRAD SRX2000 MODIFICATION

Other readers may be interested in a cheap modification I recently carried out with my Amstrad SRX200 satellite TV receiver. I am very interested in the radio stations available from Astra, but the SRX200 doesn't cater for those that use the 7·74/7·92MHz subcarriers. The modification gives reception of these stations.

The receiver uses a crystal mixer circuit, with 10·7 and 10·52MHz ceramic filters to select the stereo subcarrier pair. The crystals are very accessible, on a small subpanel. I removed the top, 18·08MHz audio-2 crystal and soldered two thin wires to where it had been fitted. These wires were taken outside the case through the nearest slot. I then had an 18·44MHz crystal made, and etched a small PCB to take the original and the new crystal plus a small PCB-mounted two-pole signal push-switch from Maplin. The crystals were connected to the outer switch contacts, the centre contacts being connected to the original 18·08MHz crystal position.

This modification gives me perfect stereo reception of RTL, Radio 538, Radio RMF, Radio Eviva etc. The small PCB sits on top of the receiver's case, operation of the switch bringing audio 2 from either 7·38/7·56MHz or 7·74/7·92MHz. As I'm interested in only Astra at present, the modification has saved me the cost of upgrading to a new receiver or carrying out the alternative, more complex modifications that are mainly for multi-satellite reception.

J. Outen,
Grays, Essex.

COWBOYS

I would like to add my views to the on-going correspondence about dealers and cowboys.

It is a fact that the chap without formal qualifications can often do the job as well as someone with a gallery of qualifications on the workshop wall. What makes me angry however is when the question of costs is overlooked.

In my experience the 'average cowboy' works from home or low-cost premises and very often supplements his basic day-to-day income by doing repairs 'on the side'. He has a pile of scrap chassis as his spares supply and is able to be choosy about which repairs he undertakes. He is probably not VAT registered and has no employees.

Conversely the high street Repair Centre has a never-ending list of costs relating to its trade. Premises, heat and light, wages, vehicles etc. are not cheap, and it's essential that first-class repairs are carried out to maintain the reputation of the firm and the livelihoods of all involved. In striving to give the customer the best service it's not possible to make jobs cheaper by using second-hand spares etc., while costs mount because of the need to maintain reception areas, invest in test equipment and even in clothing. These are often required to meet the criteria of manufacturers whom the business represents as their agent.

So when L.J. Pitts suggests (April) that dealers should charge an honest rate and clean up their acts, he should consider the fact that the majority of them do charge quite reasonable rates bearing in mind their break-even points.

The cost of running a dedicated Service Centre is becoming higher and higher. Although I recognise that there are many good engineers out there classed as 'cowboys', maybe the smaller operator shouldn't be quite so quick to write off the larger Service Centres as rip-off merchants. I don't wish to belittle the engineer who really does do a good job working from smaller premises etc. All I would ask is that some consideration is given to the larger Service Centres who, in their quest for excellence, naturally incur extra costs.

If the smaller operator believes he's not a cowboy I feel that he's going to have show the world he's a true professional by joining the ranks of respected dealers and help stamp out the real gutter-repairers who are wrecking customers' perception of our trade and treading on the toes of both the 'big boys' and the 'quality cowboys'!

J.G. Jones, TV Masters,
Northampton.

I would like to add my own perspective to the controversy over cowboys.

Not every 'unqualified' person who repairs electronic equipment is a cowboy and not every 'qualified' person is competent. Take the example of someone who qualified in the Seventies. Colour TV sets still used valves, video and teletext were still in their infancy, and satellite TV belonged to the broadcasters. How does someone who qualified then cope with today's scene? The pace of change is so fast. Will his employers have sent him on update courses? I suspect that they often won't have done so. If self-employed, has he had the time and money to attend courses? This is even less likely. So is he 'qualified' or a 'cowboy'?

I didn't qualify formally in the late Sixties/early Seventies. I taught myself. With the aid of some prior knowledge, your excellent magazine, various books and a great collection of old 'box' TVs to practise on I eventually reached the point where I could handle a respectably high percentage of repairs and went into business. By the end of the decade other dealers were sending me their repairs.

I subsequently spent four years working as a technician with a Japanese TV manufacturer in South Wales, being involved in the production of a thousand sets a day.

Family bereavement led to a move to West Wales and the prospect of 'private practice' again. The change in the TV repair scene over those four years (1980-84) was staggering. The plethora of additional audio-visual gear – videos, camcorders, CD players etc. – was mind-boggling. Even to tool up with circuit data, spares and so on would cost a mint. I therefore confine myself to handling those items I feel comfortable with and can service properly. Satellite gear apart, I turn the exotica away.

The essence of the matter lies in personal honesty. Who, these days, with such a wide range of equipment out there can say that he's 'qualified'? The need to specialise is inescapable.

The high street trade is bedevilled with problems. Overheads are colossal while policies are dictated by accountants and implemented by mendacious salesmen. Engineers are hidden away in the back room. Under such a regime charges will inevitably be high. A local dealer here charges £25 just to come and have a look at your set. He doesn't really want to do repairs, and will readily pronounce a set unserviceable. His salesmen will be delighted to 'assist' you in the choice of a replacement. You still owe the £25.

In such a situation there's a window of opportunity for repairs to be done to lower-value equipment by those who don't aspire to state-of-the-art qualifications and are honest with their customers as to what they can and cannot handle. Such folk don't merit the title of 'cowboys'.

Philip Lane,
Dyfed, West Wales.

HELP WANTED

Can anyone supply the following transistors: RCA 40406, 40407, 40408, 1A03 (equivalent 40594) and 1A04 (equivalent 40595)? P. Perkins, 13 Bridge Farm Close, Woodchurch, Wirral, Merseyside L49 9DD. 051 678 6489.

Wanted: A remote control handset for the Nokia 1100/Salora S902 satellite TV receiver, also a circuit diagram for the Luxor Mk 2 satellite TV receiver. R Baker, 17 Chapel Lane, Upwey, Weymouth, Dorset DT3 5NA. 0305 208 815.

Wanted: Service manual (or photocopy) for the NordMende 1434 colour portable (F10/11 chassis), also help with removing teletext interference with the Ferguson 3638 (960 chassis). Harry Mellor, Gatesgarth, Back Lane, Airton, Skipton, N. Yorkshire BD23 4AL. 0729 830 417.

Could someone supply one or two 20in. G11s, in any condition? A suitable price would be paid. M.J. Levy, 19 Totternhoe Close, Kenton, Harrow, Middx HA3 0HS. 081 907 3620.

Wanted: a new or good second-hand front panel assembly for the Hitachi VT33E VCR. E. Longton, HTVR, Unit 10, Croft Court, Butts Road, Thornton Cleveleys, Lancashire FY5 4JX. 0253 826 205.

Can anyone provide assistance with a Mader 4 or 5in., 12V colour TV set with radio – there's a picture but no sound. Alternatively does anyone know the set's manufacturer or importer? R. Devito, Ashleigh, Sealolme Road, Mablethorpe, Lincs LN12 2AP.

Can anyone supply a CV345 valve? John R. Taylor, 14 Lastigar, Westray, Orkney KW17 2DJ. 085 77 235.

Wanted: circuit diagram (photocopy will do) for the Binatone Royal clock radio Model 01 6217H – the one required as an LM5402N chip and three transistors on the panel. H. Wild, 32 Swanage Road, Winton, Nr. Eccles, Manchester M30 8NJ. 061 789 8320.

Wanted: line output transformer for the Hinari CT15 or VTV200. M. Stevenson, 124 Green Lane, Eastwood, Essex SS9 5QJ. 0702 522 929.

Wanted: working video head drum assembly for the Philips N1500/N1700 VCRs, also if possible the eddybrake disc and pulley that fits on to the shaft on the underside of the lower drum assembly. R. Lewis, 50 Redstone Avenue, Kilwinning, Ayrshire KA13 7JG. 0294 52 383.

It's only the on-off switch

Steve Cannon

We've all had it many times. The customer says his set is dead and for some reason thinks that the on-off switch is the only item that could cause the fault. Oh, on second thoughts the tube is also a favourite. Mind you the fault could be anything from no sound to field collapse and the customer will still come out with "I think it's the tube that's gone". I suppose they like to give the impression that they know something about the innards of a TV set.

In the days of those large things with bits of wire in them, valves they were called, everyone and his brother liked to think that they know what was causing the fault. In many cases they were right. "I think it's the valve that's gone" could be heard at every call-out. Even now some customers believe that a valve could be at fault in their six-months old, Nicam, Fastext, 28in. FST state-of-the-art TV set.

You can think yourself lucky if the on-off switch does just happen to be the cause of a dead set with modern TV receivers. Even though the on-off switch is the most often and forcefully used electromechanical part of a TV set, its reliability has definitely improved. With most brands anyway. These days if a set is dead and the mains fuse has blasted it's far more common for your test meter to read a short-circuit across the chopper transistor. But what about the sets that just don't want to be switched on; the ones where you know you might as well get the fuse drawer out and bring it over to the set; the ones where it seems that nothing will ever get the set up and running?

An Hitachi CPT2598

The first set in this series of posers was an Hitachi CPT2598 (G8Q chassis). I had a sneaky feeling that this one was going to be nasty. After removing the back this suspicion was confirmed – the mains fuse was severely blackened. That could mean only one thing: replace most of the silicon in the power supply. Not a job for monday morning, but it had to be done.

This one had really taken a hammering. The top of the chopper control chip IC901 had gone walkabout and most of the power supply semiconductor devices, including the two series-connected chopper transistors Q901 (a f.e.t. device) and Q902, were short-circuit. The usual cause of this mayhem is the small, white posistor TH902. It's in the power supply's start-up circuit, coupling the rectified mains supply to a 27V zener diode (ZD901) and IC901. The problem is that it can track through. Thus most of the components in the power supply get a whopping 350V d.c. applied to them. Well something's got to give, ain't it?!

It appeared that TH902 wasn't the cause of the fault this time however. Sure the power supply needed a rebuild, but the posistor was of the improved blue type. This hasn't given us any grief, touch wood. We replaced it however, just in case, along with the other items that usually suffer in this situation: ZD901 (27V zener diode), D902 (BYD33D), C908 (470μF, 25V), D903 (BYD33J), D905 (BYD33D), Q901 (BUZ71A or SGSP222), Q902 (SGSIF344), D907 (BYV10-40), IC901 (UC3844) and finally R910 (0·5Ω, 7W). Oh yes, and the 2·5AT fuse of course. It's not really a job to be done in the field, is it?

In all but a few cases replacing these components restores the set to normal operation. This one had other ideas. All that the power supply would do was to pulse, generating an h.t. supply of about 80V instead of 155V. Each of the outputs on the secondary side of the circuit was disconnected in turn, a dummy load being connected across the 155V line. As the power supply kept on tripping the cause of the fault was on the primary side of the circuit. D906 (1N4148) and Q903 (BC558B) were next checked and found to be faulty. We've had them fail before after a meltdown, but this usually results in a completely dead set. Replacing them failed to cure the fault, the set still tripping away merrily. Until, that is, the fuse flashed and the surge limiter resistor R901 smoked

I wiped away a tear from the corner of my eye, prayed for divine intervention and rebuilt the power supply yet again. This time I thought that it would be a good idea to ask Pobs to switch the set on. He seems to like bangs and flashes a lot more than I do. I must admit to being something of a wimp when it comes to switching a set on after I've repaired a power supply fault. It's not that I don't have confidence in the repair: it just seems that when someone else switches the set on it works. Pobs did his bit but the set remained totally lifeless. A check on the h.t. line showed that the set appeared to start and then shut down. Time for a more detailed investigation.

A check at IC901's supply pin 7 showed that the voltage was a little below the chip's under-voltage lockout level of 10V. As a result the chip had shut down. Most of the components that could cause this had already been replaced, including the 27V zener diode ZD901 and the l.t. rectifier diode D902. Then I spotted it – zener diode ZD902 (ZTE2S1), the only semiconductor device that hadn't been replaced in the power supply. It's in series with the feed to pin 7 of IC901 and just had to be faulty. The strange thing is that in most of the sets I've worked on a wire link is fitted in this position. In fact the zener diode is present only in 25in. sets. It was whipped out in a flash, and sure enough a meter reading was obtained both ways round. A new ZTE2S1 (an Hitachi special) was fitted and, when we switched on, what do you know? – sound and a full raster. I can only assume that the diode had been slightly damaged during the first power supply blow up and had been dealt a death blow when the second blow up occurred.

The only problem now seemed to be a corrupted LED channel display. But before I turned to this new area I thought I'd better check the h.t. voltage. It was at 165V and wouldn't alter when the set-h.t. control VR941 was twiddled. This worried me. Now feedback for regulation is via the optocoupler OC941. Again this item and associated components are incorporated in only some models. The driver and error sensing transistors Q941 and Q942 were checked and found to be o.k. Next came the reference diode ZD941 (BZV10), which was leaky. At first glance you might think that it's a 10V device, but its rating is actually 5·5V. It was lucky that I checked on this – I hate to think what might have happened had I fitted a 10V device. Another order to Hitachi produced the component we required, and when it was fitted the h.t. could be set correctly.

The display fault was fairly straightforward. The LED display is driven by transistors Q1502/3/4/5 which are controlled by the SAA1293H chip. Q1505 was leaky collector-to-emitter, a new BC548 putting matters right.

I would certainly like to know what had caused all this damage to the set. I'm not convinced that the blue posistor was to blame. Lightning damage crossed my mind as a possibility, but this usually results in the destruction of many more components. An e.h.t. crackover perhaps?

A Panasonic TC1785

Next up was a Panasonic portable, specifically a TC1785 (Z3 chassis). It was another dead set. I took the back off and made some checks before switching it on. The surge limiter R801 (4·7Ω, 5W) was open-circuit, which obviously meant that there was a direct short. It's a shame that these resistors fail instead of the mains fuse. Fuses are always in stock, but high-wattage resistors are quite varied in value and shape and are usually manufacturer specific. Being a safety component a replacement surge limiter resistor has not only to be of the correct type in every respect, it also has to be mounted in the same manner as the original one. What's easier than replacing a fuse? Fortunately we had the correct resistor in stock, but other checks had to be made before it was fitted.

As the bridge rectifier diodes were o.k. it was probable that the STR50103A-M chopper chip IC801 was short-circuit, and indeed checks produced short-circuit readings at most of the pins. So R801 and IC801 were replaced, but when the set was switched on it remained lifeless. We now had 350V d.c. at the chopper however. What next? The logical suspect was the 110V protection diode D816, type SR2KN. This would have gone short-circuit when IC801 did, protecting the rest of the circuitry down the line. That's the theory anyway, but the set still didn't kick up when a replacement had been fitted. Maybe D816 hadn't gone short-circuit quickly enough to provide the required protection.

The h.t. rose slowly to about 25V however. We next found that the 2SA683 standby switch transistor Q806 was short-circuit collector-to-emitter. When this was replaced we had a full 110V h.t. supply but no sound or picture. R559 (10Ω, 7W) in the feed to the line output transformer was open-circuit. Now these resistors don't fail for the sheer hell of it, so presumably the line output transistor was short-circuit. But my meter failed to detect any shorts in the line output stage. So R559 was replaced and the set was switched on. There was still no picture, but a squealing sound from the power supply indicated that something disagreed with it. I switched off quickly, before the squealing turned into something more melodramatic.

When the 2SD1439 line output transistor Q551 was removed and tested out-of-circuit we found that though it wasn't short-circuit there was a definite leak between its collector and emitter. A new 2SD1439 finally restored normal operation. The set went off to the soak test area where it even withstood the ultimate workshop test, staying on for the whole duration of El Dorado. After that it was definitely ready for return to the customer.

A Philips 2A

The final set to grace my bench in this succession of destructive faults was one fitted with the Philips 2A chassis. Its mains fuse had disintegrated – not a good sign! As usual with this chassis however we soon found that a couple of the bridge rectifier diodes, the chopper transistor and D6664 had gone short-circuit. The culprit in this case is usually C2664, which splits a kipper, taking out the above mentioned components. This set was no different (so far!) and I thought that we had a bread-and-butter fault. But when replacements had been fitted and the set was switched on again it went BANG. The mains fuse had blasted: so much for a bread-and-butter fault. Checks in the power supply showed that the chopper transistor had also failed.

The rest of the power supply, which is self-oscillating, is d.c. coupled. So it was obvious that something had failed in the chopper driver section. I found that the pnp transistor Tr7686 (BC369) was short-circuit all ways: D6686 (BYD33D) which is connected to the base of the chopper transistor was also short-circuit. A note here about BYD33 diodes – the suffix letter is the voltage rating, as follows: D = 200V, G = 400V, J = 600V, K = 800V and M = 1kV. So Tr7686 and D6686 were replaced, also the 82Ω chassis return resistor R3690 in the same area – it had visibly suffered and measured 40kΩ.

Well that was about it I thought. The other semiconductor devices were o.k. when checked. I had a nagging doubt about the optocoupler, which in other Philips chassis is usually the first to suffer when there's a power supply crisis, so a new CNX62A was fitted. This time the set was powered via a variac: up came the h.t., with a full picture and sound. The rear cover was fitted and the set ran on test for the whole of the next day without a murmur. It was declared fit and returned to its owner. Only to come back two days later with 'dead again' stuck to the screen.

For what seemed the umpteenth time I removed the back and was surprised to find that the mains fuse was intact. But the set was completely dead – no thump from the degaussing circuit or anything. No a.c. input to the mains bridge rectifier in fact. The 4·7Ω surge limiter resistor R3654 had failed. I assumed that there was a reason for this, so I once more checked through the rest of the power supply. To my surprise there were no shorts. A new resistor was fitted and the set was switched on. There were no bangs or flashes anywhere and the set ran on test for the rest of the week without any problems. Presumably R3654 had been weakened by the earlier blow-ups, even though it checked all right previously.

At least an on-off switch takes only ten minutes to replace, and you know that it is a definite cure!

ANSWER TO TEST CASE 365

– SEE PAGE 514 –

That Sony KVX21TU had baffled three men in turn – its owner, Philbert and Sherlock, who in the end had to sort it out. In the type of circuit used in this model the tuning data is stored in digital form in a non-volatile memory. This type of memory doesn't need a back-up supply when the set is without power but does need a relatively high voltage supply when its contents, in this case the tuning data, are to be overwritten. In this design overwriting requires –30V at pin 2 of the chip. In the absence of this supply the data in the memory can't be changed.

Sadder and wiser since replacement of the memory chip failed to cure the problem, Sherlock discovered this too late! When he did get around to this aspect of the circuit's operation he found that the –30V supply was missing. It's derived from a winding on the line output transformer, via the rectifier circuit D809/C826. The diode had failed, its replacement restoring full operation of the memory system. This is one that's worth remembering when similar cases of loss of memory occur in the tuning systems of TV sets and VCRs.

Our stores now contain an M58655P, slightly secondhand but guaranteed to be in working order. We'll probably never need it, but if ever we do Sherlock will have made sure that all the supply lines are in order before soldering it in.

Long-distance Television

Roger Bunney

February 1993 was a truly depressing period for DX-TV reception. Only a few signals filtered through via the E layer, though a high-pressure system provided a long spell of tropospheric enhancement over much of the UK – local u.h.f. TV interference was severe in coastal areas.

The tropospheric opening produced Band III and u.h.f. signals from the Benelux countries, France, Germany and Denmark over many days, with sustained reception. The best periods were over the 5-10th and the 13-15th. On the 5th Tim Anderson logged a new version of the PM5544 pattern, being used by RTL (Luxembourg). The second was the more intense period however, with Danish Band III and u.h.f. TV2 stations being received.

On the 24th Iain Menzies heard a radio amateur comment that the m.u.f. had risen to 46MHz, but there have been no reports of reception of F2/TE signals from Africa. Here's the SpE log:

7/2/93	TVE (Spain) chs. E2, 3.
10/2/93	TVE E2; SVT (Sweden) E2.
13/2/93	TVP (Poland) R2; RAI (Italy) IA.
14/2/93	TVE E2, 3.
20/2/93	SVT E2.
21/2/93	TVE E2.
26/2/93	TVE E2; very strong unidentified programme on ch. R1 at 1900.

My thanks to Ian Menzies (Aberdeen), David Glenday (Arbroath), Simon Hamer (Powys), Roger Fussell (Torpoint), Tim Anderson (St. Leonards), and Peter Schuman (Rainham) for sending in reception reports, albeit rather sparce ones.

Matters Arising

David Harding of Deal, Kent has identified the mystery signal received by Ryn Muntjewerff – see photograph in the March column. The letters in the top left-hand corner translate as Dnipro, which refers to the South Ukraine town of Dniepropetrovsk. It seems that the item was a regional studio insert received from the ch. R1 TV-2 transmitter (0·1kW) at Kromatarsk or a main channel relay via the Ostankino Kanal 1 network.

Now for a satellite TV identification: 'CTS-PBD' on the test pattern is 'Centre de Transmission Satellite Pleumeur Beudeu', which is the main satellite uplink station at Betagne, near Lorient, France – the French equivalent of Goonhilly.

A reader who has noticed a planning application for the construction of an 'enormous VOR aircraft beacon' within 250 yards of his house has expressed concern about its effects on his domestic TV reception – can anyone advise on possible problems?

News Items

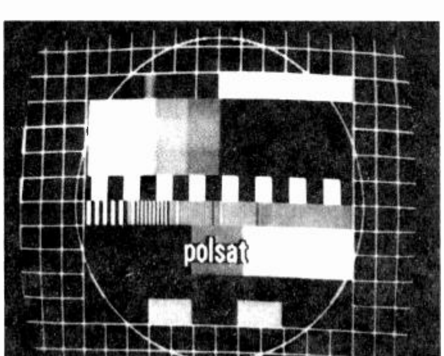
France: Canal Plus has recently signed an agreement to co-operate with the Swiss Kudelski company in research and development to produce improved encryption techniques – they will trade as 'Nagra+'. The aim is to improve the security of the Syster/Nagravision scrambling system for both terrestrial and satellite transmission and continue development for the expanding Pay-TV market in France and Europe generally. The agreement also covers digital compression techniques. It seems that SECAM is not suited to 16:9 operation: it cannot handle a.m. stereo sound and there would be increased colour noise.

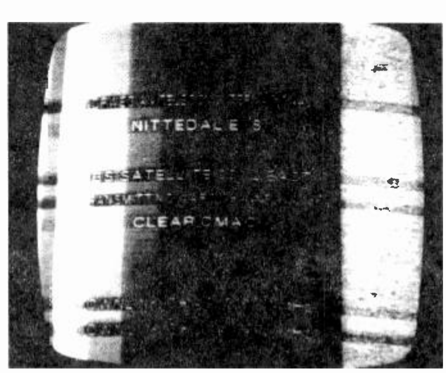
Sweden: The programme hours of the Kanal 1 and 2 networks have been increased and TV-2 is now providing a breakfast offering.

Germany: New terrestrial and satellite channels include VOX, RTL-2, DSF and n-tv.

Czechoslovakia: The new arrangements following the split into separate countries are as follows: In the Czech region the first network is called Ceska TV1 or simply CTV 1; the second, regional service is called Ceska TV 2 or CTV2. The Premiera company has been awarded a licence to transmit a regional/commercial service in Prague on ch. R24. In the Slovakian region there are Slovenska TV1/STV 1 and Slovenska TV 2/STV 2. Check TV will continue to transmit the OK-3 service, with satellite sourced programmes, until the winter of 1995. The equivalent Slovak TA3 service is now off air: it is to be used for commercial TV transmissions at a later date.

50MHz amateur band: Polish amateurs are now authorised to use the 50-52MHz band, with a 10W power limitation and using SSB/CW though with few or no restrictions as to aerials and geographical areas. Swiss amateurs now have





Left: The distinctive Polsat test pattern, received via Eutelsat II F3 at 16°E. Centre: A Norwegian Telecom test transmission from Marco Polo 2 after being relocated at 0·8°W: though incorrectly displayed, the picture was stabilised by using a sync inserter. Right: Seasonal greetings from the EBU's Rome switching centre via Eutelsat, a sound-in-sync transmission stabilised by using a PDS sync inserter.

access to the restricted 50-50·2MHz band with up to 25W on a secondary basis, i.e. not causing interference to preferred band users.

Ireland: A second RTE-1 transmitter is now in operation at Magherea (Gort), using ch. IE (Band III) at 100kW e.r.p. It runs in parallel with the original ch. IB 100kW transmitter. This suggests that RTE plans to end Band I transmissions from Gort in the foreseeable future. With the ch. IC RTE-1 relay at Glanmire likely to move to ch. IH, it could well be that Irish transmissions in Band I will eventually come to an end.

Russia: The Russian TV network now has the identification 'Telekanal Rossija'.

Albania: The ch. IC transmitter at Tirana has been deleted from the latest EBU station listing. Presumably coverage is now provided by the ch. E57, 800kW transmitter.

Band I Preamplifier

Brian Williams has developed another Band I preamplifier, whose main design considerations were complete freedom from 'birdies', from cross-modulation/overloading in the presence of nearby radio/PMR stations, and low noise. Brian suffers from nearby high-level transmissions at his location: he finds that the problem has been eliminated by this latest design, which uses two junction f.e.t.s.

The new design – see Fig. 1 – has a common-drain first stage feeding a common-gate second stage. The f.e.t.s don't damp the input and output tuned circuits and a clean response is obtained. Though the gain is less than that theoretically possible, complete stability and no breakthrough from out-of-band transmissions were the main considerations. Brian used Philips concentric type (beehive) 25pF trimmers, but subminiature trimmers work equally well. L1 and L3 consist of six turns of 24 s.w.g. enamelled wire wound over the length of a 3/8in. iron dust core. The small v.h.f. choke L2 consists of one and a half turns wound on a 2mm diameter screwdriver blade (same wire). The design as shown has a bandwidth of 4-5MHz in Band I. MPF102 transistors can be obtained from Maplin. The 2N3819 is a suitable equivalent (but has different pin connections). Component values are not critical.

Satellite TV

Intelsat 504 has been moved from 41°W to 31°W to provide an improved Ku band service to Europe and across the Atlantic. The east spot beam of Intelsat 515 at 18°E has been realigned to include the nearer CIS-member states. The Intelsat K craft's station keeping at 21·5°W will be maintained within 0·05° to enable smaller TVRO dishes to be used.

Eutelsat II F3 at 16°E is fast becoming the Arabic hot bird. Radio TV Marocaine (RTM – Morocco) is now on transponder 25 at 10·972GHz vertical, joining RTT (Tunisia) and the Egyptian Satellite Channel at the same orbital position. There's a new Turkish service, TGRT (Turkiye Gazetesi Radyo Televizyonu), at 11·095GHz. Another newcomer is Poloniasat, via transponder 32 with the largest on-screen logo ever seen! Several Spanish services – Canal Plus Espana, Tele Cinco and Antena Tres – have moved to Hispasat at 12·711GHz horizontal, 12·631GHz vertical and 12·671GHz horizontal respectively.

London-based Middle East Broadcasting is to be supplied with DigiCipher equipment for the encryption of new subscription services via ArabSat and Eutelsat.

Hispasat 1 is now in operation at its new location, 30°W. Launch of Hispasat 2 has been put back to this autumn at the earliest because of technical problems.

TeleCommunications Inc. (Denver) is developing a high-capacity compression system that will initially provide a four-to-one compression ratio for its cable network, with an option to go further to ten-to-one. In theory the cable network could then offer up to 500 channels. Plans are already well advanced for the launch in 1994 of 'US Satellite Broadcasting', with a minimum of 128 channels using a 4:1 compression ratio.

Two Russian satellites have been moved into the Tongan-assigned orbital slots at 130°E and 134°E for Rimsat Ltd.'s satellite network. CIS has agreed to launch another seven satellites for Rimsat over the next five years.

Mexican media giant Televisa is to invest US$200m to expand the PanAmSat network. PAS-1 is currently in operation at 45°W. PAS-2 will be launched into a central Pacific slot in April 1994. Two further satellites will be launched in 1995.

Several readers have seen CNNI (D-MAC) and Filmnet

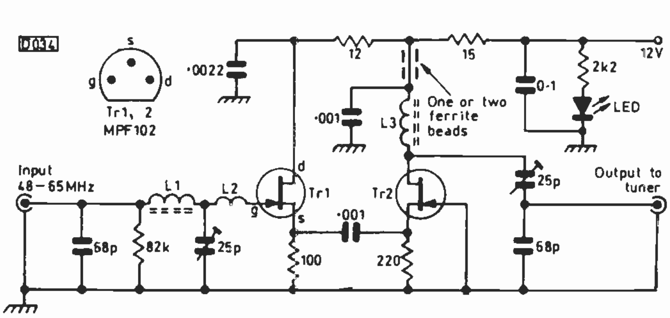


Fig. 1: Brian Williams' highly-stable, single-channel, low-noise Band I preamplifier.

(D2-MAC with Eurocrypt scrambling) via the Thor satellite at 0·8°W – this was previously Marco Polo 2 at 31°W – the transmissions being at 11·785 and 12·015GHz respectively, both with right-hand circular polarisation.

Reader Andrew Sykes has partially solved a noise problem with his wall-mounted, motorised satellite TV system. Noise from the support brackets, transmitted through the air and via contact with the wall, upset neighbours to the extent that he could't track the dish at night. Insertion of noise-absorbing material inside the vertical support tube has reduced the noise by thirty per cent. Any suggestions on how the noise can be reduced still further?

DAB and VHF TV

DAB (digital audio broadcasting) is to start in the UK within the next two years, initially in the London area then extending across the country. The BBC will be conducting a series of test transmissions in the London area this year. What is of concern to the DXer is that the proposed DAB frequencies will be in the 220MHz band and, should additional space be necessary, the 60MHz band. In addition limited tests may be carried out in the 1·5GHz band – these transmissions would be down-converted to 50-250MHz by DAB receivers.

The EC Eureka project group confirmed the DAB specification last December: it has now been passed to the European Telecommunications Standard Institution for ratification, which is expected by the end of the year.

The 60-250MHz spectrum is being considered by the UK, Germany and France for DAB transmissions. France has only 3·5MHz of bandwidth available at around 60MHz and uses Band III for TV transmissions. Hence a greater interest in exploiting the 1·5GHz band – test transmissions will start this summer in the Paris region. Germany hopes to start a DAB service in September 1995, using the 220MHz band.

The originally intended use of DAB was for high-quality satellite transmissions. But with the new data reduction technique 'Musicam' being adopted as a broadcasting standard, reducing the bandwidth required, DAB can be used by terrestrial services. Several radio services can be combined (multiplexed) to form a single DAB block for inexpensive transmission from each station. The reception technology and hardware are still being developed, but TV-DXers in the UK should be prepared to dig out those old Band I notch filters.

Nicam Decoder Follow-up

Michael A. Harris, B.Sc.

When Keith Wevill's Nicam on a Shoestring article was mentioned in the January issue Next Month box I decided to buy a couple of the decoder panels straight away, thinking that there might be a run on them. My main TV set is a Salora stereo one fitted with the H chassis, but the stereo is for the German standard, with an extra sound i.f. The VCR that's used with it is a Ferguson 3V48 hi-fi model, again with only mono sound though it has proved its worth in making it possible to record long items from the radio for subsequent copying on to ordinary cassettes. I understand that the 3V48 did appear in a West German version for use with the dual-i.f. stereo system, but it was obviously supplied to UK purchasers without the relevant decoder board or components. So I decided that its power supply would be able to cope with the Sendz decoder. I made the same assumption with the Salora TV set: it did have the decoder, and when this was removed there should be power enough.

Panel Variations

When the two decoders came I gave them a cursory look then consulted the circuit diagram that came with them. Not a very good photocopy, but just legible. My local friendly dealer let me look through his Ferguson ICC5 chassis manuals and I found a circuit that, though not quite showing identical circuitry to my specimens, was closer than the photocopied one.

My decoders weren't fitted with the second (German system) i.f. chip IS09 and its associated components, neither did they have the 4053 CMOS switching chip IS12. There were two wire links, between pin holes 2 and 15 and 12 and 14, where IS12 would have been. The crystal was correct at 6·552MHz however, and I assumed that ceramic filter LS01 was also correct. A 6MHz ceramic filter was fitted alongside the mono sound chip.

Initial Steps

Looking at the circuit I realised that I wouldn't need to use either IS04 (TDA8405) or IS05 (TDA8421), so I removed the two 12V feed resistors (both 27Ω), RS76 and RS96 respectively. For my purposes I wouldn't require remote input selection/volume/tone.

I used two external supplies to power the unit – 12V to pin 15 and 7V to pin 23 of the edge connector. The two earth pins 13 and 24 were connected together. When I switched on I found that the 7V supply current consumption was about 75mA and the 12V supply consumption about 130mA. A 68Ω resistor can be used to drop the 12V supply to approximately 7V. I soldered one across the edge connector's pins. Use a 1W component: the dissipation is approximately 0·5W, and it's best that the resistor doesn't get too hot.

In his article Keith Wevill mentioned using a 3·3kΩ resistor between the base of TS01 and the 12V supply to provide bias at the input. I found that the best place to do this is at the edge connector, between the input supply filter LS01 and pin 16. I later noticed that there are two small lands next to TS01 on the PCB: you could solder a surface-mounted resistor here if you have one.

My Nicam test feed came from an old Ferguson 3V30 VCR that usually lives at the end of the workbench. I used Keith's simple emitter-follower circuit, building it inside the i.f. can. For convenience I took a screened lead to what was the remote control cable socket at the rear of the VCR. Like a lot of other machines this VCR has the sound and vision i.f.s in one chip. The vision i.f. signal comes out via a 33·15MHz adjacent channel carrier filter, goes back in to a sound i.f. detector, comes out again through a 6MHz ceramic filter then goes back in again to emerge as audio. The Nicam feed was taken from the pin between the sound i.f. detector and the 6MHz filter. This seems to work very well. I fed it via another 1nF capacitor to pin 16 of the edge connector.

When I switched on I was straight away rewarded with Nicam sound from the two previously mentioned wire links across where IS09 would have been. Ordinary mono sound was present at pin 8 of the TDA8405 chip.

Audio Switching

Next came the problem of providing automatic switching between Nicam and mono sound. The voltage at pin 16 (the 'N line') didn't vary at all with or without a Nicam signal, but on further investigation I found that by removing diodes DW75 and DW76 on the small daughter board I got 12V with Nicam and 0V without. How can this be used to switch automatically between Nicam and mono?

I realised that I could use a 4053 i.c. for this purpose as it contains three independent single-pole changeover switches. The two wires where IS05 should be were therefore removed and a 4053 chip was soldered in. Most of the wiring required was already there. TS08 and its associated components were not present on my board however – there were just spaces where they should go. So I used a circuit similar to Keith Wevill's.

A BC108 transistor was soldered into the socket that should have contained the '2nd peri-TV' connector. Its emitter was connected to the centre pin, which is earth. I soldered in the base and the collector just for anchorage. The base was connected to the N Line (pin 16) via a 10kΩ resistor – it may be easier to solder it to the wire jumper J007 close by. The collector was soldered to a LED and to a wire link to pins 9, 10 and 11 of the 4053 chip. The three pins are already commoned together. I connected the other end of the LED to the 12V line via a 1kΩ resistor – a convenient point is the wire link J009. As the Nicam signal already went to pins 2 and 12 of the 4053 chip all that remained to be done was to feed the mono sound into the other half of the switch. Two wires were used for this purpose, one from pin 1 and the other from pin 13 of the 4053 to pin 8 of the TDA8405 chip. Result? Automatic switching, and very well it works too. The LED is not essential but serves to indicate the presence of a Nicam signal.

Tidying Up

The next step was a bit of tidying up. As I had no use for the twin output amplifiers and the 5V regulator was supplying only 75mA I decided to remove the large heatsink around the board. Even without it the 7805 wasn't warm let alone hot, and it did save some space. IS04, IS05 and the headphone amplifier IS07 were removed. A lot of small components can be removed – all those from the line formed by pins 1-14 of the TDA8405 chip to the edge of the board away from the connector, and on the other side of the daughter board all the components away from the square metal can. This provided me with quite a lot of spare small components – they always come in handy.

The only component value alteration was to change CS56/57 from 680nF to 47μF, positive side to the collectors of TS05/06, using two of the capacitors removed (CW11, 14, 19 or 20): 680nF seemed to be a bit too low for good base response, especially into an impedance like 100kΩ.

There are three jumper wires next to each other at right-angles to where the TDA8405 IS04 chip had been, J009 which is used for the 12V feed to the audio switch, J008 and J031. I removed the latter two to isolate the audio output from anything else. There may be two links, J004 and J003, close to the 4053 chip (at the pins 1 and 16 end). They were not present in my decoders, but if they are there remove them. Take the audio outputs from the ends of the links nearest to pin 16 of the 4053 chip – L from J004 and R from J003. If necessary the outputs can be reduced by inserting resistors into these holes and others to earth, with the outputs taken from their junctions. I found that the level of the ordinary mono output, which is adjustable by means of a preset control, was very slightly below that of the Nicam signal even at the maximum setting. The difference was not worth worrying about.

Power Supply Arrangements

Consumption depends on the voltage provided of course. As the supply will probably come from a parent device, be it a TV set or a VCR, the voltage available will vary. Anything between 10V and 14V works fine. As a guide the decoder takes 165mA at 10V, 170mA at 10·5V, 175mA at 11V, 182mA at 11·5V, 195mA at 12V, 210mA at 12·5V, 220mA at 13V, 235mA at 13·5V and 245mA at 14V.

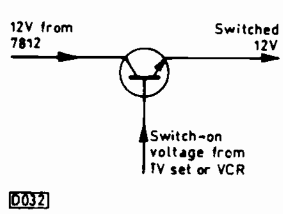
If the equipment in which you intend to install the Nicam decoder doesn't have sufficient power capability for the extra load a separate mains power supply will have to be built – as per the original article. To prevent it being on all the time a transistor switch could be used in series with the 'always present' supply, switching the decoder on only when the TV set or VCR is also switched on. See Fig. 1.

Adapting the TV Set

My Salora TV set is a bit unusual in having separate sound and vision i.f. chips. The SAWF has two balanced outputs. One feeds the vision i.f. strip, the other (with two peaks) being applied to the sound i.f. strip. The sound i.f. circuitry and audio preamplifier are contained within a TDA1236 chip, but the signal comes out and goes back in via a 6MHz filter, so access to it is easy.

I removed from the stereo board in the Salora TV set all the components associated with the German stereo system, also the 4053 switching chip. The various feeds to the decoder panel were taken from this board, the 12V supply being taken from the Salora set's 12·5V rail via a 1·2Ω safety resistor which was fitted in the RES4 position. I left the original decouplers CES4/5 in place. The outputs from the decoder were soldered to pins 14 (R) and 15 (L) of ICES5. The N line was connected to the 'stereo' connector ES2/3.

There are two user panels in the Salora TV set, one on each side. The one on the left has the treble, bass and balance controls (behind a drop-down flap), two LEDs for stereo and second language and two switches, language 1/2 and normal/wide stereo. I decided to use the language 1/2 switch for switching between Nicam and mono sources – to



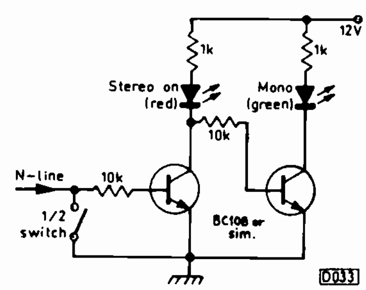


Fig. 1 (left): Decoder on/off switching transistor – use any npn type (within reason).
Fig. 2 (right): Stereo/mono indicator circuit.

Next Month in TELEVISION

SERVICING THE PHILIPS CP110 CHASSIS
This is the 110° big brother of the CP90 which was dealt with in an earlier article. It differs mainly in the use of a TDA1039 chip to drive the chopper transistor. Notes on common faults, test procedures and modifications by Richard Newman.

PAL SIGNAL DECODING
The next instalment in Eugene Trundle's Modern TV Receiver Techniques series deals with the basic video signal processing required between the vision demodulator and the tube drive circuits in a colour receiver. In addition to PAL decoding, the luminance channel and automatic grey-scale correction are covered.

DEALING WITH LIQUID SPILLAGE
Users are prone to spilling various liquids into their VCRs and TV sets. This can give rise to many strange symptoms and, if left, cause corrosion of tracks and leadouts. Treatment is possible however, as L. Stellar describes.

TEST REPORT: ITT VX600S S-S METER
The VX600S is in fact far more than a signal-strength meter: it's officially described as a 'TV measurement receiver with satellite band and f.m. coverage'. Nick Beer finds that its comprehensive facilities make it the ideal equipment for making all types of installation work easy and for carrying out any fault finding subsequently required.

SERVICING THE TOSHIBA XR9017
John Coombes provides fault finding notes and setting up guidance for this popular CD player.

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override the automatic switching if required, see Fig. 2. I also swapped over the two LEDs as I prefer a red one for stereo – it matches the channel indicator on the opposite side of the cabinet. As the small PCB for this is on the opposite side of the set to the stereo and Nicam boards, connected via a long ten-way twisted lead that's draped around the bottom edge of the c.r.t., I left the BC108 with its LED on the ICC5 decoder board and triggered another transistor soldered behind this, with a second transistor lighting the green mono LED when the red stereo one is off. Fig. 2 should make this clear.

The Nicam feed was taken from ES1/14 on the Salora stereo board. This is labelled 'RF in' and is connected to the point where the sound i.f. is taken off, before the 6MHz filter. I used the emitter-follower buffer circuit suggested in the original article, though I didn't have to.

VCR Mods

The Ferguson 3V48 has on its front panel a red LED that comes on only when you depress the 'display off' button. Rather silly to put another light on when you want the whole display to be blank, but I suppose it does tell you that the machine is not totally dead. This LED was isolated from its PCB and a pair of wires were run back to the ICC5 board. The Nicam take-off point is similar to that in the 3V30, from pin 20 of the M51316BP chip IC1. The audio feed originally went to the 'FM AUDIO 02' board at what the circuit diagram shows as a two-pin plug/socket but is in fact a two-pin socket fitted where a five-pin one could go (this board was presumably used in other models). The left and right audio inputs are connected via a small wire link (B300) which obviously has to be removed.

This socket, labelled CN204, is where the Nicam audio outputs go. The earth for the screened cables is connected to the same socket's chassis pin. As the VCR already has capacitors (C237/8) after this socket the two (CS56/7) on the Nicam panel were replaced with wire links. I subsequently found that the output from the Nicam decoder was too high, so I replaced the links with a pad consisting of two 10kΩ between them and the Ferguson ones.

A supply for the Nicam decoder was a little more difficult to find. The switched 12V supply goes through a 2SB642 transistor that didn't look man enough to cope with an additional 220mA. I eventually took the supply from across C50, which is fed directly (via L19) from the 2SD1275 switched 12V regulator transistor Q10 on the power board. It lives elsewhere on the same large PCB (labelled '02 V/A/F').

Unfortunately there's no room inside the VCR to house the Nicam board. As the VCR lives in a separate cabinet however, not under the TV set, I decided that the Nicam board could live on top of the VCR. All the cables (L and R audio, Nicam in, power plus and minus and indicator) were fed to the rear of the VCR. As the VCR's metal top has a lip at its rear edge a small rectangular piece from the machine's plastic rear panel was cut out. The cables were then wrapped in spiral plastic wrap. The Nicam decoder itself was stuck to a piece of Plasticard, using double-sided sticky pads. The other side of the Plasticard was stuck to the top of the VCR. Not at all neat, but it didn't matter.

In Conclusion

These decoders work very well. Although they are not as small and neat as the Maplin ones, at £15 plus VAT they have to be a bargain.

Test Report: The Philips

David Botto

The new, upgraded Philips Scopemeter combines an all solid-state 50MHz digital storage oscilloscope with a full 3,000 count, wide-range digital multimeter, the liquid-crystal display being common to both. The expertise of Philips and Fluke has gone into the design and production of this portable instrument that quickly analyses the complex waveforms encountered in modern electronic equipment.

As with all Fluke instruments, the quality of construction is first class. The Scopemeter is housed in a rugged, take-it-anywhere, dark grey plastic case that's sealed to industrial standards against water, dust and contaminents. It's also shielded from electrostatic interference. In addition there's a stout yellow holster for extra protection. A multi-position, patented tilt-stand enables the instrument to be hung from hooks and panels and work in virtually any position. There are three versions of the Scopemeter, Models 93, 95 and 97. Top of the range is Model 97. On my scales the Scopemeter, complete with its batteries and holster, weighed 850g (4lb, 2oz). It measures 280 x 140 x 63mm.

The Scopemeter comes with a complete set of test leads including two 10:1 close-tolerance scope probes. It's powered by four rechargeable Nicad batteries that give about four hours' operation. The power adaptor/charger that comes with the instrument recharges the batteries and gives direct operation from a 240V a.c. mains supply. Low battery voltage is indicated by a flashing battery symbol: an adaptor symbol indicates that mains voltage is present. The Scopemeter can also be operated with four standard C-cell dry batteries. An optional adaptor lead (PM9087/001) enables the Scopemeter's batteries to be recharged from a car cigar lighter socket.

Getting Started

It's essential to spend some time studying the operator's manual before you use the instrument. After that operation is simple. A useful Quick Operating Guide is tucked inside the yellow holster to get you started. Pop-up menus in conjunction with clearly-labelled function keys provide easy control over the various ranges.

The Scopemeter contains dedicated computer circuitry and software that's controlled by fixed internal programs. It's rather like operating a computer as the various pop-up menus appear. Two grey up and down buttons give quick selection of the required range and function from the menus.

The super twisted-nematic liquid-crystal screen has a resolution of 240 x 240 pixels. Dark green traces against a light-green background are clear and easy to see. The electroluminescent, back-lit display that's included in Model 97 provides a bright, crisp display with big, 16mm digits that can be read several feet away.

DMM Ranges

When the Scopemeter is switched on it emits a friendly cheep. Cheerful clicks from the Scopemeter's interior occur as the ranges autochange. All the functions and ranges are selected by chunky, solid-response buttons – there are no switches to fail. Select 'meter' and both the a.c. and d.c. voltages at a test point are displayed. I found this useful when checking d.c. supplies as any ripple due to faulty smoothing capacitors or leaky rectifier diodes is at once revealed by the a.c. reading.

Press a grey button to select d.c. or a.c. voltage only. The d.c. or a.c. r.m.s. voltage, waveform and frequency of the signal at the test point is then displayed. Minimum resolution is 0·01Hz up to 99Hz.

This facility enabled me to check digital signals at as low a frequency as 1Hz – the lowest frequency produced by my function generator – and to view them on the graphical display. I found that the Scopemeter is better than a logic probe for digital fault-finding in TV sets, VCR control systems and computers – you can clearly see, store and compare the digital signals. It's the fastest way of checking microcontroller chips in a VCR as you press the buttons.

Both manual and fast autorange models are available. Models 95 and 97 also have a scaling function that shows one voltage as a percentage of another one.

Accuracy on the d.c. ranges is specified as ±0·5 per cent plus five counts. Tests showed that the Scopemeter's readings are well within these limits. The basic accuracy of the r.m.s. a.c. ranges is ±1 per cent plus ten counts at 50Hz. Operation is up to 5MHz with a frequency count readout.

The precision 10:1 isolating probes do double duty, operating as scope probes and also as a.c./d.c. voltage measurement probes.

Touch Hold Function

Press the hold/run key and the letters HLD appear. Measure the signal and wait until you hear a beep signal. You can now remove the test leads and read off the result. Measure a new signal, wait for the beep and the new value appears. A record-button function shows the present voltage at the test point. The display simultaneously shows the maximum and minimum voltages measured and the average voltage (Models 95 and 97 only).

There's a fast/smooth function. Fast accelerates the refresh rate in the measurement result display while the

Table 1: DMM Ranges.

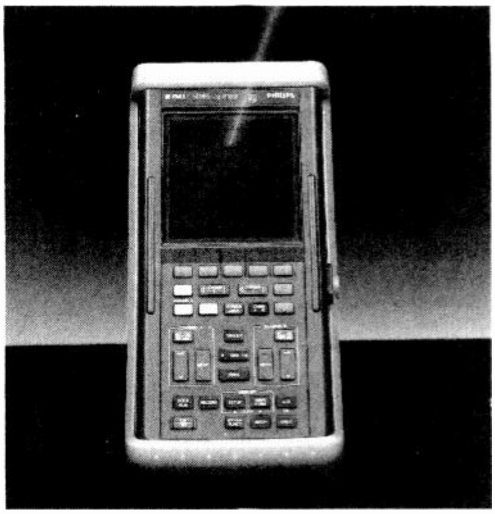
D.C. voltage: Ranges, channel A input, 300mV, 3V, 30V, 300V (600V with 10:1 probe). MV (external trigger input) 300mV, 3V. Minimum resolution 0·1mV. Specified accuracy ±0·5% + 5 counts.

A.C. or A.C. + D.C. true r.m.s. voltage: Ranges 300mV, 30V, 250V (600V with 10:1 probe). Specified accuracy 50-60Hz ±1% + 10 counts; 20Hz-20kHz ±2% + 15 counts; 5Hz-1MHz ±3% + 20 counts; d.c.-5MHz ±10% + 25 counts.

Resistance: Ranges 30Ω, 300Ω, 3kΩ, 30kΩ, 300kΩ, 3MΩ, 30MΩ. Specified accuracy ±0·5% + 5 counts. Minimum resolution 0·01Ω.

Frequency measurement: 0·1Hz-5MHz ±5% + 2 counts.

Models 95 and 97: dBV, dBm and audio watt ranges. Min/max record simultaneously.



The Philips Scopemeter Model PM97.

smooth function averages the last six seconds of readings – this is helpful when checking noisy or unstable signals.

Resistance and Continuity

In the latest upgraded Scopemeter the resistance ranges cover from 0·01Ω to 30MΩ. Accuracy is good – Table 2 shows typical readings. The ability to measure resistances as low as 0·01Ω makes it simple to check small coils and r.f. filters and trace elusive shorts in low-resistance circuitry. There's a choice of manual or autorange operation. I found that the test function voltage is just low enough to make most in-circuit tests required. The beeper sounds when the resistance measurement is below 15Ω: this is a valuable trouble-shooting aid when you're looking for nasty intermittent connections and dry-joints. The beeper function can be swicthed off when you don't want it. An effective diode check function is incorporated.

Relative Mode

The relative mode is available in all functions and ranges: it's used to measure the changes between a stored reference signal and any measurement you want to make.

dB Modes

Models 95 and 97 have dB modes which are excellent for checking amplifier gain, filters and attenuating circuits. The readouts are in dBV (decibel volts), dBm (decibel milliwatts) or audio watts. There's a wide choice of reference impedances: 50Ω to 1·2kΩ for the dB function and 1Ω to 50Ω for the dBW and audio watts ranges.

The Oscilloscope

Press the button marked scope and you've a dual-channel, 50MHz digital storage oscilloscope ready for use. Four traces can be viewed simultaneously – signals from channel A and channel B and stored waveforms to compare against each channel. Up to eight waveforms can be stored in the Scopemeter's memory.

The digital storage modes enable you to capture and analyse pre- and post-trigger events and single-shot signals exactly. There are plenty of single-shot oscillators in a typical VCR: they are hard to check with conventional instruments but easy to check with the Scopemeter. You can view spikes on power supply lines (often the cause of intermittent failures), hidden glitches and low-speed signals, all things that cannot be detected with a conventional scope.

A useful button labelled 'autoset' automatically sets the voltage, time, triggering and position on both channels A and B. This proved to be a real time saver. A pop-up menu makes it easy when you make special settings.

The Scopemeter contains a powerful combination of signal-capture, measurement and analysis capabilities. Fluke/Philips rightly claim that there has never been a hand-held digital storage scope with so much power. There's a wide range of triggering functions – all you'll ever need. In the 'roll' mode – the waveform rolls across the screen – the scope can store a single-shot pulse with 40nsec time resolution using the min-max record function. At the other end of the scale repetitive signals above 50MHz can be viewed.

To view a particular part of any waveform, centre on it and push the zoom button. The section concerned can then be viewed with magnification as high as x1,000.

Math Button

Model 97 has a 'math' button. Press it then a blue panel soft key and the mathematical function pop-up menu appears. You can then add, subtract, multiply, filter or integrate the signals. The result is stored in a destination waveform memory and is shown on the screen. Waveform inversion on one or both channels is possible – this makes calculations easier.

A special trigger computer algorithm enables duty-cycle measurements of pulse-width modulated waveforms to be carried out. The 'time stamp' function shows exactly when maximum and minimum signals occurred.

Signal Generator

Press the 'special funct' key (Model 97 only) and yet another pop-up menu appears. You can then select a 976Hz sinewave output or a squarewave output at 488Hz, 976Hz or 1·95kHz.

Component Tester

Model 97 also incorporates a component tester. This generates a ramp signal and each type of component connected to the test probes produces its own distinctive waveform. In time you get to know the waveform to expect with a given component.

RS232C Interface

An optically-isolated RS232C serial interface is incorporated in Model 97. Remote control of the Scopemeter is possible via a special, optically-isolated coupling lead, type PM9080/001. This lead also enables an output to be taken to a printer for waveform and figure printouts. The Epsom FX, LQ series or Hewlett-Packard ThinkJet compatible printers can be used.

To operate a printer, press the 'special funct' key and then use the 'printer setup' soft key to select a pop-up menu. There's a choice of 9,600 or 1,200 Baud rates. Fixed parameters are: eight data bits, one stop bit, no parity bit, handshake XON/XOFF. Then press the 'start print' soft key. Data and commands can be sent via a telephone line from or to a remote location.

Calibration

A 10:1 isolating probe that loses accuracy by even a tiny amount is useless when working on today's hi-tech equipment. There's no problem with the Scope meter however. The operator's manual that comes with the instrument shows you how to carry out straightforward probe calibration checks and adjustments using the Scopemeter's internal generator. It's essential to use only the test leads and scope probes supplied with the instrument. The Scopemeter can be returned to Philips at any time for range-accuracy calibration and for new software upgrades.

An optional service manual (part no. 4822 872 05346) is worth having, but should recalibration be necessary I'd advise returning the instrument to Philips.

Safety and Overload Protection

The Scopemeter's case, rugged input measuring circuits and well-insulated BNC connectors and sockets meet the safety levels specified for power-distribution circuits up to 600V three-phase. This includes double insulation to UL, CSA and international standards. There's surge protection against 6kV spikes as specified by ANSI/IEEE C62.41. The Scopemeter has no fuses – overload protection is electronic. Shock and vibration protection meet the requirements of MIL-T-28800D.

These precautions are important. It's all too easy to receive a severe or fatal electronic shock from cheap, poorly-designed test equipment. This is especially the case with field service work where difficult or potentially dangerous conditions may be encountered.

Conclusion

The Scopemeter is the ideal instrument for the engineer who services complex equipment in the field. It's also useful on the test bench when space is limited. Model 93 costs £899, Model 95 £1,099 and Model 97 £1,299. A hard carry case costs £79, a soft one £89. These prices are exclusive of VAT. If you decide to purchase a Scopemeter I'd recommend Model 97 in order to have available the full range of facilities.

A wide range of optional, safety-designed accessories is available from Philips. These include a.c. and d.c. shunts and clamp-on current probes, a temperature probe and high-voltage probes.

Practical experience with the Scopemeter brings full appreciation of its capabilities. I thought it a pity that capacitance ranges are not included however. The built-in component tester can be used for some capacitance tests of course.

The operator's manual is clearly written and easy to understand, though some additional pages, illustrated with component waveforms, to explain in greater detail the operation of the component tester would be welcome.

The Scopemeter is available from Philips Test and Measurement, Colonial Way, Watford WD2 4TT, telephone number 0923 240 511. My thanks to Nigel Hedges for arrangement the load of a Scopemeter and to Sue Byford who provided the photograph.

Table 2: Resistance test measurements.

Precision standard	*Scopemeter*
100Ω	100·2Ω
170Ω	170·1Ω
1·1kΩ	1·095kΩ
5kΩ	5kΩ
100kΩ	100kΩ
270kΩ	269·9kΩ
1MΩ	1·008MΩ
2·22MΩ	2·221MΩ
10MΩ	10·01MΩ
24MΩ	24MΩ

ECONOMIC DEVICES 32 TEMPLE STREET, WOLVERHAMPTON, WV2 4AN

15/85R	3.84	2SC1318	0.10	2SD525	0.77	BC109B	0.15	BD140	0.24	BF959	0.18	CD4001	0.14	M51102L	1.77	SKE5F310	1.68	TA7214P	3.74	TDA1470P	0.00	TEA1014	1.87
17052	3.20	2SC1364	0.29	2SD551	5.81	BC109C	0.00	BD168	0.76	BF960	0.27	CD4011	0.21	M51231P	2.03	SL1430	1.41	TA7217AP	1.27	TDA1506	4.59	TEA1039	2.15
17053	2.38	2SC1384	0.50	2SD613	0.63	BC117	0.14	BD175	0.29	BF966	0.61	CD4013	0.34	M51393AP	4.64	SL1431	1.70	TA7222	1.24	TDA1510	3.23	TEA2018A	1.49
17088	2.38	2SC1398	0.80	2SD636	0.14	BC119	0.00	BD179	0.34	BF970	0.30	CD4016	0.14	M51515L	2.01	SL1432	1.90	TA7222AP	1.27	TDA1512	3.17	TEA2164	2.68
17089	3.39	2SC1413A	1.36	2SD637	0.12	BC139	0.33	BD189	0.41	BFR39	0.35	CD4021	0.43	M51521L	0.54	SL471	1.70	TA7227P	2.02	TDA1515A	2.54	TEA2165	5.23
17127	1.77	2SC1509	0.39	2SD667	0.26	BC140	0.21	BD190	0.31	BFR41	0.44	CD4052	0.22	M5218L	0.42	SL490	2.31	TA7230P	1.35	TDA1516Q	3.33	TIC106D	0.55
1N4001	0.04	2SC1520	0.54	2SD669	0.55	BC141	0.34	BD201	0.40	BFR79	0.00	CD4053	0.20	M5231L	0.55	SN29764AN	1.47	TA7233P	1.77	TDA1518Q	3.32	TIC106M	0.60
15/80H	3.83	2SC1573	0.26	2SD669A	0.81	BC147A	0.06	BD203	0.46	BFR90	0.61	CD4066	0.30	M53216P	1.48	SN7474N	0.38	TA7240AP	0.00	TDA1670A	2.81	TIC45	0.59
15/80H	3.83	2SC1573Q	0.26	2SD716	1.11	BC148	0.12	BD232	0.28	BFR90A	0.77	CD4069	0.17	M54532	0.00	SN76013ND	7.99	TA7240P	2.21	TDA1701	4.86	TIL100	0.52
15/85R	3.84	2SC1675	0.09	2SD718	1.45	BC148A	0.06	BD234	0.25	BFR91	0.43	CD4070	0.14	M54543L	1.32	SN76227N	1.07	TA7241	2.30	TDA1770	0.00	TIP110	0.36
17052	3.20	2SC1685	0.14	2SD734	0.24	BC148B	0.04	BD237	0.30	BFR96	0.53	CNX62A	0.88	M54544L	1.87	SN76666N	1.26	TA7243P	0.00	TDA1870	3.37	TIP112	0.00
17053	2.38	2SC1740	0.12	2SD762	1.66	BC149	0.04	BD238	0.11	BFW92A	0.48	CR3CM	2.62	M54548L	2.53	SN76705AN	1.70	TA7250	4.03	TDA1904	1.21	TIP112H	0.58
17088	2.38	2SC1741	0.17	2SD774	0.24	BC149C	0.04	BD239	0.29	BFX85	0.55	CRD2AM	2.17	M54644BL	3.31	SR2M	0.00	TA7267P	2.02	TDA1905	0.94	TIP120	0.57
17089	3.39	2SC1815	0.14	2SD787E	0.26	BC157	0.13	BD241	0.41	BFY50	0.34	CV12E	2.70	M54648L	5.51	STA341M	2.38	TA7270	1.68	TDA1908A	1.14	TIP121	0.42
17127	1.77	2SC1826	0.72	2SD837	0.90	BC159	0.06	BD243	0.39	BFY51	0.34	CX109	7.05	M54898AP	16.94	STA401	2.30	TA7270P	1.68	TDA1940	2.77	TIP126	0.48
1N4001	0.04	2SC1827	0.77	2SD841	1.61	BC160	0.00	BD243A	0.43	BR100	0.17	DTA124EF	0.13	M58485P	5.95	STA441C	2.80	TA7271P	1.90	TDA1950	1.86	TIP132	0.46
1N4002	0.07	2SC1845	0.20	2SD856	0.87	BC161	0.27	BD243C	0.55	BR101	0.98	DTA144EF	0.17	MB3730	2.38	STK0029	5.88	TA7273	3.21	TDA2002	0.85	TIP137	0.48
1N4003	0.05	2SC1846	0.51	2SD869	3.28	BC167	0.42	BD244A	0.34	BR103	0.39	ER1400	2.15	MB3731	2.04	STK0039	7.45	TA7274P	2.72	TDA2003V	0.00	TIP2955	0.83
1N4004	0.07	2SC1923	0.14	2SD870	3.07	BC171B	0.14	BD244C	0.42	BR303	1.22	HA11235	1.68	MB3732	2.47	STK0040	7.40	TA7280	2.11	TDA2004	1.27	TIP29C	0.30
1N4005	0.06	2SC1942	3.33	2SD871	5.08	BC177	0.14	BD245C	0.72	BRX44	1.02	HA11244	3.83	MC13002	0.00	STK0059	9.75	TA7281	0.00	TDA2005	1.27	TIP29E	0.41
1N4006	0.06	2SC1959	0.11	2SD880	0.34	BC178	0.11	BD246C	0.71	BRY56	0.43	HA1124A	1.21	MC13002P	5.74	STK025	9.66	TA7299	2.34	TDA2006	1.06	TIP3055	0.77
1N4007	0.06	2SC1969	2.15	2SD882	0.43	BC182	0.06	BD278A	0.56	BSS38	0.23	HA11423	2.02	MC1310P	0.85	STK043	0.00	TA7313AP	0.62	TDA2009	2.29	TIP30C	0.17
1N4148	0.04	2SC1983	0.87	2SD898B	2.97	BC182A	0.07	BD317	0.87	BT120	1.28	HA11440	2.92	MC1327AP	1.62	STK3042	5.08	TA7317P	0.93	TDA2020	3.72	TIP31	0.00
1N4448	0.06	2SC2001	0.14	2SD904	5.95	BC182L	0.06	BD318	1.10	BT129	3.26	HA1166X	3.43	MC1330AIP	1.26	STK3062	8.88	TA7325P	0.45	TDA2030	0.00	TIP31A	0.32
1N5061	0.23	2SC2029	0.00	2SD973	0.38	BC182LB	0.06	BD380	0.34	BT139600	0.95	HA11713	1.24	MC1350P	1.82	STK4131	7.79	TA7343AP	0.72	TDA2030H	0.61	TIP31B	0.30
1N5402	0.09	2SC2073	0.51	74LS00	0.21	BC183	0.06	BD433	0.27	BT151/500R	3.40	HA11741	6.77	MC1352P	1.45	STK4141	8.25	TA7358P	0.78	TDA2030V	0.73	TIP31C	0.39
1N5404	0.13	2SC2078	0.77	7805	0.24	BC184	0.09	BD434	0.34	BT151800	1.15	HA11745	5.10	MC1358P	1.59	STK4142	8.21	TA75358P	0.68	TDA2040	0.00	TIP32A	0.39
1N5406	0.12	2SC2141	1.48	7805T022	0.00	BC184L	0.04	BD435	0.38	BU205	1.07	HA13001	1.78	MC14493P	0.00	STK4162M	9.51	TA7607AP	2.11	TDA2170	2.55	TIP32C	0.38
1N5408	0.12	2SC2166	0.96	7808	0.30	BC184LC	0.10	BD436	0.32	BU208A	1.16	HA13108	2.76	MC14528BCP	1.70	STK4171	10.50	TA7609P	1.95	TDA2270	1.68	TIP33	0.00
1N914	0.04	2SC2168	0.85	7812	0.30	BC204	0.37	BD437	0.32	BU208D	1.53	HA13118	1.87	MDA2062	2.21	STK4181 II	12.85	TA7630	0.00	TDA2525	0.00	TIP33A	0.92
1S1555	0.22	2SC2236	0.25	7815	0.30	BC207B	0.23	BD438	0.31	BU326A	1.36	HA13119	2.03	MJ2955	0.97	STK4181A	12.46	TA7630P	1.87	TDA2530	4.76	TIP33C	0.98
1S2076	0.29	2SC2271	0.22	7818	0.41	BC212	0.06	BD441	0.34	BU406	0.79	HA13403	4.66	MJ802	2.29	STK4332	5.54	TA7640AP	0.98	TDA2540	0.38	TIP34	0.00
2N2219A	0.27	2SC2274	0.22	7905	0.34	BC212B	0.06	BD442	0.29	BU406D	1.02	HA1374A	0.00	MJE13005	0.82	STK4352	1.70	TA7676P	4.25	TDA2541	0.72	TIP34C	0.89
2N2222	0.17	2SC2274K	0.22	7912	0.43	BC212L	0.06	BD510	1.34	BU407	0.53	HA1377	1.60	MJE2955	0.68	STK437	8.30	TA7680AP	4.52	TDA2560	2.55	TIP41A	0.38
2N2905	0.21	2SC2314	0.33	AA119	0.36	BC213	0.11	BD529	0.97	BU407D	0.97	HA1388	2.63	MJE3055	0.51	STK4392	6.31	TA7698AP	5.93	TDA2576A	5.95	TIP41B	0.31
2N2926G	0.37	2SC2335	1.11	AA143	0.13	BC214	0.00	BD530	1.10	BU426A	0.96	HA1389	2.52	MJE340	0.40	STK441	10.28	TA7705P	1.68	TDA2577	0.00	TIP41C	0.37
2N3053	0.36	2SC2458	0.09	AC127	0.11	BC214L	0.09	BD535	0.43	BU426E	2.13	HA1392	1.61	ML237B	0.00	STK459	10.27	TA7769P	1.43	TDA2577A	4.25	TIP42A	0.34
2N3054	0.98	2SC2482	0.34	AC141K	0.46	???????	0.05	BD536	0.48	BU500	1.09	HA1397	2.63	ML923	10.66	STK461	9.27	TA8205	3.65	TDA2578A	2.55	TIP42C	0.37
2N3055	0.77	2SC2547E	0.24	AC176K	0.30	BC237A	0.08	BD675	0.30	BU508A	0.95	HA1398	2.33	MN1405VHF	11.08	STK4843	11.10	TA8210H	4.66	TDA2579	0.00	TIP47	0.51
2N3442	0.75	2SC2565	6.40	AC187	0.16	BC237B	0.05	BD677	0.32	BU508AF	1.27	HA1452	3.36	MN1435VX	14.35	vSTK5211	15.78	TA8215	4.57	TDA2581	10.15	TIPL791A	1.11
2N3702	0.11	2SC2570A	0.29	AC187K	0.33	BC238	0.11	BD707	0.51	BU508D	1.27	HM6232	11.78	MN1435VXB	10.66	STK5322	5.59	TA8691N	6.67	TDA2581Q	10.15	TIS43	0.66
2N3704	0.14	2SC2577	2.13	AC188	0.30	BC238B	0.05	BD839	0.51	BU508DF	1.49	HM6251	9.52	MN650	2.50	STK5325	6.85	TAA550	0.00	TDA2582	1.95	TL011CP	1.36
2N3773	1.02	2SC2581	2.45	AC188K	0.67	BC239	0.04	BD901	0.51	BU508V	1.16	HM7103	14.07	MPSA42	0.23	STK5326	5.08	TAG626	1.05	TDA2591	1.15	TL071CP	0.38
2N3819	0.34	2SC2632	0.29	AD149	0.52	BC252B	0.07	BD902	0.51	BU526	1.41	ICH28I	0.26	MPSA56	0.12	STK5331	3.02	TBA120	0.53	TDA2593	0.75	TL494	1.57
2N3904	0.11	2SC2655	0.25	AD161	1.02	BC300	0.48	BD911	0.65	BU536	1.60	KA2101	0.60	MPSA93	0.09	STK5332	2.74	TBA120AS	0.90	TDA2594	2.21	TMP47C432AP	
2N4444	2.68	2SC2671	0.68	AD162	0.96	BC301	0.24	BD912	0.63	BU608	1.44	KBL08	0.47	MPSU10	0.00	STK5333	4.28	TBA120S	0.89	TDA2595	2.16		11.24
2N6292	0.62	2SC2688	0.30	AF124	0.77	BC302	0.36	BDV65B	1.16	BU705	1.61	KSR1004	0.09	MR854	0.14	STK5372	5.28	TBA120T	0.59	TDA2600	3.08	TMP47C434N−3555	
2SA1015	0.10	2SC2785	0.17	AF127	0.59	BC303	0.28	BDW84C	1.28	BU806	0.82	L200CV	1.13	MSM5840H	15.36	STK5421	2.60	TBA120U	0.39	TDA2611A	0.64		16.50

SPECIAL OFFERS – ENDS 30/05/93 OR WHILE STOCKS LAST

TDA 2600 x 2	3.95
TDA 4601D x 2	2.95
BUT 11AF x 5	3.25
BU 208A x 5	3.60
⁻14BU 508A x 5	3.50
CO AXIAL AERIAL PLUG x 25	3.75
'F' CONNECTOR (SCREW TYPE) x 25	3.00
TDA 2029 x 2	1.90
TDA 3654 x 2	2.20
TBA 120S x 5	1.55
TDA 4601 x 2	2.50
TDA 3562A x 2	3.99
VIDEO FAULT FINDING GUIDE	10.29
TV FAULT FINDING GUIDE	9.26
BU 508AF x 5	5.00
TDA 4501H x 2	2.49
STR 54041 x 2	7.50

2SA1016	0.17	2SC2791	5.44	AF139	0.29	BC307	0.06	BDW93C	0.59	BU806A	0.80	LA1201	0.56	MVS240	0.53	STK5422	5.74	TBA2800	0.68	TDA2611AQ	2.03	UC3844	1.78
2SA1020	0.43	2SC3150	1.44	AF239	0.43	BC307A	0.06	BDW94C	0.46	BU807	0.51	LA1230	1.95	NE545B	3.20	STK5451	5.27	TBA395	0.68	TDA2640	3.98	UPA81C	0.72
2SA1020Y	0.30	2SC3153	2.37	AF279	0.34	BC307B	0.06	BDX32	1.70	BU826A	1.59	LA1385	1.45	NE555	0.21	STK5466	5.08	TBA520	0.85	TDA2652	14.32	UPC1181H	6.80
2SA1095	7.44	2SC3156	6.28	AL102	5.08	BC308	0.06	BDY20	2.13	BU908	1.17	LA3161	0.40	NE555N	0.37	STK5471	4.51	TBA540	1.97	TDA2653A	3.26	UPC1182H	5.95
2SA1102	2.54	2SC3182	3.25	AN245	0.00	BC308A	0.09	BF115	0.41	BUK444	2.38	LA4140	0.37	NE592	1.85	STK5476	5.00	TBA540Q	0.77	TDA2680	5.10	UPC1185H	10.20
2SA1143	0.17	2SC3225	0.50	AN3821K	7.23	BC308C	0.06	BF179	0.31	BUT11	0.68	LA4182	1.75	NE646N	2.47	STK5481	5.82	TBA560C	0.68	TDA3190	1.27	UPC1188	3.83
2SA1175	0.25	2SC3795	1.95	AN5265	1.75	BC327	0.10	BF184	0.41	BUT11A	0.85	LA4192	1.14	NP1106	11.86	STK5482	3.98	TBA570A	1.77	TDA3190P	1.36	UPC1212C	0.83
2SA1186	3.73	2SC380	0.12	AN5435	1.45	BC327B	0.17	BF185	0.29	BUT11AF	0.85	LA4220	1.29	OA47	0.25	STK6962	2.65	TBA651	1.01	TDA3300B	18.48	UPC1225H	0.00
2SA1208	0.26	2SC388A	0.59	AN5512	2.14	BC328	0.07	BF194	0.22	BUT12A	0.85	LA4261	1.65	OA90	0.10	STK7216	5.53	TBA750Q	5.10	TDA3330	10.78	UPC1228HA	0.56
2SA1265	1.95	2SC458	0.10	AN5515	2.76	BC337	0.09	BF196	0.15	BUT56A	0.57	LA4270	2.11	OA91	0.15	STK7226	8.14	TBA800	0.51	TDA3541	0.95	UPC1230	2.21
2SA1286	0.34	2SC536	0.09	AN5521	1.65	BC337L	0.22	BF197	0.44	BUW11	1.03	LA4282	7.28	R2540	2.77	STK7308	5.91	TBA810P	1.66	TDA3560	3.65	UPC1230H	2.80
2SA473	0.71	2SC710	0.12	AN5612	2.97	BC338	0.06	BF198	0.17	BUW11A	0.90	LA4422	1.27	R2540X	1.92	STK7348	4.67	TBA810S	0.66	TDA3561A	3.31	UPC1278H	2.13
2SA562	0.17	2SC867A	5.25	AN5900	1.27	BC368	0.09	BF199	0.04	BUW41B	1.02	LA4440	1.68	R2M	0.77	STK7356	5.59	TBA820	0.55	TDA3562A	4.21	UPC1318	2.96
2SA634	0.54	2SC945	0.10	AN6310	4.69	BC369	0.17	BF200	0.39	BUW81A	2.29	LA4445	1.29	R3297	4.27	STK7358	5.46	TBA820L	0.55	TDA3565	2.29	UPC1335V	2.81
2SA639S	0.83	2SD1051	0.48	AN6326	3.61	BC372	0.47	BF240	0.11	BUW84	1.11	LA4460	1.48	R4050	2.38	STR1096	4.67	TBA820M	0.34	TDA3566	3.40	UPC1351C	1.70
2SA673	0.09	2SD1128	1.02	AN6341	2.29	BC546	0.00	BF244	0.30	BUX84	0.34	LA4461	1.48	R4051	2.95	STR40090	8.07	TBA920	0.51	TDA3571B	3.08	UPC1353	1.34
2SA684	0.21	2SD1138	0.94	AN6610	0.93	BC546A	0.06	BF245A	0.19	BUX85	0.60	LA4475	2.11	RB156	2.07	STR4090	16.80	TBA950	1.68	TDA3576	11.90	UPC1363C	1.06
2SA733	0.17	2SD1207	0.26	AN6671K	5.35	BC547	0.	BF245B	0.41	BUZ71	0.52	LA4476	2.29	RGP10	0.00	STR4211	5.95	TBA970	4.08	TDA3640	6.12	UPC1363CA	2.13
2SA769	1.02	2SD1265	0.77	AN7158	2.73	BC547A	0.04	BF255	0.11	BY127	0.15	LA4500	1.68	RGP15	0.41	STR440	6.38	TCA270S	1.03	TDA3650	9.45	UPC1365C	1.70
2SA798	0.38	2SD1273	0.82	AN7161	3.23	BC547B	0.11	BF256	0.24	BY133	0.06	LA4505	1.79	RGP15J	0.35	STR441	6.27	TCA440	1.95	TDA3651A	0.00	UPC1378H	1.19
2SA872	0.14	2SD1275	0.88	AN7171K	3.98	BC547C	0.00	BF256LC	1.40	BY164	0.67	LA4507	0.00	RGP30M	0.30	STR451	12.00	TCA660B	0.43	TDA3653AQ	1.92	UPC1391H	0.52
2SA872A	0.20	2SD1276	0.85	BA145	0.11	BC548	0.00	BF257	0.36	BY179	0.80	LA4508	2.29	RM11C	0.38	STR50020	9.02	TCA800Q	1.65	TDA3653B	1.86	UPC1394	1.23
2SA940	0.82	2SD1279	5.26	BA156	0.06	BC548A	0.29	BF258	0.04	BY184	0.39	LA4520	1.11	S2000AF	1.19	STR50103	5.92	TCA910	1.21	TDA3654	1.66	UPC1420CA	6.60
2SA952	0.14	2SD1292	0.41	BA157	0.07	BC548B	0.18	BF259	0.31	BY20320	0.00	LA4700	3.81	S2055AF	1.81	STR54041	6.75	TCA940	3.40	TDA3810	2.55	UPC1488H	1.85
2SA958	0.44	2SD1308	0.77	BA158	0.07	BC548C	0.12	BF324	0.12	BY206	0.13	LA5112	5.89	S2530A	1.98	STR5412	6.02	TD3F900H	6.57	TDA4420	1.27	UPC2002	2.08
2SA966Y	0.41	2SD1397	1.89	BA159	0.30	BC549	0.06	BF337	0.33	BY207	0.18	LA5512	0.48	SAA1004	1.14	STR58041	6.35	TDA1004A	3.40	TDA4427	2.05	UPC324C	1.74
2SA970	0.17	2SD1398	2.13	BA317	0.06	BC556	0.00	BF338	0.40	BY210400	0.19	LA7223	2.54	SAA1121	11.22	STR6020	5.46	TDA1010	1.30	TDA4442	3.49	UPC4558C	0.43
2SA984	0.21	2SD1426	3.08	BA318	0.04	BC556B	0.06	BF355	0.55	BY224600	5.10	LA7520	2.75	SAA1174	5.10	STR6020KIT	11.23	TDA1011	1.27	TDA4500	3.79	UPC574	1.07
2SB1010	0.34	2SD1427	2.89	BA5102A	1.27	BC557	0.07	BF392	0.32	BY226	0.13	LA7800	1.44	SAA1250	2.92	T6064V	2.63	TDA1011A	1.32	TDA4501	5.08	UPC580C	2.55
2SB546	0.53	2SD1432	4.88	BA536	1.14	BC557B	0.06	BF393	0.17	BY227	0.14	LA7801	1.27	SAA1251	5.74	T6076V	3.34	TDA1013A	1.45	TDA4503	3.38	UPD1937C	3.15
2SB633	0.93	2SD1439	5.51	BA5406	1.61	BC557C	0.11	BF419	0.65	BY228	0.38	LA7820	1.57	SAA1293	0.00	T9013V	5.23	TDA1015	0.99	TDA4505E	4.64	X0065CE	1.70
2SB643	0.00	2SD1453	1.87	BA6109	1.85	BC558	0.00	BF422	0.15	BY229	1.64	LA7830	1.27	SAA1351	8.23	T9034V	1.45	TDA1020	1.27	TDA4600	1.70	X2402	4.62
2SB643S	0.20	2SD1497−02	7.05	BA6209	1.31	BC558A	0.06	BF423	0.14	BY229600	1.27	LM1303N	0.88	SAA3027P	6.37	T9035V	1.50	TDA1035SB	4.15	TDA4600/2	2.14	ZPY120	9.17
2SB644	0.34	2SD1497−06	7.06	BA6219	1.45	BC558B	0.06	BF435	1.97	BY229800	0.97	LM1877	1.45	SAA5010	3.12	T9038V	6.09	TDA1035T	2.25	TDA46002D	4.23	ZTX650	0.51
2SB688	1.28	2SD1541	3.40	BA6222	1.61	BC559	0.11	BF450	0.19	BY238	0.31	LM317T	0.52	SAA5012	3.31	T9053V	0.92	TDA1037	8.50	TDA4600F	1.70	ZTX753	1.17
2SB772	0.43	2SD1555	2.80	BA656N	0.84	BC560C	0.21	BF458	0.30	BY255	0.14	LM324N	0.25	SAA5030	6.42	T9054V	0.88	TDA1044	1.43	TDA4601	1.56		
2SB772Q	0.43	2SD1577	3.35	BA718	0.77	BC635	0.23	BF459	0.29	BY298	0.15	LM339N	0.15	SAA5050	4.68	T9064	1.20	TDA1060	1.58	TDA4601D	2.42		
2SB793	0.31	2SD1649	1.80	BAS11	0.32	BC637	0.15	BF469	0.34	BY299	0.12	LM358	0.23	SAB3013	5.42	T9065V	4.66	TDA1082	4.25	TDA4605	2.58		
2SB819	0.48	2SD1650	2.47	BAV18	0.07	BC639	0.13	BF470	0.29	BY476A	0.68	LM358N	0.22	SAB3021	6.15	TA7063P	1.14	TDA1083	1.19	TDA4950	1.07		
2SB861	0.97	2SD1876	4.88	BAV20	0.26	BC640	0.06	BF480	0.67	BYD14J	0.31	LM380N	0.82	SAB3035	6.35	TA7122BP	0.63	TDA1151	0.51	TDA7240A	1.53		
2SB891	0.38	2SD1877	2.12	BAV21	0.49	BC879	0.39	BF493S	0.34	BYD33G	0.77	LM386	0.00	SAF1032P	5.50	TA7146P	5.86	TDA1170	1.59	TDA7270S	8.20		
2SC1008	0.17	2SD1911	4.45	BAW62	0.07	BC880	0.38	BF597	0.16	BYD33J	0.35	LM393N	0.27	SAF1039	2.36	TA7176P	1.30	TDA1170N	1.23	TDA8140	2.38		
2SC1061	0.59	2SD234	0.94	BAX14	0.28	BCY70	0.07	BF757	0.43	BYV10−40	2.20	M192B1	1.86	SDA2112	13.35	TA7193AP	3.36	TDA1170S	1.16	TDA8153	5.10		
2SC1096	0.50	2SD313	0.56	BB105B	0.24	BD131	0.28	BF758	0.32	BYV95C	0.36	M21C	1.65	SG264A	10.62	TA7193P	6.94	TDA1180	0.00	TDA8170	2.58		
2SC1114	1.16	2SD350A	1.23	BC107	0.14	BD132	0.21	BF759	0.34	BYV96D	0.27	M293	14.63	SG613	18.79	TA7205	0.00	TDA1190Z	4.08	TDA8180	5.35		
2SC1162	0.31	2SD401	3.46	BC107B	0.20	BD135	0.22	BF760	0.24	BYW56	0.17	M490	15.37	SGSIF344	5.51	TA7205AP	1.44	TDA1200	0.91	TDA8190	3.30		
2SC1213	0.14	2SD438	0.34	BC108	0.15	BD136	0.20	BF762	0.29	BYX55600	0.20	M491	7.94	SKE2G202	0.00	TA7205P	0.00	TDA1270	1.79	TDA9503	2.13		
2SC124	0.44	2SD468C	0.00	BC109	0.00	BD137	0.45	BF869	0.25	CA1310E	0.78	M494	0.00	SKE4F104	0.97	TA7207P	1.68	TDA1412	0.77	TEA1002	4.98		
2SC1306	1.16	2SD476	0.97	BC109A	0.12	BD139	0.29	BF870	0.23	CA3094	3.06	M50115AP	2.50	SKE4F210	0.87	TA7210P	1.50	TDA1470	0.00	TEA1009	7.74		

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	Part No	Price
AIWA		
AV-66		
Video Head	VID 2546	£16.12
Pinch Roller	VID 1755	£3.83
Belt Kit	VID 7519	£2.03
Idler Replacement Set	VID 1001	£3.65
Idler	VID 1005	£2.12
Capstan Motor	VID 2160	£25.00
Tension Band	VID 1423	£3.65
Reel Table Rubber Tyre	VID 1335	£1.18
CTL Unit	VID 2637	£61.55
AV-77		
Video Head	VID 2546	£16.12
Pinch Roller	VID 1755	£3.83
Belt Kit	VID 7509	£1.33
Idler Replacement Set	VID 1000	£5.69
FWD Limiter	VID 1002	£3.83
Idler	VID 1004	£1.45
Idler	VID 1005	£2.12
Capstan Motor	VID 2118	£29.36
Tension Band	VID 1423	£3.65
CTL Unit	VID 2567	£47.83
AKAI		
VS-9800		
Video Head	VID 2511	£9.18
Pinch Roller	VID 1756	£3.23
Belt Kit	VID 7506	£1.61
Take Up Idler	VID 1025	£5.27
REW Idler	VID 1026	£6.71
FF Rubber Tyre	VID 1029	£0.85
FF Rubber Tyre	VID 1030	£0.85
Unloading Idler Rubber Tyre	VID 1207	£0.93
Capstan Motor	VID 2119	£25.34
Drum Motor	VID 2120	£20.20
Cassette Lamp	VID 1943	£0.27
Tension Band	VID 1391	£3.65
Repair Kit	VID 7911	£15.27
Take Up Rubber Tyre	VID 1028	£0.85
ALBA		
VCR-4000		
Video Head	VID 2713	£16.30
Pinch Roller	VID 1787	£3.74
Belt Kit	VID 7596	£3.81
Idler	VID 1049	£3.31
Cassette LED	VID 1981	£1.53
Tension Band	VID 1399	£2.04
AMSTRAD		
VCR-4600		
Video Head	VID 2676	£14.79
Pinch Roller	VID 1758	£3.15
Belt Kit	VID 7593	£1.81
Clutch	VID 1226	£4.76
Gear Holder	VID 1227	£13.14
RF Clutch	VID 1231	£7.78
Cassette LED	VID 1981	£1.53
VCR-9000		
Video Head	VID 2502	£15.61
Pinch Roller	VID 1758	£3.15
Belt Kit	VID 7592	£1.18
RF Clutch	VID 1225	£4.33
Clutch	VID 1226	£4.76
Gear Holder	VID 1227	£13.14
Cassette LED	VID 1981	£1.53
BANG & OLUFSEN		
VHS-65		
Video Head	VID 2506	£14.14
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7538	£1.27
FF × REW Idler Arm	VID 1020	£1.79
Clutch Plate	VID 1211	£8.52
Capstan Motor	VID 2147	£23.15
Cassette LED	VID 1981	£1.53
DECCA		
VHN-8300		
Video Head	VID 2511	£9.18
Pinch Roller	VID 1814	£3.15
Belt Kit	VID 7812	£1.29
Reel Idler	VID 1036	£2.63
Take Up Clutch	VID 1037	£2.38
Take Up Idler	VID 1038	£1.07
Brake Pad	VID 1361	£0.59
Reel Motor	VID 2169	£28.97
Capstan Motor	VID 2164	£33.80
Loading Motor	VID 2168	£10.62
Cassette Lamp	VID 1947	£0.44
Tension Band	VID 1389	£1.79
Repair Kit	VID 7913	£16.09
Take Up Reel Table Rubber Tyre	VID 1080	£0.68
Supply Reel Table Rubber Tyre	VID 1080	£0.68
FERGUSON		
3-V-30		
Video Head	VID 2647	£9.18
Pinch Roller	VID 1814	£3.15
Belt Kit	VID 7812	£1.29
Reel Idler	VID 1036	£2.63
Take Up Clutch	VID 1037	£2.38
Take Up Idler	VID 1038	£1.07
Brake Pad	VID 1361	£0.59
Reel Motor	VID 2169	£28.97
Capstan Motor	VID 2164	£33.80
Loading Motor	VID 2168	£10.62
Cassette Lamp	VID 1947	£0.44
Tension Band	VID 1389	£1.79
Repair Kit	VID 7913	£16.09
Take Up Reel Table Rubber Tyre	VID 1080	£0.68
Supply Reel Table Rubber Tyre	VID 1080	£0.68
3-V-36		
Video Head	VID 2647	£9.18
Pinch Roller	VID 1813	£3.15
Belt Kit	VID 7543	£1.02
Take Up Clutch	VID 1031	£2.11
Take Up Idler	VID 1038	£1.07
Reel Idler	VID 1039	£3.40
Brake Pad	VID 1361	£0.59
Capstan Motor	VID 2165	£25.16
Loading Motor	VID 2168	£10.62
Front Loading Motor	VID 2168	£10.62
Cassette LED	VID 1981	£1.53
Tension Band	VID 1389	£1.79
Remote Control	IR 9100	£11.01
Repair Kit	VID 7918	£12.51
Mains Transformer	VID 2223	£24.18
Take Up Reel Table Rubber Tyre	VID 1080	£0.68
Supply Reel Table Rubber Tyre	VID 1080	£0.68
Cassette Housing	VID 1099	£21.75
3-V-57		
Video Head	VID 2573	£17.81
Pinch Roller	VID 1813	£3.15
Belt Kit	VID 7540	£0.68
Clutch Mechanism	VID 1083	£15.00
Capstan Motor	VID 2188	£45.96
Loading Motor	VID 2167	£14.11
Front Loading Motor	VID 2168	£10.62
Cassette LED	VID 1981	£1.53
Tension Band	VID 1388	£2.13
Repair Kit	VID 7920	£21.85
Cassette Housing	VID 1315	£21.90

WE GUARANTEE THAT ALL VIDEO SPARES SUPPLIED BY US ARE OF THE FINEST QUALITY AND THAT ALL STOCKED ITEMS WILL BE DISPATCHED THE SAME DAY.

	Part No	Price
3-V-57		
Video Head	VID 2573	£17.81
Pinch Roller	VID 1813	£3.15
Belt Kit	VID 7540	£0.68
Clutch Mechanism	VID 1083	£15.00
Capstan Motor	VID 2188	£45.96
Loading Motor	VID 2167	£14.11
Front Loading Motor	VID 2168	£10.62
Cassette LED	VID 1981	£1.53
Tension Band	VID 1388	£2.13
Repair Kit	VID 7920	£21.85
Cassette Housing	VID 1315	£21.90
FV-108		
Video Head	VID 2580	£19.73
Pinch Roller	VID 1817	£7.05
Belt Kit	VID 7564	£2.81
Idler Arm	VID 1091	£2.48
Reel Motor	VID 2193	£16.24
Capstan Motor	VID 2190	£24.72
Loading Motor	VID 2412	£6.37
Front Loading Motor	VID 2412	£6.37
Cassette LED	VID 1981	£1.53
Tension Band	VID 1386	£0.85
Repair Kit	VID 7921	£9.97
FV-12L		
Video Head	VID 2581	£25.82
Pinch Roller	VID 1817	£7.05
Belt Kit	VID 7564	£2.81
Idler Arm	VID 1091	£2.48
Reel Motor	VID 2193	£16.24
Capstan Motor	VID 2190	£24.72
Loading Motor	VID 2412	£6.37
Front Loading Motor	VID 2412	£6.37
Cassette LED	VID 1981	£1.53
Tension Band	VID 1386	£0.85
Repair Kit	VID 7921	£9.97
FIDELITY		
VCR-100		
Video Head	VID 2502	£15.61
Pinch Roller	VID 1758	£3.15
Belt Kit	VID 7593	£1.81
Clutch	VID 1226	£4.76
Gear Holder	VID 1227	£13.14
RF Clutch	VID 1231	£7.78
Cassette LED	VID 1981	£1.53
FINLUX		
VR-1030		
Video Head	VID 2558	£44.82
Pinch Roller	VID 1803	£3.83
Idler	VID 1006	£3.46
Tension Band	VID 1432	£5.87
Remote Control	IR 9034	£14.52
Repair Kit	VID 7930	£12.58
VR-2010		
Video Head	VID 2578	£62.15
Pinch Roller	VID 1827	£6.66
Belt Kit	VID 7588	£1.09
Idler	VID 1252	£5.20
Loading Gear	VID 1253	£7.23
Modification Set	VID 1254	£10.61
Tension Band	VID 1431	£4.85
Remote Control	IR 9034	£14.52
FISHER		
FVH-P520		
Video Head	VID 2500	£17.39
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7532	£1.35
Take Up Idler	VID 1015	£3.85
FF × REW Pulley	VID 1016	£0.93
Idler	VID 1023	£3.46
Tension Band	VID 1378	£2.76
Take Up Reel Table Rubber Tyre	VID 1293	£0.77
Supply Reel Table Rubber Tyre	VID 1293	£0.77
FVH-P530		
Video Head	VID 2500	£17.39
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7532	£1.35
Take Up Idler	VID 1015	£3.65
FF × REW Pulley	VID 1016	£0.93
Idler	VID 1023	£3.46
Tension Band	VID 1378	£2.76
Take Up Reel Table Rubber Tyre	VID 1293	£0.77
Supply Reel Table Rubber Tyre	VID 1293	£0.77
FVH-P720 × 720K × 721		
Video Head	VID 2500	£17.39
Pinch Roller	VID 1810	£3.04
Belt Kit	VID 7532	£1.35
Gear Idler	VID 1013	£4.51
Idler	VID 1014	£3.06
Loading Gear Set	VID 1230	£1.02
Cassette LED	VID 1981	£1.53
Tension Band	VID 1376	£2.38
Take Up Reel Table	VID 1295	£8.07
Supply Reel Table	VID 1294	£6.55
FVH-P722 × 725		
Video Head	VID 2501	£28.57
Pinch Roller	VID 1810	£3.04
Belt Kit	VID 7813	£1.19
Gear Idler	VID 1013	£4.51
Idler	VID 1014	£3.06
Loading Gear Set	VID 1230	£1.02

	Part No	Price
3-V-57		
Cassette LED	VID 1981	£1.53
Tension Band	VID 1376	£2.38
Take Up Reel Table	VID 1295	£8.07
Supply Reel Table	VID 1294	£6.55
FVH-P900K × XV		
Video Head	VID 2501	£25.17
Pinch Roller	VID 1818	£3.06
Belt Kit	VID 7568	£3.15
Idler	VID 1093	£4.85
Clutch	VID 1094	£14.59
Cassette LED	VID 1981	£1.53
Tension Band	VID 1377	£2.47
Supply Reel Table	VID 1296	£11.30
FUNAI		
VCR-4600		
Video Head	VID 2676	£14.79
Pinch Roller	VID 1758	£3.15
Belt Kit	VID 7593	£1.81
Clutch	VID 1226	£4.76
Gear Holder	VID 1227	£13.14
RF Clutch	VID 1231	£7.78
Cassette LED	VID 1981	£1.53
VCR-5843		
Video Head	VID 2708	£25.04
Pinch Roller	VID 1758	£3.15
Belt Kit	VID 7615	£1.70
Idler	VID 1364	£2.56
Cassette LED	VID 1981	£1.53
GEC		
V-4004		
Video Head	VID 2506	£14.14
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7538	£1.27
FF × REW Arm	VID 1020	£1.79
Clutch Plate	VID 1211	£8.52
Capstan Motor	VID 2148	£20.45
Cassette LED	VID 1981	£1.53
Tension Band	VID 1379	£2.38
Repair Kit	VID 7922	£17.24
GOLDSTAR		
GHV-8000 × 8200 × 8210 × 8215		
Pinch Roller	VID 1815	£3.15
Belt Kit	VID 7585	£1.53
Idler	VID 1052	£1.69
Bracket Centre	VID 1223	£13.51
Clutch Gear	VID 1228	£2.29
Limiter Roller	VID 1440	£1.53
Cassette LED	VID 1981	£1.53
Tension Band	VID 1399	£2.04
VCP-4100 × 4130		
Video Head	VID 2645	£21.23
Pinch Roller	VID 1815	£3.15
Belt Kit	VID 7585	£1.53
Idler	VID 1052	£1.69
Bracket Centre	VID 1223	£13.51
Clutch Gear	VID 1228	£2.29
Limiter Roller	VID 1440	£1.53
Cassette LED	VID 1981	£1.53
Tension Band	VID 1399	£2.04
VCP-4200 × 4326		
Video Head	VID 2645	£21.23
Pinch Roller	VID 1815	£3.15
REW Belt	VID 7234	£0.43
Cassette LED	VID 1981	£1.53
GRANADA		
VHS-EY1 × EY2		
Video Head	VID 2539	£14.75
Pinch Roller	VID 1822	£3.31
Belt Kit	VID 7605	£2.83
Reel Drive Unit	VID 1255	£6.69
Loading Gear A	VID 1268	£1.95
Loading Gear B	VID 1271	£1.36
Capstan Motor	VID 2404	£46.16
Cassette LED	VID 1981	£1.53
Tension Band	VID 1414	£3.52
GRUNDIG		
MVS-400		
Video Head	VID 2596	£15.75
Pinch Roller	VID 1757	£3.06
Belt Kit	VID 7567	£0.85
Idler	VID 1052	£1.69
Loading Gear	VID 1222	£1.57
Clutch Gear	VID 1228	£2.29
Limiter Roller	VID 1440	£1.53
Cassette LED	VID 1981	£1.53
Tension Band	VID 1400	£2.39
Remote Control	IR 8965	£22.53
VS-520 GB		
Video Head	VID 2595	£16.24
Pinch Roller	VID 1821	£3.52
Timing Belt	VID 1482	£2.18
Centre Pulley	VID 1482	£8.16
Cassette LED	VID 1981	£1.53
Tension Band	VID 1401	£3.83
HINARI		
VXL-30 × 35 × 4		
Video Head	VID 2518	£21.85
Pinch Roller	VID 1815	£3.15
Belt Kit	VID 7566	£2.38
Clutch	VID 1316	£6.21
Idler	VID 1317	£2.77
Loading Motor	VID 2167	£14.11
Cassette LED	VID 1981	£1.53

	Part No	Price
HITACHI		
VT-11		
Video Head	VID 2504	£15.84
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7538	£1.27
FF × REW Idler Arm	VID 1020	£1.79
Clutch Plate	VID 1211	£8.52
Capstan Motor	VID 2147	£23.15
Cassette LED	VID 1981	£1.53
Tension Band	VID 1379	£2.38
Repair Kit	VID 7922	£17.24
VT-16 S		
Video Head	VID 2505	£25.56
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7538	£1.27
FF × REW Idler Arm	VID 1020	£1.79
Clutch Plate	VID 1211	£8.52
Capstan Motor	VID 2147	£23.15
Cassette LED	VID 1981	£1.53
Tension Band	VID 1379	£2.38
Repair Kit	VID 7922	£17.24
VT-33 × 330		
Video Head	VID 2504	£15.84
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7538	£1.27
FF × REW Idler Arm	VID 1020	£1.79
Clutch Plate	VID 1211	£8.52
Capstan Motor	VID 2148	£20.45
Cassette LED	VID 1981	£1.53
Tension Band	VID 1379	£2.38
Repair Kit	VID 7922	£17.24
VT-61 × 62 × 63 × 64		
Video Head	VID 2628	£24.98
Pinch Roller	VID 1818	£3.06
Belt Kit	VID 7583	£1.61
FF × REW Idler Arm	VID 1020	£1.79
Clutch Plate	VID 1211	£8.52
Capstan Motor	VID 2154	£21.34
Cassette LED	VID 1981	£1.53
Tension Band	VID 1379	£2.38
Repair Kit	VID 7924	£15.35
VT-8000 × 8500		
Video Head	VID 2509	£15.76
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7803	£0.77
Take Up Idler	VID 1015	£3.85
Wind Roller	VID 1016	£0.93
FF × REW Idler	VID 1023	£3.46
Capstan Motor	VID 2155	£52.02
Tension Band	VID 1381	£2.21
Remote Control	IR 9097	£15.92
Repair Kit	VID 7928	£13.72
Take up Reel Table	VID 1302	£13.00
Supply Reel Rubber Tyre	VID 1300	£0.85
VT-9300 × 9500 × 9700		
Video Head	VID 2509	£15.76
Pinch Roller	VID 1788	£3.15
Belt Kit	VID 7802	£0.94
FF × REW Idler Arm	VID 1019	£2.89
Play Idler	VID 1075	£3.99
FS Brake	VID 1212	£1.99
Capstan Motor	VID 2156	£50.55
Cassette Lamp	VID 1951	£1.02
Tension Band	VID 1382	£2.20
Remote Control	IR 9096	£16.95
Repair Kit	VID 7927	£15.67
Take Up Reel Table	VID 1303	£9.43
ITT		
VR-3913		
Video Head	VID 2511	£9.18
Pinch Roller	VID 1814	£3.15
Belt Kit	VID 7812	£1.29
Reel Idler	VID 1036	£2.63
Take Up Clutch	VID 1037	£2.38
Take Up Idler	VID 1038	£1.07
Brake Pad	VID 1361	£0.59
Reel Motor	VID 2169	£28.97
Capstan Motor	VID 2164	£33.80
Loading Motor	VID 2168	£10.62
Cassette Lamp	VID 1947	£0.44
Tension Band	VID 1389	£1.79
Repair Kit	VID 7913	£16.09
Take Up Reel Table Rubber Tyre	VID 1080	£0.68
Supply Reel Table Rubber Tyre	VID 1080	£0.68
VR-3993		
Video Head	VID 2647	£9.18
Pinch Roller	VID 1814	£3.15
Belt Kit	VID 7523	£1.27
Reel Idler	VID 1036	£2.63
Take Up Clutch	VID 1037	£2.38
Take Up Idler	VID 1038	£1.07
Roller Bar	VID 1363	£4.87
Brake Pad	VID 1361	£0.59
Reel Motor	VID 2169	£28.97
Capstan Motor	VID 2187	£47.57
Loading Motor	VID 2168	£10.62
Front Loading Motor	VID 2168	£10.62
Cassette Lamp	VID 1946	£0.59
Tension Band	VID 1389	£1.79
Repair Kit	VID 7914	£13.42
Take Up Reel Table Rubber Tyre	VID 1080	£0.68
Supply Reel Table Rubber Tyre	VID 1080	£0.68

	Part No	Price
JVC		
HR-3300		
Video Head	VID 2511	£9.18
Pinch Roller	VID 1756	£3.23
Belt Kit	VID 7506	£1.61
Take Up Idler Large	VID 1025	£5.27
REW Idler	VID 1025	£5.27
Unloading Idler	VID 1027	£10.54
FF Rubber Tyre	VID 1029	£0.85
Unloading Idler Rubber Tyre	VID 1207	£0.93
Capstan Motor	VID 2119	£25.34
Drum Motor	VID 2120	£20.20
Cassette Lamp	VID 1943	£0.27
Tension Band	VID 1391	£3.65
Repair Kit	VID 7911	£15.27
Take Up Rubber Tyre	VID 1028	£0.85
HR-D110 × 111 × 120 × 121		
Video Head	VID 2647	£9.18
Pinch Roller	VID 1813	£3.15
Belt Kit	VID 7543	£1.02
Take Up Clutch	VID 1031	£2.11
Take Up Idler	VID 1038	£1.07
Reel Idler	VID 1039	£3.40
Brake Pad	VID 1361	£0.59
Capstan Motor	VID 2165	£25.16
Loading Motor	VID 2168	£10.62
Front Loading Motor	VID 2168	£10.62
Cassette LED	VID 1981	£1.53
Tension Band	VID 1389	£1.79
Repair Kit	VID 7918	£12.51
Mains Transformer	VID 2223	£24.18
Take Up Reel Table Rubber Tyre	VID 1080	£0.68
Supply Reel Table Rubber Tyre	VID 1080	£0.68
Cassette Housing	VID 1099	£21.76
MATSUI		
VX-850		
Pinch Roller	VID 1815	£3.15
Belt Kit	VID 7566	£2.38
Clutch	VID 1316	£6.21
Idler	VID 1317	£2.77
Cassette LED	VID 1981	£1.53
MITSUBISHI		
HS-307		
Video Head	VID 2606	£33.96
Pinch Roller	VID 1808	£3.15
Belt Kit	VID 7542	£1.26
Reel Idler Unit	VID 1040	£8.48
FF Idler Rubber Tyre	VID 1081	£0.77
Capstan Rubber Tyre	VID 1264	£1.36
Cam Gear A	VID 1274	£1.36
Gear 2	VID 1275	£1.53
Cam Gear B	VID 1276	£1.53
Gear 1	VID 1277	£1.45
Cassette LED	VID 1981	£1.53
Tension Band	VID 1393	£2.89
Take Up Reel Table	VID 1307	£3.31
Supply Reel Table	VID 1299	£3.54
HS-318		
Video Head	VID 2607	£43.65
Pinch Roller	VID 1808	£3.15
Belt Kit	VID 7559	£1.81
Reel Idler Unit	VID 1040	£8.48
FF Idler Rubber Tyre	VID 1081	£0.77
Capstan Rubber Tyre	VID 1264	£1.36
Cam Gear A	VID 1274	£1.36
Gear 2	VID 1275	£1.53
Cam Gear B	VID 1276	£1.53
Gear 1	VID 1277	£1.45
Cassette LED	VID 1981	£1.53
Tension Band	VID 1393	£2.89
Take Up Reel Table	VID 1307	£3.31
Supply Reel Table	VID 1299	£3.54
NEC		
N-830 E6 × 831 × 832 × 833		
Video Head	VID 2647	£9.18
Pinch Roller	VID 1813	£3.15
Belt Kit	VID 7543	£1.02
Take Up Clutch	VID 1031	£2.04
Take Up Idler	VID 1038	£1.07
Reel Idler	VID 1039	£3.40
Brake Pad	VID 1361	£0.59
Capstan Motor	VID 2165	£25.16
Loading Motor	VID 2168	£10.62
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Cassette LED	VID 1981	£1.53
Tension Band	VID 1389	£1.79
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Cassette LED	VID 1981	£1.53
Tension Band	VID 1387	£2.55

	Part No	Price
Remote Control	IR 8947	£16.23
Repair Kit	VID 7919	£17.92
Cassette Housing	VID 1315	£21.90
N-9013 × 9014 × 9033 × 9034 × 9053 × 9054 × 9055		
Video Head	VID 2695	£20.10
Pinch Roller	VID 1828	£3.06
Belt Kit	VID 7601	£3.49
Reel Drive Pulley	VID 1265	£7.31
Cassette LED	VID 1981	£1.53
PANASONIC		
NV-2000 × 2010		
Video Head	VID 2520	£9.19
Pinch Roller	VID 1757	£3.06
Belt Kit	VID 7800	£1.79
Idler	VID 1054	£0.90
Idler	VID 1055	£0.85
Cam Gear	VID 1221	£0.61
Intermediate Gear	VID 1216	£1.27
Driving Gear	VID 1217	£0.59
Cassette Lamp	VID 1948	£0.25
Tension Band	VID 1397	£3.49
Repair Kit	VID 7901	£10.86
Take Up Reel Table	VID 1312	£11.47
Supply Reel Table	VID 1310	£7.57
NV-300 × 333		
Video Head	VID 2520	£8.19
Pinch Roller	VID 1787	£3.74
Belt Kit	VID 7521	£1.35
Play Idler	VID 1048	£2.81
Idler	VID 1057	£0.88
Idler Arm	VID 1220	£4.33
Cam Gear	VID 1215	£1.19
Intermediate Gear	VID 1216	£1.27
Driving Gear	VID 1217	£0.59
Reel Motor	VID 2158	£19.52
Capstan Motor	VID 2421	£40.62
Cassette LED	VID 1982	£1.78
Tension Band	VID 1399	£2.04
Repair Kit	VID 7903	£10.89
Take Up Reel Table	VID 1312	£11.47
PHILIPS		
Video Head	VID 2526	£10.45
Pinch Roller	VID 1757	£3.06
Belt Kit	VID 7530	£0.93
Idler	VID 1052	£1.69
Loading Gear	VID 1222	£1.57
Idler	VID 1370	£2.04
Idler	VID 1371	£6.12
Limiter Roller	VID 1440	£1.53
Cassette LED	VID 1981	£1.53
Tension Band	VID 1400	£2.39
Repair Kit	VID 7906	£8.22
VR-6540		
Video Head	VID 2537	£18.57
Pinch Roller	VID 1815	£3.15
Belt Kit	VID 7547	£1.02
Idler	VID 1060	£1.61
Master Cam	VID 1265	£7.31
Reel Motor	VID 2127	£26.85
Loading Motor	VID 2142	£16.70
Cassette LED	VID 1981	£1.53
Tension Band	VID 1420	£5.78
PYE		
DV-761		
Video Head	VID 2621	£57.10
Pinch Roller	VID 1827	£6.66
Belt Kit	VID 7588	£1.09
Idler	VID 1252	£5.20
Loading Gear	VID 1253	£7.23
Modification Set	VID 1254	£10.61
Tension Band	VID 1431	£4.85
SAISHO		
VR-2000 × 3800		
Pinch Roller	VID 1815	£3.15
Belt Kit	VID 7565	£0.94
Idler	VID 1060	£1.61
Reel Motor	VID 2121	£17.12
Cassette LED	VID 1981	£1.53
SALORA		
SV-8620		
Pinch Roller	VID 1808	£3.15
Belt Kit	VID 7600	£3.31
FF × REW Idler Arm	VID 1233	£3.23
FF × REW Idler Arm	VID 1234	£3.51
FF × REW Idler	VID 1235	£1.87
Cassette LED	VID 1981	£1.53
Tension Band	VID 1394	£3.31
Take Up Reel Table	VID 1308	£5.37
Supply Reel Table	VID 1305	£4.67
SAMSUNG		
VI-510 × 520 × 611 × 616 × 621		
Video Head	VID 2648	£17.88
Pinch Roller	VID 1815	£3.15
Belt Kit	VID 7598	£1.40
Idler	VID 1232	£1.53
Idler	VID 1346	£3.76
Reel Motor	VID 2407	£15.77
Capstan Motor	VID 2409	£27.62
Loading Motor	VID 2142	£16.70
Cassette LED	VID 1981	£1.53
VX-710 × 720 × 730		
Video Head	VID 2648	£17.88
Pinch Roller	VID 1759	£3.06
Belt Kit	VID 7608	£2.72
Cassette LED	VID 1981	£1.53
SANYO		
VHR-1100 EX × EE × 6		
Video Head	VID 2583	£22.68
Pinch Roller	VID 1787	£3.74
Belt Kit	VID 7558	£1.09
Reel Drive Roller	VID 1076	£6.18
Reel Motor	VID 2198	£15.87
Cassette LED	VID 1981	£1.53
Tension Band	VID 1411	£2.72
VHR-1500 EX × 6		
Video Head	VID 2585	£48.28
Pinch Roller	VID 1787	£3.74
Belt Kit	VID 7558	£1.09
Reel Drive Roller	VID 1076	£6.18
Reel Motor	VID 2198	£15.87
Cassette LED	VID 1981	£1.53
Tension Band	VID 1411	£2.72
VTC-M10 × 11 × 20 × 21		
Video Head	VID 2530	£20.35
Pinch Roller	VID 1758	£3.15
Belt Kit	VID 7809	£0.77
Reel Drive Pulley	VID 1079	£7.05
Idler	VID 1219	£1.95
Reel Motor	VID 2179	£20.44
Tension Band	VID 1408	£2.13
Supply Reel Table	VID 1319	£9.77
SENTRA		
VX-5000 × 8000		
Video Head	VID 2713	£16.30
Pinch Roller	VID 1787	£3.74
Belt Kit	VID 7596	£3.81
Idler	VID 1049	£3.31
Cassette LED	VID 1981	£1.53
Tension Band	VID 1399	£2.04

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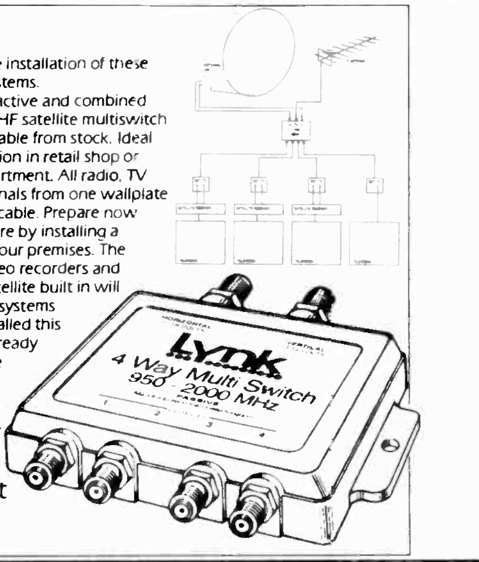

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Philips' Double-scan Technique

George Wilding

Improvements in picture tube technology have resulted in high brightness and contrast level pictures. The only drawback is that, especially with the larger screen sizes, there's a greater susceptibility to field-frequency flicker. Four factors in particular contribute to this: low field frequency; high brightness levels; large picture areas with high luminance content; and viewing angle. With regard to field frequency, the current 50Hz represents a good compromise between bandwidth considerations and the need to reproduce fast-moving picture information adequately – it has the added bonus of being the mains frequency. The fourth factor arises because flicker is more apparent when a picture is viewed slightly away from the front or when the screen is looked at closely – periphery of eye vision is more sensitive to flicker than the central area.

Philips, Cineline Tubes

Philips Cineline 16:9 aspect ratio picture tubes achieve high performance as a result of the use of a new, improved black matrix system, the use of Invar shadowmasks that allow the tube to be driven at fifty per cent higher beam power, and the use of DAF (dynamic astigmatism and focusing) guns. The DAF technique provides pin-sharp focusing over the entire picture area. Using higher beam drive enables faceplates with a lower light transmission characteristic to be used, thereby improving the contrast level. Ideally, such improved performance should be matched by complete freedom from flicker.

Eliminating Flicker

Research carried out by Philips engineers established that complete freedom from flicker under all practical luminance conditions and viewing angles could be guaranteed by increasing the field frequency to at least 92Hz. The most convenient way of meeting this requirement is to double the frequency to 100Hz, with the line frequency similarly doubled. To scan the tube in this way with a standard video source requires the use of a memory chip signal storage/retrieval system. By using a memory read-out rate double the write-in rate, correct modulation for double-scanning is achieved.

Philips has used this approach in the state-of-the-art FL1.2 chassis, which is designed to drive 16:9 tubes. A four-step signal processing system is employed. First conversion of the luminance (Y) and colour-difference (B – Y and R – Y) signals to digital form. Secondly feeding the digital video signal components into memory chips that are clocked at 13·5MHz. Thirdly reading the video data out at 27MHz. And finally conversion back to analogue form followed by matrixing and processing to obtain RGB signals for voltage amplification. Fig. 1 shows the system in simplified block-diagram form. In the FL1.2 chassis it's referred to as the 'high-end box'.

An Advanced Video Processing System

It's interesting to see where the high-end box fits into the overall video processing system used in the FL1.2 chassis. Fig. 2 shows the arrangement in block diagram form. The TEA6414 is a switching chip to select from different video sources, providing luminance (Y) and chrominance signal outputs. We'll trace through the luminance channel first.

A sharpness circuit follows the TEA6414 chip. It uses three transistors and a handful of passive components, see Fig. 3. There are two inputs, luminance and a crispner switching voltage. The luminance input is fed directly to the output via R3316 and to the base of transistor Tr7312 via a bandpass filter, tuned to approximately 2MHz, consisting of C2310 and L5310. When the crispness input rises to 0·7V all three transistors are brought into operation and the 2MHz signal is added to the output, producing a sharpened luminance output.

The next stage is a switchable chroma trap – this is used because the set has a multi-standard decoder. The nominal centre frequency is determined by outputs (auto-system select) from the TDA4650 colour decoder chip, which recognises the different transmission standards by the nature of the colour bursts in the case of PAL and NTSC transmissions or the identification signals in the case of SECAM.

The following luminance delay line is incorporated in a TDA4565 chip, which also includes a signal sharpening feature. Fig. 4 shows the relevant circuit. A positive crispeness control input at the base of transistor Tr7326 reduces the voltage at pin 15 of the chip. This action decreases the degree of signal delay. The processed luminance signal is then fed to the high-end box.

The chrominance output from the TEA6414 chip is fed to the TDA4650 multi-standard decoder chip via a switchable bandpass filter. One of the auto-system select pins of the decoder chip goes high to activate transistor switching within the filter block.

The decoded R – Y and B – Y outputs are fed to baseband delay lines in a TDA4660 chip, where the direct inputs are added to signals delayed by one line, producing corrected output signals. Between these and the high-end box a TDA8663A chip provides matrixing and source-selection.

The High-end Box

We are now back at the high-end box, where the luminance and colour-difference signals are first fed to an analogue-to-digital converter so that they can be stored in the memory chips at the write-in frequency of 13·5MHz and then clocked out at the doubled rate of 27MHz.

While the digitised luminance signal is fed to the

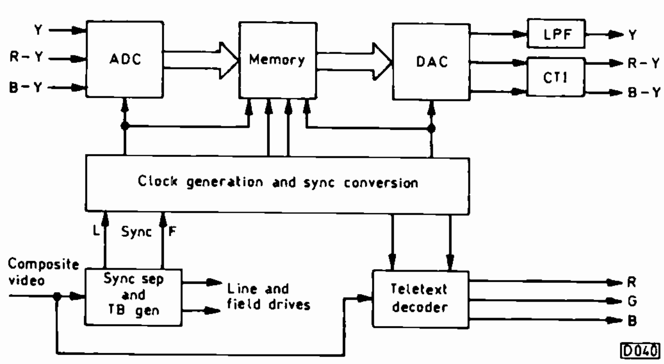

Fig. 1: Simplified block diagram showing the main operations carried out in the high-end box in the Philips FL1.2 chassis, in particular conversion of the signal to 1,250, 100Hz line/field frequency rates.

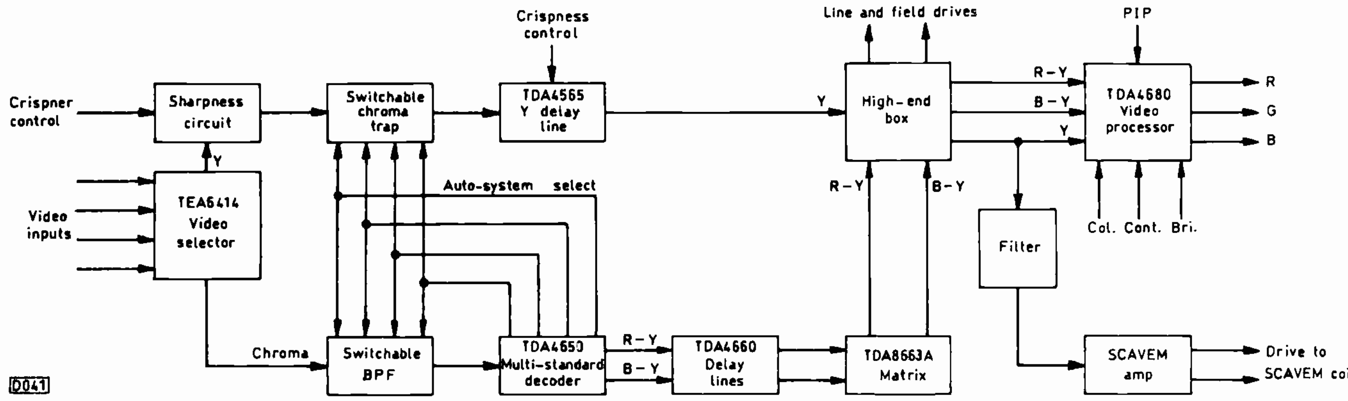

Fig. 2: Block diagram of the signal processing arrangements in the Philips FL1.2 chassis

memory directly, the converted colour-difference signals go to the RAM via shift registers. The reason for this is that the converter's bandwidth of 6·75MHz is not required for the colour-difference signals, 1·5MHz being more than adequate. So the bandwidth of the colour-difference signal outputs from the converter is reduced by a factor of four. This is done by reading them into the shift registers at a clock frequency of 3·375MHz, so that for each four bits fed in three are discarded. The bits are read out serially at a clock frequency of 13·5MHz, the result being that four parallel bits remain of the fourteen original parallel R – Y and B – Y bits. It's these bits that are fed to the RAM.

The RAM consists of three special video memories, each with a capacity of 1Mbits. They are used in parallel, driven by the same clock signals.

The repetition frequency of the write reset pulses is 50Hz, that of the read reset pulses 100Hz. Thus with a write clock frequency of 13·5MHz, 18·5msecs of video information can be stored. As a frame lasts for 20msecs some information must be discarded. This is taken care of by not writing in the lines that occur during the frame flyback.

The 100Hz signals are read out at 27MHz, the four-bit colour-difference signals being converted to seven-bit form. Y, R – Y and B – Y then go to three digital-to-analogue converters. The Y signal is fed out of the high-end box via a low-pass filter, the colour-difference signals going first through a CTI (colour-transient improvement) chip where the steepness of signal flanks is increased. Where there are no signal flanks, i.e. in a relatively large area of unchanging colour, the colour-difference signals pass through unchanged.

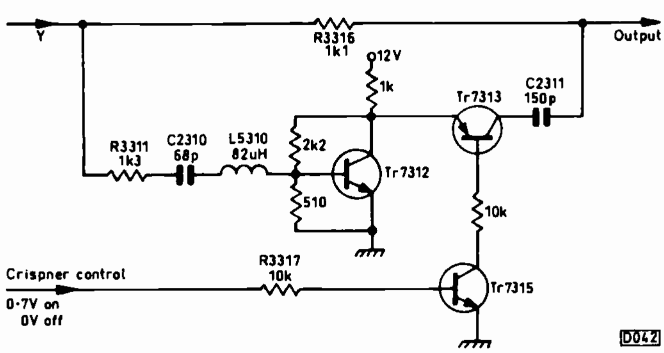

Fig. 3: Luminance sharpness circuit.

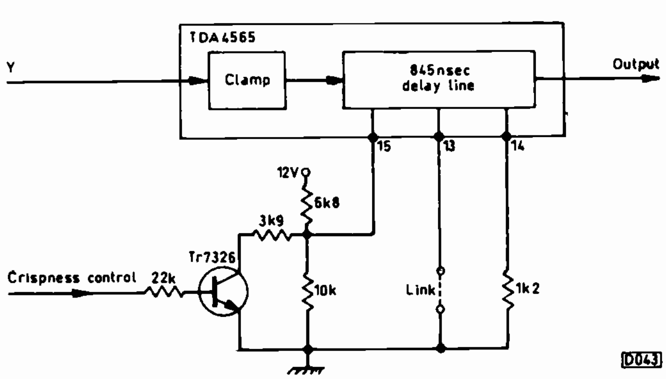

Fig. 4: The luminance delay line chip.

RGB Processing

The Y, R – Y and B – Y outputs from the high-end box, with correspondingly fast blanking signals, are passed to a TDA4680 video processing chip that produces RGB outputs and carries out brightness, contrast and saturation control, beam current limiting, peak white limitation and black-level stabilisation. This chip also receives inputs from the teletext decoder and from the PIP (picture-in-picture) module when fitted. Its RGB outputs are fed to three TDA6100 voltage amplifier chips that are mounted on the tube's base panel to minimise capacitive loading.

Scan Velocity Modulation

The Y output from the high-end box is also used to drive the SCAVEM (scan velocity modulation) system. This varies the beam velocity over the large screen area in accordance with the instantaneous picture content. The effect is to balance white-to-black transitions, giving improved overall picture resolution. Because of the tube's input capacitance, white-black transitions take longer than black-white transitions, the problem being more evident with a 16:9 aspect-ratio.

The SCAVEM filter feeds a symmetrical SCAVEM amplifier that drives an additional coil on the neck of the tube to modulate the velocity of the beams.

Synchronisation and Clock Generation

A TDA2579B-N8S1 chip in the high-end block incorporates the sync separator, providing line and field sync outputs to synchronise the clock generator section and line and field drives at 31,250Hz and 100Hz respectively. The line drive output goes to a conventional driver stage while the field drive output is fed via an emitter-follower to a TDA3654 output chip.

The frame blanking level of the sandcastle output from this chip, at pin 17, is 2·5V. If the reference voltage fed back from the frame output stage to pin 2 is greater than 1·9V or less than 0·5V the output at pin 17 will be a minimum of 2·5V, providing tube protection.

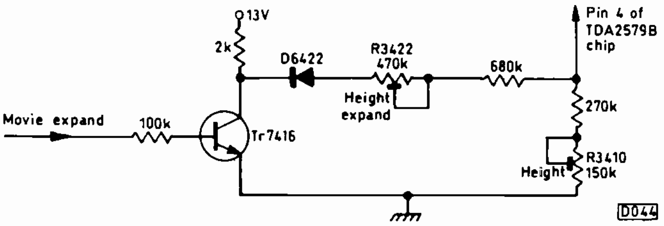

Fig. 5: The height control circuit is complicated by the movie mode arrangement for 4:3 pictures.

There's a movie mode for displaying 4:3 aspect ratio pictures as 16:9 pictures. This calls for vertical expansion. Fig. 5 shows the simple circuitry involved. R3410 is the height control in most circumstances. For 4:3 movie expansion transistor Tr7416 is forward biased. Thus R3422 is returned to chassis via D6422 and Tr7419, taking over height adjustment in this mode.

The clock generation/sync conversion section of the high-end box receives line and frame sync pulse inputs, generating from them clock pulse signals to control the digital video processing circuitry. It also controls the teletext decoder, which differs from normal ones in that pages are generated with a 100Hz field frequency.

Scan Coil Heating

Doubling the scanning frequencies naturally results in greater power dissipation/heating in the scan coils, particularly those used for line deflection. To take this into account Philips use special Litz wire: each strand is individually coated with polyurethane, the overall wire being encapsulated in a thermoplastic material.

Since current flow tends to be concentrated increasingly in the surface of a wire as frequency is increased (the 'skin effect'), a multi-strand wire with individually insulated strands provides a much greater conductive path than the equivalent single-strand wire.

Modern TV Receiver Techniques

Part 5

Eugene Trundle

Though the majority of viewers use the analogue sound systems described last month, the trend in broadcasting is towards digital transmission of TV sound. In terrestrial broadcasting this is currently an 'optional extra' in the form of Nicam; with satellite services that use MAC encoding it's an integral part of the signal package. In radio too DAB (digital audio broadcasting) is at present generating much interest. The first large-scale use of digital sound in the TV field was the BBC's sound-in-sync network distribution system which came into use in the early Seventies.

As with all digital technology, the processing circuitry for the new audio systems mainly lies buried in LSI chips, with only a few peripheral components/circuits. In this article we'll examine the operation of typical chips and their interfacing with the rest of the TV set, satellite receiver or VCR.

NICAM

Terrestrial transmitters broadcast Nicam digital sound data in the form of a four-phase modulated, low-level carrier at a frequency (UK system I) 6·552MHz above the vision carrier. It emerges from the tuner as an i.f. signal whose carrier is at 32·948MHz. After amplification this beats with the 39·5MHz vision carrier (either in the video demodulator or, as shown Fig. 1, in a separate dedicated mixer stage), producing a 6·552MHz carrier which is phase-modulated with the data that conveys the sound signals. A narrow-band filter selects the Nicam carrier from the other mixer beat products, presenting it to the first Nicam chip whose job it is to demodulate the carrier, translating its phase changes back to a data stream.

Carrier Demodulation

Fig. 2 shows the arrangements used in a typical QPSK (quadrature phase-shift keying) demodulator chip. The 6·552MHz Nicam signal is fed to the Nicam board at C55, is amplified by Tr1 and selected by the ceramic filter BPF1. It enters the demodulator chip at pin 4, where the first gain-controlled stage ensures that it's passed on at a constant level. The carrier is next fed to a pair of phase detectors, A and B, each of which consists of a sampling gate. These gates are opened once per carrier cycle, their opening times being 90° apart, that is in quadrature. The carrier samples thus obtained pass via separate low-pass filters between pins 10-20 and 11-19 of the chip. After re-entering the chip each sample train goes two separate ways. One is to an analogue switch that's part of the phase-locked loop embracing the VCO (voltage-controlled oscillator) carrier regenerator. This loop holds the 6·552MHz crystal oscillator connected to pins 6 and 8 of the chip at the mean (average) phase of the carrier. The flywheel filtering components are connected to pin 9. As a result the reference carrier feeds to phase detectors A and B are correct and of constant phase.

The next detection process examines each sample in turn to check on whether it's a logic one or zero. Because noise and interference continuously vary the signal level, the slicing point (the level above which the sample is deemed to be a one and below which it comes out as zero) must be

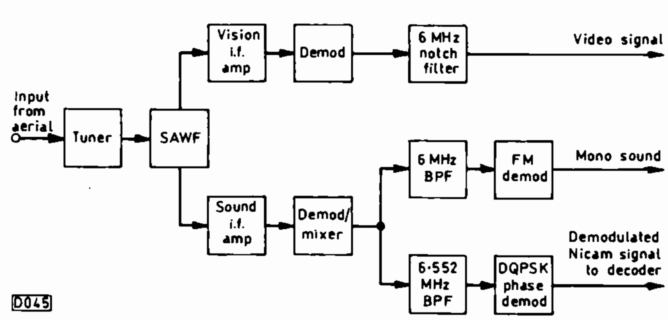

Fig. 1: Obtaining the Nicam carrier. The SAW filter has separate sound and vision outputs. Both sound and vision carrier components are present in the sound feed: they beat together in the sound demodulator to produce f.m. intercarrier and Nicam sound signals. These are selected by separate sharply-tuned filters.

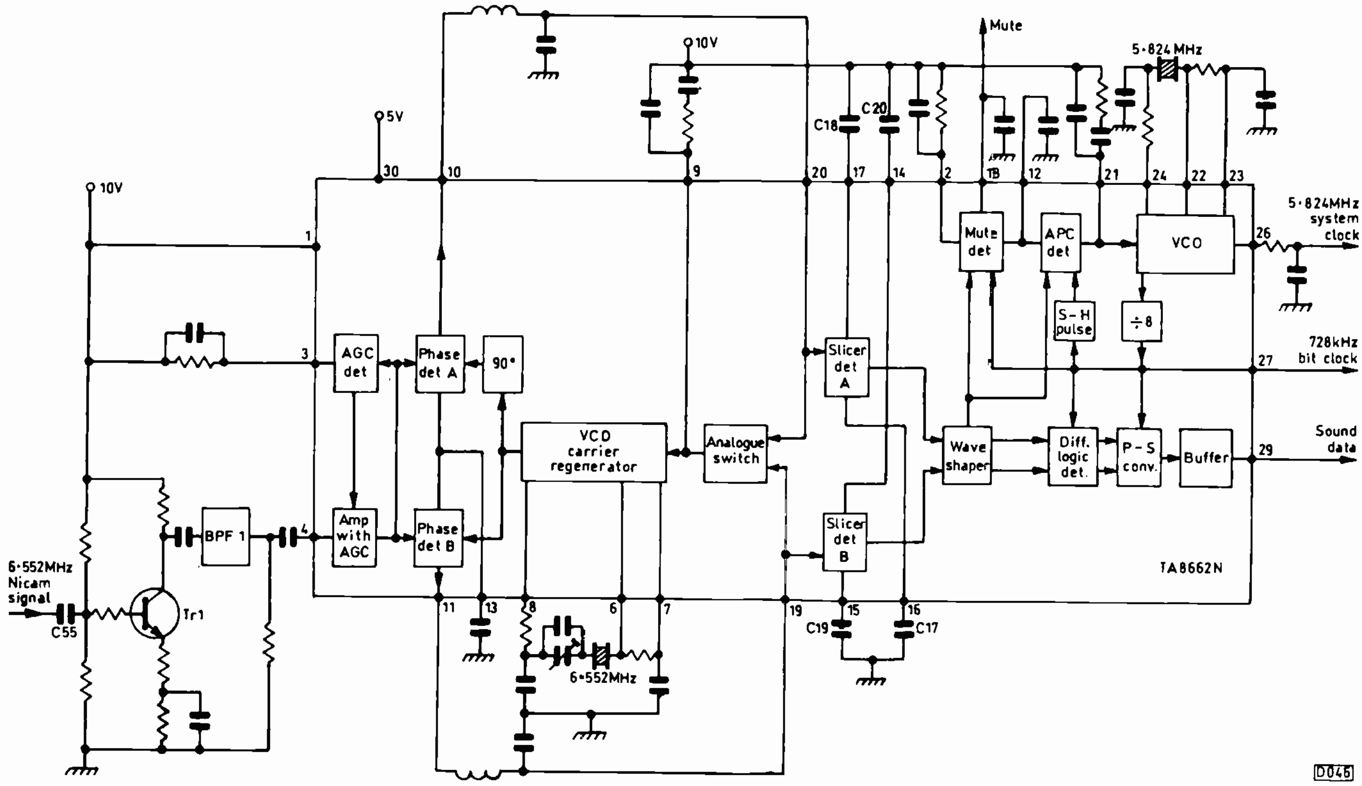

Fig. 2: Nicam sound demodulator circuit used in a Bang and Olufsen TV set.

continuously adjusted to the mean signal level. All this is carried out by the auto-slicer detectors: capacitors C17/18/19/20 store the high and low operating point levels for the detectors. The outputs pass via the wave shaper to the a.p.c. detector and the difference logic.

The Nicam bit rate is 728kHz. Thus in order to sample the signal we need a synchronised clock that runs at this rate. It's obtained from the 5·824MHz (eight times the bit rate) VCO connected to pins 22 – 24. The output from this is divided by eight and compared with the incoming signal by a phase detector whose response time is set by the RC network connected to pin 21. If the PLL comes out of lock the mute detector provides a low output at pin 18 to shut down the Nicam decoder downstream – or switch the set back to the ordinary f.m. sound.

Logic System

With the data-clock PLL locked, the difference logic block samples the signals synchronously, making one or zero decisions on the basis of their amplitude at the moment of gating. This logic detector has parallel outputs (bit pairs) that correspond to the pairing introduced in the modulation system at the transmitter. They are selected alternately by the parallel-to-serial converter, which is driven at bit rate.

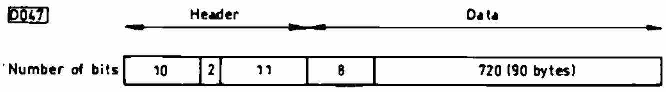

Fig. 3: Packet structure of a D-MAC sound/data burst.

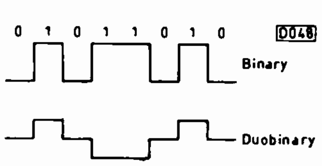

Fig. 4: How binary and duobinary coding compare: MAC transmissions use duobinary coding.

We thus end up with the demodulated data stream, which is then buffered and fed out at pin 29 for decoding. For use by the following Nicam decoder chip, system- and bit-rate clock pulse outputs are provided at pins 26 and 27 respectively.

Like the VIP chip in a teletext decoder, this i.c. is a hybrid design. A 10V supply (pin 1) is required for its analogue sections and a 5V supply (pin 30) for its digital circuits.

MAC Audio

While the Nicam signal conveys the audio data in the form of continuous phase modulation of a carrier, MAC systems use a line-rate data burst for the sound signal and 'house-keeping' services. The data format is illustrated in Fig. 3, which shows one 'packet' of data consisting of 751 bits. The header section contains a ten-bit address which is used to route the packet to the appropriate part of the receiver, also a two-bit continuity code that's used to link together successive packets of the same service and an eleven-bit suffix that acts as a check word, giving a high degree of protection to the address and index information. The actual data follows: first an eight-bit PT (packet type) word that provides decoding information then 720 bits of sound information.

D- and D2-MAC encode the data in duobinary form (see Fig. 4) to conserve bandwidth. There are three signal levels, the middle one signifying zero and the other two one. How is bandwidth saved? If you take the worst case, 01010101 etc., and imagine the squarewave smoothed to form a sinewave the effective frequency is lower. At the data rate of 20·25Mbits/sec, the 3dB bandwidth required is reduced from 10·125MHz to just over 8·4MHz.

Leaving aside modulation and demodulation, the MAC and Nicam signal formats are similar and, apart from the compression time-scale (and hence memory-writing rate), the Nicam demultiplexing circuit described next is largely applicable to MAC signal processing. In practice Nicam chipsets are not used in satellite receivers, though the principles they both use are very similar.

Nicam Demultiplexer

Fig. 5 shows in block diagram form the Nicam decoding carried out in a typical chip. This demultiplexer chip takes the demodulated Nicam data stream, descrambles, expands and de-interleaves it then adapts the data for application to a standard digital-to-analogue converter. It also provides information on the type of signal, i.e. stereo, bi-lingual etc., and can be controlled by a serial data bus.

The pulse train enters at pin 23 and passes to the FAW (frame alignment word) manager which recognises and locks on to the data. To avoid interference the data is scrambled prior to transmission. The FAW section initiates the descrambling process, the associated control bit decoder providing outputs at pins 35-39 for mode control and status indication. The main data path is to the memory manager, which selectively routes it to three 64 x 11 bit memories. By reading the data out of these in a different sequence from which it was read in, the bit-interleaving introduced at the transmitter as a precaution against data corruption by interference is cancelled. The read-out sequence is held as a 'code book' in the ROM. Each memory holds one frame of audio samples. While one is being read by the de-interleaver, fresh data received is being fed into another one. Thus two memories are in constant use during stereo reception. The third memory is required for use with dual-language programmes, in which the two monaural sound channels are transmitted in separate frames but may be needed simultaneously.

To conserve bandwidth the audio data is compressed from a word length of 14 bits to ten bits prior to transmission. The accompanying control data governs its expansion back to 14-bit form in the receiver. This is done in the expand and correct section, where the control data is used for both digital expansion and error correction by means of the commonly-used parity-check system.

The audio data has now been divested of its protective clothing, special packing, address labels and repair kits and is ready for conversion back to analogue form. There are three outputs from the demultiplexer chip: the data, consisting of alternate L and R (or bilingual) 14-bit words, at pin 3; an L/R ident (word select) squarewave at pin 33; and a clock pulse train at pin 4. These are all used by the DA converter, the next and last chip in the Nicam decoder.

DA Converter

The fourteen bits in each Nicam word can signify 16,384 different sound levels. It's the job of the DA converter to convert each word in turn to the exact voltage level it represents. The most significant bit (MSB) in effect contains fifty per cent of the information in the word. The next bit contains 25 per cent of the information and so on down to the fourteenth, least significant bit (LSB) that contributes less than 0·01 per cent to the signal output voltage.

The operation of a DA converter for applications like this is outlined in Fig. 6. The 14-bit data words are loaded into a pair of 7-bit registers and held there while two constant-current sources, one for each register, are switched on to charge a capacitor. As the charge progresses, the data in each of the registers is steadily decremented (counted down) until it reaches zero. At this point the relevant constant-current source is switched off. The generator associated with the high-order (7 MSBs) counter provides 128 times as much current as the constant-current source that works with

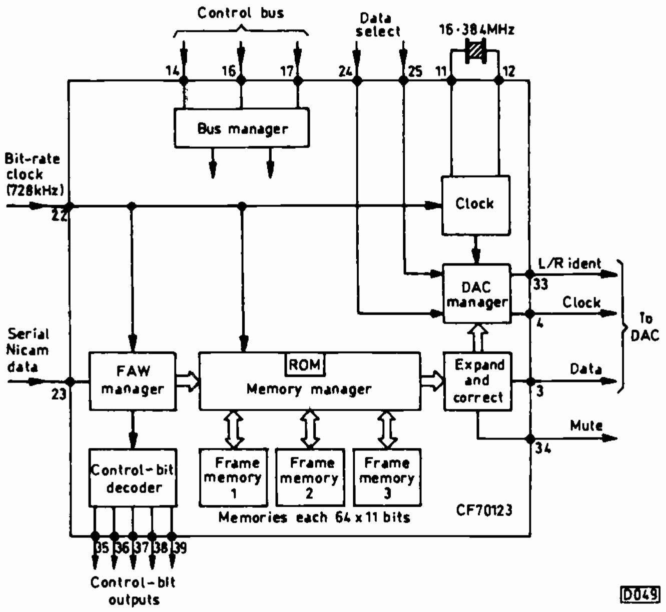

Fig. 5: Internal arrangement of a Nicam demultiplexer chip with on-board data memories. This type of chip is designed for use with standard DA converters.

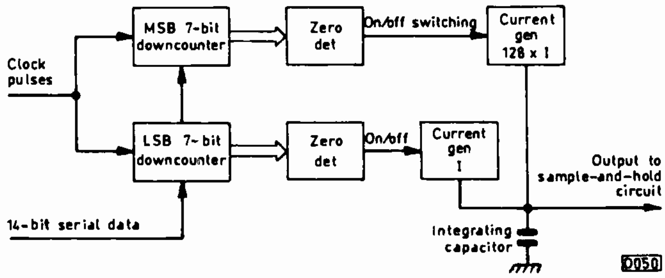

Fig. 6: Basic principle of an integrating type DAC.

the low-order (7 LSBs) counter, thus giving the correct weighting to each half of the word. When you charge a capacitor with a constant current (in this case I + 128I) the charge it acquires is proportional to the time during which the current flows. Thus the voltage developed across this integrating capacitor at the end of the charging period is proportional to the number represented by the digital word, with each digit given due weight in accordance with its position and significance. Between samples the capacitor is discharged by an electronic shorting switch.

The voltage across the integrating capacitor is 'true' for only a very brief period in the conversion cycle, that between the end of the charging phase (both current generators having been switched off) and the closing of the discharge switch preparatory to the conversion of the next word. Thus we need to transfer the charge into another, 'hold' capacitor at just the right moment in each conversion cycle so that a series of samples builds up as an analogue voltage. It's at the output of this sample-and-hold circuit that the original audio signal is recreated, as a series of steps whose average value is a facsimile of the studio audio waveform.

In the Nicam system the data alternates between L and R stereo samples: the L/R ident signal from the demultiplexer chip alternately switches the single DA converter between two separate integrating capacitors, one for L and the other for R.

Fig. 7 shows the internal arrangement of a DA converter chip for Nicam or CD-type applications. The outputs from the demultiplexer chip enter at pins 5 (L/R toggle), 6 (clock)

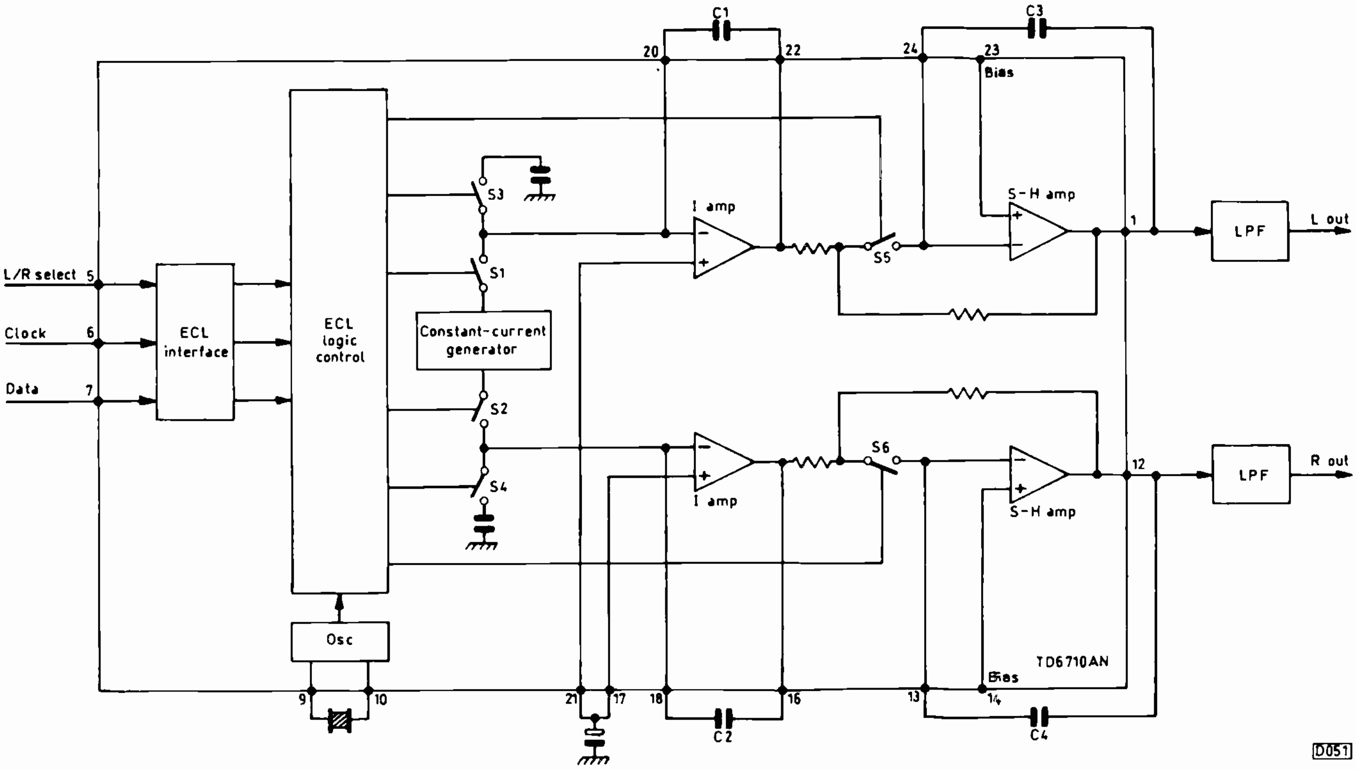

Fig. 7: Internal arrangement of the TD6710AN DAC chip which contains clock, converter and sample-and-hold sections. The ECL interface is fed directly from pins 3, 4 and 33 of the demultiplexer chip shown in Fig. 5.

and 7 (data). The constant-current charging switches that govern the charging periods of the integrating capacitors C1 (L channel) and C2 (R channel) are S1 and S2. S3 and S4 are the discharge switches, while the sample-and-hold system consists of S5/C3 for the L channel and S6/C4 for the R channel. The analogue-converted outputs appear at pins 1 and 12, after which they are passed through low-pass filters to smooth out the step waveform. Most DA converters use oversampling, being clocked at double or quadruple rate. Doubling or quadrupling the number of steps in the waveform makes each of them smaller and thus easier to smooth out: a gentler filtering action reduces the amount of phase distortion in the output signal.

The L/R audio signals are de-emphasised before being passed to a routing switch (typically under the control of a serial bus) and then to the sorts of amplifiers and speaker systems we looked at last month.

Further Integration

Although Nicam transmissions started only about three years ago we are already on the third generation of decoder systems. The first, which predated the broadcasts, had a demodulator chip, a demultiplexer chip with a separate memory chip for de-interleaving, and an AD converter system borrowed from CD player technology. The second and currently most used arrangement is the one described in this article, with three chips – demodulator, decoder and ADC. The latest approach is represented by the Philips SAA7282 i.c., a 32-pin C-MOS chip that incorporates the decoder and DAC with four times oversampling. It requires only a demodulator chip like that shown in Fig. 2 to form a complete two-chip, full-feature system with the following specification: selectable digital de-emphasis; one-bit DA conversion; internal/external sound routing; I2C bus control; interfacing for a digital audio output; separate DACs for the L and R channels; availability as a surface-mount package; and low peripheral component count. When used with the Philips TDA8732 demodulator chip only five filters, two crystals and a handful of passive components are needed.

Next Month

Having completed our survey of TV receiver audio systems, next month we'll turn to post-detector video signal processing – colour signal decoding, picture control and tube drive.

HELP WANTED

Can anyone supply a c.r.t. (type D10 230) for the Advance OS240 scope? David Thornton, 1a Heyes Mount, Rainhill, Prescot, Merseyside L35 0LU.

Wanted: All copies of *Television* in Vols. 38-42. Good price plus postage would be paid. Chris Davies, 52 The Close, Johnston, Haverfordwest, Dyfed SA62 3QQ. 0437 890 561.

Wanted: A LOPT for the Sentra STX200 colour portable. P. Chadwick, 14 Myers Gardens, Sutton, St. Helens, Merseyside WA9 3YY.

Wanted: The following issues of *Television*. June 1989 to Feb 1991, April 1991 to Oct 1991, Dec 1991, Feb 1992, Oct 1992, Nov 1992. D. Wells, 11A Westbury Road, Nuneaton, Warks CV10 8HG. 0203 329 901.

Wanted: Complete colour decoder panel or the SL901B chip for the Rank A823 chassis. F.C. Bailey, 2 Elmridge, Leigh, Lancs WN7 1HN. 0942 675 299.

Wanted: Remote control kit (type 22AV5500/00) for the Philips VR2020 or VR2022. A.W. Hankin, 27 Ingram House, Park Road, Hampton Wick, Kingston-upon-Thames KT1 4BA. 081 977 4917.

AZ ELECTRICS

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AN240P	£1.30
AN253P	£1.80
AN3821K	£8.75
AN3822	£7.50
AN5015	£3.30
AN5033	£5.00
AN5132	£3.95
AN5265	£1.35
AN5510	£4.50
AN5512	£1.95
AN5521	£5.50
AN5730	£3.20
AN5750	£2.50
AN5760	£2.00
AN5900	£1.50
AN6326	£4.00
AN6332	£4.40
AN6341	£2.75
AN6344	£8.80
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AN6346	£4.50
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AN6360	£3.75
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AN7112	£3.00
AN7116	£1.20
AN7143	£1.65
AN7148	£1.70
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CNX62A	£1.50
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AN7224	£1.40
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AN7310	£1.10
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BA3704	£2.75
BA4210	£2.50
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BA4236	£2.75
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BA6109	£1.80
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BA6219	£1.95
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BA6259	£3.00
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BA6305	£1.75
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BA7001	£1.90
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BA728	£1.10
BA7767S	£5.00
BTT6018	£3.50
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HA11223	£3.75
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HA11235	£3.10
HA1124A	£1.75
HA11414	£2.50
HA11701	£3.10
HA11713	£8.90
HA11714	£3.50
HA11715	£3.20
HA11747A	£12.75
HA11749	£7.00
HA11750	£5.10
HA12005	£3.80
HA12017	£2.00
HA12026	£2.00
HA2413	£1.20
HA13001	£1.80
HA13402	£6.50
HA13403	£4.00
HA1350	£9.00
HA1368R	£2.55
HA1374	£8.00
HA1377	£2.00
HA1388	£4.00
HA1392	£3.00
HA1394	£4.00
HA1397	£5.40
HA1398	£3.50
HA1406	£2.00
HA1457	£2.10
HA4219	£2.70
HD14081	£0.25
HD4539	£0.70
KA2210	£2.30
L7805	£0.80
L7806	£0.80
L7808	£0.80
L7812	£1.00
L7815	£0.80
L7818	£0.80
L7824	£0.95
L7905	£0.80
L7912	£0.80
L7915	£0.80
L7918	£0.80
L7924	£0.80
LA1180	£2.80
LA1185	£2.80
LA1201	£0.95
LA1235	£2.50
LA1260	£1.75
LA1403	£3.75
LA3160	£1.90
LA3210	£1.90
LA3220	£1.00
LA3350	£1.50
LA3361	£1.50
LA3600	£1.50
LA3700	£2.50
LA4100	£1.90
LA4102	£1.20
LA4125	£2.00
LA4140	£0.70
LA4160	£1.25
LA4182	£2.10
LA4183	£2.75
LA4192	£1.70
LA4422	£1.30
LA4440	£2.70
LA4445	£2.50
LA4460	£1.70
LA4461	£1.80
LA4500	£2.70
LA4570	£2.20
LA5522	£2.20
LA5527	£1.95
LA6358	£1.00
LA7016	£2.50
LA7096	£4.00
LA7210	£3.10
LA7305	£6.90
LA7309	£3.75
LA7507	£4.00
LA7520	£3.25
LA7800	£1.50
LA7801	£1.25
LA7820	£1.90
LA7830	£2.50
LA7913	£1.30
LM1011N	£3.00
LM1017/M192B1	£2.30
LM1035	£5.75
LM1036N	£3.70
LM1112CN	£3.30
LM13600	£5.00
LM1868N	£1.50
LM1894N	£5.75
LM317T	£1.00
LM324	£0.80
LM339	£0.80
LM339N	£0.75
LM384	£3.80
LM386N	£0.80
LM556CN8	£2.50
LM6402G-2003	£10.00
LM641	£1.80
LM748CN 8 PIN	£1.25
LM748N	£2.00
M104	£7.00
M29381	£11.00
M490BB1	£12.50
M491B/BB1	£11.50
M50127AP	£6.00
M50453-012P	£8.20
M50560-01P	£2.70
M51014L	£1.95
M51164	£1.40
M51356P	£5.00
M51381P	£1.50
M51393	£4.25
M51513	£10.00
M51515L	£3.10
M51516	£4.00
M51903L	£3.50
M5213L	£3.10
M52184	£1.00
M52314	£1.10
M54519P	£1.00
M54543	£1.75
M54544L	£1.85
M54548L	£4.50
M58478P	£4.75
M58655P	£8.50
M58839	£8.00
M708	£5.50
M709	£4.75
MA150-E	£2.20
MB3106	£1.00
MB3730	£2.75
MB3731	£3.25
MC13002P	£5.00
MC1310	£1.25
MC1330P	£2.95
MC14001BCP	£1.10
MC14093B	£1.50
MC14426P	£2.50
MC14429P	£2.20
MC14497P	£5.50
MC14516BCP	£2.00
MC1458/UPC1458	£1.95
MC3359	£1.10
MCU2632	£1.90
MEA2050	£4.60
MEA2901	£3.00
MH27316	£3.00
ML232B	£4.50
ML237 (BTT6018)	£3.50
ML238B	£7.50
M293	£4.50
ML923	£4.50
ML923DP	£4.50
ML926	£4.20
MM314APL	£1.75
MM53108N	£1.25
MM5387	£2.90
MM5402	£1.50
MM5405N	£3.50
MM5456	£2.25
MM5457N	£2.50
MM5458N	£2.50
MM55108	£2.65
MM7317	£3.75
MM74C901	£1.10
MPD4011C	£2.00
MPD4069C	£1.10
MPD4081	£1.10
MPD4514BC	£5.00
MPD5521066	£11.00
MSL9378RS	£3.50
SAA1006	£2.50
SAA1025	£5.80
SAA1124	£3.95
SAA1174	£6.50
SAA1250	£2.60
SAA1251	£8.50
SAA1276	£4.50
SAA1290-02	£10.70
SAA1293-02	£8.00
SAA1293-03	£5.70
SAA3027	£6.00
SAA5000	£3.00
SAA5010	£5.80
SAA5012	£6.60
SAA5020	£5.80
SAA5030	£9.00
SAA5040A	£5.00
SAA5040B	£3.50
SAA5041	£9.50
SAA5050	£7.00
SAA5231	£9.00
SAB3013	£4.60
SAB3037	£11.00
SAF1032P	£6.00
SAF1039P	£2.00
SAS560	£3.50
SAS570	£3.00
SAS580	£3.50
SAS590	£3.50
SL1430	£2.80
SL1431	£1.60
SL1432	£2.00
SL471DP	£2.20
SL480	£3.30
SL490	£3.00
SL901B	£3.00
SL917B	£4.00
SN76670N	£1.25
SSA1075	£5.90
SSA1250	£3.50
ST082	£12.00
ST1195	£5.50
STA401A	£3.75
STA441C	£3.00
STK0029	£4.30
STK043	£15.00
STK082	£12.00
STK2029	£8.50
STK2125	£10.00
STK2250	£9.20
STK3041	£5.70
STK40090	£8.00
STK4121 II	£8.75
STK4141 II	£6.90
STK4142 II	£10.00
STK4151	£11.50
STK4171 II	£9.00
STK430	£8.00
STK4311	£10.20
STK433	£7.50
STK435	£8.00
STK4352	£5.80
STK437	£10.00
STK4392	£7.00
STK441	£10.50
STK459	£11.00
STK461	£10.50
STK463	£14.50
STK465	£12.00
STK5315	£8.50
STK5322	£6.50
STK5325	£5.50
STK5331	£6.00
STK5332	£3.50
STK5333	£4.00
STK5338	£8.00
STK5339	£4.00
STK5361	£8.25
STK5421	£8.50
STK5422	£5.00
STK5434	£8.50
STK5451	£5.30
STK5471	£5.25
STK5476	£8.00
STK5481	£5.00
STK5482	£5.20
STK5720	£7.00
STK5730	£5.25
STK6962	£3.20
STK6972	£6.00
STK7216	£6.10
STK7308	£5.75
STK7309	£5.30
STK7348	£5.00
STK7356	£8.50
STK7358	£6.50
STK772B	£4.75
STR1096	£3.60
STR3125	£5.50
STR40090	£8.50
STR4211	£5.95
STR440	£5.00
STR451	£8.00
STR454	£4.85
STR50020	£7.90
STR50103A	£5.50
STR5412	£5.95
STR58041	£6.75
STR6020	£6.00
STR8050	£14.15
SVM993C	£2.00
TA4180	£3.00
TA4193	£5.00
TA4194	£5.50
TA4301	£4.50
TA4345	£3.40
TA4350	£8.00
TA7120	£1.25
TA7137	£1.25
TA7176	£2.50
TA7176AP	£2.40
TA7193AP	£4.00
TA7193P	£6.00
TA7205	£1.75
TA7205AP	£1.25
TA7222	£2.25
TA7223	£2.50
TA7227P	£2.30
TA7230P	£1.65
TA7232P	£1.50
TA7233P	£2.10
TA7240	£2.50
TA7241	£2.50
TA7241AP	£3.00
TA7243	£3.30
TA7245	£4.50
TA7267P	£2.80
TA7270P	£2.50
TA7271P	£3.25
TA7274	£2.60
TA7280	£3.00
TA7280P	£3.00
TA7281	£2.75
TA7281P	£2.75
TA7299P	£3.00
TA7302	£1.30
TA7303	£1.10
TA7310	£1.75
TA7312	£1.75
TA7313	£0.90
TA7313AP	£1.40
TA7314	£2.00
TA7323	£3.25
TA7325	£2.00
TA7325P	£1.50
TA7328	£2.00
TA7335	£1.50
TA7335P	£4.20
TA7342	£2.10
TA7343	£1.75
TA7350	£2.10
TA7358	£1.50
TA7607	£3.50
TA7607AP	£2.40
TA7609P	£2.70
TA7614	£2.50
TA7628P	£2.40
TA7629	£4.00
TA7629P	£2.75
TA7630P	£2.00
TA7640	£2.00
TA7658	£2.00
TA7668	£2.00
TA7680	£4.80
TA7681AP	£5.75
TA7687	£2.00
TA7698A	£6.85
TA7698AP	£7.50
TA7705P	£1.50
TA7709	£2.50
TA7738	£2.50
TA78L010P	£1.75
TA8101N	£4.25
TA8102P	£4.25
TA8644	£5.50
TAA310A	£2.00
TAA550	£2.10
TBA120S	£0.50
TBA530	£1.00
TBA560	£1.00
TBA750Q	£4.20
TBA800	£0.85
TBA820M	£0.45
TBA920S	£1.00
TCA640	£3.75
TCA650	£3.95
TCA660B	£3.50
TDA1005	£2.50
TDA1010A	£1.10
TDA1011	£1.20
TDA1013	£2.75
TDA1013A	£1.90
TDA1015	£1.20
TDA1020	£2.50
TDA1022P	£4.50
TDA1035	£1.90
TDA1035T	£1.90
TDA1037	£2.90
TDA1044	£2.50
TDA1044U	£1.50
TDA1057	£2.00
TDA1082	£3.50
TDA1083	£1.70
TDA1151	£1.50
TDA1154	£2.70
TDA1170S	£1.20
TDA1180	£1.80
TDA1180P	£3.00
TDA1190	£1.90
TDA1270M	£4.10
TDA1365	£4.90
TDA1412	£1.00
TDA1470	£5.00
TDA1501A	£3.20
TDA1506	£8.50
TDA1510	£3.20
TDA1510A	£3.20
TDA1512	£3.75
TDA1515A	£2.50
TDA1520	£3.95
TDA1522	£1.50
TDA1670A	£3.00
TDA1701	£4.00
TDA1770A	£3.00
TDA1870A	£2.80
TDA1905	£1.40
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
TDA2020	£3.50
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	£3.80
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
TDA2611A	£1.00
TDA2640Q	£3.50
TDA2653A	£2.75
TDA2822	£2.00
TDA3190	£0.95
TDA3303	£7.50
TDA3330	£9.50
TDA3540	£4.00
TDA3541	£2.25
TDA3560	£4.80
TDA3562A	£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
TDA4500	£3.80
TDA4501	£5.80
TDA4503	£4.50
TDA4505	£6.75
TDA4510	£4.40
TDA4600	£2.60
TDA4600-2	£2.80
TDA4601	£2.10
TDA4610	£4.50
TDA5101	£2.00
TDA7250	£5.50
TDA7606AP	£2.40
TDA8180	£6.00
TDA8190	£3.80
TDA8341	£3.00
TDA9503	£2.55
TDA9513	£2.95
TEA1009	£2.00
TEA1014	£2.00
TEA1039	£2.00
TEA2018	£2.10
TEA2018A	£2.10
TEA5101	£6.00
TLO11CP	£2.00
TLO72CP	£2.00
TMM 2114AP	£5.75
TMS1944AN2L	£2.00
TMS1952	£2.50
TMS1956	£2.30
TMS1965NL	£2.00
TMS3450	£2.10
TMS3615	£1.75
U410B	£1.60
U416B	£1.60
UA767PC	£1.20
UA78/10	£2.00
UA78M15	£2.00
UAA1008DP	£2.00
UC38445	£5.00
UPC1185H2	£5.00
UPC1225H	£2.75
UPC1230	£3.00
UPC1238V	£2.10
UPC1263	£2.20
UPC1288V	£2.95
UPC1361C	£3.90
UPC1362C	£4.50
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
UPD4011	£1.75
UPD4066	£1.95
TRANSISTORS	
2N3773	£1.90
2SA1095	£5.50
2SA1102	£1.90
2SA1112	£0.95
2SA1124	£0.35
2SA1220	£1.10
2SA1386	£4.70
2SA564	£0.40
2SA673	£0.20
2SA942	£0.35
2SA985	£0.95
2SB1016	£1.50
2SB772	£0.40
2SB775	£1.80
2SB819	£0.55
2SB965	£2.30
2SC1413A	£2.50
2SC1826	£1.80
2SC1942	£5.50
2SC1983	£1.30
2SC2003	£0.25
2SC2027	£4.50
2SC2230	£0.50
2SC2238	£0.75
2SC2331	£1.00
2SC2335	£1.50
2SC2531	£0.26
2SC2564	£3.04
2SC2570	£0.55
2SC2577	£1.50
2SC2592	£0.95
2SC2621	£1.25
2SC2631	£0.30
2SC2632	£0.30
2SC2655	£0.80
2SC2958	£2.50
2SC2979	£3.00
2SC3153	£3.40
2SC3402	£0.40
2SC3519	£4.60
2SC3678	£2.70
2SC3715	£4.80
2SC458	£0.20
2SC789	£2.50
2SD1047	£2.75
2SD1051	£0.85
2SD1128	£1.50
2SD1138	£0.85
2SD1159	£0.75
2SD1207	£0.75
2SD1273	£1.00
2SD1275	£1.30
2SD1288	£1.70
2SD138	£0.85

18 BROOKWOOD ROAD, SOUTHFIELDS, LONDON SW18 5BP.
TEL: 081-877 3492/877 3518 FAX: 081-877 3518

A Z ELECTRICS

TRANSISTORS Cont.

2SD1391	£4.20	2SD845	£2.70
SDC1397	£3.75	2SD868	£3.50
2SD1398	£2.25	2SD869	£3.00
2SD1426	£4.50	2SD870	£3.50
2SD1432	£5.00	2SD871	£4.50
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
2SD1497-02	£5.95	BC107B	£0.10
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
2SD667	£1.00	BC147A	£0.07
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

TDA8180 ORIGINAL £9.50

TRANSISTORS

BC184	£0.09	BF422	£0.15
BC212	£0.09	BF458	£0.22
BC213	£0.09	BF459	£0.22
BC214A	£0.07	BF469/BF471	£0.25
BC214B	£0.07	BF471	£0.25
BC214L	£0.09	BF472	£0.25
BC237	£0.07	BF870/BF472	£0.25
BC238	£0.07	BU108	£0.75
BC307	£0.12	BU126	£0.70
BC308B	£0.07	BU208	£1.00
BC327-25	£0.07	BU208A	£1.10
BC328-40	£0.05	BU208D	£1.15
BC337	£0.07	BU208T	£1.00
BC372	£0.95	BU326A	£1.00
BC392	£1.50	BU406	£0.90
BC441	£0.25	BU406D	£1.50
BC461	£0.25	BU407	£0.50
BC547	£0.07	BU426A	£1.00
BC548	£0.07	BU500	£1.00
BC549	£0.07	BU508A	£1.00
BC557	£0.30	BU508AF	£1.70
BC559B	£0.07	BU508D	£1.00
BC639	£0.18	BU806	£0.75
BC640	£0.30	BU807	£0.75
BD131	£0.50	BUT11	£0.95
BD132	£0.40	BUT11AF	£1.95
BD137	£0.35	BUW84	£1.65
BD237	£0.22	BUX84	£0.60
BD238	£0.22	SD12659	£0.75
BD243B	£0.30	T9064V	£2.28
BD243C	£0.40	TIP110	£0.45
BD244	£0.30	TIP112	£0.45
BD244C	£0.30	TIP29	£0.30
BD278A	£0.80	TIP30	£0.45
BD434	£0.80	TIP31	£0.30
BD508	£0.90	TIP32	£0.30
BF195	£0.07	TIP41	£0.27
BF196	£0.15	TIP42C	£0.40
BF197	£0.15	TIP47	£0.98
BF198	£0.07	TIPL791A	£1.20
BF199	£0.14	ZTR604	£0.55
BF244	£0.40	ZTX650	£0.70
BF259	£0.22		

DIODES AND THYRISTORS

BA157	£0.07	FB2506	£1.50
BR100	£0.20	IN4001	£0.06
BR101	£1.40	IN4002	£0.06
BR103	£0.75	IN4004	£0.10
BR303	£1.50	IN4005	£0.10
BRY56	£0.75	IN4006	£0.08
BT116	£2.50	IN4007	£0.08
BT128P	£4.50	IN4148	£0.10
BT129P	£4.50	IN5408	£0.25
BT151/800R	£1.75	KBL08	£1.95
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
BY179	£1.10	RGP30K	£0.70
BY179/SK2/08	£1.10	RHI	£1.30
BY184	£0.65	RM11C	£0.45
BY189	£2.00	SG264	£8.50
BY190	£2.00	SG613	£12.00
BY223	£2.00	SKB/02	£0.60
BY206 (BYB96R)	£0.55	SKB/08	£1.20
BY210/800/BYV96	£0.55	SKB2/02	£0.90
		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
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ASK FOR SEMICONDUCTORS NOT LISTED

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PSF2-VCR4600,4700 .... £14.00
PSF3-VCR6000 .... £16.00
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3HSS4VB-3V32/HR7655 .... £22.00
3HSS4VC-3V48/HRD565 .... £24.00
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 .... £11.00
3HSSU2N-NV230,470,480,G9,10, 11,15PX £17.80

VIDEO HEADS Continued

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3HSSU3N-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 .... £28.50

SHARP
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3HSSSPB-VC581,583,651,670 etc £14.50
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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 .... £17.00
Toshiba V93 .... £19.00

ASK FOR VIDEO HEADS NOT LISTED
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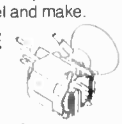
CLUTCH BASE



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ITT CVC1150/1175 .... £20.00
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Fidelity 22" ZX3000 .... £18.50
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Philips KT3 .... £12.95
Thorn TX100 Green Spot 110 .... £14.50
Ferguson TX90 LOPT specify size screen £17.75
Ferguson 3V35/36 Mains Transformer £23.00
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3V58,59,64,65,FV10,11,12,13,14 Idler Arm £1.80
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FVHP905,910 Gear Idler Assembly £5.00
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VR6843 Reel Drive Pulley £9.00

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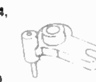

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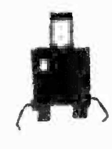

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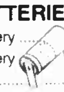
Philips Pinch Roller for models VR6180, 6185, 6285, 6362, 6367, 6467, 6468, 6470, 6561, 6670, 6760, 6761, 6870 .... £6.00

BACK-UP BATTERIES



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Cassette Housing Assembly Hitachi VT11 .... £15.00
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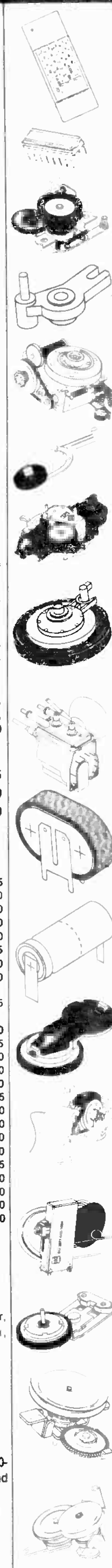

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VISA

VCR Clinic

Reports from PhilipBlundell, AMIEIE, John Edwards, Roger Burchett, Graham Richards, Chris Watton, Richard Newman, Mike Leach, Terry Lamoon, J. LeJeune, and Stephen Leatherbarrow

Philips VR6490

There was intermittent sound on the tape that was brought in with this machine. It came on and went off suddenly, as if the muting circuit was operating. When we tried the customer's tape in another machine there was a different symptom – the sound stayed on but there was a warble. I put the cassette back in the customer's machine and checked the control track pulses. They were weak and varied in amplitude. When the pulses were large the sound remained on: when they were small the sound was muted. All that was wrong was that the control track head was dirty. Cleaning its face and making a test recording proved that the problem had been cured. **P.B.**

Grundig VS300

The customer complained of tape damage. He brought two casettes along with the machine, both of which were creased towards the end of the tape. When I tried fast forward then stop, tape spilled out as the brakes didn't come on. The cause of the problem was that the BC876 brake solenoid driver transistor T2141 was short-circuit. **P.B.**

Fisher FVHP715

There was a loud, 50Hz hum in the E-E and playback modes. Slight flexing of the mains transformer's PCB would make the hum come and go. Resoldering the transformer's nine pins and every other soldered joint didn't cure the problem but linking across the three PCB-mounted fuses in turn proved that F904 was responsible. It had gone high-resistance. **J.E.**

Hitachi VT120

The mode switch in this VCR has given us trouble in the past. The symptoms are numerous and varied. Should you suspect the mode switch, check the following voltages at pins 47, 48 and 49 of the HD614042SD37 system control chip IC901:

Mode	*47*	*48*	*49*
Rec/play/forward search	0	0	0
Fast forward/rewind	0	5	0
Stop (carriage up or down)	5	5	0
Rewind search	5	0	0

J.E.

Triumph VR9500

This machine would switch on and the clock/channel indicators worked normally. But there were no functions when a cassette was inserted. A check in the power supply showed that the 5V output at pin 5 of the STK5326 regulator chip IC501 was missing. A new regulator got the machine working and we also fitted a new idler in case the machine came back with the same symptoms (what's the point of getting older if you don't get wiser?). **J.E.**

Ferguson 3V45/JVC HRD150

Rewind and fast forward were o.k. but during playback or record the machine would enter the stop mode. It would sometimes play almost to the end of a tape before shutting down: at other times it wouldn't even enter the play mode after lacing up. We noticed that slight pressure anywhere on the main PCB would make the machine shut down. Voltage checks were of no use in this situation, so we used a magnifying glass to carry out a careful scan of the board. This revealed that R501 (680Ω, 0·5W) was dry-jointed at one end. IC404 in the servo section receives its 17V supply from R501. Resoldering provided a complete cure. **J.E.**

Hitachi VT33

It's quite common with many Hitachi models to find that the tape threads up then almost immediately unthreads. What happens is that the drum slows down because the servo reference signal is missing. It comes from the 4·43MHz chroma subcarrier oscillator section of the HT4539B hybrid chip IC203. I changed IC203 on this machine as a matter of course, but this time the fault was still present. Doing what I should have done to start off with, I then checked the voltages around IC203. The 9V supply was missing at pin 9 because choke L216 was open-circuit. The questions now were whether IC203 had been faulty and whether L216 had burnt out? I broke L216 open and found that it wasn't obviously burnt: I guess that one day I'll fit the old HT4539B to another machine to see what happens. It's the unpredictability of it all that keeps me going! **R.B.**

Hitachi VT120

Very intermittent vision overloading in the E-E and record modes was traced to the HT4757 hybrid chip. **R.B.**

Hinari VTV100

During play, record or any other mode this machine would intermittently refuse all commands. Spraying the microcontroller chip with freezer proved that this was the culprit. It's a Sony type CXP5058H-118. Fitting a replacement and cleaning the tape path put the machine back in working order. **G.R.**

Ferguson 3V29/JVC HR7200

Sound was o.k. but there was no E-E video. We traced the luminance signal right up to the HA11738 chip IC201 on the bottom PCB where the E-E video was present at pin 26 but no output appeared at pin 5. Voltage checks around this chip showed that there was only 0·4V at pin 8 instead of 2·9V. C243 (220μF, 6·3V) which is connected to this pin via R244/5 was leaky. **G.R.**

Amstrad D8900 Double Decker

There was no display from the digitron – this includes the clock, timer, counter, channel information etc. – because the –28V supply, measured at pin 11 of connector CN2, was missing. Investigation showed that D24 was short-circuit and the 15Ω safety resistor R29 was open-circuit. Replacing these restored the display. We used a 1N4005 in position D24. **G.R.**

Hitachi VT11/33/64/120/520 etc

The capstan motor slowing down, usually intermittently, is a problem with these machines. In this event replace the VDR in the capstan servo circuit – it's marked CH4R7-20V. In an emergency a 4·7Ω resistor will work. Note that some machines have a second VDR in the drum servo circuit, so make sure that you replace the correct one! **G.R.**

Samsung VI710

There was no display. A few checks in the power supply soon revealed that the 6·8V zener diode ZD102 was faulty, a replacement putting matters right. **C.W.**

Amstrad VCR4600

The job card said "crinkled pictures". And crinkled they were – almost like a Thorn 3000 chassis when the 140μF electrolytic had failed (those were the days!). I first checked the tape path for anything that might make the tape shudder. But everything seemed to be running nicely and evenly and looked clean. The lower drum wasn't damaged and didn't look at all worn. As I had one available however I decided to change it. To my pleasure this cured the fault – except for one thing. The head switching point now appeared at the top of the picture. The lower drum had been taken from a new full deck assembly that we'd recently purchased for about £25. It must have been for a different model however, as the magnet assembly at the bottom had the pulse magnets in a different position with respect to the drum's position of rotation. Taking off this assembly and fitting the one from the old drum allowed the switching point to be set up perfectly. **C.W.**

Matsui VX1000Y

I have had the following problem several times now. The symptoms can appear as poor drum servo lock, a head switching type fault or as if one head has failed – the fault can also be intermittent. To ensure a permanent cure remove the FG pick-up on the drum, clean the two pins and the PCB connections thoroughly, then resolder.

I would add that with a lot of the faults experienced with Matsui/Saisho VCRs it pays to look for bad soldering or poor connections. Doing this will probably cure many of the faults that come your way. **T.L.**

Philips VR202

When any key on the control panel was used it would lock up totally and the command that was entered would be totally ignored. On investigation we found that the main data line became continuously busy. After trying the obvious chips we moved to the on-screen display i.c. When this was replaced the machine was back in full working order. **T.L.**

Sony SLV625

No output from one head almost caused me to order a new drum – after the normal cleaning and checks had been carried out. But I decided to take off the drum and use a magnifier to see whether I could find anything amiss. A non-soldered connection was found on the lower drum, and when this had been resoldered the whole machine worked perfectly. This goes to show how important it is always to check around, even when the fault appears to be such an obvious one. **T.L.**

Toshiba V83

I've had various intermittent speed faults with this and similar models due to defective mode switches. A complete cure is usually possible by removing and cleaning the switch. Recently however I had a machine that suffered from intermittent capstan rotation. It was no better after replacing the loading belt and cleaning the mode switch. It transpired that the capstan motor had a dead spot, a replacement putting everything right. **R.N.**

Matsui VX820/Saisho VR1200HQ

This machine was dead when it came in. Voltage checks showed that the STK5332 power supply module was faulty, so a new one was fitted. The machine then powered up, but there was no drum or capstan rotation. Voltage checks around the servo chip IC2001 were inconclusive, but scope checks showed that there was a distinct lack of activity in this area. Replacing this i.c. restored normal operation. Presumably the faulty STK5332 had destroyed the servo chip.

This machine also appears as the *Hinari* VXL35 and the *Orion* VHML. **R.N.**

Philips VR6920

In the February issue (page 254) I wrote about a problem I'd had with a VR6460. The VR6920 is a Panasonic clone with hi-fi stereo sound, using the same deck. This one came in dead and we soon found that the 0·39Ω safety resistor R1001 was open-circuit. It's a fairly common fault, so we were not surprised. After fitting a new resistor, replacing the loading belt and giving the machine a good clean up it gave excellent results. But as it was getting late I left casing up until the following day.

When the machine was checked from cold next morning it didn't work, or rather it was permanently in the rewind mode, stopping after a few seconds and not accepting a cassette. This straight away rang bells, and a check on the little subpanel at the front of the deck revealed that it was loose. Removing the deck and tightening the screw cured the problem, so it seems that this happens on all these decks. It thus pays to make this a part of the standard service procedure. **R.N.**

Amstrad VCR6000

I had two of these machine in recently, both with the same complaint but with different faults. Both machines would switch between the SP and LP modes at random. The cause on the first machine was easy to see: the tape was being pulled down across the audio/sync head because the pinch roller bracket was bent. A new bracket and pinch roller put matters right.

Tracing the cause of the problem with the second machine was more difficult. The tape path was perfect, and the heads were clean. A scope check at test point HP1 (TP402) however showed that the sync pulses were of very low and varying amplitude, with a lot of noise present. As checks on components in this area failed to show that anything was amiss I decided to replace the 14DN363 servo chip IC402. This cured the problem and cleaned up the waveform. **R.N.**

Ferguson 3V54

If the capstan motor appears to run through with no control pulses present at the control amplifier, check the condition of C405 on the main PCB. You will probably find that it's either dry-jointed or open-circuit. **M.L.**

Sanyo VHR1100E

This machine chewed tapes whenever stop or eject was selected. The tape was not being wound back into the cassette. We replaced the idler and checked the condition of the loading motor, but the VCR came back into the workshop two or three times before we finally traced the cause of the fault. When stop or eject was selected the loading guides would occasionally return from the loaded to the stop position extremely fast. The reel motor then didn't have a chance to load the tape back into the cassette. The cause of the problem was simply dirty mode select switch contacts. We should probably have replaced the mode switch, but the job was an urgent one and a good strip down and clean seemed to work just as well as a new switch would have done.

Panasonic and JVC switches can also be cleaned quite successfully provided care is taken when reassembling the switch. **M.L.**

Ferguson 3V57

The cause of no playback colour was traced to IC301 on the main PCB. Part no. is PU22046A. Chroma was present at pin 24 of the chip but there was no output at pin 22. **M.L.**

Hitachi VTM722

The P50116 microcontroller chip in this model deals with a wide range of functions. It's responsible for deck control, tuning, the timer clock functions etc. Deck control problems can easily lead one astray.

A VTM722 came in recently with what looked like a power supply fault. The machine appeared to be completely dead, with no clock and no loading motor movement. As the power supply checked out all right we came to the conclusion that the microcontroller chip was faulty. It's on the top of the main panel, in close proximity to the front escutcheon. A replacement was therefore fitted, which is not easy as the print is very fine, but the fault remained as before.

I then remembered a conversation with Jim from Hitachi some time ago. He told us that these machines can easily become confused if the deck is out of sync. The microcontroller chip has to deal with so many functions that a wrong signal from the mode control switch can produce total lock up. This is in fact what had happened. With the loading motor and the mode switch removed I was able to re-sync the mechanism and could then reset the mode switch to position one (eject). Up came the clock and all functions worked correctly. The eject mode is quite easy to find when winding the mechanism by hand. After removing the loading block simply turn the main cam until the eject gear beneath the deck – it drives the carriage – turns when the capstan motor is rotated. This is the eject mode. Then set the mode control switch to position one and replace the loading assembly. It's important that the cam and the mode switch are correctly aligned. When the capstan motor rotates the eject gear, as described above, you will usually find that by turning the cam to one end then backing it off until it clicks into its first position it is in the correct eject position. Be sure always to replace the mode switch. **M.L.**

Ferguson FV31R

The problem with this machine was very intermittent loss of drum sync, the symptoms being picture disturbance and momentary loss of sound. After an extensive investigation of the motor drive and servo circuits a chance brush against the ribbon cable connector immediately behind the upper drum produced the fault. Remaking the ribbon cable connection to the free socket cured the trouble. **J.LeJ.**

Philips VR6463

There was no E-E or playback sound. We eventually discovered that an 11·6V supply was missing because C2023 (330μF, 16V) was short-circuit. The 220Ω series resistor was none the worse for its experience. **S.L.**

Osaki VCR33/GoldStar GHV1232I

A recent case of channel-dependent cogging and pulling from cold, clearing after an hour or so, was cured by replacing the a.g.c. reservoir capacitor. The offending item is C704 (1μF, 50V). **S.L.**

Panasonic NVG21

This nice machine was dead. We quickly found that a 5V supply was missing. We removed the power supply can and then, with some difficulty, took off its covers. After this it was a simple matter to discover that IC1001 (STK5338) was faulty. Why do manufacturers fit the wire-ended/push-in type connectors when a plug/socket would surely be a more practical solution? We've had many of this type of connector produce intermittent results in various machines. **S.L.**

Sharp VC381

This old front-loader would only intermittently allow you to set the clock and timer information. On the odd occasion when this was possible the machine would begin to load under the control of the timer, then unload with the clock resetting to zero. Severe patterning was evident on playback of a tape, to the extent that the picture was almost obliterated. The E-E pictures remained normal.

Scope checks showed that some very bad hash was present on the supply rails. The following capacitors were found to be open-circuit: C12 (100μF, 16V); C17 (100μF, 16V); and C16 (10μF, 50V). As a precaution all other capacitors of this type – there aren't many – were removed and tested. **S.L.**

Ferguson FV11

There was very bad hum in both the E-E and the playback modes. A scope check proved that this was being caused by the 5V supply from the STK5481 regulator chip. The input at pin 2 of this regulator is smoothed by C4 (2,200μF). A replacement capacitor cured the initial problem but on test F3 (1AT) failed. It took us some time (and some fuses) to establish that the STK5481 chip had an intermittent fault. **S.L.**

What a Life!

Donald Bullock

I wish I could grow up. Chaps of my age ought to be dignified and wise, which I'm not. Had I been wise I would have given this trade the elbow long ago and taken up something easy and profitable. But I didn't, and there's no such thing as a dignified television engineer. Sometimes, on holiday, I meet people who don't know what I do for a living. They treat me with respect. If gives me a wonderful lift, but it doesn't last.

Mrs Taffy

Greeneyes thinks I'm undignified because of my silly behaviour. Take the other day for example. Mrs. Taffy, who has the highest and squeakiest voice I've ever heard, brought in her Hitachi VT418 VCR for repair.

"You did it a month ago, before we went abroad, and it's never been right since, isn't it?" she squeaked.

After she'd gone Steven and I began this talking in ridiculously squeaky voices with Welsh accents. We were enjoying ourselves immensely, then Steven had to go to the wholesaler. Twenty minutes later, as Greeneyes brought in my tea, the phone rang. A high-pitched voice with a welsh accent assailed my ear.

"Mr. Bullock?"

I smiled to myself, thinking of Steven, and replied in a similar voice.

"Yeh-es?"

"Mr. Bullock the television man?"

"The very same, and very clever I am, can't they?" I replied.

"Have we got a crossed line Mr. Bullock?" said the voice. I suddenly realised that it was a customer. Getting out of that one was tricky. I had to lower my voice and fade out the Welsh business by degrees. Then I had to face up to Greeneyes, who was shaking her head sadly.

I decided that it was time to look at Mrs. Taffy's Hitachi recorder. The playback and E-E pictures were marred by travelling hum bars. Our records showed that last time we had cleaned the heads – and that was five months ago, not one.

The picture was in fact unwatchable. My diagnosis was a.c. ripple on the d.c. supplies and I spent a long time looking for a faulty component. But I couldn't find anything amiss in the power supply. Then Mrs Taffy phoned for a progress report and asked whether the mains voltage in Belgium was similar to ours. At that I glanced at the mains voltage selector carousel at the back of the machine. It was set for 200-220V. Resetting it to 240V cured the trouble.

Terry's Hinari VXL8

Brother Terry came in next, with his Hinari VXL8 VCR.

"Watch this" he said, slipping our test tape into it and pressing the eject button. The cassette shot out and he caught it. "Yesterday it would't eject at all" he said. "I cured it myself, but now it won't play."

"How did you cure the sticky tape ejection?" I asked.

"Sprayed some WD40 into it's mouth – quite a lot, actually." Then he turned to Steven.

"I reckon you'd better take it to Snoddies, or buy another one from Crubb's Foodstore – they'll be about twenty five quid there" I said, but he took no notice. It's difficult to get a word in when he gets going.

As Steven sat listening to Terry I quickly slipped the test tape into Mrs. Taffy's machine before declaring it to be fit. The tape squeeled to a halt and I could hear scrunching. When I ejected it I found that it was well tangled up and dripping with WD40.

When Terry left I settled down again to Mrs. Taffy's machine while Steven tackled Terry's. He got it right in the end, but it was hard going. He's gone out to buy a pencil, and if all goes well you'll be able to read about it in a subsequent VCR Clinic.

Ed's Fault Guide

Ed Rowland called in the other day and brought us a copy of his latest *Amstrad, Logik, Matsui and Saisho Fault Guide* which, he tells us, is selling like hot cakes. I'm not surprised. These makes are a mystery to many, and now that Mastercare no longer runs a technical advice service there's nowhere much to turn.

Whilst Ed was here we had a Matsui 1480A that refused to go into standby. Ed's guide referred us to R126, and fitting a replacement cured the trouble.

Another similar set we had in, this time a Saisho CT149X, suffered from loss of sync. The guide referred us to R507 (1Ω), which was open-circuit. Again a replacement restored normal operation.

The guide also contains a Matsui/Saisho chassis equivalent table. Nice to see you Ed, and thanks for the Guide. Very useful.

An Osaki Portable

The next set on the bench was an Osaki 14in. colour portable. It looked like a Fidelity set and bore a label marked CTV14 underneath. We looked out a circuit we had obtained from Jackson Products. It was for an unspecified make but matched the set, which had field collapse with full beam current that couldn't be turned down by means of the brightness control. So we reduced the setting of the first anode control on the line output transformer to avoid etching the line into the tube's phosphors, then set about trying to find a voltage supply fault that could be responsible for both symptoms.

We soon found that 25V supply F, which is derived from the line output transformer via rectifier diode D22 (RGP15J), wasn't reaching pin 9 of the TDA3651 field output chip IC2. To get there it has to pass through the fusible 12Ω resistor R50 which was open-circuit. A replacement brought back the field scanning and restored the action of the brightness control. We gave the set a thorough soak test in case there had been some other reason for the failure of R50, but it behaved itself impeccably. So we passed it fit.

Triumph CTV8209

Immediately afterwards we put a Triumph CTV8209 on the bench. It too had field collapse and when we opened it we found an identical chassis to the Osaki set. So we went straight to R50 which was once again open-circuit. A new one put matters right.

Enter Mr Blowfly

Then Mr. Blowfly buzzed in with his Nikkai NVR500RC VCR.

"Dead – ha ha" he announced, "dead as a dodo, ha ha" and off he went.

We opened the machine, which looked like many other badge-engineered ones including the Alba 3000 and 4000 series, the Sentra VX8000, VX820 and VX500, the Solavox NCVR1000 and NCVR5000 and the Daewoo VCR30BDB/50DBD/50DFD/50DFP. They often come in totally dead or with just a few random display segments alight. I referred to them in this column a few months back, mentioning that the service manager of a multiple retailer had told me to add a 4·7kΩ resistor from the positive side of C821, the 5·5V "battery", to the base of Q809 to get the machine working again. Some correspondence followed. One reader insisted that replacing C821 was the answer. Another reported that having replaced C821 it was sometimes necessary to wind the cassette housing down by hand and then operate eject before the microcontroller chip would toe the line and normal operation was resumed. I've since found that sometimes the machine won't come to life even after doing this. But they always respond when the 4·7kΩ resistor is added!

We checked the voltage across C821. As it read 5·5V we wound the cassette housing down and operated eject. It made no difference. So we replaced C821 and went through the cassette housing procedure again. Still no good. We finally added the resistor and switched on. Hey presto! – the machine sprang to life with a full display.

Mr. Blowfly later called to collect it. We explained what we'd done. "Good, ha ha!" he said. "Thanking yew, ha ha, Mr. Block."

A Philips CTX-E

The last job of the day kept us working till late. It was a Philips TV set, Model 20CT2226/05T, which is fitted with the CTX-E chassis.

Once tuned in it would drift. We changed the 2·4V "battery" without much confidence, and weren't too disappointed when this made no difference. A check on the tuning voltage with a digital multimeter showed that it was stable. We nevertheless decided to try a new control chip (IC7800). This made no difference, neither did a new tuner. Finally we checked the stability of the 33V supply, which is stabilised by the ZTK33 chip D6101, and found that it varied intermittently between 33V and as low as 29V. A replacement ZTK33 chip produced a stable 32·8V supply and solidly-locked tuning. Why hadn't we checked the 33V supply first?

TEST CASE 365

The phone in the service department trilled for the first time on this bright morning. Putting on her plum voice our Pam picked it up and greeted Mr. Norris, who told her that he had just moved to the area from somewhere far away. Could we come and tune in his Sony TV set? Certainly.

The job was given to Philbert, who was soon on his way. He found a Sony KVX21TU with nought but snow on its screen. So he popped outside to check whether there was an aerial on the roof. There was. Back indoors then and try to tune the set. The auto-tune system seemed to be working, but at the end of the procedure none of the programmes came up when called. Manual search-tuning was tried next. All the local stations were found, but the set seemed to be unable to memorise them. Philbert checked with the user's handbook but found that he was doing all the right things. After a final try he loaded the set into the big van and, in the fullness of time, it reached the repair bench in the workshop.

Our rapidly improving trainee Sherlock was assigned to this one. Like Philbert and Mr. Norris, he found that the set couldn't memorise the station tuning data though it seemed to work properly in every other respect. Armed with the service manual (Sony AE1 chassis), he removed the back cover and stared at the innards. He had an idea that the memory was maybe not being invoked because the store keyswitch wasn't making contact. A check with a continuity meter soon proved otherwise however: all the keys made contact correctly when pressed.

Plainly the set used some form of key-scan system, so Sherlock checked with an oscilloscope. There were plenty of pulses about, and when any key was depressed both contacts carried identical pulse trains. Time to look elsewhere. The core of the whole system is the microcontroller chip IC001, which provides the key scan and command decoding operations to control the tuning, and much else besides. There's also a subcontroller, IC002. Blimey! Sherlock wished he could swap over with Real Technician who, in the other corner, had a field-collapse job on his bench. After checking the presence and correctness of the 5V supply and the clock oscillator output our man went off to concult the expert Television Ted – he was wreathed in cigarette smoke in the far corner as he soldered a line output transformer into a Ferguson TV set.

Ted's advice was to look for a memory chip, perhaps a PCD something or other, and check that. Back in the Sony set Sherlock found such a chip, IC003 – type M58655P, with fourteen pins. He checked that its 5V supply was present at pin 1 and that there was plenty of pulse activity at its data pins. There was, so he decided to condemn it on the basis of amnesia – perhaps it had had a knock on the head in transit! As the workshop didn't boast anything as exotic as an M58655P one was ordered from Sony, not without misgivings.

A couple of days later the replacement chip arrived. It was soldered in carefully, taking the usual precautions against the effect of static electricity. With the power applied and the aerial plugged in, Sherlock went through the tuning and memorisation procedure – only to find that just as before the tuning memory didn't work. What basic feature of this type of non-volatile memory system had been overlooked in investigating the cause of the fault? What else should in fact have been checked before replacing the memory chip? The cause of the problem was not specific to this particular make or model – it could crop up in any system that uses a similar control and memory arrangement. For the solution, turn to page 491.

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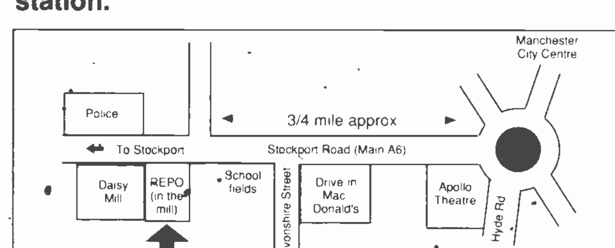

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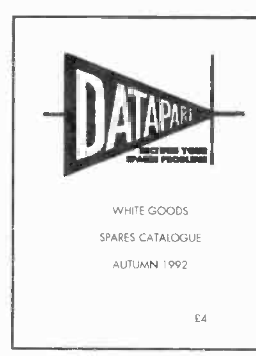

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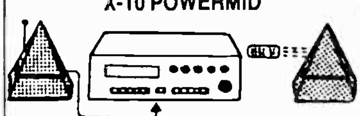

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With a simple cable attachment lets you CONTROL and VIEW your Cable TV, VCR and Satellite reception from any room in the house.
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Does not require your old remote control or remote control commands because your requirement is already stored in its memory

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LITTLE EXTRA Astra Eutelsat Arm £16.75
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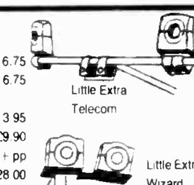
LITTLE WIZARD Astra Eutelsat Arm for Amstrad/Concentric Dishes £13.95
Manual Push Button LNE Switch £9.90
Electronic Amstrad LNB Switch, outdoor use ..... £24.00 + pp
Electronic Voltage Controlled LNB Switch £28.00
(Note: Second LNB required – see LNB section)



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Yagi 20 A B CD OR WR £30.63
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Unix 44 A B CD F OR WB £39.82
Unix 92 A £71.40
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Unix 92 CD £58.66
Unix 92 WB £58.66
BB Grid £26.73
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FM 2 Ele. Heavy Duty £7.54
FM 3 Ele. Heavy Duty £11.15

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FM 2MT £15.30
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FM 8 Stereo £41.74

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THE LENSON HEATH REFLECTORS
all 22 off set reflectors
63cm Oval Black Mesh 36 dB £34.00
60cm Oval Light Solid 36 dB £34.00
60cm Oval Black Solid 36 dB £34.00
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80cm Oval Light Solid 39dB £56.00
80cm Oval Black Solid 39dB £56.00
1 mtr Oval Light Solid 41dB £95.00
1 mtr Oval Black Solid 41dB £95.00

Lenson Heath Antenna Accessories
80 60 55cm Vertical Mast Adaptor £9.40
4ft Mast side entry £8.08
9 ft Mast side entry £16.96
4 ft Mast side entry Black £12.93
9 ft Mast side entry Black £21.81
2.5ft Patio Mount side entry £18.42
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60mm LNB clamp (replacement) £3.75
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H to H adaptor kit & Back Plate for Old Style Dish £14.69

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90cm Dish offset £84.41
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Az-el Mount for 0.9-1.2 mtr. Dish £32.00
Polor Mount for 0.9-1.2 mtr. Dish £46.00
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12" Jager Jack for 1.2 mtr. Dish £62.98
18" Jager Jack for 1.2 mtr. Dish £74.99
1.2 mtr. Dish & Polar Mount £180.00
1.2 mtr. Kit Dish Polor Mount Wall Floor Stand £225.00

THE TECHNISAT FLAT PLANE
45cm Flat plate antenna £149.95

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The Little Extra designed for offset Astra receiving antenna where a second satellite can be received from a single fixed antenna
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DBS 11.75 to 12.5 GHz
K5 12.5 to 12.75 GHz Telecom Band

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FSS 40mm collar 1.2dB £45.00
FSS 40mm collar .75dB £55.00
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LSS Dual 40mm collar, 1.2dB £80.00

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FSS Blue Cap Black 1.8dB £35.00
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FSS Dual V H 40mm Col. 1.6dB £80.00

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FSS Dual V H 60mm col 1.5dB £110.00

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FSS 4 bolt fix Hempt 9dB £62.50
FSS 4 bolt fix Hempt 8dB £95.00
FSS K5 Dual Band LNB 1dB £105.75
FSS 4 bolt fix Gardner 0.8dB £155.00
K5 4 bolt fix Maspro 1.5dB £52.00

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Black LNB Cover £2.94
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FEEDS
Horn offset C120 32mm Collar £10.58
Horn offset WR75 32mm Collar £10.58
Horn offset C120 40mm Collar £17.63
O.M.T. V H Microwave Splitter £34.55

Feeds with combined Magnetic Polorota
Horn offset WR75 32mm Collar £26.00
Polyrod Lens offset WR75 23mm £40.00
Polyrod Lens Prime WR75 23mm £40.00

MAGNETIC POLOROTA
Racal C120 ..... £40.00
Racal WR75 ..... £40.00

Pulse to Magnetic Polorota Interface
IRTE Interface P to Mag £29.95

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ANTENNA TO MAST CLAMPS
15mm Aerial to 2" Mast Clamp £1.68
Universal Aerial Cross Clamp £1.69
Amstrad Dish to Mast Clamp £5.64
80 65 55cm Vertical Mast Adaptor £9.40

MAST TO MAST CLAMPS
Universal Mast Cross Clamp £2.06
Universal Mast to Mast Clamp £3.29
2" – 15'2" Mast Coupler £11.14

"V" BOLTS & MAST GRIPPERS
1.75" V Bolt & M8 Nut £0.22
2.5" V Bolt & 3/8" Nut £0.42
2.5" V Bolt & M6 Nut £0.22
Universal Mast Gripper £0.50

MASTING
ALLOY STRAIGHT MASTS
1' – 1" 18g (1.2mm) £0.77
3' – 1" 18g (1.2mm) £1.98
5' – 1" 18g (1.2mm) £3.36
6' – 1" 18g (1.2mm) £4.04
10' – 1.5" 16g (1.6mm) £10.19
13' – 1.5" 16g (1.6mm) £13.25
16' – 2.0" 16g (1.6mm) £21.64
16' – 2.0" 14g (2.0mm) £26.79
20' – 2.0" 14g (2.0mm) £33.45

STEEL STRAIGHT MASTS
Prime Steel to BS6323
Zinc Plated Inside & Out
13' – 1.5" 18g £9.87
13' – 1.5" 16g £13.01
20' – 2.0" 16g £27.21

STEEL (NOT PERFECT) SECONDS SUBJECT TO AVAILABILITY
10' – 1.0" £3.53
10' – 1.25" £5.82
10' – 2.00" £7.20
20' – 2.00" £15.86

MAST LASHING EQUIPMENT
Rope Grips 1/4" ..... per set of 2 £3.53
Metal Thimble ..... per set of 2 £0.68
3 Way Guy Collar £2.68
4 Way Guy Collar £3.74
50 mtr. Guy Wire £24.15
2" – 15" Mast Coupler £11.14

ALLOY SHAPED MASTS
2' – 1" 18g L-Cranked £1.43
3' – 1" 18g L-Cranked £1.97
3' – 1" 18g S-Cranked £2.61
5' – 1" 18g Cranked £4.16
6' – 1" 18g Cranked £4.85
6' – 1.25" 18g Cranked £6.03

STEEL SHAPED MASTS
1' – 1' – 35mm Arm for Sat £5.65
4' – 1' – 35mm Arm for Sat £8.00
9' – 1' – 35mm Arm for Sat £14.95
4' – 1' – 35mm Arm for Sat Black £9.40
9' – 1' – 35mm Arm for Sat Black £16.95
4' – 1' – 1.5 Arm for Sat £8.00
9' – 1' – 1.5 Arm for Sat £14.95
S-Arm for Sat £8.59

BRACKETRY
CHIMNEY BRACKETS
Aluminium Painted
6" – 6" Welded Painted Ch £2.35
6" – 9" Welded Painted Ch £3.10
7'5" Welded Painted Ch £4.70
13'5" Crade Welded Painted Ch £6.30
Double Lash Pad Welded £6.82

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25 kilo Lashing Wire £50.00
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Metal Thimble ..... per set of 2 £0.68
Corner Plates Standard ..... per set of 3 £0.42
Corner Plates Extra ..... per set of 3 £1.00
4.75" J-Bolt & 3/8" Nut £0.32
1.75" V-Bolt & M8 Nut £0.22
2.5" V-Bolt & 3/8" Nut £0.42

LOFT & LIGHT OUTDOOR
Loft Facia Pressed Foot £1.36
Loft Facia Swivel Bracket £1.48
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12" – 1" Alloy with foot (Loft stand) £2.00
12" – 1" Alloy with Swivel Bracket (Loft Stand) £2.50
24" – 1" Alloy 90 foot (Loft Stand) £3.00
24" – 1" Alloy 90 with Swivel Bracket

WALL BRACKETS
Aluminium Painted
6" – 6" Welded Painted Wall £2.35
6" – 9" Welded Painted Wall £3.10
9" – 9" Welded Painted Wall £3.53
12" T&K Welded Painted Wall £7.05
18" T&K Welded Painted Wall £8.74
24" T&K Welded Painted Wall £10.72

SATELLITE WALL BRACKETS
2" – 1" – 35mm L-Patio Wall £19.95
2" – 1" – 1.5 L-Patio Wall £19.95

SATELLITE GROUND STANDS
Polyester Black Powder Coat
2' – 1' – 35mm L-Patio Wall £19.95
2' – 1' – 1.5" L-Patio Wall £19.95
2' – 1.5" dia. Straight Patio £14.85
2" Ground-Wall Stand Poly £28.20

Zinc/Galvanized
2" – 28" Tripod Ground Stand £30.00

FIXINGS
NYLON PLUG & BOLT
Bolts have 13mm Hex Head & Nylon Plug
Require a 10mm Bore Hole
Mungo 10 – 50mm Nylon P & Bolt £0.50
Mungo 10 – 90mm Nylon P & Bolt £0.70
Spit 10 – 60mm Nylon P & Bolt £0.70
Hilta HRD-H 10 10S P & Bolt £1.00
Mungo 10 – 50mm Ny. P & Bolt 100 £23.50
Spit 10 – 60mm Ny 1' & Bolt 100 £39.16

STEEL EXPANSION ANCHOR
The Nut has a 13mm Hex Head & Anchor requires a 10mm Bore Hole.
Spit 10 – 70mm Steel Exp An £0.50

PVC WALL PLUGS
5.5mm PVC Wall Plug Red 100 £1.00
7mm PVC Wall Plug Brown 100 £1.00

PLASTER BOARD PLUG & SCREEN
With Self Screw Plug & Screw
35" – 9mm Plug & P-Head Screw £0.50

STEEL SCREWS COUNTER SUNK
NO 14 – 1.25" CS Self Tappers SC £0.10
NO 14 – 1.25" CS Self Tappers BZ £0.15

CABLE CLIPS
THE UNI-CLIP RANGE
5mm Round Black Uni-Clip 100 £2.09
5mm Round White Uni-Clip 100 £2.09
6mm Round Black Uni-Clip 100 £2.23
6mm Round White Uni-Clip 100 £2.23
7mm Round Brown Uni-Clip 100 £1.85
7mm Round White Uni-Clip 100 £1.90
7mm Round White Uni-Clip 100 £1.85
9mm Round White Uni-Clip 100 £2.76
9mm Round White Uni-Clip 100 £2.76
11mm Round Black Uni-Clip 100 £3.52
13 – 6mm for Sat1002 Bi-Clip 100 £3.95
26 – 7mm for K1015 Bi-Clip 100 £5.28

THE TOWER CLIP RANGE
6mm Round Black Tower Clip 100 £1.85
6mm Round Brown Tower Clip 100 £1.85
6mm Round White Tower Clip 100 £1.85

ADHESIVE TAPE (PVC)
20 mtr – 0.75" Black PVC Tape £0.59

VOLEX COAXIAL CABLE
Attenuation figures are approx at 860MHz per 100 Metres
Coax Cut from The Drum

DOMESTIC COAX
Domestic TV Low Loss Coax
C55BC 21dB Brown ..... Mtr £0.40
C55WC 21dB White ..... Mtr £0.40
Domestic Signal Screened Coax for TV Low Loss & Satellite Use
C56BC 17dB Black ..... Mtr £0.40
C56WC 17dB White ..... Mtr £0.40
Domestic Double Screened Coax for TV Low Loss & Satellite Use
SA1100BC Black ..... Mtr £0.68
SA1100Wc White ..... Mtr £0.68
Special Use Satellite Coax
SAT1002 Coax – 2 core Black ..... Mtr £1.25
K1015 Coax – 7 core Black ..... Mtr £2.25

LIGHT COMMERCIAL COAX
Light Commercial Double Screened Coax for TV Low Loss, Satellite & SMA/V Networks
C1100B1 19dB Black ..... Mtr £0.68
C1100W1 19dB White ..... Mtr £0.68
C1125B1 Black ..... Mtr £0.89

COAX ON 100 METRE DRUMS
Price per 100 metres
See above details for Coax usage
C55B1 21dB Brown ..... 100mm Drum £17.57
C55W1 21dB White ..... 100mm Drum £17.57
C56B1 17dB Black ..... 100mm Drum £17.57
C56W1 17dB White ..... 100mm Drum £17.57
SA11000B1 Black ..... 100mm Drum £33.61
SA11000W1 White ..... 100mm Drum £33.61
SA11002 Coax – 2 core Black ..... 100mm D £70.27
K1015 Coax – 7 core Black ..... 100mm D £134.55
C1100B1 19dB Black ..... 100mm Drum £32.90
C1100W1 19dB White ..... 100mm Drum £32.90
C1100B Dual 19dB Black ..... 100mm Drum £82.25
C1125B1 15dB Black ..... 100mm Drum £30.54
C1125W1 15dB White ..... 100mm Drum £25.85

DOMESTIC COAX
Supplied on 25 Metre Drum
Price per 1000 Metres
C55B2 21dB Brown ..... 250m Drum £158.00
C55W2 21dB White ..... 250m Drum £158.00
C56B2 17dB Black ..... 250m Drum £158.00
C56W2 17dB White ..... 250m Drum £158.00
SAT100B2 Black ..... 250m Drum £290.00
SAT100W2 White ..... 250m Drum £290.00

LIGHT COMMERCIAL COAX
Supplied on 250 Metre Drum
Price per 1000 Metres
C100B2 19dB Black ..... 250m Drum £294.00
C100W2 19dB White ..... 250m Drum £294.00
CT100B 1 Dual 19bB Black 250m Drum £709.00

COMMERCIAL GRADE COAX
Supplied on 250 Metre Drum
Price per 1000 metres
Drum size 500 & 1000 Metre to order
CT100PE 18.7dB Black ..... 250m Drum £365.00
C1125PE 15.3dB Black ..... 250m Drum £499.00
C1167PE 11.9dB Black ..... 250m Drum £861.00
CT1233PE 8.9dB Black ..... 250m Drum £1222.00
CT1261PE 8.1dB Black ..... 250m Drum £1293.00

UNDERGROUND & HEAVY INDUSTRIAL COAX
Price per 1000 Metres
Drum size 250, 500 or 1000 Metre to order
C1100RBS 18.7dB ..... D size to order £501.00
CT125RBS 15.3dB ..... D size to order P.O.A.
CT167RBS 11.9dB ..... D size to order £979.00
CT233RBS 8.9dB ..... D size to order £1406.00
CT264RBS 8.4dB ..... D size to order £1487.00

COAXIAL CABLE
LIGHT COMMERCIAL COAX
Supplied on 250 Metre Drum
Screen Copper Braid Copper Tape
Screen Copper Braid Copper Tape
DS1001 Black Far East Supp ..... 100m D £30.63
Screen Copper Braid Alloy Tape
RG6 Black Far East Supp ..... 100m D £21.55

FLEXIBLE CABLES
LOUDSPEAKER CABLE
Cut from the Drum
Price per Metre
LS Cable Grey 2' 13.2mm ..... Mtr £0.20
LS Cable Black 2' 13.2mm ..... Mtr £0.20

LOUDSPEAKER CABLE
Price per 100 Metres
LS Cable Grey 2' 13.2mm ..... 100mm D £8.40
LS Cable Black 2' 13.2mm ..... 100mm D £8.40

COAXIAL CONNECTORS
PIB Connector Sealing Tape
19mm – 10m PIB Self Amal Tape £4.63
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STANDARD COAX CONNECTORS
Coax Plug Alloy British soft claw ..... each £0.35
Coax Plug Alloy Screw on ..... each £0.50
Coax Coupler British White ..... each £0.30
Coax Coupler British Black ..... each £0.30

Bulk Purchase Prices
Coax Plug Alloy Belling Lee 100 £31.11
Coax Plug Alloy British soft claw 100 £23.50
Coax Plug Alloy Foreign 100 £18.43
Coax Plug Alloy Screw on 100 £34.56
Coax Coupler British White 100 £16.45
Coax Coupler British Black 100 £16.45

COAX CONNECTORS (In Line)
"F" Coaxial Connectors
F-Screw on C1100 RG6 ..... each £0.30
F-Screw on C56 ..... each £0.30
F-Crimp Bonded Ring CT100 RG6 ..... each £0.26
F-Crimp Bonded Ring CT125PE ..... each £1.26
F-Crimp Bonded Ring CT167PE ..... each £2.95
Crimping F Tool for Above £40.89
F-Crimp Loose Ring CT100 ..... each £0.22
F-Elbow Socket to Plug ..... each £1.22

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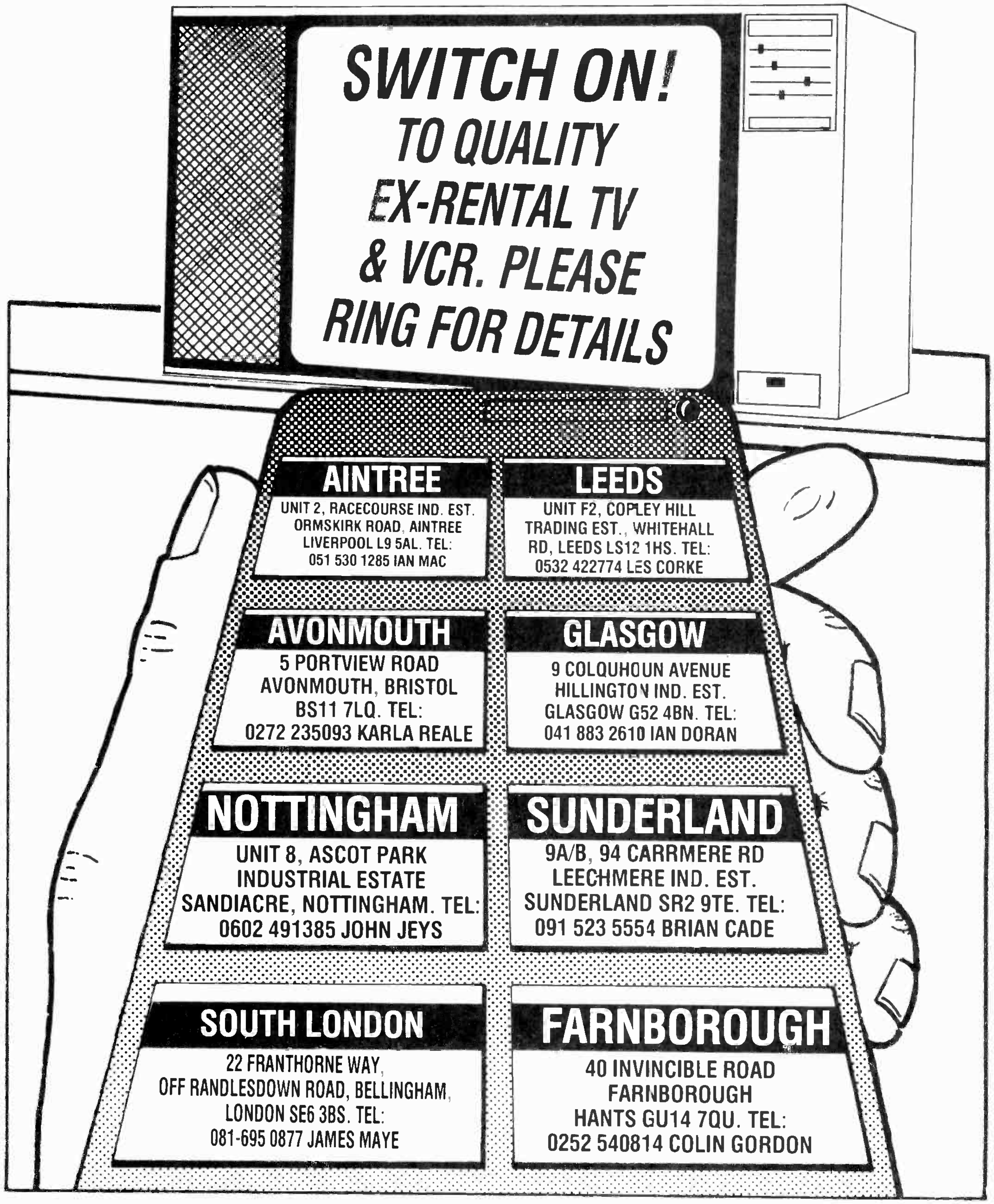
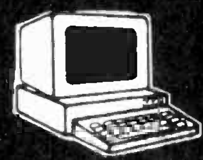


CENTRAL TV



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- Hewlett Packard 1741A, 100MHz dual channel with analogue storage £350
- Hewlett Packard 1744A, 100MHz dual channel with analogue storage £350
- Philips, 3211 15MHz dual channel .... from £150
- Philips, 3217 50MHz dual channel .... from £250
- Philips, 3226 15MHz dual channel .... from £150
- Philips, 3240 50MHz dual channel .... from £250
- Philips, 3261 120MHz dual channel .... from £325
- Tektronix 453, 100MHz dual channel £250
- Tektronix 515A £150
- Tektronix 2230, 100MHz dual channel, digital storage £1250
- Tektronix 2335, 100MHz dual channel £575
- Tektronix 2445, 150MHz dual channel £1250
- Tektronix 7313, 100MHz 4-channel with analogue storage £350
- Tektronix 7403N, 60MHz 4-channel .... from £300
- Tektronix 7603, 100MHz 4-channel .... from £350
- Tektronix 7623, 100MHz 4-channel with analogue storage .... from £500
- Tektronix 7904, 500MHz 4-channel .... from £750
- Telequipment D34 dual channel (battery/mains) .... from £150
- Telequipment D75 50MHz dual channel .... from £225

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Racal Dana 9000, 520MHz
Racal Dana 9500, 520MHz
Racal Dana 9520, 20MHz
Racal Dana 9824, 560MHz
Racal Dana 9901, 50MHz
Racal Dana 9903, 50MHz
Racal Dana 9905, 200MHz
Racal Dana 9917, 560MHz
Racal Dana 9919, 1GHz
Marconi TF2432, 560MHz
Marconi TF2435, 2GHz
Hewlett Packard 5342A, 18GHz

Digital Multimeters

Racal Dana 5003
Advance Alpha II
Datron 1041/1051
Fluke 8010A/8050/8600A
Fluke 8800A
Gould Alpha III and Alpha IV
Keithly 191
Solartron A210/LM1420.2
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Many more items available such as power supplies, pulse generators, function generators, synthesisers, power meters, spectrum analysers, chart recorders, LCR bridges, oscillators, isolating transformers, variacs, level meters, noise generators, pats testers, AM/FM signal generators and modulation meters etc.
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Wavetek 1855B CATV sweep transmitter x 2, Wavetek 1865 CATV sweep analyser x 3, Wavetek MC661E CATV field strength meter x 3, Wavetek CRW 1 CATV card reader x 1, Wavetek SAM JR CATV 450MHz signal analyser meter x 3 – ALL PACKAGE FOR SALE AT £2.5k

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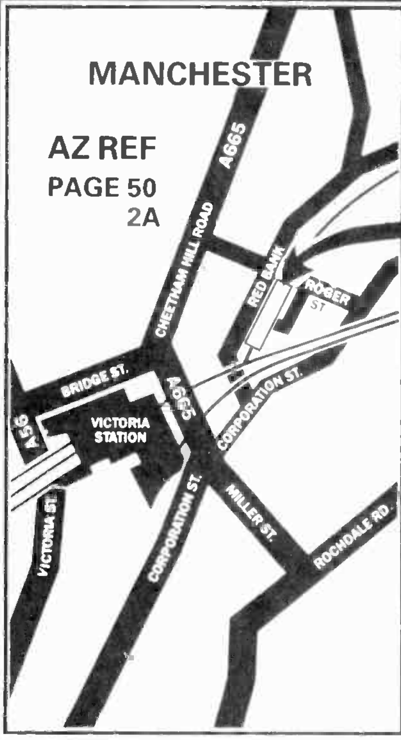

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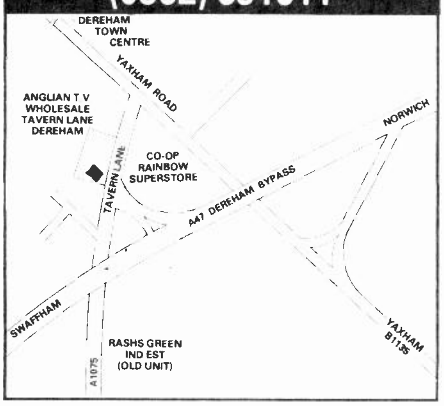

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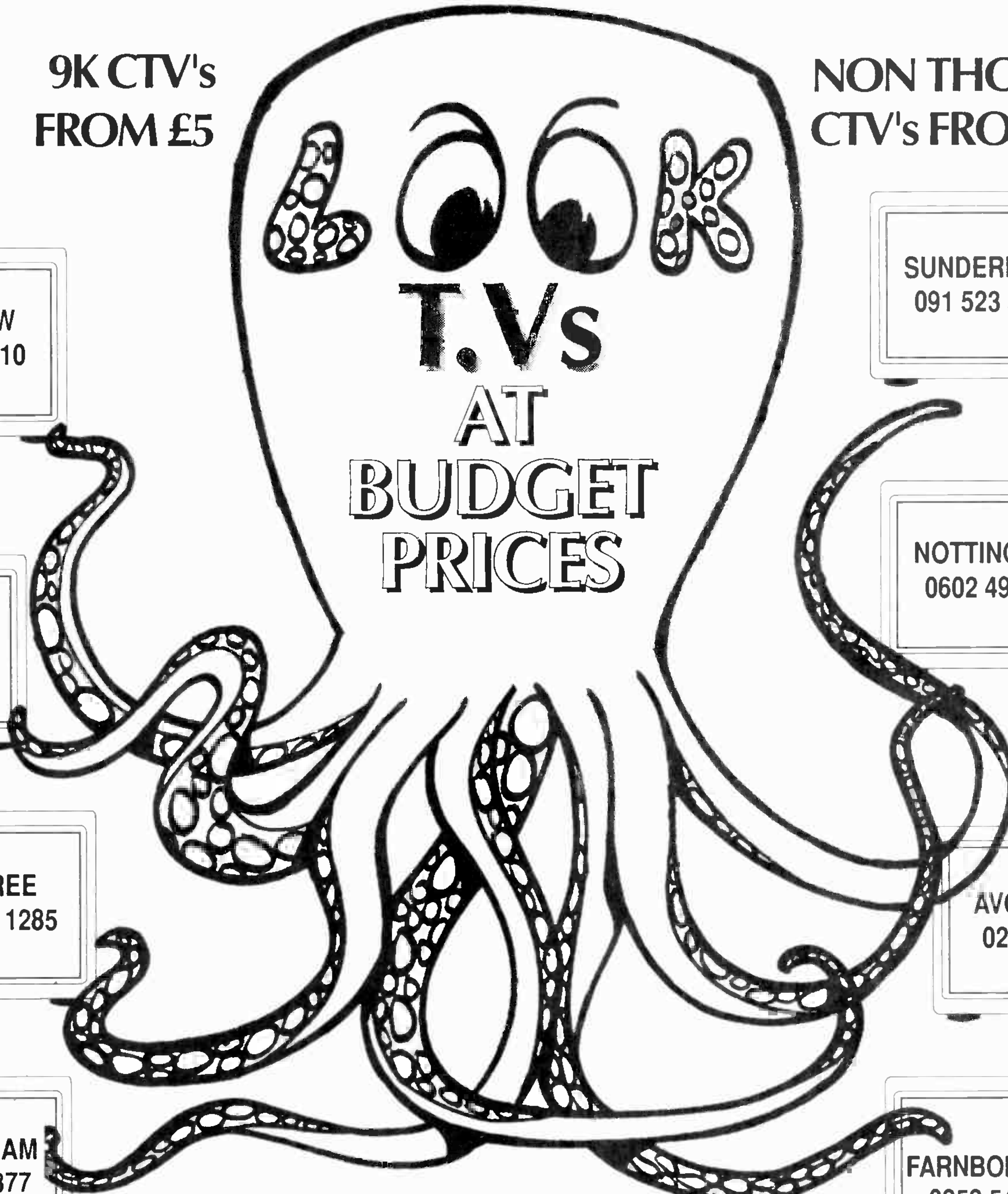

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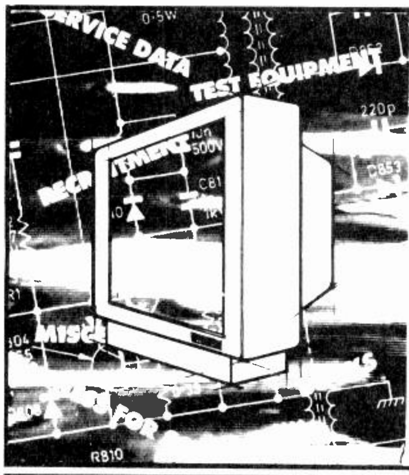

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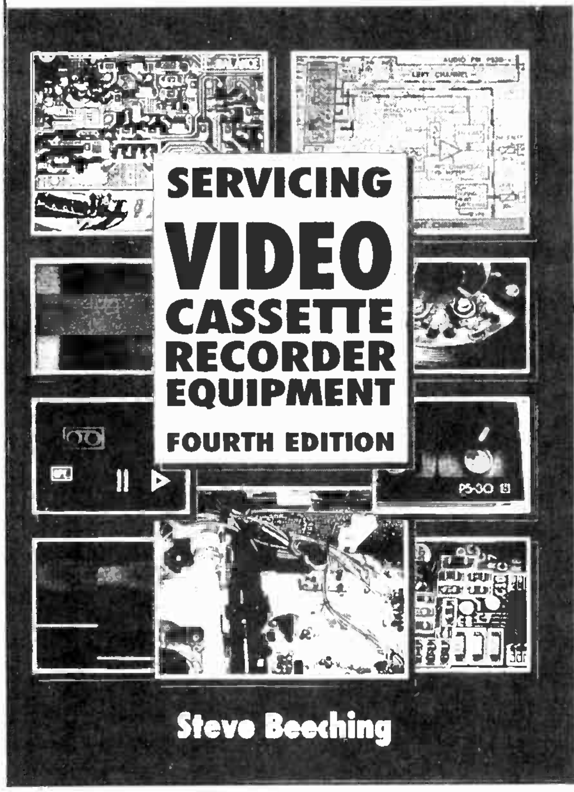

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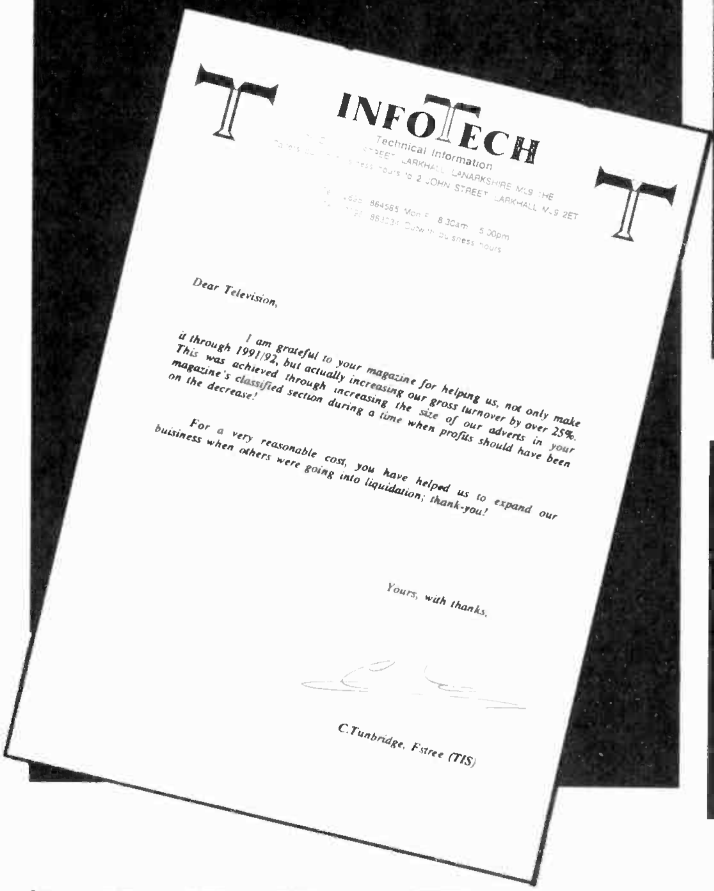
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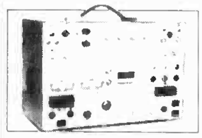

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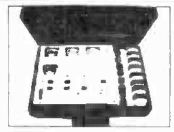

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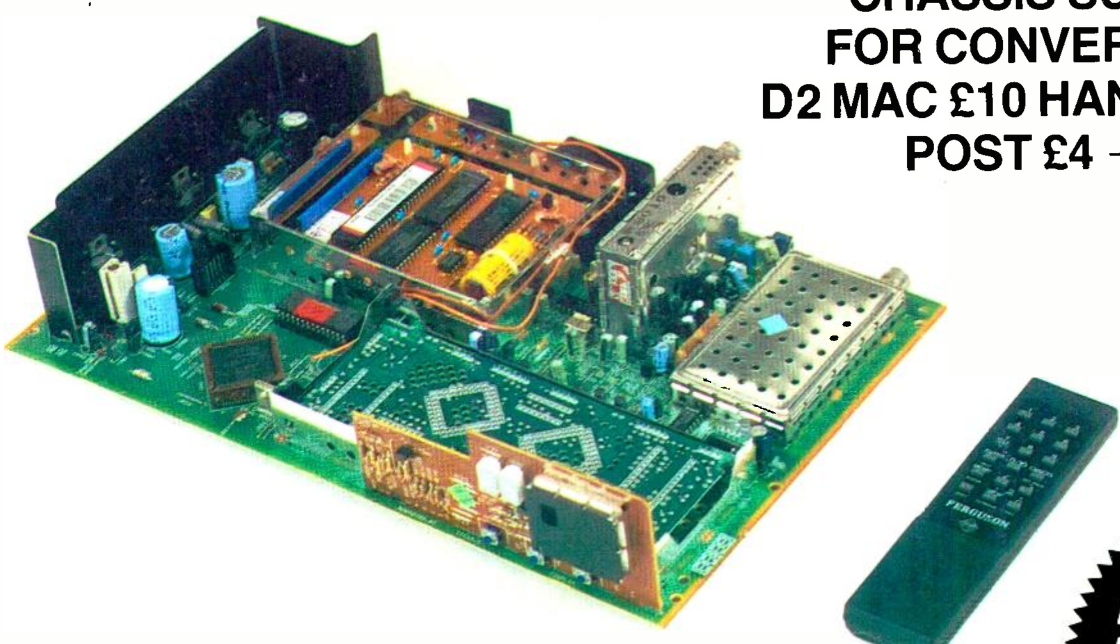

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