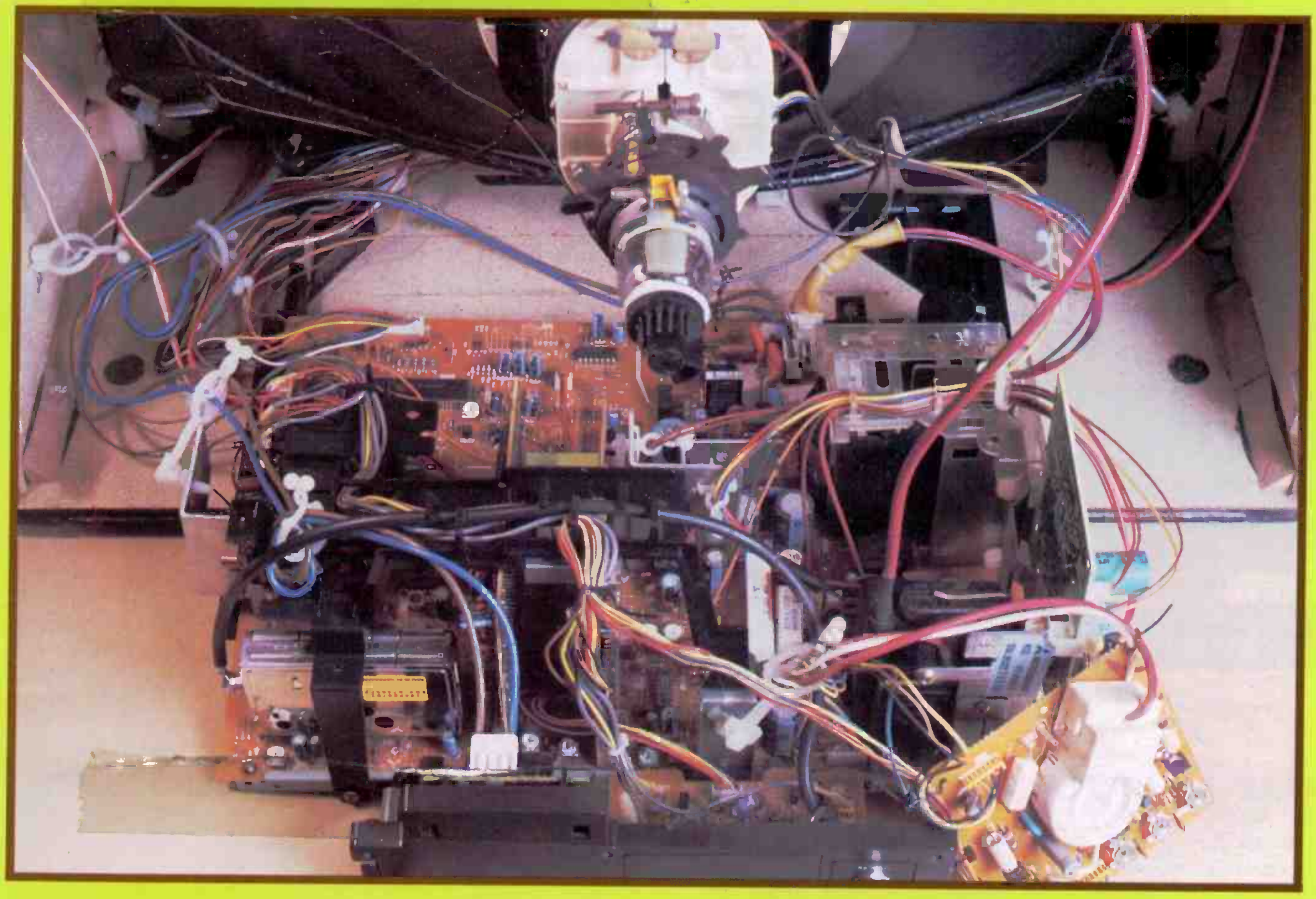
JULY 1991 £1·80

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

FREE ZENER DIODE PACK



The Mitsubishi Euro-4 Chassis
Video Equivalents•Test Report
Assessing Satellite TV Reception
Hitachi Servicing Briefs•DX-TV
TV Fault Finding•VCR Clinic

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TELEVISION

July 1991

Vol. 41, No. 9
Issue 489

On sale June 19th

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

INDEXES AND BINDERS
Indexes to Vols. 37 and 38 are available at £1 each from the Editorial office (address above). Photostats of the indexes to Vols. 31-36 can be supplied at £1 each.
Binders that hold twelve issues of *Television* are available for £4·50 from Television Binders, 78 Whalley Road, Wilpshire, Blackburn BB1 9LF. Make cheques out to "Television Binders".

SUBSCRIPTIONS
An annual subscription costs £21·60 in the UK, £25·50 overseas (by surface mail – ask for airmail quote if required). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

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Subject to availability, copies of issues published during the last 12 months are available at £1·80 each from Television, John Denton Services, Unit 13, Thornham Grove, Stratford, London E15 1DN. Please make cheques/postal orders payable to IPC Magazines Ltd.

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

this month

OUR NEXT ISSUE DATED AUGUST WILL BE PUBLISHED ON JULY 17

AAY32	9p
AC107	40p
AC125	30p
AC126	30p
AC127	30p
AC128	35p
AC128K	40p
AC141K	45p
AC142K	45p
AC176	22p
AC167K	28p
AC187	25p
AC187K	40p
AC188	25p
AC188K	40p
ACY18	48p
ACY19	48p
AD149	60p
AF125	50p
AF127	50p
AF139	30p
AF239	30p
BA145	10p
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BA157	12p
BB105B	18p
BB205B	24p
BC107	8p
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BC461	28p
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BR303	85p
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BRY56	33p
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2N3711	12p
2N3771	85p
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2N5296	30p
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2N5496	80p
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2N6109	40p
2N6292	40p
2N6385	120p
2N6403	160p
3N143	65p

DIODES

Rectifier Diodes

BY100	40p
BY103	32p
BY127	8p
BY133	8p
BY164	40p
BY179	35p
BY184	32p
BY196	20p
BY206	11p
BY207	11p
BY208	18p
BY210	22p
BY225	120p
BY226	18p
BY227	19p
BY228	28p
BY296	20p
BY298	23p
BY299	22p
BYX10	15p
BYX55/350	30p
BYX55/600	25p
BYX70/500	32p
BY70/800	36p

OA47	10p
OA90	10p
OA91	10p
OA200	10p
OA202	10p
IN.914	2p
IN.4001	3p
IN.4002	3p
IN.4003	3p
IN.4004	3p
IN.4005	3p
IN.4006	3p
IN.4007	4p
IN.4148	2p
IN.5400	9p
IN.5401	8p
IN.5402	8p
IN.5403	8p
IN.5404	8p
IN.5405	11p
IN.5406	12p
IN.5407	12p
IN.5408	12p
RGP15	15p
RGP30	16p
SKE4F2/06	60p
SKE4F2/08	80p
SKE4F2/10	100p
SR2M	60p

I.C. SOCKETS

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

ZENERS

400 MW
BZY88 RANGE
2V7 to 39V 6p
1.3W
BZX61 RANGE
2V7 to 39V 10p

CRYSTALS

Freq in MHz

1.0	260p
2.0	200p
2.4576	180p
3.276	115p
3.579	95p
4.0	110p
4.194	130p
4.43	95p
5.0	130p
6.0	115p
8.0	125p
8.867	125p
10.0	140p
11.0	250p
12.0	120p
14.0	125p
14.756	200p
15.0	160p
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
DAF96	80p
DL92	80p
DY86	70p
DY87	80p
DY802	90p
EABC80	85p
EB91	50p
EBF80	60p
EBF89	60p
ECC82	90p
ECC83	120p
ECC84	80p
ECC85	90p
ECH81	100p
ECH84	90p
ECL80	65p
ECL82	80p
ECL84	100p
ECL85	80p
ECL86	90p
EF80	80p
EF85	80p
EF89	85p
EF183	75p
EF184	85p
EL34	280p
EL36	90p
EL84	100p
EL95	85p
EL500	100p
EL504	130p
EY86	70p
EY87	70p
EY88	80p
EZ35	80p
EZ80	90p
EZ81	70p
PC97	100p
PCC85	60p
PCF80	100p
PCF200	135p

PCF801	110p
PCF802	80p
PCF806	115p
PCH200	100p
PCL81	65p
PCL82	80p
PCL84	60p
PCL85	80p
PCL86	80p
PCL805	80p
PFL200	110p
PL36	120p
PL82	60p
PL83	60p
PL84	80p
PL95	180p
PL500	110p
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	150p
AN241	135p
AN252	150p
AN259	250p
AN262	140p
AN271	230p
AN274	250p
AN301	330p
AN303	250p
AN304	360p
AN305	320p
AN315	210p
AN316	350p
AN360	100p
AN362	140p
AN366	150p
AN503	450p
AN610	160p
AN612	160p
AN3215K	650p
AN3310	350p
AN3312	350p
AN3320K	800p
AN3331K	900p
AN3792	400p
AN3794	450p
AN3795	500p
AN3821	800p
AN3821K	900p
AN3822K	900p
AN3830K	800p
AN3990K	300p
AN3991K	400p
AN5010	450p
AN5011	400p
AN5015	350p
AN5020	200p
AN5025	250p
AN5030	550p
AN5033	500p
AN5034	500p
AN5111	550p
AN5132	250p
AN5135	600p
AN5138	450p
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AN5151	600p
AN5215	100p
AN5250	150p
AN5256	150p
AN5260	350p
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AN5352	600p
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AN5732	160p
AN5753	170p
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AN5790	300p
AN5791	350p
AN5835	450p
AN5862	300p
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AN6238	400p
AN6247	200p
AN6270	400p
AN6300	600p
AN6306	850p
AN6307	250p
AN6320	300p
AN6328	400p
AN6332	450p
AN6337	420p
AN6341	350p
AN6344	440p
AN6350	610p
AN6359	810p
AN6360	400p
AN6362	480p
AN6371	510p
AN6387	560p
AN6811	130p
AN6884	240p
AN7105	210p
AN7110	130p
AN7114	150p
AN7115	150p
AN7116	130p
AN7120	130p
AN7130	110p
AN7140	450p

AN7145	195p
AN7146	210p
AN7154	180p
AN7156	240p
AN7168	260p
AN7178	270p
AN7222	300p
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
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BA532	140p
BA534	290p
BA536	180p
BA546	180p
BA612	160p
BA656	150p
BA658	380p
BA684	400p
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BA1320	110p
BA1330	150p
BA1360	160p
BA4403	220p
BA5101	400p
BA5102	220p
BA5204	200p
BA5402	230p
BA5406	280p
BA5408	180p
BA6104	250p
BA6208	250p
BA6209	260p
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BA8411	250p
BA6993	150p
BA7001	150p
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CA3090Q	250p
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CA3130S	100p
CA3134E	280p
CA3140E	38p
CA3160	85p
CA3661E	140p
CA3162E	450p
CA3189E	230p
CA3193E	230p
CA3240E	90p
CA3260E	170p
CA3290E	150p
CX108	950p
CX134A	950p
CX136	600p
CX139	1450p
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CX141	750p
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CX150B	325p
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CX175	325p
CX186	750p
CX187	825p
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CX877	300p
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HA13001	170p
HA13002	250p
HA13006	400p
HA13007	400p
HA13108	350p
HA13412	600p
HA13432	400p
HA17524	250p
HA17805	100p

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ICL7660	240p
ICM7555	60p
ICM75556	80p
KA2101	100p
KA2102	160p
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KA2206	160p
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KA2914A	300p
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LA1201	75p
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LA2101	270p
LA2200	190p
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LA3210	65p
LA3220	100p
LA3300	140p
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LA4032	140p
LA4051	160p
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LA7507	250p
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LA7910	150p
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LC7132	400p
LC7137	450p
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LF353	48p
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LF357	70p
LF398	300p
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LM741MET	45p
LM747	55p
LM748	30p
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MAB8441P	650p
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MC1496	65p
MC3302	70p
MC3401	45p
MC3403	60p
NE555	20p
NE556	40p
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NE567	115p
NE571	290p
NE592	85p
NE5532P	140p
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STK0070	1100p
STK0080	580p
STK011	370p
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STK016	800p
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STK080	600p
STK082	580p
STK084	660p
STK085	1050p
STK086	870p
STK420	400p
STK430	500p
STK433	490p
STK435	400p

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STK439	550p
STK441	680p
STK443	740p
STK457	800p
STK459	560p
STK460	720p
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STK463	780p
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STK501	580p
STK561	550p
STK563	480p
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STK745	600p
STK760	600p
STK770	750p
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STK1040	700p
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STK1050	750p
STK1060	780p
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STK3083	850p
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STK3152II	990p
STK3156	560p
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STK4112	950p
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STK4192	1000p
STK4231II	990p
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STK4813	950p
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STK4843	720p
STK4853	900p
STK4863	850p
STK4873	990p
STK4893	1400p
STK4913	1180p
STK5314	550p
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STK5322	620p
STK5324	520p
STK5325	580p
STK5331	400p
STK5332	220p
STK5333	700p
STK5335	450p
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STK5361	420p
STK5372	300p
STK5412	650p
STK5421	625p
STK5422	600p
STK5431	650p
STK5434	650p
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STK5441	600p
STK5451	480p
STK5457	425p
STK5461	700p
STK5462	600p
STK5466	850p
STK5467	500p
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STK6922	600p
STK6932	600p
STK6962	320p
STK6972	630p
STK6981B	860p
STK6982	800p
STK7216	500p
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STK7358	650p
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STK7404	400p
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STK7408	880p
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STR53041	650p
STR53043	650p
STR54041	500p
STR55041	650p
STR58041	480p
STR59041	650p
STR60001	650p
STR61001	750p
STR80145	700p
STRD1806	800p
STRD1816	800p
T2800D	52p
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TA7061	115p
TA7063	70p
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TA7157	140p
TA7176	240p
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TA7272	260p
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TA7274	260p
TA7280	330p
TA7281	270p
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TA7283	260p
TA7288	260p
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TA7313	110p
TA7314	210p
TA7315	200p
TA7317P	240p
TA7324	200p
TA7325	90p
TA7328	200p
TA7335	200p
TA7336	250p
TA7341	250p
TA7343	250p
TA7357	400p
TA7358	200p
TA7401	400p
TA7607	270p
TA7608	360p
TA7609	270p
TA7611	280p
TA7612	360p
TA7614	230p
TA7616	400p
TA7621	820p
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TA7630	300p
TA7632	400p
TA7640	150p
TA7641	170p
TA7658	130p
TA7668	160p
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TA7688	250p
TA7698	720p
TA7699	1200p
TA7705	300p
TA7750	200p
TA7757	250p
TA7769	300p
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TBA990	80p
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TC9106	500p
TC9109	450p
TC9121P	580p
TC9122P	430p
TC9123	600p
TC9125BP	410p
TC9132	400p
TC9134	750p
TC9142	320p
TC9143	300p
TC9145	150p
TC9147BP	700p
TC9148	200p
TC9149	225p
TC9150	425p
TC9152	425p
TC9153	300p
TC9154AP	275p
TC9156	300p
TC9163	375p
TC9164	400p
TC9172P	300p
TC9176P	500p
TC9178AF	1600p
TC9179F	2000Pp
TC9305	300p
TCA740	130p
TCA940	100p
TCEP100	100p
TD62308AP	200p
TD62381	200p
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TD62506	200p
TD62705	250p
TD62781AP	250p
TD62795	200p
TD62803	700p
TD6304AP	300p
TD6306P	350p
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TD6359N	600p
TD6359P	300p
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TDA1002	200p
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TDA1011	120p
TDA1012	120p
TDA1013A	120p
TDA1015	100p
TDA1016	200p
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TDA1024	200p
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TDA1035	120p
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TDA1062	200p
TDA1070	400p
TDA1072	300p
TDA1074	420p
TDA1082	290p
TDA1083	200p
TDA1085	400p
TDA1097	550p
TDA1151	60p
TDA1154	50p
TDA1170	85p
TDA1180	140p
TDA1190	90p
TDA1200B	80p
TDA1220	150p
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TDA1236	295p
TDA1270	150p
TDA1327	250p
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LINEAR IC's — Cont.

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TDA1941	300p
TDA1950	280p
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TDA2005	90p
TDA2006	70p
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TDA2020	140p
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TDA2038	900p
TDA2040	200p
TDA2048	750p
TDA2054M	120p
TDA2151	300p
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TDA2690	100p
TDA2730	250p
TDA2760	400p
TDA2780	600p
TDA2790	450p
TDA2791	270p
TDA2795	250p
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TDA2840	200p
TDA3047	200p
TDA3048	150p
TDA3082	300p
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NV850/NV950 £38.00
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NVG33 £38.00
NVG30/NVG31/NVG130 £20.00
NVG10/NVG11/NVG12/NVG14/NVG15/ NVG16/NVG120/NV250/NV280/ NV450/NV465 £16.50
NVG18 £30.00
NVG20/NVG21/NVG22/NVG25/NVG28/ NVG200/NVD48 £25.00
NVG60 £30.00
NVG45/NVG46 £30.00
NVH70 £50.00
NV688 £32.00
NV600 £23.00
NVH65 £50.00
NVG7/NVG9/NV230 £18.00

N.E.C.
N9011/N9012/N9013E/N9014E/N9014G/ N9015/N9016/N901A/N902A/N9033/ N9034/N9054/N9063/N9065/N9066/ N906A £20.00
N911A/N915A/N916A/N917 £27.00
PCV754/PV2300/PV2400/PV760/ PV794/PV770/PV774/PVC763E £18.00
N380/N381/N830/N831/N832/N833/ N834/N835/N836 £7.00
8261/AH1 £48.00

NORDMENDE
4609-460/V100/V140/V200/V250/ V304/V341/V450/V550 £7.00
V1001/V1005/V1015/V1025/V1035/ V1041/V1055/V1065/V1105/V2005 £18.00
V110/V333 £20.00
V101/V102/V103/V112/V141/V142/ V200/V300/V3005/V300/V301/V302/ V350/V500 £7.00
V1205/V1215/V1235/V1245 £20.00
V1305 £33.50
V380 £27.00
V502/V503/V5005 £37.00

ORION
VH3/VH555/VH600/VH700/VH844/VH900/ VH1000 (ALL MODELS) £13.00

PHILIPS
VR6460/VR6520/VR6920/64VR60/ VR6420 £8.50
VR6711 4 HEAD £41.00
6920/VR6440 £58.00
VR6441/VR6540/VR6541/VR6640/ VR6642 £14.00

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

REDSON
MR100 £17.00

SABA
2A10/2A70/2B20 £23.00
4A10/4B20 £33.50
6A10/6A70 £33.00
8A10/VR6038 £39.50
CVR6083/VR6006/VR6007/VR6008/ VR6009/VR7006/VR7007 £18.50
PVR6068/PVR6070/PVR8070/VR2000/ VR6000/VR6010/VR6012/VR7000/ VR9010 £7.00
VHR7000/VR5005 £16.00
VR6004/VR6005/VR6011/VR6013/ VR6014/VR6020/VR6022/VR6014/ VR6023/VR6024/VR7004/VR7011/ VR7014/VR7720/VR7730/VR8011 £7.00
VR6018/VR7018 £30.00
VR6028 £27.00
VR7016 £24.00

SAISHO
VR100/VR605/VR705/VR805/VR905/ VR1000/VR1100/VR1200/VR1600 £13.50
VR3300X/VR3600X/VR3650/VR3800 £15.00
VR3200/VR3500 £16.00
VR3300/VR3600 £16.00

SALORA
6500/6600 £21.50

SAMSUNG
SVX301/VB900/VB910/VT510/VT320/ VT5600/VX510/VX511/VX520/VX616/ VX626/VX627/VX717 £19.00

SANYO
VTC5000/VTC5400/VTC6000/VTC6500/ VPR6000/VTC1500/VTCM10/VTCM11/ VTCM20/VTCM21/VTCM25/VTC2000/ VTC5100/VTC5150/VTC5300/ VTC5400/VTC5350/VTC5370/ VTCNX10/VTCNX15/VTCNX20/ VTCNX30 £18.50
VTC5500/VTC5550/VTC9100/VTC9300/ VTC9350/VTC9355/VTC9455/VTC9500 £19.00
VHR1110/VHR1150/VHR1300/ VHR1700/VHR2300 £16.00
VHR3200/VHR3270/VHR3100/ VHR3150/VHR3300/VHR3400 £18.00
VHR1100/VHR1200 £18.00
VHR1500/VHR2500 £28.00

SHARP
VC300/VC381/VC383/VC386/VC387/ VC388/VC482/VC483/VC486/VC3300/ VC8381/VC9100/VC9300/VC9500/ VC9700/VC9400/VC9600 £14.00
VC582/VC583/VC651/VC681/VC750/ VC780/VC781/VC683/VC684 £14.00
VC6000/VC6200/VC6300/VC7300/ VC7700/VC7750/VC8000/VC8300 £31.00

SONY
DSR-19R (FOR SL-T 9ME) £39.00
DSR-35R (FOR C20/C30/C40/ SLF1UB/SLF1E) 2 PIN £15.00
DSR-43R (FOR SLC7 RANGE/SL5000/ SL5100/SL3000) 1 PIN £13.00
DSR-21R (FOR SLC8/C9) £30.00

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

TRIUMPH
VR9500/VR9501/VR9525 £13.00

VCR PINCHROLLERS

AKAI
VS9300, VS9500, VS9700, VS9800 £2.50
VS1, VS2, VS3, VS4, VS5, VS6, VS9, VS10 £3.20
VS105, VS112, VS115, VS116, VS126, VS244, VS245, VS247, VS248, VS515, VS516 £2.50
VS201, VS301, VS303, VS304, VS603, VS606, VS607, VP58-P82 £2.50
VS125, VS155, VS165, VS220, VS240, VS250, VS512, VSX9 £2.50

AMSTRAD
VCR4500, VCR4600, VCR4600 MKII, VCR4700 £2.50
VCR5200 £3.20
VCR7000 £3.20

FERGUSON
3V00, 3V16, 3V22, 3V23 £2.50
3V29, 3V30, 3V31, 3V32 £2.50
3V35, 3V36, 3V38, 3V39, 3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 3V58, 3V59, 3V64, 3V65, FV10, FV11, FV12, FV14 £2.50

FISHER
FVHP420, FVHP520, FVHP530 £3.20
FVHP615, FVHP710, FVHP715, FVHP716, FVHP722, FVHP725, FVHP830 £3.20
FVHP905, FVHP970, FVHP980, FVHP990 £3.20

HITACHI
VT11, VT33 £2.50
VT61, VT62, VT63, VT64, VT65, VT86, VT88, VT110, VT122, VT120, VT128, VT130, VT135, VT138, VT150, VT168, VT220 £2.50
VT5000, VT8000, VT9300, VT9500 £2.50

ITT
VR3605, VR3905, VR3935, VR3985, VR3986, VR3993, VR3994 £3.20
VR3913, VR3914, VR3943, VR3954, VR3963, VR3984 £3.20

JVC
HR300, HR3330, HR3360, HR3660, HR4100, HR7700 £2.50
HR7200, HR7300, HR7600, HR7610, HR7650, HR7655 £2.50
HRD110, HRD111, HRD120, HRD121, HRD140, HRD150, HRD160, HRD225, HRD455, HRD565, HRD725 £2.50

MITSUBISHI
HS200, HS300, HS301, HS302, HS303, HS304, HS310, HS320, HS700 £2.50
HS306, HS307, HS400, HS710 £2.50

NATIONAL
NV100, NV180, NV300, NV333, NV340, NV366, NV600, NV688, NV777, NV788 £2.50
NV230, NV370, NV430, NV460, NV730, NV810, NV830, NV850, NV870, NV890, NV2000, NV2010, NV3000, NV7000, NV7200, NV7800, NV8600, NV8610, NV8620, NVG14 £2.50
NVG7, NVG19, NVG12, NVG18 £3.20
NVG21, NVG25, NVH65 £3.20

PHILIPS
VR6460 £2.50
VR2020, VR2021, VR2022, VR2023, VR2024 £3.20

SANYO
VHR1100, VHR1300, VHR1500, VHR2300 £3.20
VTC5000, VTC5150, VTC5500, VTC9300, VTCM10, VTCM20 £2.50

SHARP
VC381, VC386, VC2300, VC3300, VC7300, VC7700, VC8300, VC9100, VC9300, VC9500, VC9700 £3.20
VC387, VC481, VC483, VC486, VC496, VC581, VC582, VC583, VC585 £3.20
VC651, VC681, VC685, VC750, VC780, VC781, VC785, VC787, VC793, VCT72 £3.20

SONY
SLC5, SLC6, SLC7 £3.20
SLC9, SLC20, SLC24, SLC30, SLC33, SLC44, SLHF100, SLF1, SLF11, SLF25, SLF30, SLF60, SLF100 £3.20

VCR BELT KITS

AKAI
VP7100 £1.60
VS-1 £1.50
VS2EG £1.00
VS4 £1.20
VS5EG £1.00
VS9300 £1.60
VS9500 £1.55
VS9700 £1.60
VS9800 £1.55

AMSTRAD
TVR1-2-3 £2.10
VCR4600 & MKII £2.10
VCR4700 £2.10
VCR5200 £2.10
VCR7000 £0.80

FERGUSON
3292, 3V00, 3V01, 3V16, 3V22 £1.50
3V23 £0.65
3V29, 3V30 £1.20
3V31, 3V32 £0.85
3V35, 3V36 £0.80
3V38, 3V39 £0.80
3V42, 3V43 £0.65
3V44, 3V45 £0.65
3V34, 3V54, 3V55 £0.65
3V58, 3V59, 3V64, 3V65 £1.40
8950, 8951, FV10, FV11, FV12, FV13, FV14 £1.40

FISHER
VBS7000 £2.45
VBS9000 £1.20
FVHP520, FVHP530 £0.80
FVHP710, FVHP716 FVHP722, FVHP905, FVHP906, £1.20
FVHP907, FVHP910 £1.30
FVHP615, FVHP715, FVHP725, FHP830 £1.20

GEC
4005 £1.50

HITACHI
VT11, VT33 £1.00
VT5000 £1.20
VT5500 £1.30
VT8000 £0.60
VT8500 £0.60
VT9300 £0.50
VT9500 £0.60

HITACHI
VT9700 £0.60
VT14, VT17, VT19, VT35, VT38, VT88, £1.20
VT52, VT62, VT64, VT65, VT86 £1.50

ITT
VR3605, 3905, 3935, VR3985 £1.00
VR3913, VR3914 £1.00

JVC
HR3300, HR3330 HR3360, HR3660 £1.50
HR4100 £1.80
HR7200 £0.70
HR7600 £0.80
HR7610 £0.95
HR7650 £0.75
HR7655 £0.90
HR7700 £0.77
HRD110, HRD111, HRD120, HRD225, HRD250, HRD455, HRD565, HRD566, HRD725, HRD755 £1.00
HRD170, HRD180, HRD230, HRD370, HRD430, HRD530 £1.30

MITSUBISHI
HS200 £2.00

NATIONAL
NV300 £1.60
NV333 £1.35
NV777 £1.00
NV2000 £1.50
NV3000 £1.60
NV7000 £0.95
NV7200 £0.90
NV8600 £1.60
NV7500, NV7800 £1.10
NV340, NV366 £1.40
NV600, NV788 £1.20
NV230, 250, 280, 370, NV380, 430, 450, 460, NV465, 600, 630, 730, NV810, 830, 850, 870, NV890 £1.35

PHILIPS
VR6460 £1.70

SANYO
VTC5000 £0.75
VTC5300 £1.00
VTC5500 £0.95
VTC9300 £2.20
VTC1100, 1300, 1500 £1.00

SHARP
VC381, VC383, VC386 £1.25
VC6300 £1.50
VC7300, 7700, 7500 £1.50
VC8300 £1.50
VC8381, VC9100 £1.25
VC9300, VC9500 £1.35

SONY
SL-C5, SL-C6 £1.40
SL-C7 £1.40
SL-C9 £1.65
SL8000, SL8080 £2.00

TOSHIBA
V55, V57 £0.85
V5250, V5280 £2.30
V5480 £2.10
V5475 £1.60
V7540 £1.60
V8600 £1.50
V9600 £0.85

SOLDERING IRON
ANTEX XS25W 240V
Soldering Iron 240Vac £6.50p
Spare Element for XS25W 240V £3.40p
ANTEX C15W 240V
Soldering Iron 240Vcm £6.50p
Spare Element for C15W 240V £3.40p

DESOLDERING PUMP
Desolder Pump £3.50p
Spare Nozzle £0.60p

SOLDER MOP £0.65p

SOLDER
18 SWG 500g £5.00p
20 SWG 500g £6.50p

SOLDERING IRON STAND
Soldering Stand £2.60p
Spare Sponge £0.55p

FLOPPY DISCS
5¼ inch DSDD (10 in box) Branded Name £6.00
5¼ inch DSDD (bulk pack) 25 £10.00
3½ inch DSDD (10 in box) Branded Name £11.00
3 inch CF2 Branded Name £2.10
3 inch CF2D Branded Name £2.50

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

SERVICE KITS
Each Kit Contains Belts Set, Pinch Roller, Tension Band & Idler Tyres

NATIONAL
NV300/NV340 £5.80p
NV7000/NV7200 £5.50p
NV2000 £6.25p

JVC & FERGUSON
3V35-36,38-39 £5.50p
3V29/30 £6.25p
HRD110/111/120/225 £5.50p
HR7200 £6.25p

HITACHI
VT11/VT33 £6.25p

FISHER
SERVICE KIT £5.50

HITACHI T.V.
OUTPUT MODULE HM 6251 REF: 2370551 £6.50

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V. HEAD CLEANER 125p
SWITCH CLEANER 130p
SILICONE GREASE 150p
FREEZE IT 140p
FOAM CLEANER 140p
ANTI-STATIC 140p
AEROKLEANE 125p
AERO DUSTER 140p
PLASTIC SEAL 130p
GLASS CLEANER 130p

If you purchase more than one Servisol product postage will be £2.00

UNIVERSAL TRIPLERS 450p

SONY ON/OFF SWITCHES 200p

SONY THYRISTOR SG264A 600p SG613 1000p

PHILIPS SWITCHES 150p
K30, K35, K40, KT3, KT4

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IDLERS & PULLEYS REPLACEMENTS

		Reference	
AMSTRAD			
VCR7000		150280	£1.50
AKAI			
VS1-2, VS4-5, VS15	FF-REW IDLER	M1327773	£4.50
VS1-2, VS4-5, VS15	T-UP IDLER	BV327815	£6.00
V9700	IDLER	BV321979	£6.00
VS125, 126, 155, VS165, 240, 244, VS245, 247, 248, VS250, 512, 515, 516	IDLER ASSY	MZ366960J2	£11.00
FERGUSON			
3V16-22	T-UP IDLER	PU47752	£4.50
3V16-22	T-UP IDLER	PU49280	£6.30
3V23, 3V29-30, 3V31-32, 3V35	REEL IDLER	PU48967	£3.00
3V23	ROLLER ASSY	PU49042A	£4.00
3V29-30, 3V31-32, 3V35-36, 3V38-39, 3V49	T-UP IDLER	51402	£1.45
3V29-30,3V31-32	T-UP CLUTCH	PU51380	£2.60
3V35-36, 3V38-39, 3V49	REEL IDLER	PU55374	£2.85
3V35-36, 3V38-39, 3V49	T-UP CLUTCH	PU55373	£2.25
3V58-59, 3V64-65, FV10-11, FV12-13, FV14	IDLER ARM	PU58645	£2.50
3V42	CLUTCH ASSY	PU55822	£13.50
3V44	CLUTCH ASSY	PU57658	£11.50
3V42, 43, 48, 53, 56	T-UP CLUTCH	PU56043-1-4	£2.80
3V42, 43, 48, 53, 56	SUPPORT CLUTCH	PU56044-1-5	£2.80
FISHER			
FVHP520, FVHP530	FF-REW PULLEY	HI638531	£1.00
FVHP615	COMP. IDLER ASSY	FI1430420400300	£3.30
FVHP615	GEAR IDLER ASSY	FI1430490400900	£5.50
FVHP840	REEL T-UP ASSY	FI1430410400900	£6.50
FVHP905, 906, 908, FVHP910, 916	GEAR IDLER ASSY	FI1430490402400	£6.20
FVHP975, 990, 999, FVHP5000, 5100	IDLER	FI1430420400700	£5.20
GOLDSTAR			
	IDLER	435038A	£2.50
HITACHI			
	FF-REW IDLER	6886971	£1.50
	PLAY IDLER	V-6861482	£3.20
VT11-33, VT63-64, VT14, 17, 19, 38, 57, VT86, 88	CLUTCH ASSY	6879515	£7.50
VT120-220	CLUTCH ASSY	6886824	£7.50
VT8000-8300, VT8500-8700	FF-REW IDLER	6413663	£2.80
VT8000-8300, VT8500-8700	PLAY IDLER	6414221	£3.60
VT8000-8300 VT8500-8700	FF-REW PULLEY	6383531	£0.80
VT9300-9500	FF-REW IDLER	8681471	£3.30
VT9300-9500	PLAY IDLER	6861482	£3.20
VT9300-9500	IDLER	681505	£3.00
	IDLER	687043	£3.80
VT11-33, VT63-64	FF-REW IDLER	6886971	£1.50
HINARI			
VXL3, VXL20	REEL IDLER	40000009	£1.50
ITT			
VR3905, VR3906	T-UP IDLER	PU51402	£1.45
VR3906	REEL IDLER	PU55374	£2.85
VR3913, VR3943	REEL IDLER	PU48967	£3.00
JVC			
HR330, 3660, 4100	T-UP IDLER SML	PU49280	£6.00
HR7200, HR7600, HR7650, HR7655	T-UP CLUTCH	PU53462A	£3.00
HR7200, HR7600 HR7650, HR7655,	REEL IDLER	PU48967	£3.00
HR7700	ROLLER ASSY	PU49042A	£4.00
HR3300, 3660, 4100	T-UP IDLER LRG	PU47752	£4.50
HR7200, 7600, 7650 HR7655, HRD110, HRD120-121, HRD225	T-UP IDLER	PU51402A	£1.45
HRD110, HRD120-121, HRD225	T-UP CLUTCH	PU55373	£2.25
HRD110, HRD120-121, HRD225	IDLER ARM	PU55374-3-8	£2.85
MATSUI			
VX730, 735, 750, 755, VX810, 820, 880, 990	CLUTCH	850A00005	£6.50
MITSUBISHI		Reference	
HS306, 307, 318, 319, HS410, 710	GEAR ASSY	522P00201	£6.25

IDLERS & PULLEYS REPLACEMENTS — Cont.

NATIONAL			
NV322, NV600, NV688, NV777, NV788	IDLER UNIT	VXP0463	£3.00
NV333	IDLER ARM	VXL0997	£3.60
NV333, NV366	IDLER UNIT	VXP0401	£0.75
NV333, NV366	PLAY IDLER	VXP0433	£3.00
NV333, NV3000	ACTION GEAR	VDG0016	£0.60
NV333, NV2000, NV3000 NV7800	LOADING GEAR	VXP0325	£2.00
NV333, NV2000, NV3000,	INTERMEDIATE GEAR	VXG0017	£0.65
NV333	CAM GEAR	VXG0158	£1.00
NV366	IDLER ARM	VXL0997	£3.60
NV370, NV430, NV730, NV830, NV850, NV870, NVG7, NVG10, NVG12, NVG18	IDLER ARM	VXP0521	£1.70
NV370, NV430, NV870, NV730, NV830, NV850	CAM GEAR	VDG0200	£1.20
NV730	IDLER UNIT	VXP0581	£2.50
NV2000, NV3000	IDLER UNIT	VXP0331	£1.20
NV2000, NV3000	IDLER UNIT	VXP0329	£1.20
NV2000, NV3000	CAM GEAR	VDG0069	£1.00
NV2000, NV3000	ACTION GEAR	VDG0016	£0.60
NV7000, 7200, 7800	IDLER UNIT	VXP0344	£1.00
NV7000, 7200, 7800	CLUTCH	VXP0343	£5.50
NV8400, NV8600, NV8610, NV8620	IDLER UNIT	VXP0245	£1.20
NV8600, NV8610, NV8620	PLAY IDLER	VXP0243	£1.20
NV8620	CLUTCH	VXP0343	£5.50
NV600	IDLER	VXP0488	£3.50
NVG21-25, NVG40-45	PULLEY UNIT	VXP0767	£5.80
ORION			
VH200-201 VH555-700, VH844-900, VH1000-1500, VH1800,	IDLER	850A200004	£3.50
VP200, VH530 VH535-630, VH635-640, VH893-1440, VH2500-2600, VH2700-4010, VH5010	IDLER	850A200005	£6.50
PHILIPS			
DV464, VR6462, VR6463, VR6660, VR6860	IDLER	52220334	£2.50
VR6460, VR6520, 6920	IDLER ARM	40340162	£1.70
DB532, VR6542, VR6843	REEL IDLER		£7.50
SANYO			
VHR110, VHR1300, VHR1500	IDLER	1430662T14730	£5.00
VTC5000, VTC5150	FF-REW IDLER	1430741T20001	£3.00
VTC9100, VTC9300	IDLER	1430551T01400	£1.20
VTC9300	FF ROLLER ASSY	1430547T00200	£2.20
VTCM10-20	REEL DRIVE PULLEY	1430662T10350	£5.00
VHR2100, VHR2300	IDLER	6130374899	£5.00
VTC5000, VTC5150	PULLEY	143-0-662T-01201	£5.20
VTCM10	PULLEY	143-0-662T-10350	£5.50
SHARP			
VC651, VC681, VC685	IDLER ASSY	NPLYV0107GEZZ	£6.15
VC7300, VC7700	PLAY IDLER KIT	NPLYV0041 + NDA1V1007	£5.00
VC381, VC383, VC386, VC8381, VC9100, VC9300, VC9500, VC9700	IDLER	NIDL0005GEZZ	£1.50
VC300, VC387, VC481, VC482, VC483, VC496, VC571, VC585	IDLER	NIDL0006GEZZ	£1.50
VC780-781, VC785-787, VC793-VCT72	REEL IDLER	NPLTV0111GEZZ	£7.00
SAISHO			
VR1100, VR1200, VR1200HQ, VR1600, VR2500, VR3300, VR3500, VR3600	CLUTCH	850A20000	£6.50
SAMSUNG			
VT510-511, VT520-610, VT611-616, VT620-621-626	IDLER WHEEL	65224704220	£1.50
VT510-511, VT520-610, VT611-616, VT620,621, 626	IDLER COMPLETE	69000250330	£4.50
SONY			
C6	IDLER KIT ASSY	A 6706391	£3.50
C7	IDLER ASSY	X 36533100	£3.80
SL-C5, SL-C7	REW PULLEY	A-6706-348-B	£4.00
SL-C6	REW PULLEY	A-6706-391-A-B	£3.00

CASSETTE DC MOTORS

6V MOTOR	£2.00
9V MOTOR	£2.00
12V CW MOTOR	£2.00
12V CCW MOTOR	£2.00
13.2V CW MOTOR	£2.90
13.2V CCW MOTOR	£2.90

CASSETTE TAPE HEADS

MONO HEAD	£0.90
STEREO HEAD	£1.50
MINI HEAD	£2.30
AUTO REVERSE HEAD	£2.60

VIDEO MOTORS

AMSTRAD		
VCR 7000	REEL MOTOR	£17.00
FERGUSON & JVC		
PU 45979, 3V16, 3V22, HR3300, HR3660	CAPSTAN MOTOR	£21.00
PU 55371V, 3V35, 3V36, 3V38, 3V39, 8943, 8944, HRD110, HRD120, HRD121, HRD225	CAPSTAN MOTOR	£19.50
PU 46414, 8904, 8922, HR3300, HR3320, HR3330, HR3360, HR3600, HR3660	DRUM MOTOR	£19.50
PU 51381V, 3V39, 3V30, 8930, HR7200, HR7300	REEL MOTOR	£26.50
PU 58635V, 3V58, 3V59, 3V64, 3V65, 8950, 8951, FV10B, FV11R, FV12L, FV13H, FV20B, FV21R, FV22L, HRD170, HRD180, HRD230, HRD370, HRD430	CAPSTAN MOTOR	£29.00
PU 58636W, 3V58, 3V59, 3V64, 3V65, 8950, 8951, FV10B, FV11R, FV12L, FV13H, FV14T, FV20B, FV21R, FV22L, HRD170, HRO180, HRD230, HRD370, HRD430, HRD530	REEL MOTOR	£18.00
3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 8945, 8947 8948, HRD140, HRD150, HRD455, HRD565, HRD725, HRD755, HRP50, R73AF	LOADING MOTOR	£8.00
MITSUBISHI		
288P02801, HS300, 301, 302, 310	MOTOR REEL SPOOLING	£33.50
288P02806, HS303, 304, 320, 330, 700	MOTOR REEL SPOOLING	£31.50
288P03401, HS303, 700	MOTOR REEL TAKE-UP GEN	£21.00
NATIONAL		
MYN 135V5L, NV332, NV333, NV340, NV366	REEL MOTOR	£13.50
VEM0212, NV730-NV770	MOTOR REEL GEN	£30.00
SANYO		
4-529V-10800 (RM11), VTC5000, VTC5150	REEL MOTOR	£6.30
SHARP		
RMOTV 1008GEZZ, VC200, VC381, VC384, VC385, VC386, VC483, VC3300, VC8381, VC9100, VC9300, VC9500, VC9700	REEL MOTOR	£13.50
RMOTV 1007GEZZ, VC387, VC483, VC486, VC585	REEL MOTOR	£16.50
RMOTV 1010GEZZ, VC300, VC402, VC471, VC477, VC481, VC482, VC488, VC496, VC500, VC571, VC581, VC582, VC583, VC584, VC5F3, VC8481, VC8581	REEL MOTOR	£16.00
SONY		
BHF 1100D, SLC7	CAPSTAN MOTOR	£25.00

CASSETTE HOUSING

FERGUSON & JVC	
3V38, 3V39, 8943, 8944, 8951, 3V35, 3V36, HRD110, HRD120, HRD121, HRD225	£24.00
3V42, 3V43, 3V44, 3V45, 8945, 8947, HRO140, HRD141, HRD150, HRD455, HRD725	£24.00
8948, 8950, FV10B, FV12L, FV13H, FV14T, FV20B, FV21R, FV22L, HRD230, HRD430, HRD530	£24.00
3V58, 3V59, 3V64, 3V65, FV11R, HRD170, HRD180, HRD370	£24.00

VIDEO LAMPS

UNIVERSAL VIDEO LAMPS 12V 60mA (300mm WIRES)	£0.30
PANASONIC VIDEO LAMPS	£0.50

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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, 2056EC, 2060SA, KV-2062E(ESP)	£22.75
1-439-311-00	KV-1440AEC, 1440AS MK2, CPS-14CD3, CPV-14CD2, KTX-1350NF, KTX-1430UB	£22.00
1-439-332-21	KV-2756, 2730EC, 2730FE, 2764EC, 2752UB, 2752F	£30.00
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-19HT1A, 19FX1MT, 18G2, 1602M7, 1602GE, ADM-16B, KV-2092UB, 2096UB	£22.00

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TLF 14567F	£26.00
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2716	150p
2732	250p
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2764	180p
27C64	400p
27128	190p
27256-25	300p
27512	500p
4116	50p
4164-15	110p
4164-12	120p
4164-10	130p
41256-15	130p
41256-12	140p
41256-10	150p
41464-12	240p
41464-10	250p
6116	110p
6264-15	160p
6264-12	200p
6264-10	210p
62256-12	450p
6502	300p
6502A	360p
65C02	930p
6522	280p
6551	380p
6800	210p
6802	220p
6803	500p
6808	500p
6809	500p
6810	150p
6818	380p
6821	130p
6840	290p
6845	370p
6850	110p
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	240p
8253	210p
8255	200p
8256	700p
8257	220p
8271	3400p
8279	270p
8283	400p
8284	440p
8287	260p
8288	650p
8748	700p
8755	800p
Z80ACPU	110p
Z80ABCPU	200p
Z80ADMA	300p
Z80AP10	170p
Z80BP10	200p
Z80ACTC	170p
Z80BCTC	250p
Z80AS10	350p
Z80AS10-1	300p
Z80AS10-2	300p
Z80ADART	350p
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

256K × 9-80	1300p
256K × 9-70	1500p
1MB × 9-80	3800p
1MB × 9-70	4000p

SIPS

256K × 9-80	1400p
256K × 9-70	1600p
1MB × 9-80	3900p
1MB × 9-70	4100p

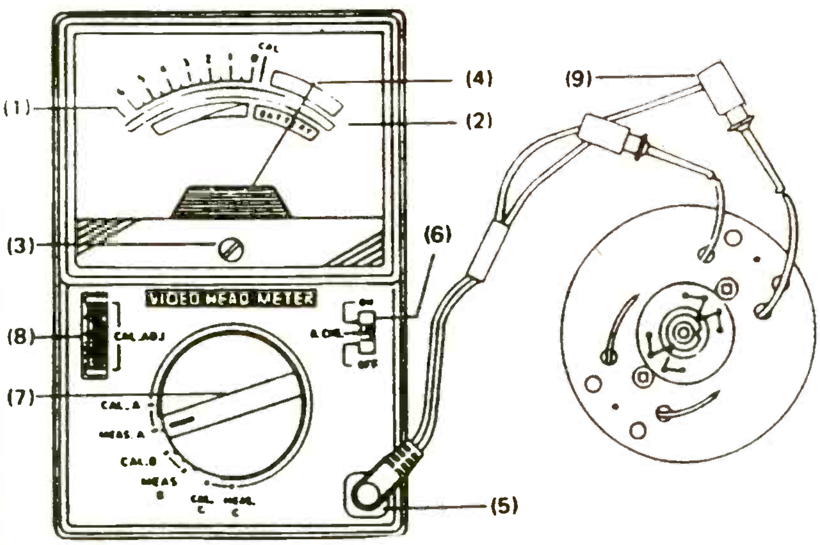
OPTO COUPLERS

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

LED DISPLAY

MAN74	100p
MAN8910	200p
DL747	120p

VIDEO HEAD TESTER



1. Mechanical Position of Pointer
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4. Pointer
5. Measuring Socket
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7. Range Selector Rotary Switch
8. CAL. ADJ (calibration volume)
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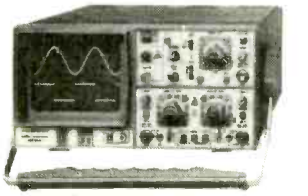
All supplied with **2 PROBES**, a **COMPREHENSIVE MANUAL** and a **2 YEAR WARRANTY**.

HM203-7 20MHz STANDARD

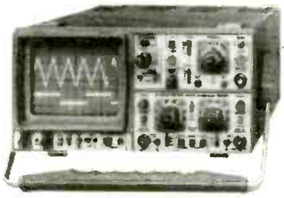


SPECIFICATION
- 2 Channels
- Bandwidth: DC - 20MHz
- Sens: Ch.1, Ch.2, 1mV/cm
- Timebase: 0.1s - 20ns/cm
- Triggering: DC - 40MHz
- Active TV - Sync - Separator
- Variable hold-off
- Trigger LED indicator
- Calibrator: 1KHz Square wave
- Component tester
- Plus many features

Price £338.00 + £59.15 V.A.T. **FREE Specialist Carrier Delivery**

HM604 60MHz UNIVERSAL

SPECIFICATIONS
- 2 Channels
- Bandwidth: DC - 60 MHz
- Sens: Ch.1, Ch.2, 1mV/cm
- Timebase : 2.5s - 5ns/cm
- Triggering: DC - 80MHz
- Active TV - Sync - Separator
- After delay trigger
- Sweep delay
- Delay line
- Trigger LED indicator
- Calibrator: 1KHz & 1MHz Sq. Wave
- Component tester



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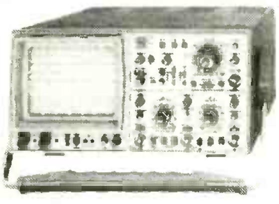
HM1005 100MHz UNIVERSAL

3 CHANNELS - UP TO 6 TRACES

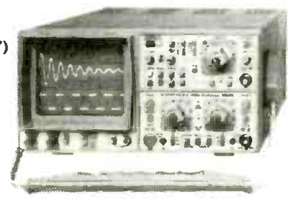


SPECIFICATION
- 3 Channels
- Bandwidth: DC - 100MHz
- Sens: Ch.1, Ch.2, Ch.3, 1mV/cm
- Timebase A: 2.5s - 5ns/cm
- Timebase B: 0.2s - 5ns/cm
- Triggering DC - 130MHz
- After delay trigger
- Delay line
- Trigger LED indicator
- Overscan LED indicator
- Active TV - Sync - Separator
- Calibrator: 1KHz & 1MHz Sq. Wave

Price £792.00 + £138.60 V.A.T. **FREE Specialist Carrier Delivery**

HM205-3 20MHz DIGITAL STORAGE

SPECIFICATION
- Digital Storage
- Analogue real time (Same as 203-7)
- Bandwidth: DC - 20MHz
- Sens: Ch.1, Ch.2, 1mV/cm
- Timebase Digital: 5s-1μs/cm
- Triggering DC - 40MHz
- Active TV - Sync - Sampling
- Max sampling rate: 2 x 20MHz
- Memory: 2 x 2048 x 8 Bit
- Dot joiner
- Printer/plotter output



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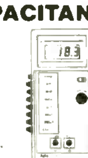
B.K.'s CRT TESTER REJUVENATOR

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

Price £32.00 + £5.60 V.A.T.

DIGITAL CAPACITANCE METER

- High accuracy.
- 0.1pl-2,000μf.
- LCD display.
- 8 ranges.
- Accuracy +/- 0.5%. Full scale +/- 1 digit.
- Inc. protective case.

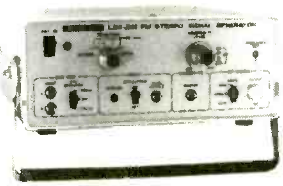


Price £38.00 + £6.65 V.A.T.

LEADER FM STEREO SIGNAL GENERATOR

At last! A generator specifically designed for testing and fault finding on FM stereo and monaural VHF receivers including stereo multiplex circuits.

FEATURES
- Carrier frequency 100 +/- 1MHz (adjustable).
- Output level 0.1mV - 10mV.
- Pilot signal 19KHz +/- 2Hz.
- L & R separation over 50dB.
- External Modulation 50Hz - 15KHz.
- Pre-emphasis 50μs, 75μs & off.
- Comprehensive test lead set included.
- Mains powered.
- Size: 80 x 200 x 250mm.



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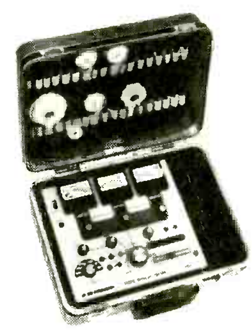
LEADER HIGH VOLTAGE METERED EHT PROBE

Light weight, easy-to-grip high-impact plastic handle with arc-over protection and no need of extra equipment. An indispensible item in your TV service kit. Measures up to 40kV DC with safety and the greatest of ease. Entirely self-contained. Connect the lead clip to chassis and probe tip to the check point, read the meter for voltage.
A must for the Health and Safety at Work Acts.

Price £66.00 + £11.55 V.A.T.

B & K PRECISION CRT ANALYSER-RESTORER

The number one CRT Test Instrument. Over 5000 U.K. Television engineers wouldn't be without it.



* All CRT's checked identically, including all in-line and one gun types * Tests all three guns of colour CRT's simultaneously under actual operating conditions (model 490) * Exclusive multiplex technique (model 490) * Measure true dynamic beam current that actually passes through G1 aperture to screen * Measures all shorts and leaks - preserving more CRT's * Tests focus electrodes lead continuity finding faults that other testers miss *Uses most powerful restoration method known with minimum danger to CRT * Rejuvenated CRT's guaranteed as new for two years * Obsolescence proof - perpetual set up chart updated and new adaptors developed * Tests and rejuvenates VDU's and oscilloscope tubes * A range of over 40 CRT base adaptors available * Increase profit * Pays for itself in months.

Prices

Model 490 Tri-dynamic three meler instrument inc. 6 common adaptors	£446.00 + £78.05 V.A.T.
Without adaptors	£393.00 + £68.77 V.A.T.
Model 480 Single meter instrument Inc. 6 common adaptors	£334.00 + £58.45 V.A.T.
Without adaptors	£281.00 + £49.18 V.A.T.

SADELTA SIGNAL STRENGTH METERS

The **Sadelta Field Strength Meters** have been designed to facilitate the dish alignment of satellite TV systems and aerial alignment of VHF/UHF television and radio systems. Signal levels can be accurately measured on the TC402-C and the TC90, allowing the evaluation of signal conditions for satisfactory operation. Both models have a clear LCD direct frequency readout, coupled to a multiturn tuning control enabling precise channel identification.

TC402-C VHF & UHF

FEATURES
- Three bands:
  - Low VHF: 45-110MHz
  - High VHF: 110-300MHz
  - UHF : 470-862MHz
- Digital display for direct frequency readout.
- Built-in monitor loudspeaker AM/FM.
- Signal measurement from 20μV to 100mV.
- Powered by eight 1.5 AA batteries.
- Fully portable with sturdy carrying case.

Price 259.00 + £45.33 V.A.T.

TC90 VHF-UHF- SAT.

FEATURES
- Five bands:
  - Low VHF : 45-110MHz
  - High VHF : 110-300MHz
  - Hyper VHF : 300-470MHz
  - VHF : 470-862MHz
  - Satellite : 950-1750MHz.
- Digital display for direct frequency readout.
- Signal measurement VHF/UHF 20μV to 3V.
- Signal measurement satellite -70dBm to -10dBm.
- Audible indication of satellite signal level.
- Built-in-monitor loudspeaker AM/FM (not satellite).
- Powered by rechargable battery (complete with charger 220/240V AC).
- Fully portable with sturdy carry case.

Price £470.00 + £82.25 V.A.T.

BLACK STAR COLOUR PATTERN GENERATOR

THE 'ORION' THREE-IN-ONE

PAL VHF/UHF - PAL VIDEO COMPOSITE - R.G.B.

The Orion is a compact, bench instrument offering a wide range of patterns and facilities at a truly low cost.

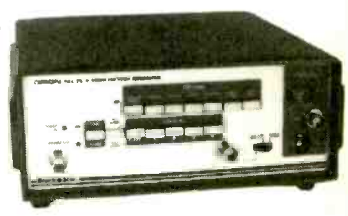
In addition to a switchable sound carrier facility which allows use with the majority of PAL TV systems, the Orion provides highly flexible RGB outputs, ensuring compatibility with most video monitors.

More than 50 pattern combinations can be selected, including those for testing static and dynamic divergence, video amplifier linearity, colour purity, general colour performance, focus etc.

A separate video input to modulate camera signals; fully variable RF and video output levels facilitating AGC testing; trigger output allowing easy triggering of difficult oscilloscope waveforms; external sound modulation input via DIN connector for frequency response testing of TV sound systems; adjustable wide frequency coverage of VHF and UHF TV bands.

Just some of the features making the Orion Pattern Generator an indispensible tool in the manufacture, test, and servicing of televisions, and computer and video monitors.

FEATURES
- Colour bars, purity, greyscale, crooshatch, dots, focus, etc.
- VHF/UHF Channels.
- 5.5MHz, 6.0MHz, 6.5MHz Sound Carriers.
- Internal/External Sound.
- External Video Output.
- Trigger Output.
- PAL B,D,G,H,I,K.
- Separate R, G, B and sync. O/P's.
- RGB @ TTL & 1V.
- Green + 0.3V Syncs.
- Composite Video Output.
- Variable RF/Video Output.
- Switchable Video Polarity.
- Mains powered 220/240V AC 50/60Hz.
- Size: 98 x 219 x 240mm.



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VIDEO HEAD TESTER
A VHS video head tester for determining whether a video head is in good condition by detecting the wear state and displaying it on a meter. Complete with carrying case and leads.

SPECIAL PRICE £39.50

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DAF	0.70	EF95	0.90	PCL84	1.30
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DK96	3.10	EF184	0.90	PCL88	2.95
DY86/87	0.90	EH90	0.45	PCL805	1.55
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EBC81	1.65	EL519	8.50	PL519/509	8.85
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EBF83	1.35	EM84	0.92	PY81/800	2.00
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ECC82	2.35	EY88	1.15	UABC80	1.05
ECC83	2.55	EY500A	2.55	UAF42	1.30
ECC84	0.65	EZ41	3.45	UBC41	4.15
ECC85	1.30	GY501	1.65	UBC81	2.05
ECC86	3.25	GZ32	2.85	UCH42	2.85
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ECF83	2.25	PCC85	0.95	2D21	3.05
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ECL80	0.80	PCF80	1.35	6C4	2.40
ECL82	1.85	PCF82	0.75	6K7G	3.05
ECL83	3.80	PCF86	1.35	6X4	1.80
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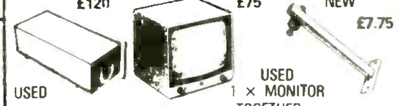

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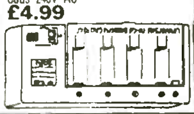

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Signal to noise ratio	<90dB
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Input impedance	High level input 100Ω; Low level input 20Ω
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COVER PHOTO
Our cover photograph this month shows the Mitsubishi Model CT2532TX, a Euro 4 chassis receiver with teletext. See servicing article on pages 642-3.

A Better Way?

By the closing date the Independent Television Commission had received forty applications for the new Channel 3 (ITV) franchises that will come into effect on January 1st 1993. Thirty seven were for regional licences and three for the national breakfast time service (6 a.m. to 9·25 a.m.). The new franchises will last for ten years. Three of the present areas attracted no counter bids, the regions that received most applications, four each, being Wales and the West of England and South and South-East England.

The ITC intends to award the new franchises by October. Applications are by a process referred to as "competitive tendering". Tender payments for each licence consist of a percentage, set by the ITC, of an annual qualifying revenue (income for advertising, subscriptions and sponsorship) together with a cash bid, representing the annual payable sum, which had to be submitted in a sealed envelope with the application. The cash bid is to be index linked, and both parts of the tender are to be collected by the ITC on behalf of the treasury.

The applications will first be checked by the ITC to see that they conform with the stated requirements. For a bid to be eligible, applicants must first pass a quality threshold assessment. Following this the highest bidder will usually be awarded the licence. In what are described as "exceptional circumstances" however the ITC is emplowered to award the licence to a lower bidder: this might be if the ITC considers that the quality of the service proposed by a particular applicant is exceptionally high and is substantially better than that proposed by the highest bidder.

Copies of the plans submitted by each applicant, covering ownership, structure and programmes – but not business plans and the amounts of the cash bids – are available for examination at the ITC's Library, Brompton Road, at all ITC national and regional offices and at 275 major UK libraries. Summaries of the applications can also be requested from ITC offices. In addition an ITC guide, *New Channel 3 (ITV) Lincences – Your Chance to Comment*, is available on request. It explains how viewers can comment on the proposals put forward by the licence applicants and outlines the licensing process. A fairly tight deadline has been set – if you want to comment you have to do so in writing by June 26th, which is just seven days after the publication day of this issue of *Television*. The ITC states that such comments will be taken into account when assessing whether applicants have passed the quality threshold. On awarding the licences later this year the ITC will publish the names of the successful applicants together with the amounts of their cash bids, also the names of those who passed the quality threshold assessment and, if any licences have been awarded to lower bidders on the basis of exceptional circumstances, the reasons for making such awards.

On the whole it seems to be a fair procedure. There had always been a great deal of disquiet about the way in which franchises were awarded by the previous authority, the IBA, a process described as going into conclave, though it had served us reasonably well for thirty seven years. Certainly the new process is a bit more open, but some of us may be concerned that the emphasis seems to be rather more on the cash bid than the quality of programming, except under those "exceptional circumstances". But at least the importance of quality, what we are going to get on our screens, was eventually accepted by the government, following a great deal of pressure from the industry.

One major factor that still gives rise to concern is that takeovers are allowed. It doesn't seem sensible to go through a process of careful franchisee assessment if the company awarded a licence can be taken over shortly afterwards. We shall have to see how this works out. Could there be a wave of takeovers from unsuccessful bidders following the ITC's awards? If such a situation did arise the whole process would be seen to have been rather pointless. Anyone taking over a licence holder would be under the threat of losing the licence the next time round if the service provided was poor: in the meantime there could be loss of audience and hence revenue, especially now that there is greater competition from alternative channels. But it has never been suggested that the criterion for quality is simply the ability to hold the largest audience. Balanced programming and the will to try out new ideas are all part of what's involved in quality assessment.

One major change stands somewhat apart from the whole licensing business, the move to greater contracting out of programme making. The government's pressure on the broadcasters to move in this direction affects both the ITV companies and the BBC. Whether it will result in better quality will depend both on the ideas generated by independent programme makers and the ability of the broadcasters to respond to new ideas and generate and commission them themselves. Probably things will go on in much the same way as present, which is reasonably satisfactory in terms of international comparisons. What has still to be seen is the effect of increased satellite TV broadcasting in Europe, with satellite footprints that show little regard for the niceties of national boundaries. At the present stage of the economic cycle however the satellite TV broadcasters are struggling to keep going. We shall have to await a general upturn to see how the potential of satellite TV broadcasting develops.

Changes always involve danger. The next bit of business on the horizon comes with renewal of the BBC's charter, to cover the years 1996-2006. Will the government, of whatever variety, decide to interfere with the present arrangements? The BBC and the industry can usually be relied upon to take care of their interests, but public vigilance is a necessity, particularly at a time of change.

Letters

WHY OH WHY?

Why do most replacement chips supplied by setmakers, especially those with forty or more DIL pins, arrive securely packed in foil and conductive foam but with their two rows of pins spaced 5mm too far apart to fit either the holes in the PCB or the i.c. socket, thus requiring additional undesirable handling to bend the pins to the correct spacing?

Why, when you've forked out £12 or more for a service manual from an obscure importer of downmarket rubbish, do you receive an almost unreadable photocopy with some pages missing, upside down or duplicated? When you send it back with a letter of complaint the replacement you receive is invariably worse.

Why do fifty per cent of customers who have purchased an item of hi-tech gear immediately lose or throw away the user handbook, while the fifty per cent who do hang on to it either refuse to read it or are incapable of understanding it? A few days ago, after showing a customer (a successful local businessman) that his "fault" was due to wrong understanding/operation, and having demonstrated the correct procedures and pointed out the relevant pages in the manual, I was aggressively told that "when you have a business to run you haven't time to mess about with damned silly books"! I wonder how he manages with a new piece of equipment for his works? He was also peevish about paying for the call!

Why don't manufacturers cater for the elderly, with a few basic CTVs and VCRs with simple controls that are easily seen and used and a minimum of hi-tech gimmicks?

Relevant to the above two items, with the proliferation of teletext and the ever decreasing cost of memory chips wouldn't it be a good idea for CTVs and VCRs to be equipped with a "help" button that, when pressed, would put one or two pages of basic instructions on the screen to help with tuning and the use of the controls? This data could be held in a ROM chip and called up by the central control chip whenever "help" is requested. Such a scheme would be invaluable when a customer has moved to a new area and needs to retune his set, or when someone has pressed a search tuning button by accident and wiped all the channel settings from the memory. Information on the correct channel position for VCR use and how to tune one in would also be necessary. VCRs so equipped should show clock and timer setting in addition to tuning and control details.

Why, when you return a wrongly picked chip to a manufacturer and point out that although you'd specified the circuit reference, type and part numbers correctly you've received say a 48-pin DIL microcomputer chip instead of an 8-pin EPROM, are you told that the part number on the invoice is that of an equivalent i.c. and two days later another 48-pin chip arrives? Does no one ever go to check the contents of the bin until at least four dealers have received wrong goods?

Why is it that customers find out about peculiarities and anomalies in the operation of esoteric functions with new equipment before the dealer does and before the manufacturer's technical section has any advice to offer?

Why will people buy their TV set from one dealer, their VCR(s) from another and their satellite TV gear from a third, all different makes, then expect the last dealer to sort out all the intricacies of interconnections, compatibility and functions as part of a normal delivery and setting up, and object to paying for the extra time involved and the various adaptors, scart leads etc. that may be required?

Why don't more manufacturers provide VCRs with two buffered scart sockets? The problems with linking a satellite TV receiver, one or two VCRs and a CTV set to provide video and stereo sound from the satellite TV receiver or VCR via scart leads can be daunting. Ordinary paralleled single-to-multiple scart adaptors are rarely of any use as multiple signal paths and the transition times through the various items produce multiple images on the screen at the end of the chain. Most customers are reluctant to abandon their remote controlled convenience to grovel on the floor swapping scart leads about, and the cost of separate buffered single scart to two or more slave adaptors is horrendous.

John C. Priest,
Blackpool, Lancs.

VIEWDATA SYSTEMS

Roy Baines' article on viewdata systems (June) was very interesting. I would like to make a couple of points however. First the Panasonic viewdata system does have a local call facility, via the Istel system. Secondly, no mention was made of the JVC Service Desk viewdata system, which has order entry and parts enquiry facilities. Access is at local rates using an 0345 number.

I make frequent use of the Willow Vale COPS system, which I find easy and very well designed. Dave Allen at Willow Vale is always willing and able to give help and advice on using the system.

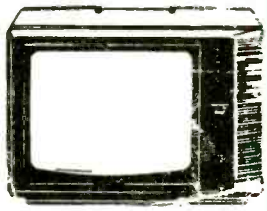
Mike Fletcher,
Great Barr, Birmingham.

We were surprised to find that no mention of Euras International was made in the article on viewdata systems in the June issue. The Euras system is the largest indepedent computer database, containing technical information and repair tips relating to over 180 manufacturers. At present it has 72,000 items on 5,200 models, including TV receivers, VCRs, CD players and white goods. We also have a free electronic mailbox, free notice board and ordering pages for Wizard. In addition the system is available in book form and will shortly be available in a stand-alone PC version.

D. Smith, Euras System Administrator,
Euras International Ltd., Heston House,
7/9 Emery Road, Brislington, Bristol BS4 5PF.
0272 724 475.

BLUMLEIN BIOGRAPHY

My biography of Britain's most prolific and diverse electronics inventor and patentee, Alan Dower Blumlein (1903-42), will be ready for publication in 1992-93. May I appeal to your readers to send me for possible inclusion in appendices (1) copies of papers or articles referring to Blumlein and/or his associates' development of stereophony, telecommunications, cable, television, radar, measuring instruments, military etc. circuits or equipment, and circuits, ideas etc. relating to post-war computer, aerial or electromechanical systems; and (2) particulars of papers, articles, books etc. in any language for inclusion in the bibliography. The IEE, the publishers of *The Gramophone* and others have given me permission to reproduce papers and articles free, subject to suitable



acknowledgements, and I hope readers will accord me a similar privilege.

The loan of letters, notes and photographs from the Thirties would also be of great help.

Please post letters to me marked "Blumlein Biography" on the envelope, to arrive here before mid-August.

F.P. Thomson, O.B.E., C. Eng., M.I.E.E.
39 Church Road, Watford, Herts WD1 3PY.

AMSTRAD SATELLITE TV RECEIVERS

With reference to R.N. Baker's letter (May) about Amstrad satellite TV receivers, as a former self-employed satellite TV installer now involved in front-line service problems I'm well aware of the problem he describes. It occurs only with Amstrad receivers: substitute a Ferguson or a Sakura and there are no more problems. It seems that the problem is due to standing waves and, as Mr. Baker has observed, it gets worse the shorter cable run used. The fault always clears if a large extension is added to the cable, but this is not a very neat solution. Another approach is to change the channels affected by shortening the cable an inch at a time. With patience (!) the fault can be made to appear only on the foreign channels, which is satisfactory to most viewers.

As other makes of receiver don't suffer from this fault however I'm sure that someone out there could come up with an inexpensive receiver modification which will cure the problem once and for all. How about it?

S.K. Guy,
Netherton, Dudley.

SATELLITE TV PROBLEM

R.N. Baker's letter (May) on the length of the coaxial cable used with his satellite TV installation prompted some investigation here, using the two sets of Hewlett-Packard equipment in our LNB repair department. They are capable of gain and noise measurements to within 0.1dB.

Three 20m lengths of coaxial cable were taken from new, unused drums from different manufacturers. During the test the lengths were reduced by 5m each time measurements were made then, from the 5m critical point described in the letter, to 2.5m in order to test the validity of Mr. Baker's findings. Our results, see Table 1, show that with all three makes of coaxial cable a critical point is reached at around 10m. At this point the apparent gain of the system starts to rise at some frequencies and fall at others due, as suggested in the letter, to an increase in the SWR or reflections, the frequency at which the variation occurs being dependent on the type and length of coaxial cable used.

To prove that different LNBs didn't unduly affect the measurements we started by checking two Marconi and one Grundig LNB with a standard length of coaxial cable. The equipment was then calibrated with one metre of coaxial cable, using readily available F plugs, providing the reference to which all measurements were referred, both the LNB and F plugs being in effect removed from the circuit under test.

In conclusion, while more samples from different drums would need to be assessed for a definitive result to be obtained, it seems that Mr. Baker has uncovered a little known though readily understandable factor in the satellite TV field, in that no installation should have less than 10m of coaxial cable between the dish and the receiver if optimum results are to be obtained across the band.

J.A. Glenton, MCES Ltd.,
15 Lostock Road, Davyhulme,
Manchester M31 1SU.

Table 1: Results of cable tests.

Length	*Ch 1*	*Ch 16*	*Ch 32*
	Antiference 5540, copper with copper screen		
20m	−2·2dB	−4·3dB	−4·2dB
15m	−0·3dB	−3·2dB	−3·3dB
10m	+1·7dB	−3·3dB	−0·8dB
5m	−0·5dB	−1·5dB	+2·4dB
2·5m	−0·2dB	−0·5dB	+3·1dB
	Altai, copper with aluminium screen		
20m	−4·7dB	−5·3dB	−6·7dB
15m	−2·2dB	−4·4dB	−4·6dB
10m	−0·5dB	−3·3dB	−2·6dB
5m	+2·0dB	−0·8dB	−1·8dB
2·5m	−0·5dB	−0·6dB	+1·5dB
	Normal RG59BU coaxial cable		
20m	−6·7dB	−8·5dB	−9·8dB
15m	−4·7dB	−5·7dB	−7·4dB
10m	−2·0dB	−3·9dB	−5·7dB
5m	−0·7dB	−3·6dB	−1·2dB
2·5m	+3·8dB	+2·1dB	+1·1dB

All measurements taken with reference to 1m of Antiference 5540 Quadaire cable. Positive readings are a result of standing waves.

What Mr. R.N. Baker omitted to say in his letter (May) on poor reception with his Amstrad 100 receiver was whether, when he increased the length of the feeder by 20ft, he added extra cable to the previous length or used a new cable run. If you add 20ft of cable to an existing length it's like connecting two resistors in series, thus increasing the impedance.

Mr. Baker's fault sounds as though he's feeding his signal into a cable that goes to other sockets instead of straight into the 100. If this is the case the other sockets' cables are acting as tuning stubs. The way to overcome this is to terminate the other sockets using a coaxial plug fitted with a 75Ω resistor. The best course is to have one cable going straight from the dish to the receiver, not terminated anywhere, without even a wall socket. There could of course be an impedance fault with his Amstrad 100's input circuit.

B.D. Andrew.
Devizes, Wilts.

HELP FOR THE DEAF

Recently our local church installed a loop system to aid the deaf. The results are amazing. My wife, who is deaf, can now hear everything very clearly via her deaf aid. I'm wondering whether the loop system has ever been considered for attachment to a normal TV receiver? Perhaps one of your contributors could provide details of a suitable system. It would be a boon to many, especially older viewers.

W.J. Gadsby, 2 Church Way,
Sanderstead, Surrey CR2 0JQ.

VINTAGE RADIO

As a collector and restorer of vintage radio sets, I have read with interest the correspondence in recent issues on the Bush DAC90A. I have one of these in my collection. It

required considerable work to restore it to working condition. Friends thought I was mad splashing out money on a forty year old radio, but their attitide changed when they heard its performance. A set that's well worth restoring! I'd be interested to hear from anyone who has a DAC90A, the original DAC90 (1946) or a DAC10 in non-working order (cabinet in good condition) and wants to sell it. Also does anyone have spare knob sets for the Marconiphone T90DA Companion? These are for on-off/volume and wavechange — a specimen can be forwarded. The T90DA dates from about 1959.
Mike Horne, 100 Cockshott Lane,
Leeds, West Yorkshire LS12 2RQ.

HINARI SPARES

The price of the Hinari limiter post lever assembly mentioned in a letter in your May issue, page 490, was incorrect at the time of publication – neither the writer of the letter nor the magazine rang to confirm whether the catalogue price was still applicable. With the demise of Hinari we have had to source the spares ourselves: price increases, sometimes of very large proportions, have had to be incurred. The new price for the limiter post lever assembly however, £1.95, is still considerably cheaper than the Matsui part and offers good value for money.
Richard Duckett, Sales Director,
CPC plc, 180-200 North Road,
Preston PR1 1YP.

TESTING IR HANDSETS

The simple methods of testing infra-red remote control handsets with a radio receiver, as described by G. Cox and John S. in the April issue, are not wholly reliable. In the case of a faulty (dead) transmitting LED in the handset you will still hear audible pulse train tones from the receiver because the tones are generated by the resonator and are not transmitted by the LED. You can thus be misled about the handset's operation. I strongly recommend use of a checker such as the one by Colin Birch described in the February issue.
Joseph M. Borg, I. Eng.,
Mosta, Malta.

FOR DISPOSAL

I have for disposal almost all copies of *Television* from 1981 to 1990.
P. Hill, 3 Mayfair Avenue,
Sowood, Halifax HX4 9JH.
0422 370 338

The following are free to anyone who can collect them: a Bush 22in. Model CTV184S (A823 chassis), working when last tried; two 20in. ITT sets with the CVC8 chassis, both with a line timebase fault; and a working Sanyo VTC8300 (Beta) VCR.
R. Bowsher, 21 Cherwell Gardens,.
Chandler's Ford, Eastleigh, Hant SO5 2NH,
0703 267 867 (before 9 p.m.).

I have for disposal a Mullard "high-speed" c.r.t. type valve tester complete with data cards. It works, but could probably do with a new set of valves. It tests most types of valves though not the newer types such as the PL509, PFL200 etc. for colour sets. Any dedicated enthusiast is welcome to it, but please write first with s.a.e. Collection will be necessary.
Brian Renforth, 174 Hemsley Road,
Sandyford, Newcastle-upon-Tyne NE2 1RD.

HELP WANTED

Can anyone supply a mains transformer, part no. 21050, for the Avo universal measuring bridge type 1? Winding details available.
H.M. Mellor, Gatesgarth, Back Lane,
Airton, Skipton, N. Yorks BD23 4AL.
072 93 417

Can anyone supply a radio/TV changeover switch for the Alba Model TV10? Alternatively we are willing to purchase a complete working or non-working set.
Leon Electronics, 11 Woodend Close,
Three Bridges, Crawley, W. Sussex.
0293 520 536.

Can anyone supply a manual or circuit diagram for the Condor VHS 8120 VCR, made in the UK for export to Germany?
M.B. Wilson, 1 Playwell Court,
Glanton, Alnwick NE66 4BL.
0665 78 437.

Can anyone supply a TA7153P chip for the Toshiba Model C400B?
H.S. Downing, 16 Mayfield Crescent,
Lower Stondon, Henlow, Beds SG16 6LF.

Can anyone supply a left-hand cassette door for the Sharp 6F450 radio/cassette?
Susan Melluish, Thundridge Hill,
Ware, Herts SG12 0UF
0920 2500.

Can anyone supply a 60mm jockey wheel for a Grundig TK40 reel-to-reel tape recorder, or an old machine for spares?
N. Reay, 12 Northolt Avenue,
Cramlington, Northumberland NE23 9RJ.

Can anyone supply a Signetics 2650 40-pin microprocessor chip, new or used? Will buy several if available.
Allan Bone, PO Box 97, Coolangatta,
Queensland, 4225, Australia.

Lonely DAC10 radio seeks companionship of a Bush TV22 to share an active retirement.
A. Meade, 48 Mosside Drive,
Portlethen, Aberdeen,
0224 781 496

Can anyone supply a service manual or any technical information for the JVC GX77E colour camera?
D.P. Marsh, 10 Cedric Crescent,
Thurcroft, Rotherham, S. Yorks S66 9PA.

Does anyone know of an ex-UK engineer living in the Alicante area in Spain who would be willing to assist with the conversion of a couple of Solavox colour sets to work there? I can supply manuals for the sets, Models NB14 and 20S19.
John G. Copeland, 48 Cherry Lane,
Alsager, Cheshire ST7 3QF.
0270 877 213.

CD Player Casebook

Reports from Mike Leach and E.M. Beddow

Marantz CV55

This Philips-based CD video player came in with a standard compact disc Sellotaped to the top cover. The customer's complaint was that the machine wouldn't play the outermost tracks on this particular disc. It played all the customer's other compact and video discs all right, and the disc concerned played back o.k. on other, conventional players. Basically, when an attempt was made to play tracks 21 and 22 the machine would skip and jump. Occasionally when these tracks were selected from the stop mode the machine would have difficulty in finding them and a loud screeching noise could be heard coming from the direction of the laser assembly. The machine would eventually revert to the stop mode.

The disc concerned was a compilation by Status Quo. It had a total playing time of 78 minutes, which is quite a lot to pack on to one little compact disc. I tried using the long playing time as an excuse for not fixing the machine but my colleagues would have none of it and the job had to be done. Just to be sure, I tried the disc in two other conventional players, a Technics and a Sony model. They were in good working order and have different types of laser and sled systems.

I eventually found a suitable test point at which to check the r.f. eye pattern. When this waveform was displayed on a scope you could see that it was good at the beginning of the disc and remained all right until the last two tracks. It then deteriorated badly, the level being very low and unstable. Setting up made no difference at all. After much head scratching I found that gentle pressure on the laser CDM assembly produced a much better waveform, the two outer tracks then playing all right. When the pressure was taken off, the machine again played badly. So what was happening was that the laser angle was very much adrift at the outer tracks.

Because the large 30cm video discs have a tendency to warp and, as we know, the laser lens must be at a constant distance from the disc to maintain accurate focusing right across it, in a CD video player the laser angle is adjusted electronically. The correct distance is maintained by the tilt motor. A tilt sensor is placed in close proximity to the laser lens. It consists of two sensors and an LED. The latter directs two beams of light on to the disc: this light is reflected back on to the two sensors. If the disc is warped, the distances between the sensors and the point of reflection from the disc will differ and an error voltage will be produced. This error voltage is processed, amplified and passed to the tilt motor, which is mounted quite close to the turntable motor. The tilt motor drives the laser up and down to compensate for any warp in the disc. A series of cogs drive the CDM unit on which the laser is mounted.

So I assumed that the tilt motor wasn't doing its job properly at the outer edge of the disc. When tracks 21 and 22 were being played I could see the tilt sensor plainly, because the laser was at the very edge of the disc and the sensor is very close to it. I wondered whether the tilt sensor was actually shining light on to the disc. What I did next was only an experiment, but it cured the problem. I removed the tilt sensor and slightly enlarged its fixing hole so that I could move it backwards a fraction. My hope was that it would then shine a more accurate beam on to the disc. Hey presto – it worked!

The laser had been so close to the edge of the disc that the LED in the tilt sensor didn't shine enough, if any, light on to the disc. Thus the tilt motor couldn't correct the laser angle sufficiently. What a bodge! The machine has been back with our customer for some weeks now however and hasn't bounced. **M.L.**

Technics SLP22A

The fault with this machine was slight distortion on both channels. This distortion increased as the music became louder. I've had similar faults before with other players and as a result I decided to replace the UM6116M-2 RAM chip IC302. This cured the problem. **M.L.**

Pioneer PDZ71

Judging by the state of the cabinet and the front escutcheon this machine had obviously seen a lot of use and had possibly had some rough treatment in its time. The tray wouldn't open, and there was something that rattled about inside. After removing the top cover we could see that the clamp assembly had fallen off – it was this that prevented the tray opening

The mechanism was reassembled, but the tray still refused to open properly. It would catch on the clamp and grind to a halt. So everything had to come out – tray, clamp, the lot. Removal of the tray revealed one cause of the problem: the tray slides on a ball bearing that was missing. When the ball bearing was replaced the tray action was much smoother. As the machine now worked I left a disc inside in order to soak test it. I then tried to open the tray. Yes, it wouldn't do so fully – it got half way then stuck. It seemed as though the tray lift mechanism wasn't lifting the disc upwards, so the tray came out yet again. Stripping it down revealed the final cause of the problem. Because of a bad case of spillage between the tray and the tray lift the two stuck together each time a disc was loaded. So I cleaned it all off then reassembled the tray and clamp. This time the machine performed perfectly. **M.L.**

CD Power Supplies

We've had a couple of players in with strange faults, i.e. not reading the TOC or reading the TOC but not playing, that could have been due to a faulty laser unit. In both cases however the cause of the problem was incorrect outputs from the power supply. In one case the 9V line was 2V down while in the other it was down by 5V. In both cases this was due to the relevant bridge rectifier being faulty. Because they are so simple, CD player power supplies are often overlooked. But as these two cases show it can pay dividends to check the supply lines carefully before getting more deeply involved. **E.M.B.**

CD Gears

Machines that use the Sony KSS150 laser unit can suffer from a sticking sled. The usual cause is that the last gear in the train has stripped its teeth on the part that fits on the shaft. The machines with which we've had this happen have been only a few months old. We've not found any stiffness in the train to account for the problem. **E.M.B.**

Teletopics

SONY ANNOUNCES THE MINI DISC

Sony has announced a major new audio system, the Mini Disc (MD), which gives record and playback of high-quality sound on a 64mm (2·5 inch) magneto-optical disc. The MD disc is housed in a small cartridge, similar to a computer diskette, measuring 68 × 72 × 5mm. MD offers two-channel stereo sound with a frequency response of 5Hz to 20kHz and a dynamic range of 105dB. Use of a digital compression system called ATRAC (adaptive transform acoustic coding) compresses a CD or DAT signal by a factor of five, enabling the disc to store up to 74 minutes of audio, the same as with a compact disc. ATRAC is similar to the PASC system used with DCC tapes. Other techniques used include eight-to-fourteen modulation and cross-interleaved Reed-Solomon error correction.

A new terbium-ferrite-cobalt magnetic coating enables the magnetic polarity to be reversed using a third of the power required with previous, computer MO discs. As a result, erasure and recording can be carried out in a single cycle, i.e. re-recording can be done simply by overwriting the previous recording. The pickup can read both MO and compact discs as it incorporates two different sensors. Because the format is aimed initially at the portable audio market an anti-jolt system is included. The off-disc audio is stored in a 1Mbit RAM so that, provided the pickup returns to its correct position within three seconds, the user doesn't hear any interruption to the music.

Sony plans to incorporate a serial copy management system (SCMS) to prevent multiple digital recording. The MD system is due to be launched late next year. No price details have been suggested so far.

NTL DEVELOPMENTS

Some interesting TV developments are being worked on by National Transcommunications Ltd. (NTL), formerly the IBA's transmitting section. One of these is a Eureka 625 project called VADIS (video-audio digital interactive system) that uses digital video at bit rates of around 10Mbit/s. The work is being coordinated with the development of audio-visual coding standards within the ISO/IEC Moving Pictures Expert Group (MPEG). VADIS is designed to strengthen European participation within the MPEG. It could put into question the future of the Eureka 95 group, which is working on an analogue HD-TV system using MAC technology. An EC statement on its future is expected this summer.

NTL is also working on SPECTRE (special purpose extra channel for terrestrial radiocommunications enhancements), which permits some "taboo" u.h.f. channels to be used for digital TV transmission (taboo channels are ones not used because of the likelihood of interference effects). The technique uses a digital video redundancy-reduction coding system and a modulation system called orthogonal frequency division multiplexing that's extremely efficient in bandwidth use, allowing the signal spectrum to be shaped to minimise interference with existing PAL transmissions. OFDM can convey at least 13·5Mbit/s using a standard 8MHz TV channel – the bit rate includes provision for wide-screen pictures, teletext and over-air subscriber addressing. Picture resolution is said to be equivalent to MAC and the aspect ratio can be 4:3 or 16:9. Teletext page updating and subscriber addressing are done by the packet data system during scenes that contain little activity. SPECTRE's audio system has two-channel stereo sound compressed to 256kbit/s.

NTL has developed an upconverter, Model NTL1000, for large-screen, extended-definition TV (EDTV) systems. It's designed to improve the picture quality with interlaced broadcast signals. The technique is to convert from interlaced to sequential scanning or to retain the interlacing but double the number of lines per field. 625/50 and 525/60 signals can be handled by the NTL1000. Advantages are the removal of inter-line flicker, reduced line visibility and improved vertical resolution. In addition a digital processing system uses motion-adaptive interpolation to improve the quality of static and moving pictures. The NTL1000 is housed in a 19in. case and weighs 7·5kg.

SATELLITE TV

According to the *Financial Times* Satellite Monitor the number of domestic satellite TV installations at the end of April 1991 had risen to 1·48 million from 653,000 on the same date in 1990. About seven per cent of homes now have access to BSkyB programmes. During April there were a further 71,000 installations.

W.H. Smith is selling its TV business for a reported £65m to a consortium that includes Canal Plus, the US communications group Capital Cities/ABC and Compagnie Generale des Eaux. The business includes the Screensport, Lifestyle and Cable Juke Box channels, the TV services group Molinare and a 19·5 per cent stake in Yorkshire TV. It's understood that some £80m has been spent on building up the business, which is said to be two years from breaking even.

The Eurosport channel was closed down on May 6th following an EC decision on the contractual relationship between its owners, a consortium of seventeen EBU members and Sky Television/News International.

BSkyB has arranged financing to fund its development during the next eighteen months. Since the merging of Sky Television and BSB losses have fallen from £9·7m a week to £6m a week, half in operating costs and half in financing charges. City analysts estimate that a further £100-400m will be required before BSkyB reaches the break-even point at some time between 1993 and 1995.

BSkyB has granted a national UK agency franchise to Homevision Direct Ltd. for the sale of subscriptions to BSkyB's two movie channels. Homevision will also acquire and market satellite receiving equipment on a direct sales to consumer basis. It will pay BSkyB a fee of up to £3m over a five-year period.

VIDEO NEWS

Panasonic has just launched in Japan what is claimed to be the world's lightest camcorder, Model NV-S5, which weighs just 680g. Features include a digital ×12 zoom, digital image stabilisation and a digital focus system. There's also a "mirror effect" which splits the screen into two halves and displays a mirror image on the right, while the battery tells users how much charge remains. Panasonic says that the weight reduction has been made possible by use of the new 170g DL mechanism, which is 100g lighter than the one used in previous models. There are no details of launch dates or prices in Europe.

Automatic head cleaning is a feature of the latest VCRs from Hitachi and Sony. Hitachi's VT-M822 at £330 includes long play and an on-screen display while the VT-M830 at £370 adds four heads to the specification. Sony's SLV315 at £350 is a three-head machine with a real-time counter and tape remaining indicator and automatic tracking. Using the shuttle enables you to freeze the picture cleanly and advance frame by frame or variably in slow motion. The SLV415 at £400 is a four-head machine with long play, editing functions and front-mounted AV inputs in addition to the SLV315's features. Both models have greatly simplified controls with a quick-start switch for recording.

Mitsubishi's latest camcorder, Model HCS50 at £900, weighs 1·18kg, a considerable reduction compared with the 1·9kg of its predecessor Model HCS35. A feature of this S-VHS-C hi-fi machine is the interchangeable lens mount. In addition to the basic ×6 zoom lens there are optional ×6 wide-angle and telephoto lenses at £70 each.

The Commodore interactive CD-TV system has now been launched in the UK. The player comes with three discs at £600. Additional discs cost around £25 each. About thirty titles are available so far.

SONY'S UK EXPANSION

Sony is to build a £147m TV factory and R and D centre at Pencoed, Mid-Glamorgan, South Wales. The existing Bridgend plant will concentrate on c.r.t. manufacture, with annual output increased to two million from the present 1·4 million by 1993. Production capacity at the new Pencoed plant will be 1·5 million sets a year compared to the present one million at the Bridgend factory, which is now 18 years old. Employment at Pencoed is expected to rise to 2,300 by 1995, when the two plants should employ 3,600 between them. The research and development activities at Pencoed will concentrate on colour TV sets, computer displays and broadcasting equipment.

TV NOTES

JVC is to launch a 36in. 16:9 aspect ratio TV receiver, Model AV-36W1, in Japan this September. The set will be able to receive standard NTSC and HD-TV transmissions. A Muse/NTSC converter, Model HV-MC1000, is also being launched: this will allow HD-TV pictures to be watched on NTSC sets and recorded by NTSC VCRs. Prices will be the equivalent of £3,125 and £1,040 respectively. Japan's BS-3a satellite currently transmits an hour of HD-TV programmes a day. A second satellite, the BS-3b, due to be launched in August, will be used exclusively for HD-TV. JVC has also announced a number of professional HD-TV products.

The new Philips TDA4670 picture signal improvement (PSI) chip is a successor to the TDA4565 colour transient improvement (CTI) chip. It incorporates the CTI circuitry together with a luminance section that gives signal peaking and noise reduction. In addition to improving the colour definition and luminance/colour fit, the contrast is enhanced. The chip's operation can be controlled via an I2C bus. Philips has also introduced a new series of chips for World System Teletext.

The Black Line series of Philips 45AX tubes incorporate a low-expansion invar shadowmask, enabling them to be driven at higher beam current than with an iron mask. This means that lower-transmission faceplate glass can be used, giving a darker screen and improved contrast. A new black matrix system is used: this will also be incorporated in standard 45AX tubes.

Sharp is to launch colour TV sets with 8.6in. flat-panel LC displays to hang on the wall in Japan this summer. Initial production is planned at 1,000 sets a month and the price will be the equivalent of about £2,500. This high price is due to the wastage involved at present in the production of large colour LC displays – understood to be as high as 90 per cent. Sharp is investing in a new £450m plant however and hopes that this will enable prices to be brought down. The displays are of the thin-film transistor, active matrix type, with 437,760 pixels arranged in 456 rows and 960 columns.

Motorola and IBM have collaborated in the design of a chip set that enables video signals to be fed into a personal computer for manipulation and display.

The EC has extended the provisional anti-dumping duties imposed on small-screen colour TV sets imported from China and Hong Kong.

CATALOGUES/PUBLICATIONS

HRS Electronics Plc, Garretts Green Lane, Birmingham B33 OUE, has published at £6·95 (or £6·50 in quantities of five) a TV Fault Finding Guide. This useful work has 150 pages of fault information: the 2,000 fault/remedy entries relate to over 400 models/chassis. Its handy 6 × 4in. size enables it to be slipped into the pocket. Further volumes will include fault finding guides for video, audio and satellite TV equipment.

A new illustrated catalogue is available from HS Publications, 7 Epping Close, Derby DE3 4HR. Publications in the catalogue relate to long-distance TV, station identification, amateur radio, short-wave listening, aerials, propagation and TV and video theory. Equipment listed covers a wide range including aerials, masthead and distribution amplifiers, filters, accessories and the D100 upconverter system. The compact VF100 v.h.f./TV array covers all Band I/II/III channels with a boom length of less than six feet. The catalogue is available for 66p (or send three first class stamps).

Blue Rose Electronics, which specialises in the supply of surface-mount components, has published a 76-page mail order catalogue covering a vast array of s.m. devices – just about every electronic component in s.m. form. Ancillary equipment (soldering irons, chemicals, PCB production equipment, project boxes, workstations etc.) is also listed and there are a number of project kits. Well worth investigating. BRE's address is 538 Liverpool Road, Great Sankey, Warrington, Cheshire WA5 3LU; telephone 0925 727 848.

The Modern Book Company, 19-21 Praed Street, London W2 1NP, has published a new catalogue listing electronics, radio, TV and communications books. The company has also issued its computer catalogue update for 1991. Copies of these catalogues are available free of charge: they are certainly the best way of finding out what books are available in these fields.

IN BRIEF

The Cable Television Association has moved to the Fifth Floor, Artillery House, Artillery Row, London SW1P 1RT, telephone 071 222 2900, fax 071 799 1471. . . HRS Electronics Plc., Garretts Green Lane, Birmingham B33 0UE has been appointed official distributor of Pace satellite TV receiver spares by Pace Micro Technology of Shipley, W. Yorks. . . The Leader LCG412C hand-held battery-portable colour pattern generator for TV receiver and VCR testing is available from Thurlby-Thandar Ltd., 2 Glebe Road, Huntingdon, Cambs. PE18 7DX at £253 plus VAT. The price includes a carrying case and r.f. and video leads. Patterns available are full-field colour bars; crosshatch and dot patterns with corner markers for convergence and linearity adjustment; plus white, red, green and blue rasters. Selection is by soft keys. A 1kHz signal is superimposed on the 6MHz intercarrier sound output. The extremely compact unit weighs just 390g, measuring 80 × 172 × 35mm.

Servicing the Mitsubishi Euro 4 Chassis

John Coombes

The Mitsubishi Euro 4 chassis was used in models released during 1988-90, including the CT2131, CT2132, CT2141, CT2142, CT2144, CT2154, CT2531, CT2532, CT2534 and CT2964. Our experiences have been mainly with the initial CT2131BM/CT2531BM – suffixes are used to indicate the facilities included with particular models.

The power supply section of the chassis is of interest in that there are two separate chopper circuits. This is done for standby operation purposes, the secondary chopper circuit providing −30V and 5V outputs that are used for the EAROM and microcontroller circuits respectively.

Fig.1 shows the main chopper circuit and Fig.2 the secondary one. Both circuits are of the self-oscillating type. The chopper transistor in Fig. 1 is contained within IC901. Base bias is provided by R906 and R972 to get the circuit started. Once the chopper transistor starts to conduct, positive feedback from winding 3-4 on the transformer is applied to the chopper transistor's base via R917 and C911. This drives the primary circuit to saturation, at which point the chopper transistor switches off. The rectifier diodes on the secondary side of the circuit then conduct, charging their respective reservoir capacitors. When current in the secondary windings ceases, a small voltage is induced in winding 3-4 and the chopper transistor again switches on. The circuit operates at approximately 30kHz.

Regulation is achieved by adjusting the chopper transistor's base bias. A negative voltage that's proportional to the other output voltages is generated across C908. This appears across the resistor network R905/VR901/R904. As a result the voltage at pin 5 of IC901 shifts and the base bias is adjusted via the drive control circuit within IC901.

Should the chopper transistor pass excessive current, due for example to a short-circuit in the secondary side of the supply, the voltage developed across R903 will be sufficient to switch Q901 on. This reduces the chopper transistor's drive, limiting the current.

Power on/off control for standby operation works in a similar way: for standby Q955 and Q954 conduct, shorting out the drive to the chopper. For mains isolation purposes, the on/off control is applied to the chopper circuit via the optocoupler PC951. When the microcontroller chip requests power on, the voltage at pin 10 goes high, Q953 conducts and the optocoupler short-circuits the base of Q955. As a result Q955/Q954 switch off.

Q902 and its associated circuit provide protection in the event of an open-circuit on the secondary side of the supply. This would increase the chopper transistor's base drive current. Q902 senses this condition, turning on to short out the drive circuit.

The secondary chopper circuit operates on the same principles but, since the load is assumed to be constant, load regulation is not incorporated. D957 and IC951 regulate the output voltages. D954/C956/D953 provide open-circuit protection/limiting. The circuit operates at about 19kHz.

No Sound or Picture

While the no sound or picture symptom may be due to a fault in the power supply, the most common cause is a short-circuit line output transistor. This is Q552, type 2SD1877. Q552 can fail of its own accord or because of shorted turns in the line output transformer T553. The usual cause of Q552's failure however is dry-joints at the pins of the line driver transformer T551. If you have to replace Q552, always check T551.

A smell of burning is generally due to breakdown of the insulation in the line output transformer. This will of course lead to the no sound/picture condition. A smell of burning can also be due to arcing at the tube's e.h.t. cap because of excessive damp. Replace the cap or the whole transformer assembly.

No sound/picture with the standby light out should lead to a check on the 5V output from IC951, at pin 2. If missing the chip could be faulty or the input at pin 1 might be missing – check whether R957 or D956 is open-circuit.

No sound/picture with the standby light on could also be caused by loss of the 5V supply from IC951. If this is present, check whether R958 is open-circuit or the optocoupler PC951 is faulty.

For the dead set symptom check whether fuse F901 is open-circuit. If it has simply died, fit a replacement. If it has blown, check for shorts in the mains bridge rectifier D901-4 and the associated protection capacitors C901/2/5/6, also the reservoir capacitor C907. If fuse F901 is all right, check whether the surge limiter resistor R901 is open-circuit.

For no sound or picture with the set operational (on-screen indications present) and the standby light on, check that the regulated 5V supply is present at pin 2 of IC903. If there's no input at pin 1 of this regulator check D914, C922 and circuit protector Z902. Check IC903 (by replacement) and C923 if about 7·2V is present at the input but there's no output.

No sound or picture with a loud screeching noise coming from the receiver and LEDs M1/M2 on the front of the receiver alight should lead to a check on the regulated 12V supply, at pin 2 of IC902. There should be an input of about 15V at pin 1 of this regulator. If this is absent check D913, Z901 and C920. If the input is present but there's no output check IC902, C925 and C580.

No sound or picture with a loud whistle occurs when the line output transistor Q552 goes short-circuit. If a replacement fails, check D909 and R911 in the power supply – one or the other or both may be open-circuit. If D909 is open-circuit IC901 and Q552 can be ruined.

No sound or picture or very intermittent loss of the sound and picture can be caused by dry-joints on the pins of the line driver transformer T551. If the fault is very intermittent however suspect the chopper chip IC901. A replacement will be supplied with a small packet of a different heatsink compound: remove all the old compound, fit the new chip and reassemble.

No Picture and Bright Raster Faults

For no picture with the sound all right check whether the 0·82Ω fusible resistor R563 is open-circuit. This is the surge limiting resistor in the rectifier circuit that produces the 24V supply for the field output chip. Its input comes from pin 3 of the line output transformer. If necessary go on to check the 2W fusible resistor R671 on the tube base panel. Its value (e.g. 1·8Ω or 2·2Ω) depends on the type of tube

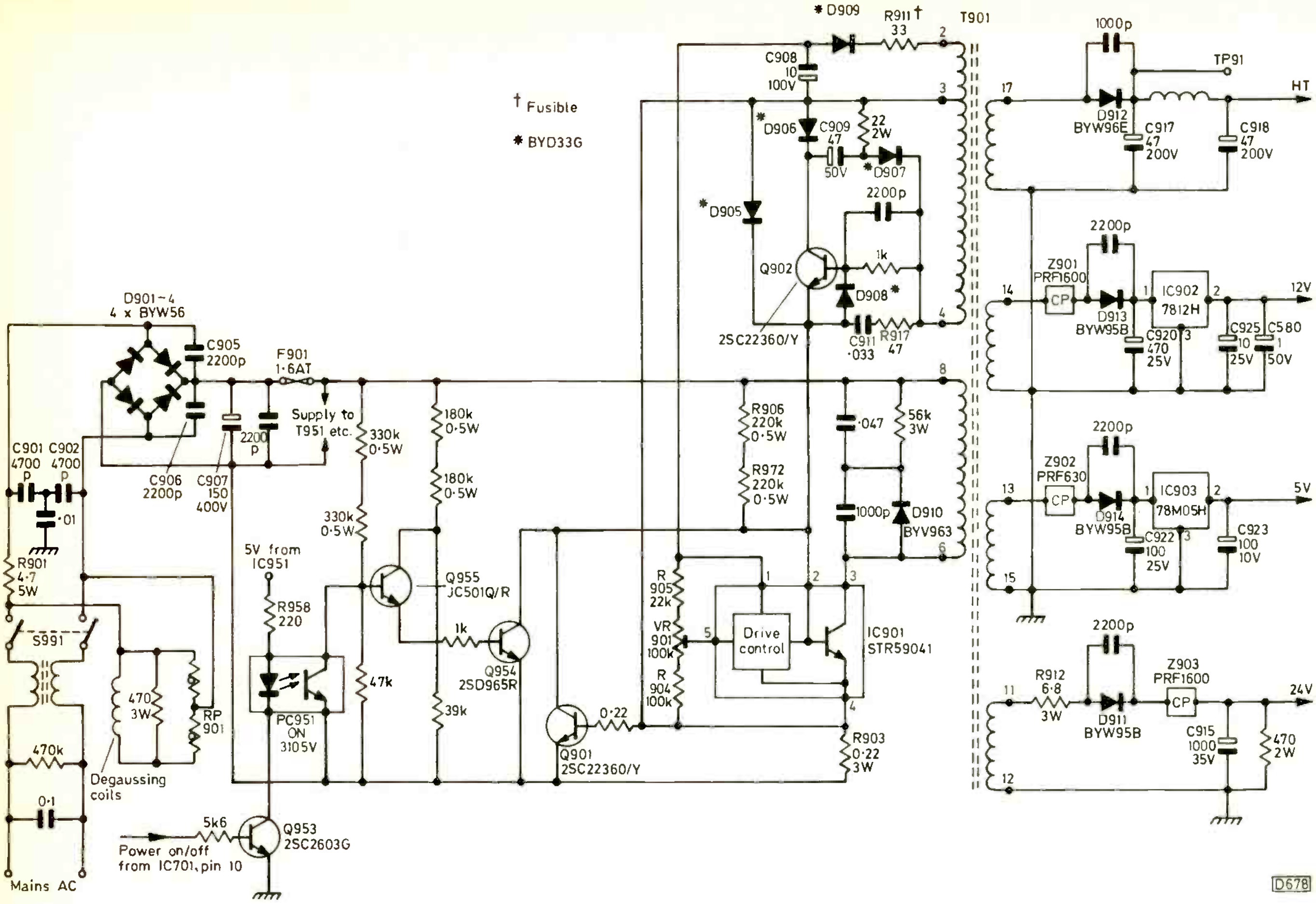


Fig. 1: The mains input and main, regulating chopper circuitry used in the Mitsubishi Euro 4 chassis.

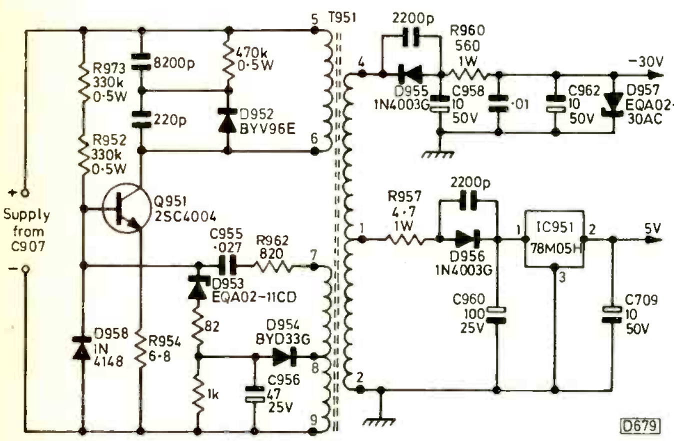


Fig. 2: The standby chopper circuit.

fitted. It's the heater supply ballast resistor.

For a bright raster with the sound all right check whether the 2·2Ω fusible resistor R559 is open-circuit. This is the surge limiter in the rectifier circuit that produces the h.t. supply for the RGB output transistors. Its input comes from pin 6 of the line output transformer. If necessary go on to check the reservoir capacitor C565 (33μF, 250V) and the decoupling capacitor C654 (1μF, 250V) on the tube base panel.

Field Collapse

In the event of field collapse check that there's 25V at pin 3 of the field output chip IC401. If this voltage is absent the boost diode D401 (1N4003G) is open-circuit. If the voltage at pin 3 is low, the chip is probably faulty – it may be a μPC1378H or AN5521 depending on tube type. If necessary check that the field drive output is present at pin 1 of the TDA2579 timebase generator chip IC501. If this output doesn't reach pin 4 of IC401 check whether R401 (3·9kΩ) is open-circuit or C409 (0·01μF or 0·022μF depending on chip type) is short-circuit. If necessary check IC501 by replacement.

Loss of Sync

For loss of sync check the d.c. conditions at the pins of IC501 and that sync pulses are reaching pin 5. If they are missing check back via pin 7 of connector TX1 on the Fastext panel. Items to check on this panel are the JC501QR sync output transistor Q7706 and the SAA5231 video processor chip IC7705. Check the d.c. conditions at the pins of this chip and if necessary check it by replacement.

No Sound

For no sound check the voltages at the pins of the AN5265 audio output chip IC3A3 on the AV-M panel. There should be 11V at pin 1 and 24V at pin 9. If either supply is missing, check back to source. The 24V supply is provided by R912/D911/Z903/C915 in the power supply circuit. The 11V supply is derived from this via R304 (390Ω, 1W) and the 11V zener diode D3A3. If the supplies are all right, check whether the 4·7Ω resistor R387 in the Zobel network connected to pin 8 (output) of the chip is open-circuit. If necessary check the chip by replacement and the 470μF, 25V output coupling electrolytic C3C3.

TV/VCR Equivalents: Granada

Vast quantities of ex-rental sets and VCRs are in use. They can be a bit of a problem when they arrive in the workshop and you don't know the manufacturer/model, maybe just a rental company code number being present. Many of these sets have come from Granada: the following details should help with the identification of makes and models.

Rental Models

A typical ex-Granada rental TV set will have a number such as C20XA1. The first digit (C) is the designation, the second and third digits (20) give the screen size, the fourth digit (X) is the year code, the fifth digit (A) indicates the manufacturer while the sixth digit (1) indicates the set's features. We'll take these in turn.

Table 1: Popular Granada rental VCRs.

Granada code	*Manufacturer*	*Model*
VHSFG2	Amstrad	6000
VHSFG4	Amstrad	6100
VHSTJ1	Ferguson	3V22
VHSTJ2	Ferguson	3V16
VHSTJ3	Ferguson	3V23
VHSWJ1	Ferguson	3V29
VHSWJ3	Ferguson	3V30
VHSXJ3	Ferguson	3V31
VHSYJ2	Ferguson	3V35/6
VHSFS1	Fisher	F5000
VHSFS2	Fisher	F5100
VHSFH6	Hinari	VXL10
VHSVH4	Hitachi	VT7000
VHSWH1	Hitachi	VT8300
VHSWH3	Hitachi	VT8700
VHSXH1	Hitachi	VT8000/8300
VHSXH3	Hitachi	VT8700
VHSYH2	Hitachi	VT9300/9500
VHSAH1	Hitachi	VT14/VT19
VHSAH3	Hitachi	VT17/VT19
VHSBH1	Hitachi	VT63
VHSCH1	Hitachi	VT63
VHSEH2	Hitachi	VT420
VHSFJ4	JVC	HRD750
VHSVN1	Panasonic	NV2000
VHSNV3	Panasonic	NV7000
VHSWN2	Panasonic	NV2010
VHSXN2	Panasonic	NV333
VHSAN3	Panasonic	NV370
VHSBP1	Philips	VR6460/6542
VHSDP1	Philips	VR6467
VHSDP7	Philips	VR6067
VHSFP2	Philips	VR6285
VHSXY2	Sharp	VC9500
VHSAY3	Sharp	VC386H
VHSBY3	Sharp	VC486H
VHSFY2	Sharp	VCA140
VHSFY3	Sharp	VCR5011
VBXAS1	Sanyo	VTC5000
VHSDS2	Sanyo	VHR2300
VHSES2	Sanyo	VHR3300
VHSES5	Sanyo	HRD500
VHSCC1	Samsung	VI510T
VBXVB1	Sony	SLC5
VBXWB2	Sony	SLC7
VBXXB1	Sony	SLC6
VBXYB3	Sony	SLC9
VHSFB5	Toshiba	V500B

With designation C = colour, M = mono and P = Prestel. With VCRs VHS is obvious while VBX indicates a Betamax machine.

The year code is as follows:

G up to 1969	R 1977	A 1984
H 1970	S 1978	B 1985
J 1971	T 1979	C 1986
K 1972	V 1980	D 1987
L 1973	W 1981	E 1988
M 1974	X 1982	F 1989
N 1975	Y 1983	G 1990
P 1976		

The manufacturer code is as follows:

A = GEC	P = Philips, Pye
B = Sony	R = Rank
D = Decca	S = Sanyo
H = Hitachi	T = Thorn
J = JVC	V = Tandberg
K = ITT	X = Miscellaneous
M = Miscellaneous	Y = Rediffusion, Sharp
N = Panasonic	Z = Salora

Set feature coding depends on year of manufacture, as follows:

Up to 1983	After 1983
1 = basic model	1 = basic model
2 = VHF/UHF or cable/aerial	2 = Granadacolour basic/remote
3 = remote control	3 = Finlandia basic/remote
4 = acquisition	4 = Granadacolour teletext
5 = teletext	5 = Finlandia teletext
W = wired	6 = Granadacolour stereo/text
	7 = Finlandia stereo/text
	W = wired

Table 2: Popular Granada rental TV sets.

*Code**	*Manufacturer*	*Model/chassis*
RYW	Rediffusion	Mk3
RY1	Rediffusion	Mk3
RY2	Rediffusion	Mk3
RY3	Rediffusion	Mk3
SY1	Rediffusion	Mk3
SY2	Rediffusion	Mk3
SY3	Rediffusion	Mk3
TY1	Rediffusion	Mk3
TY2	Rediffusion	Mk3
TY3	Rediffusion	Mk3
TY5	Rediffusion	Mk3
VA1	GEC	C2233H
WY1	Rediffusion	Mk4
WY2	Rediffusion	Mk4
WY3	Rediffusion	Mk4
WY5	Rediffusion	Mk4
XA1	Hitachi	CPT2026
XK1	ITT	211
AS1	Sanyo	CPT3131
AY1	Sharp	—
AY2	Sharp	—
BS1	Sanyo	CPT3131
BY4	Rediffusion	Mk4A
CD4	Tantung	145X
DS4	Sanyo	CPT3141

* Last three digits

Table 3: Granada retail TV sets.

Maker/ model	Granada code
Ferguson	
37023	16C012
37140	14C012
37141	14C013
37493	20C012
37801	16C011
38030	12C011
38050	14C011
20C4	20C011
22B5	22C011
51A3	51C011
51G3	51E011
14C2	14E011
14J2	14E011
Fidelity	
1405S	14211
1405R	14E212
GEC	
1657	16C151
1658	16C152
2295	22C151
Grundig	
512201	20C081
512406	20C082
562201	22C081
Hinari	
TVA1	14E252
Hitachi	
2074	20C121
2076	20C122
2158	51C122
2276	22C121
2278	22C122
2476	59D121
2478	59D122
2568	59C121
2044	20C121
2178	51D124
2888	66D121
2176	51D121
1556	36D121
2174	51D123
1476	14D122
1474	14D121
ITT	
CT3315M	20C091
CT3725	26C091
CT3326	20E091
CP3120	14E091
Mitsubishi	
CP1424B	14C111
CT1501BM	36C111
CT2224B	22C111
CT2227BM	22C112
CT2117BM	51D111
CT2101TX	51D112
Network	
NE14CD	14E191
Panasonic	
TC430G	14C061
TC431GR	14C062
TX2656	26C061
TX5500	22C061
TC450	14C063
TX1752	41C061
TC2061	20C061
TC1460	14D061
TC2110WN	51C061
TC2175	51D061
TX1	51D062
210T	51D031
TX3370	78E061
TC1675	16E061
Philips	
1014	14C051
2016	16C051
2036	20C051
2206	14C052
2216	16C052
4829	51C051
5240	22C051
5751	22C052
2309	36C051
2061	22D051
2340	51D051
2060	22C053
1551	51E051
2370	59E051
3570	59E052
Sanyo	
CTP3141	14C021
CTP6134	20C021
CTP6135	20C022
CTP7133	22C021
CTP7134	22C022
CTP7135	22C023
CTP3144	14C022
CTP2146	51E021
Sharp	
C1410HD	14C041
C1411	14D041
C1420	14E041
Sony	
KV1430UB	14C071
KV2060UB	20C071
KV2212UB	22C071
KV27XRT	66E071
KV1460	14E071
KV1462	14E072
KV21XRT	51E073
KV21XMU	51E071
KV21XMT	51E072
Toshiba	
140E4B	14C031
159R4B	36C031
211E4B	51C031
212T4B	51C032
222E5B	22C031
222R5B	22C032
261T	26C031
140R4B	14C032
212R4B	51C033
202R5B	20D031
210R6B	51D031
145E7B	14D032
14E7B	14D031
258T	59E031
Zanussi	
20ZA374	20E221
24ZM366	59E222
24ZM360	59E221
28ZM360	69E221
16ZB32	16E221
24ZS366	59E223

There were one or two exceptions: Model C20RA1 has remote control, Model C20RA3 has manual control, Models C26NZ1 and C26NZ3 both have remote control.

Table 1 lists some popular VCRs and Table 2 some common TV sets.

Retail Models

Granada retail equipment is coded slightly differently. A typical TV set might bear the number 22C151. The first and second digits (22) indicate the screen size, the third digit (C) indicates the year, the fourth and fifth digits (15) indicate the manufacturer while the sixth digit (1) is used by Granada for internal purposes.

The year code is as follows:

C August 1985 to July 1986
D August 1986 to July 1987
E August 1987 to July 1988
F August 1988 to July 1989
G August 1989 to July 1990

The manufacturer code is:

17 = Amstrad	25 = Hinari	06 = Panasonic
01 = Ferguson	12 = Hitachi	05 = Philips
21 = Fidelity	09 = ITT	02 = Sanyo
10 = Fisher	18 = JVC	04 = Sharp
15 = GEC	11 = Mitsubishi	07 = Sony
20 = GoldStar	14 = NEC	03 = Toshiba
08 = Grundig	19 = Network	22 = Zanussi

Table 3 lists TV sets, Table 4 VCRs and Table 5 cameras. Table 6 lists Granada Tashiko branded TV sets and VCRs.

We shall be following up with information on JVC/Ferguson/Thorn equivalents.

Table 4: Granada retail VCRs.

Maker/ model	Granada code
Amstrad	
VCR460Mk2	VVD171
VCR4700	VVD172
TVR2	VVD173
TVR3	VVD174
Ferguson	
3V44	VVC011
3V52	VPC011
Fisher	
FVHP710	VVC101
FVHP716	VVC102
FVHP905	VVD101
FVHP910	VVD102
GoldStar	
GHV1240I	VVE201
Grundig	
VS180	VVC081
Hitachi	
VT410	VVE122
VT430E	VVE121
ITT	
VR3906	VVC091
VR3916	VVC092
VR3995	VVC093
JVC	
HRD230EK	VVE182
HRD330	VVE183
HRD210	VVE181
NEC	
N9033K	VVD141
N9034K	VVD142
Panasonic	
NV430B	VVC061
NV730B	VVC062
NV870	VVC063
NVG7G	VVD061
NVG18B	VVD062
NVG12	VVE061
NVG21	VVE062
Philips	
VR6462	VVC051
VR6462R	VVC051
VR6467	VVD051
Sanyo	
VHR1100E	VVC021
VHR3100	VVE021
VHR3300	VVE022
Sharp	
VC5F3H	VVC043
VC585	VVC042
VC8581	VVC041
VC651	VVC044
VC681	VVD041
VC685	VVD042
VC6F3H	VVD043
VCT72H	VVE041
VC780HM	VVE042
Toshiba	
V65B	VVC031
V83B	VVD031

Table 5: Granada Cameras.

Maker/ model	*Granada code*	*Maker/ model*	*Granada code*
Ferguson		GRC7EK	VCE183
3V41	VCC011	**Panasonic**	
FC04	VCE011	NVM3B	VCD061
Hitachi		**Philips**	
VMC30	VCE121	VKR6800 'B'	VCC051
JVC		**Sony**	
GRC9EK	VCE181	CCDV50	VCE071
GRC11EK	VCE182		

Table 6: Tashiko models.

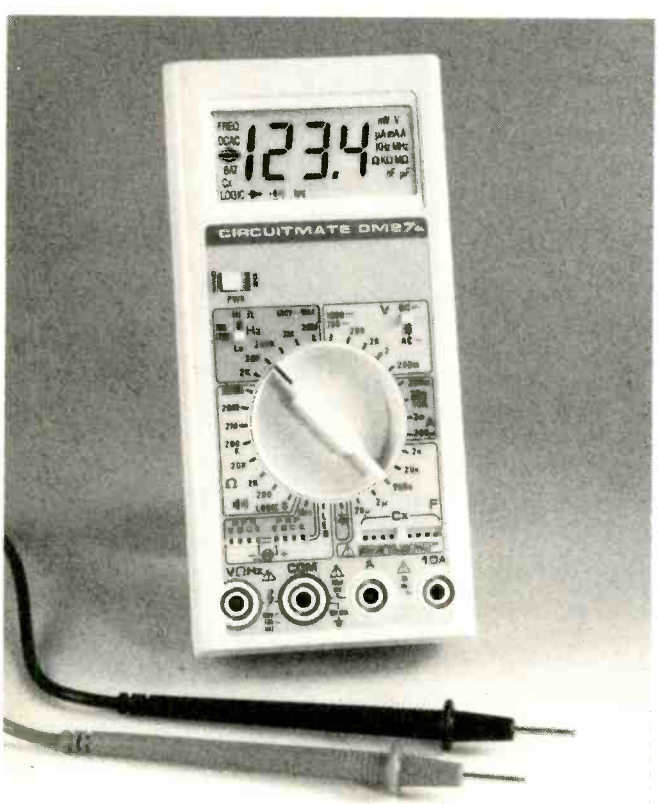
Model	*Maker*	*Model*
VVD931	Amstrad	VCR4600Mk2
VVD932	Amstrad	VCR4600Mk2
AK1	GEC	C1405
VA1	GEC	C2233
VVE921	GoldStar	GHV12211
VVE922	GoldStar	GHV21401
XA5	Hitachi	CPT2026
XA1	Hitachi	—
XK1	ITT	211
YK1	ITT	211
14E911	Jackson	Harwood 14
14E912	Jackson	—
20E911	Jackson	—
20E912	Jackson	—
14F861	Meta	—
51F861	Meta	—
14E881	Nikkai	TLG0101
45E881	Nikkai	TLG0101
51E941	Salora	C51EZ4
51E942	Salora	C51EZ4
12D971	Samsung	VT306K
14D971	Samsung	CI338F
VVD971	Samsung	VI617
AS1	Sanyo	CTP3131
BS1	Sanyo	—
DS4	Sanyo	CTP3141
14D961	Sanyo	CTP3141
14D962	Sanyo	CTP3144
VVD951	Sharp	VC681H
51F871	Shin Shirasuna/Silver	CV252
14F891	Tantung	VN1671
16E891	Tantung	DP8655

The fourth and fifth digits of six digit model numbers indicate the manufacturer.

Test Report: Beckman DM27XL DMM

David Botto

The Beckman Industrial DM27XL Circuitmate is a hand-held DMM measuring just 168 × 81 × 35mm. It's housed in a tough white plastic case with a tilt stand for easy viewing. Anti-slip pads ensure that it won't slide all over – or off – the bench. On the kitchen scales it weighed in at 375g (13oz) including its PP3 battery. Despite its small size



The Beckman DM27XL digital multimeter.

it's solidly built to stand up to regular use on the test bench.

The meter's many features and functions make it especially useful for trouble shooting in a wide variety of circuits. In addition to the usual a.c. and d.c. voltage, current and resistance ranges it measures frequency from 10Hz to 20MHz, capacitance from 1pF to 20μF, has a built in 20MHz logic probe and tests diodes, LEDs and transistor junctions, also measuring transistor hFE (d.c. current gain). If you've ever had to puff up several flights of stairs loaded with bulky instruments you'll appreciate the all-in-one, pocket-sized DM27XL.

The display is a 1in., 3·5 digit LCD readout. Some DMMs I've seen have readouts that are dark grey rather than black. The DM27XL's large, 17mm digits are jet black, so you don't have to strain your eyes when taking a reading.

The DM27XL has a full set of function indicators, including over-range, logic and low-battery symbols. It also has a useful auto-off feature which turns the meter off if it's left unattended for 45 minutes. Range selection is manual, by means of a single rotary switch. Will this stand up to repeated workshop use? I think so: it appears to be sturdy and has a positive click.

The lack of auto-ranging might be considered a drawback, but I don't think so. With TV sets and VCRs the majority of d.c. voltage tests are carried out on the 2V, 20V and 200V ranges, which doesn't involve excessive range switching. It might however have been better to have had the ohms ranges adjacent to the voltage ranges since these are the most frequently used ones.

Ranges and Tests

There are five auto-polarity d.c. voltage ranges covering 200mV to 1kV. Accuracy is ±0·5 per cent, with the resolution on the lowest d.c. voltage range being 100μV.

The five a.c. voltage ranges cover 200mV to 750V, with an accuracy of ±1·2 per cent. The input impedance on the a.c. and d.c. voltage ranges is 10MΩ.

Not all the DMMs I've encountered live up to the claimed d.c. accuracy. The DM27XL does even better. When it was confronted with a precision 5V d.c. source it gave a spot-on reading of 5·00V. Further tests using a precision Heathkit experimenter's breadboard and a DMM of known accuracy revealed that the ±0·5 per accuracy claim is valid.

The five a.c. and d.c. current ranges cover 200μA to 10A, the lowest resolution being 10nA. D.C. current accuracy is ±1·8 cent except on the 10A range when it's ±3 per cent. With the a.c. ranges the accuracy is ±1·2 per cent on all but the 10A range where the accuracy is ±2 per cent.

The seven resistance ranges cover 200Ω to 2,000MΩ, the lowest resolution being 0·1Ω. Accuracy is ±1·2 per cent on the 200Ω-200kΩ ranges, ±3 per cent on the 20MΩ range and ±5 per cent on the 200MΩ and 2,000MΩ ranges. A fixed count of ten must be subtracted from the meter's reading on the 2,000MΩ range: for example if the display says 210MΩ ten must be subtracted to give the correct reading of 200MΩ.

The open-circuit test voltage on the 2kΩ to 20MΩ ranges did not exceed a measured 0·28V d.c. Thus in-circuit resistance measurements are possible without having to remove diodes, transistors and i.c.s. On the 200Ω range the open-circuit test voltage was found to be 2·92V. This range also operates as a continuity tester, using a beeper whose note changes as resistance varies between 0-100Ω.

Capacitance can be measured between 1pF and 20μF in five ranges. This is a handy feature, especially for small-value capacitors. The capacitor under test is plugged into two slotted test sockets on the face of the meter. Accuracy is given as ±3 per cent: checks with a range of close-tolerance capacitors proved that this claim is justified.

As no input protection is provided it's vital that a capacitor being tested is discharged before it's connected to the meter.

Where the DM27XL really scores is with its wide frequency coverage. The five ranges cover from 10Hz with a sinewave input (20Hz for TTL signals) to a surprising 20MHz. There's a trigger sensitivity switch: in the "trigger lo" position the minimum sensitivity is 100mV while in the "trigger hi" position it's 1·6V.

I used an r.f./a.f. signal generator and a precision Heath quartz crystal-controlled frequency meter to check the accuracy of the DM27XL's frequency ranges. Table 1 shows some of the readings obtained.

The effective diode function test allows relative measurement of the forward voltage across a diode or bipolar transistor junction. Nothing can beat a component tester for showing up the slightest leak when good/bad junction testing of course, but one thing a component tester can't do is to measure a transistor's d.c. current gain. The DM27XL can: when a transistor is plugged into the test sockets the hFE value is shown in the display.

Table 1: Frequency checks

Signal generator output	*DM27XL reading*
22Hz	22Hz
35Hz	35Hz
102Hz	100Hz
400Hz	401Hz
600Hz	601Hz
2·004kHz	2·00kHz
5·000kHz	5·04kHz
25·180kHz	25·0kHz
0·603MHz	0·610MHz
1·000MHz	1·005MHz
10·000MHz	10·00MHz.

Overload Protection

Overload protection is provided for all functions except capacitance measurement. Voltage ranges have protection up to 1·2kV d.c./850V a.c. except for the lowest, 200mV range where the protection is 500V d.c./350V a.c. Apart from the 10A range there's fuse protection to 800mA on the current ranges. The protection on the resistance and logic ranges is at 500Va.c./d.c. On the frequency ranges the protection is at 500Vd.c./a.c. r.m.s.

In Use

The DM27XL's 4mm test sockets are recessed for safety. Its test prods are fitted with finger-protecting guards and are light and easy to use in dense circuitry.

The 200Ω continuity range with its nicely toned beeper proved to be handy for no-look checking through printed circuitry and for finding those hard-to-spot breaks in tracks. It's also excellent for checking for continuity between i.c. sockets and the print.

The logic measurement system is designed for use with TTL circuitry. I found that it worked well with C-MOS circuitry as well however. A logic high shows in the display as an upward-pointing symbol: a logic low shows as a downward pointing symbol accompanied by a soft beep.

The DM27XL's logic probe function does not draw power from the circuit under test, which is a big advantage and a useful feature when servicing VCRs with system control problems. Logic highs and lows with microcomputer/microprocessor chips are easily measured. With a microprocessor clock signal the meter's logic symbols fluctuate and a high-toned beep is emitted. This tells you that the clock oscillator is working. Logic gates are checked in the same way as with a standard logic probe.

The frequency check is invaluable when you have line drive problems. On the 20kHz range the display should fluctuate between 15·62-15·63kHz when a 15,625Hz line signal is present – but don't connect the probe to the windings of a line output transformer. A test prod applied to the 4·43361875MHz crystal in a colour decoder gave a reading of 4·33-4·34MHz: this could be useful with colour problems. Application of the probes didn't affect the colour with the set used to make the check.

I found that the DM27XL can be used for effective in-circuit resistor checks. This is better than some DMMs which don't have quite enough voltage on the ohms ranges for proper diode checks but have too much voltage for reliable in-circuit tests.

I would have preferred to have had a 3 2/3 rather than a 3·5 display readout, but the extensive ranges greatly compensate for this lack and I'd recommend the DM27XL as a good buy.

Availability

The Beckman Industrial DM27XL comes with test leads, battery and a well-written manual. The price is £79 plus VAT, including a one year warranty. To me this seems to be pretty good value. The meter is available from Beckman Industrial, Astec Building, High Street, Wollaston, W. Midlands DY8 4PG (telephone 0384 442 394).

Fifty Years in Radio and TV

Part 7: Teletext and Chips

Harold Peters

When the Isaac Shoenberg/Alan Blumlein team invented our modern TV system in the early Thirties they built in a video pause of a couple of dozen lines between the field sync pulse train and the start of the next picture. The reason for having this field blanking interval was to enable the spot to return to the start of the next scan, at the top of the screen, at a reasonably leisurely rate. This would avoid the high back-e.m.f.s that might otherwise jump the insulation of the scan coils and pierce little holes in the tube's glass neck.

VITS

Something they couldn't have foreseen was that forty years later groups of bright young men with no respect for history would eye these blank lines and say "what a waste". It happened of course. The first of these lines to be made use of were the penultimate ones before the start of the picture. Increased programme hours, duplication and Eurovision links led to the need for some sort of test signal that was present all the time, so that alignment and equalisation could be carried out during programme hours.

Originally just a pulse and bar were added. They were used for assessment of the quality of the h.f. and l.f. responses and were known as the vertical interval test signal (VITS). With the coming of colour an extended colour burst superimposed on a luminance staircase was added. Next came ICE on the line above the pulse and bar. This is a train of digital pulses that's used for network control and can provide messages such as "engineer on site at Reigate relay" etc.

Teletext

Finally, with a flourish that occupied the whole of one edition of *BBC Engineering,* came Ceefax, with the IBA's Oracle close on its heels. At first the two systems were incompatible, but once tests had proved that they were a practical proposition a common standard was agreed upon, also a common name – Teletext.

At first we could get only Ceefax on BBC-2 at the Lowestoft factory, as the IBA's tests were confined to the London area. Then the "Save it" campaign hit us, and apart from "Play School" BBC-2 was off the air for much of the working day. We persuaded the BBC to move its tests to BBC-1, and at the same time felt that improved liaison with the local transmitter people would be useful. Through the Service Committee a series of exchange visits were arranged. They helped us all quite a lot, clearing up amongst other things some early problems about eyeheight measurements.

Teletext had us looking very closely at field blanking across the whole range of our sets, especially as some earlier models had very slow flybacks indeed. In fact until Mullard at Southampton came up with its first four-chip teletext decoder that was about all we were able to do.

Remote Control

In comparison with valves and transistors, i.c.s evolved at an alarming rate. It was chips with everything: colour decoders, timebases, sound and of course cordless remote control. The first cordless remote control systems used ultrasonic techniques and were a bit of a disaster. With hindsight we would have served the public better if we'd waited for the full development of infra-red systems, but the sales people were pressing us with a view to maintaining or increasing our share of the market. Ultrasonic remote control was all right in theory. But in practice when a command was squirted across the room the system behaved like a ship's sonar, bouncing spurious reflections towards the set from the family portrait, the Ming vase and the can of coke on the table. Servicemen spent happy hours moving the receiving transducer in and out of its slot, trombone style, to get the best range.

It wasn't only ourselves who were in trouble. On all manner of sets jangling a bunch of keys would change channels, and I well recall a field service call to the home of an associate director who lived close to Brookman's Park m.f. station. His set had to be lined with baking foil and required extra decoupling to reduce the effects produced by radio programmes. Over lunch I was told about the system they had for raising the garage door on a command from within the car. The device had to be disabled because whenever the adjacent transmitters radiated the Greenwich time signal the door would go up as well. Children would gather outside the house on the hour to watch the event!

Tuned Synchronous Demodulators

Chips eventually took over the i.f. section and in so doing introduced us to the tuned synchronous demodulator. We already knew about synchronous demodulators from their use in colour decoders, but these i.f. ones were not, and are still not, true synchronous demodulators. They are more correctly known as "exalted carrier demodulators". The switching waveforms that open and close the long-tailed pair detectors are derived from the incoming signal by limiting to remove the vision modulation then amplifying and phase-shifting the residual carrier. How to get the phase shift exactly right has never been satisfactorily documented, mainly because the correct method of tuning – for minimum video output amplitude – holds good only under laboratory conditions. Put the i.f. circuit in a set and much better results are obtained by slight capacitive detuning.

Dallas

Teletext i.f.s also need more careful detector alignment than we'd been used to, but these were things of which dealers and viewers were blissfully unaware. They were enjoying Faulty Towers, Steptoe and, with the extension of broadcasting hours, many imported US series. One, Dallas, arrived in 1978 and lapsed into obscurity once we'd established that it was not connected with the death of President Kennedy. There it would have remained but for Terry Wogan who, in his early morning stint on Radio-2, observed that Bobby Ewing's new house grew with every instalment while Petrocelli's construction in a rival series never budged. "Bobby is pinching Petrocelli's bricks" observed Terry, and soon everyone was following the series. Dallas owed much to Wogan.

Pye's Finale

Back at the factory we noted that the ten years of Pye's guaranteed independence from its owners, Philips, had expired. Our design department was the first to go, since the factory's next large-screen set was to be the Croydon-designed G11 – a very successful chassis. Sales of CTV sets had by now reached saturation level, so production had to be rationalised. Factory employment was reduced in two bouts of voluntary redundancies. Our three outside feeder factories were also closed. We were still performing efficiently however, otherwise we would not have been given the KT3 CTV chassis to produce, as well as the 12in. monochrome TX range. These were both Dutch designs: the G11 was to be the last truly UK chassis to be turned out by us and our Croydon "rivals".

Have you ever noticed that, although management expects its technical employees to be of the highest possible calibre, when it comes to staff matters they are credited with having mediocre mentality? But you don't stop putting two and two together when you leave the workbench. You have to be as caring for yourself as you are for the products you nurture. So when some of us noted the presence of Japanese visitors touring the factory during the summer shut down, and when shipping agents started to survey our quayside, we knew that something was afoot. Then it was noticed that the Xerox had been used overnight to run off as many copies as there were staff. So when the management handed us all a note telling us that the factory was to close they were taken aback to find that some of us were not in the least bit surprised. But we were surprised to learn later that the factory was to be handed over, as a complete working unit, to an apparent rival – Sanyo.

That wasn't what was uppermost in our minds however. What would happen to me, we asked ourselves? I was no exception. At 57, the most likely prospect was that I would spend the time until pension age staring vacantly out to sea. I did myself a CV, and because I had a works typewriter and the CV looked convincing I had to do several more for the lads around me. They all bore fruit except mine, so I resigned myself to providing assistance in leaving the place clean and tidy.

Final Move

There were some items that we had on loan from our friendly dealer at Blofield, the one mentioned last month. I returned these personally so as to be able to thank him for his past co-operation. To my great surprise, over coffee, Roy Snelling offered me a servicing job – provided I could start fairly soon. Knowing how much finishing off there still was to do at the Lowestoft site, I approached my departmental head in some trepidation. "That's a relief" he said. "I've just been told to make two more people redundant next month, so you can be one of them."

So began the final seventh of my life with pliers and screwdriver in the radio and TV field, back in servicing again. They were to become seven and a half of the busiest, and happiest, years of my working life. They deserve an article of their own. As I left the factory, the lads were beavering away trying to find out why some of our sets buzzed when they used with the new VHS video recorders. I could have told them, but they wouldn't have taken the word of an outsider.

next month in

TELEVISION

FREE CATALOGUE

Greenwell's latest 16-page catalogue comes free with the August issue of *Television*.

● THE FERGUSON FV31R

Servicing notes on this popular Thomson designed VCR, with full details of the rather troublesome power supply.

● SURROUND SOUND FOR TV

Ian Martin on the Pioneer VSA730 Dolby ProLogic AV amplifier. The Dolby Stereo and ProLogic systems were originally devised for use by the motion-picture industry to give multi-channel sound, in its simplest form left and right audio plus a centre channel to fix the sound within the picture. The good news for viewers is that Dolby Stereo and ProLogic coding can be carried on a simple two-track system such as a stereo videotape or Laserdisc. In addition, the signals survive broadcasting and are thus available on many terrestrial and satellite TV programmes. The Pioneer amplifier enables these signals to be sorted out, with three front 60W r.m.s. and two rear 15W r.m.s. outputs, giving you surround sound in the home. Ian Martin finds it well worth having to hear movies in the original cinema form and to enhance other musical sources.

● SALORA K AND L CHASSIS

A run-down on faults experienced with the Salora K and large- and small-screen versions of the L chassis.

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TV Fault Finding

Reports from Philip Blundell, AMIEIE, Stephen Leatherbarrow, Mick Dutton, Nick Beer, Ed Rowland and Steve Cannon

Grundig P37-440

This model can change channel or turn the volume up by itself due to spurious signals being produced by the TFMS3300 infra-red receiver chip. The cure is to fit a replacement – Grundig may send you a TFMS4300. Later production have the TFMS4300 with a metal screen fitted over it. **P.B.**

Philips GR1-AX Chassis

This set was dead with no 95V output from the power supply. As no shorts could be found across the power supply outputs the set was fired up gradually via the variac. Everything was fine until the 95V line reached 50V, then the over-voltage thyristor fired. One of the sensing zener diodes, D6638 (BZX79-B36), was short-circuit. **P.B.**

Grundig CUC2401 Chassis

This set was dead with no output at all from the power supply. The dealer who brought it in had changed the TDA3640 chopper control chip IC655 and the associated electrolytics without success. A scope check at pin 18 of IC655 showed that the voltage here was varying between 7V and 10V every second or so. This indicated that the power supply was trying to start, but as the running supply at pin 2 didn't rise the chip would shut down again. The drive to the chopper transistor pulsed in sympathy with the start-up supply. Although the scope couldn't detect anything at the over-current sensing pin 7, everything pointed to the chip sensing a fault. Resistance checks at the outputs of the chopper transformer showed that nothing was amiss here and I was beginning to suspect the transformer itself. On a hunch I checked D666, which is one of the diodes in the chopper transistor's snubber network. It was short-circuit. **P.B.**

Philips G90 Chassis

The complaint was field collapse – the Wickman fuse in the supply to the field output transistors had gone open-circuit. When a replacement was fitted the set worked but the 22Ω resistors R3503 and R3507 in series with the two transistors were overheating. Resistance checks on the transistors showed that they were o.k. but R3501 (390Ω) in the upper transistor's base drive network was open-circuit. Replacing this restored normal operation. **P.B.**

Philips CP90 Chassis

This set had field collapse with a small amount of scan below it. A quick check showed that there was no 95V supply to the field output stage. The cause was a crack in the print by R3275. **P.B.**

Ferguson TX90 Chassis with RC

This 14in. colour portable was doing some bizarre things. Although the h.t. supply was correct there was no 12V supply. The 18V feed to the regulator leaves the main panel to go to the remote control board, which lives under the tube. It's then supposed to return via TR902/3/4. This wasn't happening as TR904 was open-circuit. TR904 acts as a switch, controlled by the pulse-on (standby) output from pin 3 of IC901. What was curious was the way the set behaved. If it was switched on in the normal way you could change channels. If the set was switched on using the mains switch at the socket the channels would sequence through in the normal numerical order. Puzzling. **S.L.**

GEC C1407/8H

I have owned one of these nice sets (line output transformer failure accepted) for some time now. One annoying feature relates to the sound muting circuit which gets very confused during search with a VCR. I found that replacing R702, the 68kΩ resistor connected to pin 28 of the TDA4503 chip IC201, with a 100kΩ potentiometer and carefully adjusting this improved matters no end – no more noisy gurgling and spluttering.

While on the subject of these sets, a common affliction is failure of the sandcastle pulse shaping circuit. The TDA3562A colour decoder chip is very sensitive to distortion in this waveform. Any of the following can be responsible: C724 (10nF), Q704, Q705, D705 and D603. There are also a couple of likely looking 13V zener diodes (ZD702 and ZD504) in the circuit but we've never had either of them fail. **S.L.**

Matsui 1420

A case of failure to start when cold was traced to C508 in the power supply. It's a 4·7μF, 50V electrolytic. **S.L.**

Philips 2A Chassis

We've had a number of these sets that suffer from severe patterning because of a missing capacitor. It's C2565 (390pF), which should be mounted between pins 1 and 5 of the field output chip IC7570. In each case it has been clear that the chip has been changed recently. This device (TDA3562/4) overheats and can quickly fail if C2565 is missing. Presumably engineers are failing to refit this capacitor following chip replacement. A possible reason is that it's not shown on the provisional circuit though it does appear in later ones. **S.L.**

Grundig CUC2401 Chassis

A case of very intermittent failure of the power supply was caused by a defective set h.t. control. It's R637, 1kΩ. In a further set with the same fault we couldn't find anything wrong with R637 but replacing it provided a complete cure. **S.L.**

Saisho FST212

This set came in with the usual fault – dead because the STR58041 chopper chip IC501 was short-circuit and the 5·6Ω, 7W surge limiter resistor R502 was open-circuit. Replacing these items produced peculiar results however. A normal raster appeared (no signal) but if the channel was changed or the aerial was connected the raster blanked out briefly, leaving a reduced-size picture. Both the height and the width were affected as the h.t. dropped to around

80V. R518 (1Ω, 1W) behind the heatsink had gone high in value and R512 (0·47Ω, 1W) was faulty. The two nearby 2SD863 transistors Q501/2 and R505 (47Ω, 1/4W) should always be checked when you encounter a faulty STR58041 chip in these sets. BC337 transistors make good replacements despite the apparent size difference. **S.L.**

Philips KT3 Chassis with RC

There were no remote control functions. There was no response from the front panel buttons either, though the LED winked in acknowledgement. The cause of the trouble was the SAF1032P chip on the remote control panel – it produced no outputs when requests were made to it. **S.L.**

Panasonic TX21T1 (Alpha 2 Chassis)

We've had a couple of these sets with a very poor picture, the contrast being very low irrespective of the customer control setting. The reason for this is that the beam current limiter (or ABL as Panasonic prefer to call it) is working overtime, limiting the contrast control voltage applied to the colour decoder chip. The culprit is R562 which goes open-circuit. It's a very small 0·25W, 130kΩ resistor: the replacement supplied is a fair amount larger than the original. **N.B.**

Panasonic TUS100

This unit had no polarisation control: there was virtually no current through the coil from the receiver. So the unit was in effect stuck on one polarisation. Polarisation drive comes from an npn/pnp pair of transistors which are in turn driven by an operational amplifier chip. The pnp transistor Q9810 was short-circuit. To set up the circuit connect a 90Ω resistor across the polariser terminals, then adjust R9828 so that when the current is reversed (polarity changed) the reading is the same. Finally set R9829 for a current reading of 34·9mA. **N.B.**

Sony KV1420

This brand new portable displayed a bright blue raster with a barely visible picture when taken from its box and put on display. The cause was very slight misadjustment of the G2 (first anode supply) control on the tube base. The focus setting was also a bit off. After resetting these adjustments we ran the set for a time in case it had an intermittent tube but this proved to be o.k. **N.B.**

Decca/Tatung 140 Chassis

The aerial rigger brought this one in because there was no tuning. Checks showed that there was no tuning voltage at pin 4 of the tuner. This set has voltage-synthesised tuning. An i.c. produces a variable mark-space ratio squarewave which is fed to a transistor to produce the appropriate proportion of the regulated 33V supply. There was 33V at the collector of this transistor but nothing at its base and emitter because the bias resistor RR70 (33kΩ) was open-circuit. **M.D.**

Ferguson TX9 Chassis

The customer complained that the picture would intermittently go, but during several field calls and a workshop soak test the problem had never been seen. This time the message was that the picture had permanently gone. On the bench we found that it was possible to change channels and that the sound was o.k. But there was no 115V supply because L104, which is in series with the rectifier, was dry-jointed. **M.D.**

ITT CVC45 Chassis

The symptoms were sound but no picture. As the e.h.t. was present we advanced the setting of the first anode control, revealing a blank, noise-free raster. Investigation showed that R12, which is in the line pulse feed to the decoder panel, had risen in value from 560Ω to 39kΩ. Replacing this cured the fault and the set was returned to the customer. Unfortunately this wasn't the end of the story. A few days later the same fault was reported, but this time the cause was an interelectrode short in the tube. This short removed the first anode voltage and resulted in a rather tricky situation since it was hardly worth fitting a new tube. **E.R.**

Ferguson ICC5 Chassis

The problem with this set was intermittent loss of colour. It got worse the longer the set was left on. After a couple of hours the fault was almost permanent so, armed with the trusty freezer, we delved into the colour decoder subpanel. Unfortunately no amount of freezing revealed anything, so out came the meter and scope. As the supply and the chrominance input to IV01 were o.k., a check was made on pins 12 and 13 of this chip – this is the reference oscillator section. There was no problem here. We next checked for line pulses at pin 15. They were missing. Tracing the circuit then brought us to DV21, which separates the line pulse from the sandcastle waveform. There was a perfect waveform at its anode but nothing at its cathode. A replacement 1N4148 diode provided a complete cure. **S.C.**

Hitachi G7P Chassis

This set went dead intermittently and occasionally blew its chopper transistor. After replacing the 2SC3679 a few times we found that the cause of the fault was R932, which is connected to pin 4 of IC901 (TDA4601). It had increased in value to about 220kΩ. Many sets use this type of power supply and it seems to be quite common for these high-value resistors to cause problems. **S.C.**

Hitachi G6P Chassis

The fault here was that the set started up but a couple of seconds later the power supply shut down. We found that the crowbar thyristor Q902 was being fired. After disconnecting its gate we wound the mains supply up with a variac. As the set operated perfectly it seemed that the fault was in the protection circuit itself. After checking various components we found that the 24V zener diode ZD752 in the e.h.t. sensing circuit was leaky, a replacement curing the problem. **S.C.**

Panasonic TX2234 (U4W Chassis)

We've had a number of these sets in with no sound or picture and 00 shown in the LED display. What happens is that the line oscillator shuts down because the h.t. is too high. The cause, in all cases, has been C808 (47μF, 25V) in the power supply. **S.C.**

Gremlins and Gurus

Steve Cannon

Do you believe in fate? Now I don't mean fate like the guy who was late and missed catching his reserved seat on the Titanic. No, I'm talking about real fate. Like picking up a faulty item that's in for repair and thinking it will be a noddy fault when in most cases it turns out to be a stinker that will require a mind-numbing amount of time spent head scratching and uttering expletives before the cure is found.

It was while I was working on a dead Salora TV set of this type – one fitted with the J chassis (Ipsalo-2 circuit) – that MC Mikey Guru walked in. Now Mike is a very sound guy, a shop manager at one of our branches, but he's also an affiliated member of FESTER, the Frustrated Engineers Society of Tinkery, Empiricism and Reputation. Apparently he was at one time a proper engineer, but he had a nasty experience with a cat, a budgie and the top cap of a PL509. I don't think that any explanation is called for here, but needless to say Mike came off the worst. Unfortunately his accident severely impaired many of his faculties, so our boss had to make a big decision concerning his future. Now what you do with someone who's left as a gibbering wreck? There's only one solution, make him a shop manager. Thankfully, Mike has since made a complete recovery.

So there I was with this extremely dead Salora set, and it soon became apparent that it was going to be a lot more involved than I first thought it would be. The 28V line was o.k. at pin 1 of the hybrid chopper control chip, and the V-start line from the hybrid chip to the line oscillator chip was also o.k. A quick scope check at pin 4 of the chip showed the presence of an extremely welcome line pulse which was in all respects correct. Could the hybrid chip be faulty? With the line pulse going into it and from checks on the various relevant voltages this was the only conclusion I could come to. So out it came, but before I could do anything else Mike came over.

Now since his accident he's acquired what can only be described as strange powers. He put the suspect part on the bench and placed his hand over it. "Nah, put it back in" he said, in a confident sort of way.

"What do you mean?" I asked.

"There's nothing wrong with it – it's o.k." he replied.

Now I'm no mug, so I looked at him rather sceptically. "Are you sure?" I asked.

"Well order one if you think differently and we'll see."

I looked at him, looked at the chip and then looked blank. I disagreed with him.

"Well order one then" he said and went on his way.

It took a couple of days for the part to come, but it was fitted in seconds after being unpacked. The set was switched on and, of course, it was as dead as ever. At this point I could sense Mike's laughter, as if he was behind me, but unfortunately he calls only on Thursdays and so wasn't going to be able to help out further for the present.

A new line of thinking was required. Maybe there was a heavy load on one of the secondary lines from the Ipsalo transformer? A scope check at the collector of TB701, the lower chopper transistor, seemed to confirm this idea. I was comparing the waveform trace with the guide waveforms in the trouble-shooting section of the service manual. After following the fault-finding tree, the conclusion was to "suspect an effective short-circuit in the line output stage". So I'm getting somewhere at last I thought.

After checking transistors, bridging capacitors, measuring resistors and disconnecting various parts of the set's anatomy my head was throbbing again. I was sure that this was where the fault would be. Oh to be like Nick Beer: I'd been through his article on the J chassis over and over again to see whether I'd missed anything, but it seemed that I was on my own. Was I barking up the wrong tree? Slowly but surely I was coming to this conclusion, and with not much left to check in the line timebase my thoughts went back to the power supply. Maybe the primary side of the circuit wasn't delivering the goods for some reason. I was getting pretty desperate at this stage I can tell you, and I still had ideas about shorts in the line output stage nagging away in the back of my mind.

But something had to be done. I decided to find the model number of an Hitachi set that uses the chassis and give them a ring on the technical line.

"Have you replaced the 4.7μF chopper coupling electrolytics in the power supply?" asked Mr. Hitachi. I had.

"What about the chopper transistors? We've had a few problems with those".

Now I hadn't checked or replaced them.

"Try replacements. BUW41 or MJE13005 will do" the voice said. "If that doesn't cure it, replace the hybrid chip."

I would rather that Mr. Hitachi had come up with a miraculous cure that was one hundred per cent certain, but in all fairness the technical lines are generally very helpful. In this case however I seemed to be covering old ground.

Inspiration

I decided to give the transistors a try, just in case. The original ones were taken out. They compared perfectly with new ones, but what the heck. I was just about to insert and solder the new ones when suddenly, from about an inch gap in the blind, a flash of brilliant sunlight caught me straight in my left eye. I felt as if this was a message from some higher form of intelligence and suddenly felt the presence of Guru Mike in the room with me. I looked around but couldn't see him. Nevertheless my hands had the urge to check other components in the power supply. As if guided by some invisible force, my meter probes instinctively led me to DB712, which is connected between the base and emitter of the lower chopper transistor TB701. I measured it one way, then the other way round. Open-circuit both ways. I checked it again and then finally unsoldered it and rechecked it. No doubt about it, open-circuit it was. A new 1N4148 was fitted, along with the new chopper transistors. I made sure that the rest of the set was operational, then switched on.

There are a few things in life that give immense pleasure and a feeling of well-being. One of these is the sound of e.h.t. rustling up in a set where previously there wasn't even the slightest crackle. And this was it!

I put the back on and quickly phoned MC Mikey to tell him the good news.

"Is it fixed then?" he asked.

"Yes. It took a long time, but we got to it in the end. Have you any more divine inspiration to come my way, Guru?"

"Guru? What's that?"

Now that's what I call modesty.

What a Life: the Sets and the Customers

Donald Bullock

Greeneyes greeted me on my return from a house call, something I don't often do nowadays.

"There's a Sharp video on your bench" she said, "never been right since you mended it eight months ago. Keeps flying from play into fast forward."

"Wish they'd taken it to Snoddy's" I said.

There was a cassette inside the machine. Its case was flexible to the touch. "High flyer, first quality, made in Hong Kong" screamed its shiny red label. When I'd got it out I sealed its mouth with a label on which I wrote "do not use." The machine was full of oxide dust. I cleaned it up, especially the heads, then tried it with a different tape. It behaved itself right through. Too clever for their own good some of these machines.

Mr Pearshape

Meanwhile a pear-shaped man had driven up in a Jaguar XJ10, smoking a huge cigar. Pearshape motioned me to the boot and flicked a podgy finger at a Pye KT30 colour set.

"Pink picture. Snoddy's say it's the tube. I think it's the valve" he said with authority.

I took it in and tried it. "It's the tube" I said, masterfully.

"If you fit a tube, will the condenser fail?" Pearshape asked.

"The tripler might" I said, "nothing more."

"No more than a hundred altogether" he commanded as he plopped back into his car.

I fitted a regunned tube and switched on. There was a click and the set started to pulse. I disconnected the tripler and up came the sound. A new tripler produced a good picture. I must be getting clairvoyant.

The New Meter

My Avo 8 has seen too many summers. Finding that it no longer worked on the 250V a.c. range proved to be an invigorating experience for me the other day – I should be free of rheumatism for keeps. The pointer has become sticky too. So I decided to buy a new meter. Just which one to choose was far from easy after a lifetime with the Avo. Then I recalled that Nick Beer had reviewed and spoken well of the Cirkit TM175 in these pages not long ago. Knowing Nick, as I do, this seemed a good recommendation. So I ordered one from Cirkit Distribution. When it came, next day, it looked so pretty and worked so well that I turfed the old Avo out into the shed next door.

But when I came to test a line output transistor I couldn't see how. I swear that the Avo smiled at me as I brought it back in from the cold. Nick subsequently talked me out of my trouble and wised me up on some of the other newfangled facilities the TM175 provides. I feel more confident now. I've not yet put the Avo back out in the cold though. Truth is, I haven't got the nerve.

A Battered Black Van

A battered black van I recognised drew in. Out jumped John Berryman, rosy-faced and rustic as ever. You might think he's a farmer, fruit grower, market gardner or something like that. You'd be wrong. He's an undertaker from a distant village.

"How are you Don!" he cried as he clambered into the back of his van. "Keepin well? Ain't going to get you yet, am I? How's the missus?"

"We're both fine John" I said "you'll have to wait. What have you got in there?"

"Take your pick" said John. I got an old Philips portable telly on 'is last legs or a nice old fella gone 'ome with an 'eart attack."

"I'll settle for the set" I said, "at least I've got a hope with that."

I put John's 14CF1014 (CF1 chassis) on the bench and switched on. It produced a cramped cry then fell silent. John turned his hat in his hands appropriately.

"Death rattle" I said. Then I recalled that I'd had the same symptoms before. I unsoldered the BUT11AF transistor near the line output transformer and slipped another one in. This restored the set to life and John broke into a smile.

"That's how to do it" I said, screwing the back on. "Now lets see you get to work on that fella. It's results that count you know."

The Ferguson TX100

Mr. Parker staggered in with a Ferguson 22D1 – a TX100 chassis with a 110° tube. He carried it in with the screen farthest from his chest, as they do, and stood mopping his brow and blowing before he started.

"It 'appens after an hour" he said.

I eyed him closely and waited. But that was all.

"I must ask you what it is that happens?" I said.

"The picture turns into a bright line."

"From top to bottom or side to side?"

"Into the middle."

I straightened up and ran my finger across the centre of the screen, from left to right.

"Like that?" I said. He shook his head.

I then ran my finger from the top centre of the scren to the bottom and, nodding in anticipation, said "ah, like this then!"

He looked at me blankly. "It's more sorta in the middle" he said. I waved him out and put the set on soak test, asking myself why I wasn't a lighthouse keeper.

Three hours later the picture was still all right, so I went to get a blanket. When the set had been under the blanket for an hour or so the field rolled and collapsed. By the time I'd got the back off the set it was working normally again, so for want of anything better to do I changed the TDA3652 field output chip. After another hour under the blanket it did the same thing again.

Two Days Later

A couple of days later I'd changed everything likely to be the cause of the trouble twice or more and had got nowhere. Eventually I had a brainwave and decided to use my new Cirkit meter to monitor the h.t. voltage. I connected the meter between pin 5 of the line output transformer and chassis, then returned the set to its blanket, with the meter in my line of sight. The h.t. was correct.

After the usual delay the field rolled and collapsed and the meter's digital dial raced upwards. With a cry of excitement I yanked off the back, dragged out the chassis and stared at the wicked power supply section. Out came the TDA4600-2 chopper control chip while I checked the associated components. R114 (0·39Ω) in the drive to the base of the chopper transistor was about twice its correct value. We fitted a replacement, put everything back and set up the h.t. precisely. I then gave the set a good long soak test under the blanket. It behaved perfectly, so I got Greeneyes to phone Mr. Parker.

"At last!" he said. "Took him long enough. It was only a slight fault. Can't understand what took him so long. What's he charging?"

"Twenty five pounds fifty."

"Cor! Should have done it myself. Had one of them meter things once. Wish I'd kept it."

Satellite TV Aerial Systems

Part 4: Reception Assessment

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

This time we're going to consider the more fundamental aspects of satellite TV reception, matters that are increasingly important as the skies become more crowded. Although it's unpopular, the "link budget" calculation is nevertheless a useful tool in the installer's armoury. This is particularly so if you prefer to put together your own systems from items obtained from different sources. With the increasing use of small dishes another point to watch is the possibility of interference from adjacent satellites. Calculation of the link budget is done using standard, "off the shelf" equations. These are not particularly complicated to use – it's their derivations that can present difficulties.

The Link Budget Calculation

The string of calculations that form the link budget calculation help in predicting the suitability of a particular dish/LNB combination for reception from a given satellite transponder. An installation in the UK should meet two criteria, which we'll explain in more detail below. (1) The calculated "clear sky" carrier-to-noise (C/N) ratio should exceed the satellite receiver's f.m. demodulator threshold by a margin of at least 3·2dB. This margin is to allow for precipitation effects (rain etc.) and other losses. (2) The final C/N ratio (clear sky C/N minus a loss margin) should be sufficient to provide a post-demodulation signal-to-noise ratio of at least 43dB. This figure ensures grade 4 on the CCIR scale of picture impairment for 99·5 per cent of the time during an "average year".

C/N and S/N Ratios

C/N ratio applies to the signal prior to demodulation in the receiver while signal-to-noise (S/N) ratio is the relevant factor after demodulation. The final S/N ratio obtained is thus dependent on the C/N ratio and the demodulation characteristics. With a domestic satellite TV system the pictures obtained should be of grade 4 or better on the CCIR grade of impairment scale (see Table 1).

Table 1: CCIR scale of impairment.

Quality	*Grade*	*Impairment*	*Final S/N*
Excellent	5	Imperceptible	>50dB
Good	4	Perceptible but not annoying	>42dB
Fair	3	Slightly annoying	>36dB
Poor	2	Annoying	–
Bad	1	Very annoying	–

The demodulator f.m. threshold figure is typically about 7dB, though advances in what are called threshold-extension techniques have reduced this figure slightly. The threshold is the point where the linear relationship between the input C/N ratio and the output S/N ratio from the demodulator begins to break down. When a system is operating with C/N values near the f.m. threshold the familiar sparklies and darklies (comet or tear-drop shaped interference spots) will be seen. It follows that for good reception the aerial system has to provide a signal whose C/N value exceeds the threshold figure. Further, the S/N ratio must be at least 43dB. Various factors, some difficult to predict, tend however to reduce the C/N ratio (and consequently the S/N ratio) from "clear sky" calculated values. When grouped together these losses can be conveniently referred to as the "C/N loss margin", to which we can assign a value.

Link Margins

The clear-sky C/N ratio doesn't take into account precipitation. Rain or, to a lesser extent, snow in the reception area significantly reduces the performance of a system as the microwave signals are attenuated and scattered on their way to the receiving dish. In addition rain has an inherent noise temperature similar to that of earth (290°K average), so noise is increased. Precipitation loss, corresponding with 99·5 per cent of the time in an average year, is based on the mean rainfall over a particular continent or country.

For the UK and Europe, typical contributions to the overall C/N loss margin are as follows: (1) Atmospheric absorption loss, 0·3dB. (2) Noise temperature increase due to precipitation is equivalent to a decrease of 1·2dB in the C/N ratio. (3) Atmospheric attenuation (99·5 per cent of an average year) is 1dB. (4) An aerial de-pointing loss of 0·3dB is assumed. (5) Waveguide losses are taken as a further 0·3dB.

Thus the overall losses amount to a 3·2dB margin that must be allowed for in link budget calculations. Since this margin is based on mean rainfall, it is to be expected that heavy bursts of rain will from time to time result in brief interruptions to reception. Systems that operate close to the satellite receiver demodulator threshold are likely to be plagued by sparklies and darklies when any precipitation is present.

Aerial System Specification

We know the dish size required for reception from the Astra cluster, but what if reception is required from other

Table 2: Dish diameter guide.

EIRP (dBW)	Dish diameter in metres C/N 8dB	C/N 11 dB	C/N 14dB	C/N 17dB
35	3.45	4.87	6.88	9.72
36	3.07	4.34	6.13	8.66
37	2.74	3.87	5.47	7.72
38	2.44	3.45	4.87	6.88
39	2.18	3.07	4.34	6.13
40	1.94	2.74	3.87	5.47
41	1.73	2.44	3.45	4.87
42	1.54	2.18	3.07	4.34
43	1.37	1.94	2.74	3.87
44	1.22	1.73	2.44	3.45
45	1.09	1.54	2.18	3.07
46	0.97	1.37	1.94	2.74
47	0.87	1.22	1.73	2.44
48	0.77	1.09	1.54	2.18
49	0.69	0.97	1.37	1.94
50	0.61	0.87	1.22	1.73
51	0.55	0.77	1.09	1.54
52	0.49	0.69	0.97	1.37
53	0.43	0.61	0.87	1.22
54	0.39	0.55	0.77	1.09
55	0.34	0.49	0.69	0.97
56	0.31	0.43	0.61	0.87
57	0.27	0.39	0.55	0.77
58	0.24	0.34	0.49	0.69
59	0.22	0.31	0.43	0.61
60	0.19	0.27	0.39	0.55
61	0.17	0.24	0.34	0.49

Based on the following assumptions: free space loss 206dB; aerial efficiency 60 per cent; total noise temperature 240°K; frequency 11GHz; bandwidth 36MHz.

Ku-band satellites? How is a reasonable dish diameter and LNB combination to be specified without resorting to guesswork? The answer is to calculate what we can and to make some general assumptions, erring on the side of safety when it comes to those awkward, variable characteristics. Start by making an educated guess as to a reasonable dish diameter and LNB noise figure, then carry out the link budget calculation outlined below. Table 2 can be used as a reasonable guide to dish diameter for a specific satellite e.i.r.p., but note the assumptions listed beneath the table. The general equation for the clear-sky C/N ratio is:

$$C/N = P + gt - b - nb - a$$

where P is the effective isotropic radiated power in dBW, gt is the figure of merit in dB/°K, b is Boltzmann's constant (−228·6dBW/Hz°K), nb is the noise bandwidth (dBHz) and a is the free-space loss in dB. The satellite's e.i.r.p. can be obtained from the relevant footprint map provided by the operator.

The final system C/N ratio is simply the clear-sky C/N minus the C/N loss margin (dB).

Figure of Merit

The figure of merit in dB/°K is given by $10 \log (10^{G/10}/T)$, where G is the aerial gain (see page 424, April, under the heading "aerial efficiency") and T is the total noise temperature in °K, i.e. the aerial plus the LNB noise. The equation for calculating the LNB noise temperature was given on page 575 last month. As an alternative to calculation, Table 3 provides conversions from noise figure to noise temperature. A figure for aerial noise is not possible to calculate fully. Values are sometimes quoted by aerial manufacturers for a given elevation angle (usually 30°). In the absence of such information a worst case figure for northern European latitudes can be taken as around 120°K (more on this below). Alternatively a worst case total noise figure of 240°K is often used. This is easily realised with a 1·5dB or less LNB and even a small dish, operating at UK elevation angles.

Aerial Noise

Aerial noise (in °K) is not always quoted by aerial manufacturers since it's difficult to estimate an accurate figure. Many factors affect aerial noise, some of which are as follows: (1) The smaller the aerial the greater the sky noise, because the wide beamwidth means that a larger portion of the sky is seen. (2) Noise temperature also depends on the amount of water vapour, atmospheric pollution etc. present. (3) Noise temperature also varies

Table 3: Noise figure/temperature conversion.

Noise figure (dB)	Noise temp. (°K)	Noise figure (dB)	Noise temp. (°K)
0.05	3.36	1.55	124.38
0.10	6.75	1.60	129.18
0.15	10.19	1.65	134.03
0.20	13.67	1.70	138.94
0.25	17.18	1.75	143.91
0.30	20.74	1.80	148.93
0.35	24.34	1.85	154.02
0.40	27.98	1.90	159.16
0.45	31.66	1.95	164.36
0.50	35.39	2.00	169.62
0.55	39.15	2.05	174.94
0.60	42.96	2.10	180.32
0.65	46.82	2.15	185.77
0.70	50.72	2.20	191.28
0.75	54.67	2.25	196.85
0.80	58.66	2.30	202.49
0.85	62.69	2.35	208.19
0.90	66.78	2.40	213.96
0.95	70.91	2.45	219.80
1.00	75.09	2.50	225.70
1.05	79.32	2.55	231.67
1.10	83.59	2.60	237.71
1.15	87.92	2.65	243.82
1.20	92.29	2.70	250.01
1.25	96.72	2.75	256.26
1.30	101.20	2.80	262.58
1.35	105.73	2.85	268.98
1.40	110.31	2.90	275.45
1.45	114.95	2.95	282.00
1.50	119.64	3.00	288.63

Calculated at 290°K ambient temperature.

Table 4: Estimated aerial noise.

Aerial size (m)	Elevation 15°	20°	25°	>30°
3·7	35°K	31°K	29°K	29°K
3·0	36°K	32°K	31°K	30°K
2·3	40°K	36°K	35°K	34°K
1·8	45°K	41°K	39°K	38°K
1·2	51°K	45°K	42°K	41°K
0·9	85°K	65°K	55°K	43°K
0·6	110°K	95°K	65°K	45°K

Table 5: Link budget results.

Characteristic	*Astra 1A*	*Eutelsat 13°E*
Dish diameter	65cm	65cm
Satellite e.i.r.p.	50dBW	50dBW
Carrier frequency	11·347GHz	11·6GHz
Path distance	39,001km	38,855km
Free space path loss	205·37dB	205·53dB
Aerial efficiency	60%	60%
Aerial gain	35·54dBi	35·74dBi
LNB noise figure	1·4dB	1·4dB
Aerial noise temp.	65°K	65°K
Total noise temp.	175·31°K	175·31°K
Figure of merit	13·11dB/°K	13·3dB/°K
Clear sky C/N ratio	12·19dB	10·81dB/°K
Final C/N ratio	8·99dB	7·61dB
Channel bandwidth	27MHz	36MHz
Video bandwidth	5MHz	5MHz
Video deviation	16MHz/V	25MHz/V
Clear sky S/N ratio	43·73dB	47·64dB
Final S/N ratio	40·53dB	44·44dB

with the aerial's elevation angle. Low elevation angles, required at higher latitudes, result in increased noise pick up. Not only is the signal path length through our rather grubby atmosphere greater, adding to the sky noise, but more importantly the contribution from ground noise is increased by diffraction effects at the aerial aperture (see Part 1), smaller dishes being affected most. (4) Aerial design itself: a poorly manufactured aerial may pick up excessive noise from directions other than the intended one. (5) Man-made noise.

Since aerial noise is not calculable an estimate is the best we can achieve. Table 4 can be used as a rough guide. Since values tend to vary little at elevations above 30°, aerial noise is often quoted at this elevation.

Noise Bandwidth

Noise bandwidth in dBHz is given by 10 log times the channel bandwidth, which for a particular satellite transponder is typically 27MHz or 36MHz.

Free Space Path Loss

The free space path loss of the signal on its way to earth, in dB, can be calculated from the formula:

$$a = 20 \log [(4\pi \times pd \times 1{,}000)/w]$$

where w is the wavelength in metres and pd is the path distance from the satellite to Earth, given in km by (42,164 sin C)/cos elevation. Equations for calculating C and the elevation were given in Part 2 (May, page 498). If the wavelength isn't known it can be calculated from c/f where f is the channel frequency and c is the speed of light (3×10^8m/s). Those not wishing to perform these tedious free space path loss calculations can assume a nominal value of 205·7dB.

Checking C/N and S/N Values

Once you've calculated the clear-sky C/N ratio, to obtain the final C/N value you simply subtract the 3·2dB fixed loss margin outlined above. Compare this final value with the proposed receiver's demodulator threshold figure. If the final C/N ratio is above the f.m. threshold, check that a S/N figure of at least 43dB is obtained after demodulation by performing the following calculations. This checking will ensure that grade 4 reception is obtained for 99·5 per cent of the average year.

$$S/N = C/N + fmi + pe + wf \text{ (dB)}$$

where S/N is the final S/N ratio, C/N is the final C/N ratio, fmi is the f.m. improvement (in dB), pe is the pre-emphasis improvement (typically 2dB) and wf is the weighting factor, which is typically 11·2dB for PAL/SECAM or 13dB for MAC.

The f.m. improvement on demodulation is given, in dB, by:

$$10 \log [1{\cdot}5\, (f/vf)\, (rf/vf)]$$

where f is the deviation (MHz/V), rf is the transponder bandwidth in MHz and vf is the video bandwidth or highest video frequency (MHz).

Calculation Example

When I calculated the link budget for Astra 1A at 19·2°E and Eutelsat II at 13°E for a receiving site in Liverpool I obtained the results listed in Table 5. Notice that the Eutelsat II's wider transponder bandwidth results in a higher S/N ratio for a given C/N ratio. At this location both provide clear-sky C/N CCIR grade 4 reception using a 65cm dish and a 1·4dB LNB. When the clear-sky C/N and S/N ratios are reduced by taking into account the 3·2dB link margin the S/N ratio for Astra is slightly below grade 4.

To take into account the 3·2dB loss margin, with the dish size and LNB noise figure quoted, the demodulator threshold should be about 9dB for Astra 1A but would need to be less than 7·61dB with Eutelsat II. Most quality receivers should have demodulator thresholds below these figures in the near future. The main point is that with a 27MHz transponder bandwidth the aerial size is dictated by the need for a relatively high C/N ratio in order to achieve an adequate S/N level of 43dB. With a 36MHz bandwidth the aerial size is dictated more by the need for the C/N ratio to be above the demodulator threshold, since a consistently higher S/N value is achieved for a given C/N ratio. It follows that as threshold extension techniques are further developed and refined, smaller aerials will be acceptable for Eutelsat II reception.

To bring Astra 1A reception up to standard the solution is to try a slightly larger dish or a lower noise figure LNB and recalculate, rather than risk numerous recalls because of poor reception. I don't know what Astra reception is like outside the Liverpool area, but here constant sparklies on some channels seem to be present with a fair proportion of brand new 60/65cm packaged systems. It seems to me that 70/80cm dishes should be specified for reception from the Astra cluster in the northern areas if consistent results are to be achieved with all the transponders.

More on Beamwidth

Since covering beamwidth earlier in this series of articles I've used the computer to calculate and plot theoretical beamwidth/radiation patterns for any dish size/wavelength combination. The diagrams shown in Figs. 24-26 are developed from a reasoning involving Bessel functions and are extremely tedious to produce without the use of a computer. They show the uniformly illuminated beamwidth diagrams/radiation patterns for 45, 60 and 90cm parabolic reflectors at a frequency of 11GHz.

Table 6: Theoretical aerial beamwidth (degrees) at 11GHz.

Dish diameter	−3dB	−6dB	−10dB	−12dB	−17·6dB
0.30m	5·35	7·34	9·07	9·70	10·98
0.40m	4·01	5·50	6·80	7·28	8·23
0.45m	3·57	4·89	6·04	6·47	7·31
0.55m	2·92	4·00	4·94	5·29	5·98
0.60m	2·68	3·67	4·53	4·85	5·48
0.65m	2·47	3·39	4·18	4·47	5.06
0·75m	2·14	2·93	3·62	3·88	4·39
0.80m	2·01	2·75	3·40	3·64	4·11
0.85m	1·89	2·59	3·20	3·42	3·87
0.90m	1·78	2·44	3·02	3·23	3·66
1.00m	1·61	2·20	2·72	2·91	3·29
1.20m	1·34	1·83	2·26	2·42	2·74
1.50m	1·07	1·47	1·81	1·94	2·19
1.80m	0·89	1·22	1·51	1·62	1·83
2.00m	0·80	1·10	1·36	1·45	1·64
2.20m	0·73	1·00	1·24	1·32	1·50
3.00m	0·54	0·73	0·91	0·97	1·10

Table 7: Theoretical aerial beamwidth (degrees) at 12GHz.

Dish diameter	−3dB	−6dB	−10dB	−12dB	−17·6dB
0.30m	4·91	6·73	8·31	8·89	10·06
0.40m	3·68	5·04	6·23	6·67	7·54
0.45m	3·27	4·48	5·54	5·93	6·70
0.55m	2·68	3·67	4·53	4·85	5·48
0.60m	2·45	3·36	4·15	4·44	5·03
0.65m	2·26	3·10	3·83	4·10	4.64
0·75m	1·96	2·69	3·32	3·55	4·02
0.80m	1·84	2·52	3·11	3·33	3·77
0.85m	1·73	2·37	2·93	3·14	3·55
0.90m	1·64	2·24	2·77	2·96	3·35
1.00m	1·47	2·02	2·49	2·67	3·02
1.20m	1·23	1·68	2·08	2·22	2·51
1.50m	0·98	1·34	1·66	1·78	2·01
1.80m	0·82	1·12	1·38	1·48	1·68
2.00m	0·74	1·01	1·25	1·33	1·51
2.20m	0·67	0·92	1·13	1·21	1·37
3.00m	0·49	0·67	0·83	0·89	1·01

The main lobe and first three side lobes are shown. Notice that in all three diagrams the first side lobe has a theoretical amplitude of 13 per cent with respect to the main lobe, i.e. it's 17·6dB down. In reality however the actual main lobe amplitude increases with dish size, since field strength depends on aerial gain. We are interested in beamwidth and side lobe formation here however, so the vertical axis is shown as relative field strength.

Besides their general interest and usefulness for reference purposes these diagrams may be helpful in evaluating the possibility of interference from adjacent satellites. As previously mentioned interference is first noticed at about −11dB. So if you halve the −10dB beamwidth you get an indication as to the minimum dish size that can be used with adjacent satellites that use the same frequencies and polarisation senses. This effect is relevant with only smaller dishes however. In practice, beamwidths can be up to 20 per cent wider than shown since satellite aerials usually employ an illumination taper towards the outer edge of the dish to reduce ground noise picked up from beyond the rim. This technique tends to reduce the side lobe amplitude in relation to the amplitude of the main lobe, but reduces the effective diameter and gain of the dish.

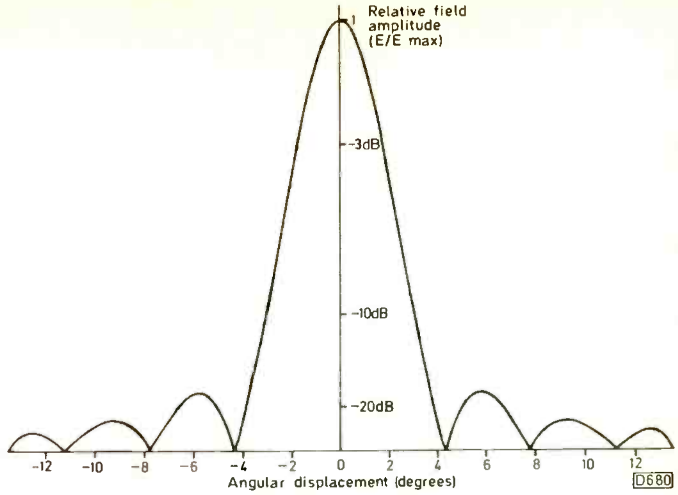

Fig. 24: Theoretical polar response for a 45cm parabolic reflector at 11GHz, with 100 per cent illumination.

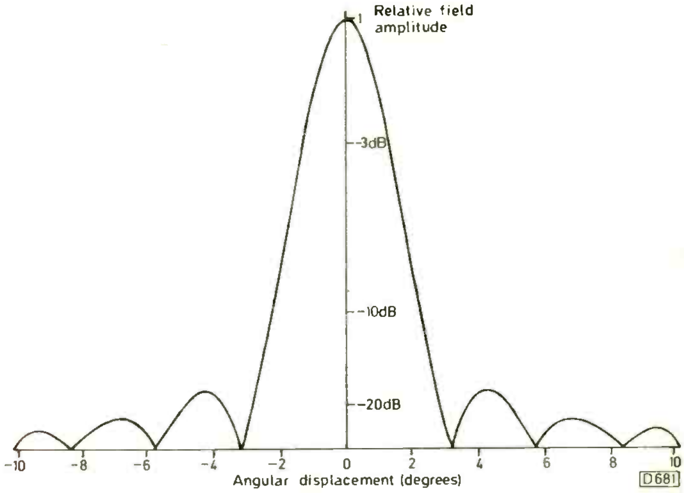

Fig. 25: Theoretical polar response for a 60cm dish at 11GHz, with 100 per cent illumination.

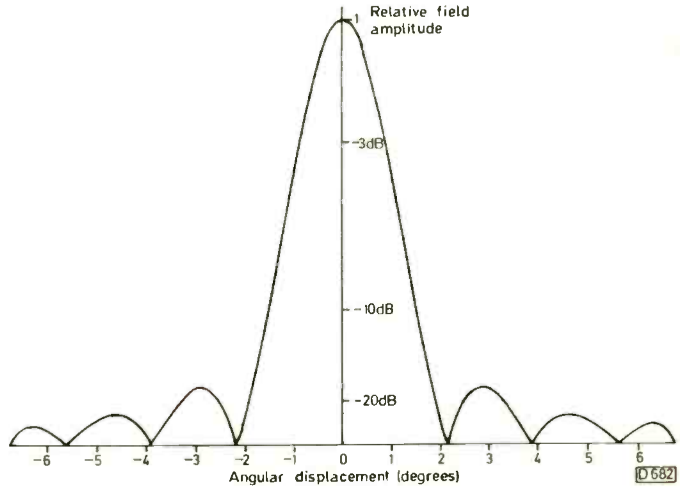

Fig. 26: Theoretical polar response for a 90cm dish at 11GHz, with 100 per cent illumination.

It's worth remembering that a satellite's aerials also have side lobes that transmit power in directions other than the main one. This effect is known as "spill over", and because of it reception of weak signals far outside the official footprint area is sometimes possible.

Finally, for reference purposes Tables 6 and 7 list theoretical beamwidths for a variety of dish sizes at 11GHz and 12GHz respectively.

The Euras Information Database

Eugene Trundle

The repair and servicing of consumer electronic equipment is not easy. It becomes more difficult as the years pass and more complex systems and techniques are introduced. The key to success is fast and accurate diagnosis: the more quickly a diagnosis is made at component level the faster the repair turn-round. If we are to stay in business, a good throughput is essential. Anything that helps with this is therefore more than welcome.

Providing Help

Over the years there have been several approaches to assisting with the diagnostic process. *Television* devotes much of its space to fault reports, articles on particular types of circuits and the appropriate servicing techniques, and run-downs on faults common on particular chassis and items of video equipment. A number of very successful books on servicing have been published, such as those in the Butterworth/Heinemann catalogue. Manufacturers produce fault listings and service bulletins, and have technical advice lines manned by engineers who are – hopefully – expert in the technical aspects and bad habits of particular products. Some manufacturers hold information in databases that are available to service agents via viewdata terminals. And, at the grass-root level, a great deal of information is stored in the memories of individual engineers – and often in notebooks and as scribbled annotations on circuit diagrams.

The Euras Approach

A new approach has been established by the Bristol-based Euras International Ltd. in the form of a database available in book, on-line or PC disc form. For the purpose of this review a complete set of books was kindly lent to us by SEME Ltd.

In book form the Euras Information System consists of a separate volume for each manufacturer. Inevitably they vary considerably in size and price – from 38 pages at £9.95 for the Mitsubishi data to 361 pages at £19.95 for the Philips volume. Each book is in A4 (300 × 210mm) size, with a transparent cover and "comb" spine binding to permit updating. The data for each type of equipment – TV, VCR, CD player – is organised under headings like servo, picture, function, radial, colour, deflection and so on. The models covered are listed in alphabetical order in an index at the front of each book.

The system lists thousands of faults reported by participating technicians all over Europe, primarily those who work in service centres where faults that dealers' engineers have failed to diagnose are investigated. The emphasis, as the introductions to the books point out, is thus on rare and unusual problems rather than the simpler stock faults.

An updating service is available so that new information can be disseminated as soon as it's available. This is available on subscription, which for the on-line system currently costs £8 plus VAT per month. Feedback forms are available for subscribers' contributions to the database.

Twelve books are available at present, covering Akai, Ferguson, Grundig, Hitachi, ITT, JVC, Mitsubishi, NEC, Panasonic, Philips, Sharp and Sony products. Books covering Sanyo/Fisher, Pioneer, Toshiba and Thorn equipment should be available soon, and there are plans for others in the near future.

In Use

To get a full feel for their usefulness we used these books constantly in the workshop over a period of several weeks. The printing quality is good, though the paper is easily soiled by grubby fingers straight out of TV sets. The binding method enables the books to be laid dead flat, and is just robust enough to stand the onslaught of a busy workshop if care is taken.

There are many spelling mistakes, and some of them really matter. For example we are told in the Hitachi book to change a capacitor from 15F to 3·35F, we have reference to "sieve electrolytes" and 30μF, 1W resistors, and there is this passage: "The swing transistors Q206 and Q206 and Q207 operate badly. In order order the trasistors can be dismantled completely. IC201 (HT4207) amplifies differently, can be tested on point 1". This is of course just garbage, suggesting translation problems and/or that the books have never been edited, checked or corrected.

Similarly, some of the questions and answers are meaningless."Colour moire in the picture is missing", "randamly useing all functions" and the "HF-channel is changed" take some figuring out if you can do so at all. Amongst the answers, "longterm line" (just that), "the tape's voltage is too high. The tape guide spring is too short, dismount the cassette" and "filter CP1805 is twisted" are hardly helpful.

Most of the information can be followed however, and a great many faults and cures are given. It's plain that many of the faults listed are one-offs, even extending to the effect of liquid spillage. Some of these faults are, by their nature, very unlikely to occur again. Nevertheless we found that some, but by no means all, the commonly recurring faults are included.

In general the database is much more useful to the VCR serviceman than to his TV or audio colleague. In the Panasonic book for example there are 186 pages on VCRs, 43 on TV sets and three on CD equipment. For Mitsubishi there are 35 pages on VCRs and two on TV sets; the ITT book has 228 pages on video equipment, some duplicated in other books under different brands, 36 pages on TV sets and one on audio; while the Philips book, the largest by far, has 162 pages on VCRs, 125 on CD equipment, 64 on TV sets plus some information on hi-fi, clock radios and in-car entertainment – certainly this one seems to be the best bargain of them all. The books have an average of nine faults per page.

The database reaches back quite far enough from our point of view: to the JVC HR3300, Sharp VC2000, Ferguson TX9 and the Sony KV1340 and SL8000 for example. At the other end of the time scale the coverage of new and newish models is somewhat sparse, with just one and a half pages on Sony VHS equipment for instance. Generally there's little information on products less than about three years old. No doubt the updating system will compensate for this in the fullness of time.

So how much did these repair tips help us with day-to-day repairs in the workshop? Not as much as we'd hoped, but useful information was obtained and used on a number of occasions during the several weeks we had the books. I consider that inclusion of the more common faults would have enhanced the books' value.

Conclusion

In conclusion, the concept of these books is excellent, though the compilers and publishers would probably be the first to agree that they are no substitute for technical knowledge and experience. The presentation leaves a lot to be desired, and the spelling and printing errors and the odd and careless reporting of both symptoms and cures are difficult to excuse. If ever books needed the services of a good editor and copy reader these do! Even so they manage to get most of the messages across.

In spite of these criticisms I can recommend the books for this very simple reason: the average labour charge in our industry is around £20 an hour, so that if each book saves one hour of time, perhaps with just one tip you use out of the hundreds it contains, it will have paid for itself. There is little doubt that each book will achieve this end in the first few days or weeks of use and will continue to do so, with or without updates, in the future. Plainly then the database is a worthwhile investment in whichever form it's purchased.

The information system is available from Euras International Ltd., Heston House, 7-9 Emery Road, Brislington, Bristol BS4 5PF (0272 724 475, fax 0272 723 374). The books can also be obtained from SEME Ltd., Units 2E/F, Saxby Industrial Estate, Melton Mowbray, Leicestershire LE13 1BS (0664 65 392, fax 0664 63 976).

Service Briefs – Hitachi CTVs

The following notes are based on information issued by Hitachi and items noted on recent courses.

C14-P216/218: A bright white screen can be caused by a dry-joint at C711 due to pressure from the back cover. Resolder and cut away part of the back cover to remove the pressure on C711.

A loud buzz on sound was caused by some early TA8691N chips (IC201) with mask codes 929, 932 and 942. If necessary fit a replacement – part no. T900486.

C21-P226/228, C21-P818/819, C25-P228, C2196/2198/2578/2596/2598/2598A (G8Q chassis): The line output transistor Q702 can fail intermittently due to interaction between coils L701 and L703. Ensure that the replacement transistor is an Hitachi supplied type, part no. T636041. Ease L703 away from L701 by moving it towards R707, then secure it with hot melt. Ensure that L703 does not cross the barrier line marked on the PCB. Check C710, C711, C712, L703, R707 and R724 for dry-joints.

If the set trips off intermittently check the value of R910 (0·5Ω). It tends to increase in value.

For no sync replace Q2110 (BC548B) on the teletext panel.

C25-P818/819, C28-P818/819, CPT2138/2508/2808 (G7P chassis): The dead set symptom is commonly caused by failure of the chopper transistor Q901. Replace it with an Hitachi supplied type, part no. T636035, change C914 from 2·2μF to 10μF and add a 2·7Ω resistor in parallel with R906 and R906A.

If the power supply has "blown up", replace R931 (150kΩ, metal oxide) in addition to all the defective components.

For clicking and very poor nicam reception adjust L5 on the panel between the teletext and nicam boards.

C2118R/T: R909 (39kΩ) tends to go high in value with the result that the set trips as the h.t. is too high.

CPT1455: The dead set symptom is often due to failure of zener diode ZD901. Failure of IC901 and D901 is another common cause of a dead set. Part numbers are 2911171 and 2335981 respectively. Use two diodes connected in series in the D901 position.

CPT2046/2048/2246/2248 (NP83CQ MkII chassis): If the set continues to operate in the standby mode replace Q1431 (2SC2610, part no. 2324323) and D912 (EM1A, part no. 2334591). When these are faulty the 110V line can remain high enough for the set to continue to work.

CPT2078/2158/2278: Teletext faults – no teletext, no page number, page number displayed out of sync or erratic teletext – are usually caused by failure of IC2203 (SAA5030).

CPT2158: Buzz on sound can by caused by an earthing loop associated with the field deflection circuitry. To cure, fit a shorting link on the print side of the PCB between pin 1 (chassis) of IC601 and the negative side of C713.

For corrupt teletext remove L205 and L007; short-circuit C010; add a 68pF capacitor (part no. 02486803) and a 10μH coil (part no. L420130) in series across R222; finally adjust the tuner's i.f. core for best text.

CPT2174/2176/2178/2476/2478 (G6P chassis): If there's a light, horizontal bar at the top of the picture, replace the chopper drive chip CP901.

If the set switches back on after standby has been selected, replace the 1MΩ resistor on the scan coils.

If line jitter at the top of the screen is experienced when the set is used with some VCRs, change R706 and R716 to 5·6kΩ. R706 is not fitted in Model CPT2174 where the flywheel sync filter circuit is arranged slightly differently.

CPT2188/2568 etc.: If the set is stuck in standby replace capacitor CB604.

CPT2198/2508/2578/2808 using teletext board A519600, issue 4: No teletext reception on one or two channels can be caused by incorrect timing of pulse M1 because of poor stability with C2109. In most cases removing the wire link or resistor fitted in place of VR2107 will restore the pulse to its correct position. If not, replace C2109, using an 820pF high temperature stability type (part no. C822562). If difficulties are still experienced, fit a 4·7kΩ preset (part no. E311055) in position VR2107.

CPT2218 (NP81CQ chassis): For field cramping replace C608 (22μF, 160V) which decouples the supply in the field output stage.

CPT2656/2658: If the set is stuck in standby DB506 is probably leaky.

For lack of contrast change the value of RB166 from 220Ω to 180Ω.

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Long-distance Television

Roger Bunney

April was a very quiet month for long-distance reception in Europe. There was unfortunately no hint of a mid-month Sporadic E opening, the usual indication of a good season to come. Even the Lyrids meteor shower produced little by way of signals. There was some SpE reception however, and F2 reception occurred on one day. In Australia the conditions during early April were much better. We'll report on that shortly, meanwhile the SpE log for the month is as follows:

5/4/91	TVE (Spain) ch. E2, 3.
6/4/91	TVE E2; TVP (Poland) R2.
10/4/91	TVE E2, 3.
12/4/91	SVT (Sweden) E2.
13/4/91	TVE E2; RAI (Italy) IA.
22/4/91	TVE E2, 3, 4; RTP (Portugal) E3; NRK (Norway) E2.
23/4/91	TVE E2, 3.
28/4/91	TVE E2; SVT E2.
29/4/91	+PTT (Switzerland) E2; TVE E2.

Three of our regular correspondents reported F2 reception on the 12th. The morning period through to lunchtime produced ch. E2 signals from Malaysia, Dubai and Iran, a distant ch. R1 signal from the USSR and, the icing on the cake, Australia DDQ-0 Queensland ch. 0.

There were two spells of tropospheric reception, concurrent with high pressure systems over the UK. Signals from Germany, France and the Benelux countries were received across much of central/south east England over the period 11-15th, the best catch being Poland ch. R8, received in North Wales. The second lift, during the 25-27th, produced signals from Germany, Denmark and the Benelux countries. During both openings there were signals in Band III and at u.h.f. In addition during the second opening German Band I signals were received in East Sussex.

My thanks to Simon Hamer (Powys), Tim Anderson (St. Leonards), Cyril Willis (King's Lynn), Peter Schubert (Rainham) and David Glenday (Arbroath) for sending in reception reports.

CNN on Ch. E2

We've had a report of CNN International being seen on ch. E2. Quite by chance a copy of *The Straits Times*, dated early April, arrived recently. The TV page confirms that this programme is transmitted live from 0700-0830 and 1830-2000 local time. Though only Band III transmitters are listed for Singapore, there's the possibility that an E2 outlet is operational.

Australian Reception

Meanwhile Robert Copeman (Victoria) and Anthony Mann (Perth) both report excellent reception in Australia during the first eight days of April. Robert comments that it has been the best period for many years, the low v.h.f. spectrum being jammed with signals. His TV reception report includes West and East Malaysia ch. E2, several ch. C1 Chinese stations, Vladivostok and Rostov ch. R1 in the USSR, AFKN-TV ch. A2 from South Korea and Thailand ch. E2.

Anthony Mann reports a very busy period, with the m.u.f. to the north reaching 57·75MHz on one day. He comments that such activity hasn't been experienced since the peak of the last sunspot cycle in 1979! He has some amendments to our vision channel offset list last month: there's no offset with Thailand ch. E2, but Genting Sempah, West Malaysia uses 48·24MHz while another Malaysian station uses 48·26MHz. Anthony suspects that much of the reception in Victoria is via F2 with a second boost given by SpE propagation. Conditions died down by the 15th, when only New Zealand ch. 1 was received in Perth.

News Items

France: TF1 and Canal Plus are holding discussions on starting a joint all-news channel which could be in operation by next spring. Thomson CSF is to assist in re-equipping the Kuwaiti TV service.

USSR: The Russian State TV and World Television News are to co-operate in providing a new TV service. It will initially be a local service using low-powered transmitters and should be in operation next autumn for 24 hours a day. The USSR is planning to start a DBS service using three satellites. The UK music channel MTV is now available over the Leningrad cable network. Incidentally the USSR will not be introducing summertime next year, and in the the autumn the clocks will be put back one hour. The European part of the USSR will therefore be at plus two hours with respect to GMT as the standard winter time – the same as Finland.

Poland: The Polish TV authorities have received over 250 franchise applications for private TV – there's to be one national network plus several regional licences for main centres of population. As a result of financial restraints it doesn't look as if TVP-3 will get off the ground and the future of TVP-2 is questionable.

Greece: As a result of the growth in popularity of the private stations the advertising revenues of the national broadcaster ERT fell by fifty per cent last year.

50MHz Amateur band: Spanish amateurs are now allowed to use the 50MHz band, though details of power, frequency limits etc. have yet to be released here. Israel is allowing limited activity in the band and Monaco has agreed to those with five years' experience using the band. The Swiss authorities do not allow operation during TV broadcasting hours, which restricts use of the band to 0030-0500.

New EBU Listings

France: Argent-sur-Creuse La 5 ch. E38 18kW; Autun M6 ch. E42 1,000kW, La 5 ch. E45 300kW. All with horizontal polarisation.

Germany: Niebuell chs. E40 and E56, both 20kW horizontal.

Satellite Scene

The Italian satellite TV service Raisat, which broadcasts a package of the best from the three main RAI terrestrial services, is to increase transmission time via the Olympus satellite to over twelve hours a day. It hopes to be able to offer three Europe-wide programmes via the SARIT craft from mid 1993 – if SARIT doesn't go ahead transponders may be leased on a Eutelsat series II satellite. Raisat at present transmits in the clear, but if the audience expands D2-MAC and encryption may be adopted.

Coverage of the Philippine PTV-4 Peoples TV network is to be increased by use of the Palapa II satellite to provide links to terrestrial stations throughout the island state.

Satellite Information Services, the UK group that provides a TV service to betting shops via the Intelsat craft at 27°W, is to extend its service to the general public, pubs, hotels, etc. – at a price. The full-time encrypted B-MAC service will cost £4,200 a year, inclusive of installation, a decoder and the subscription fee. A budget package will provide a two-hour evening coverage of the day's events for £75 a month subscription fee plus £600 for the equipment. The equipment consists of a fixed 90cm dish, a receiver and an addressable B-MAC decoder. B-MAC is to be used shortly for the occasional horse racing transmissions from various sites in the UK via the Intelsat craft at 21°W – these have been in the clear to date, though of variable quality because of the satellite's inclined orbit.

The FCC has introduced regulations for mandatory subcarrier identification of each uplink station. Known as ATIS – automatic transmitter identification system – the system came into operation on May 1st.

Brightstar has leased three hours a day channel time via the Gorizont craft at 14°W to transmit news from Moscow to Europe and the USA.

Astra 1B is now up and running, though concern has been expressed in Scandinavia and the northern UK about some of the transponders that use vertical polarisation. Measurements in Scandinavia, comparing Astra 1A and 1B, indicate that with 1A a carrier-to-noise figure of 14-15dB is obtained using a 90cm dish while with 1B a C/N ratio of only 8-9dB is obtained with a 2m dish.

Governments in Japan's neighbouring countries – Korea, the Philippines and Taiwan – are not too happy about footprint spillover from the new BS series of satellites, though viewers have taken to NHK's output. Government complaints have been about "cultural invasion".

Satellites could spell the end of international short-wave broadcasting as we know it today. The International Radio Satellite Corporation, based in Washington, is planning to put into orbit three satellites each capable of transmitting up to 200 L band radio channels to terrestrial receivers. This would give interference-free reception without fading, and of course high-quality sound. The plan is to put the first radio satellite into orbit in 1995. Many international broadcasters, including the BBC, Radio Moscow and the VOA, have expressed interest in direct involvement in the project.

Early DX-TV

Some while ago in this column we described what was at the time thought to be the earliest DX-TV reception on record – when BBC TV from Alexandra Palace was received at the RCA research establishment in New York state in 1938. I recall Charles Rafarel, who pioneered DX-TV in the UK and started this column, telling me in the early Fifties about his medium-wave reception of 30-line TV in Leeds in about 1933. So I was particularly interested to see in the March issue of the British Telecom publication *British Telecom World* a detailed account of the reception of Baird's 30-line transmissions in the USA during the early morning of Wednesday, February 8th 1928. Baird first demonstrated 30-line TV at his Soho, London laboratory in 1926, assisted by his engineer Benn Clapp who was well experienced in radio transmission and reception. Benn had been recruited by Baird to carry out experiments in TV transmission. These took place at m.f. Baird had already transmitted TV pictures to Benn's house near Gatwick via Post Office lines, and it was from this house that the 30-line transmissions, from a 260-foot high mast, were received in the USA.

On February 8th 1928 Benn Clapp and a number of newspaper reporters gathered at a house in Hartsdale near New York to witness the first transatlantic TV, from Baird's Long Acre, London studio. There was great interest in New York when pictures were received. Though the images were not of high quality they could nevertheless be recognised, and considerable press publicity followed. Benn Clapp even received pictures during his return voyage on the S.S. Berengaria. One result of the publicity was considerable investment interest in Baird's company Baird Television Ltd. This funded the early development of Baird's TV systems, which were eventually to be dropped in favour of EMI's 405-line system.

A particularly interesting feature of the article, entitled "Man of Vision", is a reproduction of the front page of the February 9th, 1928 issue of *The Auburn Citizen*, which carried a long report on the event at the house in Hartsdale. It also described the experience of being a model (victim?) in Baird's mechanical TV studio with its rotating wheels and flashing scanning lights. Readers interested in obtaining a copy of the March issue of *British Telecom World* should write to the magazine at the British Telecom Centre, 81 Newgate Street, London EC1A 7AJ. The article is on pages 58-61.

VCR Clinic

Reports from Philip Blundell, AMIEIE, Gerald Smith, Nick Beer, Ian Bowden, Steve Cannon, Mick Dutton and Joe Cieszynski

Philips VR6490

The E-E and record pictures were smeary though playback of a prerecorded tape was fine. Scope checks showed that the video output from the i.f. section was o.k. and remained normal right through the AV switching chip IC43. It was poor after R3A6 because Q3A3 was conducting when it shouldn't have done, placing C3B4 ($0{\cdot}01\mu F$) across the video signal – hence the smeary picture. There was 1V at the collector of Q454 when there should have been 0V. On test Q454 (2SA933) was found to be leaky. **P.B.**

Grundig VS300

This machine wouldn't accept a cassette. If one was wound in by turning the loading motor by hand however it would be ejected when asked. We found that the brake switch had a high-resistance contact. It's a two-way switch, so check both ways! When you fit a replacement be careful not to strain the switch pins – they can move if handled roughly and you then end up with the same fault! **P.B.**

Philips VR6470

The problem with this machine was wow on the playback sound. This is often due to a faulty capstan motor or belt, but not this time. The speed servo loop includes the SDA1009 chip, the capstan tacho signal and the L293 drive chip's signals. The mark-space ratio of the drive signals varied, as you would expect, but they were otherwise o.k. Phase control is via the SAB8051 chip, where there were too many control track pulses: instead of one every 40msec, each correct pulse was followed by another one 20msec later! The cause of the problem was that the control track pulse processor didn't ignore the negative control track pulses because C2326 ($4{\cdot}7\mu F$) was open-circuit. **P.B.**

Toshiba V500B

For poor rewind check that the drum guides rotate freely. In this machine the guides were jammed with dog hairs. This model rewinds threaded up – an E180 tape should rewind in less than six minutes. **P.B.**

Sanyo VHR7700

For intermittent loss of colour in the record mode first check that the 4·43MHz signal is present at pins 18 and 19 of IC111. If o.k., check that an 80mV peak-to-peak chroma oscillator signal is present at pin 17. If the chroma signal is missing, check at the CCD delay line IC102 where you may find that pin 7 is short-circuit. You can also find that the luminance output at pin 4 is missing. The cure is to replace IC102, which is type LC8992. **G.S.**

Panasonic NV7200

The complaint was that when record was selected the clock went out and the channel number went back to one. We found that it did the same if play was selected. It did this as soon as the loading motor came under pressure and the drum started, so we were looking at a supply problem. Checks showed that the unregulated 13V supply dipped to 8V when the problem arose. Disconnecting the heaviest loads in turn proved their innocence until we tried the DD unit, when the fault cleared. But fitting a replacement didn't help. This confirmed my original suspicion that it was a supply problem. The reservoir capacitor C1005 had been changed and fitting another one didn't help. A new set of bridge rectifier diodes solved the problem. **N.B.**

Panasonic NV-G45

The customer's complaint was that this machine would sometimes eject a tape during rewind. Our field engineer had tried the solenoid and resoldering the servo pack connections and noted on the job card that he'd not seen the fault. When we tried the machine it worked o.k. but then failed to half lace when a new cassette was inserted. The solenoid wasn't being energised, the most likely reason for this being a faulty mode switch. This would also account for the original complaint. Fitting a new one cured both problems. **N.B.**

Ferguson 3V57

When you get one of these machines with the mode timing out of sync, for example the arms are laced, the carriage is up and the pinch roller and post are engaged as if in the play mode, do the usual regreasing/replacement of the mode motor/cam assembly, replace the loading belt and retime the mechanism. Also expect the mode sensor photo-interrupter fitted around the black cam on the underside of the mode cam assembly to be faulty. It's not always the case, but if you want to avoid having to retime the mechanism again replace it as a precaution. The cost is negligible. **N.B.**

Ferguson 3V53/5/7, JVC HRD755

After replacing a worn audio/control head and a broken front flap I was rewarded with intermittent loss of capstan lock, the symptom being noise bars rolling through the playback picture. The fault cleared when the main PCB was hinged upwards. Careful checks around the servo circuitry revealed that there were dry-joints at both pins of the control head connector CN401. **N.B.**

Panasonic Scanner – NV-J30/35 type

This scanner wouldn't read the bar codes, the other functions being fine. After checking the usual, i.e. for dirt in the detector hole, the unit was opened. Voltage checks were then made around the scanner input chip IC2. Pin 3 was at 3V, i.e. almost the battery supply voltage. From working on these units before I knew that this was very wrong. Pin 3 is connected to chassis via a 30kΩ preset, VR1. The manual doesn't tell you anything about the adjustment of this, but we've found that it varies the scanner's sensitivity and that the voltage at pin 3 of the chip should be about 0·2V. The reason for the incorrect voltage was that a through-the-board link that connects one end of VR1 to chassis was open-circuit. Normal operation was restored by fitting a single strand of wire through the hole and soldering it to the print.

As the manual doesn't give any voltage readings for this chip, here are the ones we obtained from a working unit, measured using a meter with a 10MΩ input resistance. Pin 1 0V; pin 2 0·668V; pin 3 0·2V; pin 4 0·174V; pin 5 1·2V; pin 6 1·44V; pin 7 0·233V; pin 8 0·242V; pin 9 0·44V; pin 10 0·44V; pin 11 0·865V; pin 12 3V; pin 13 0·06V; pin 14 3·13V; pin 15 1·32V; pin 16 0·12V. **I.B.**

Panasonic NV-G10

I found the use of switched BNC and phono sockets for the external video and audio inputs to my VCR, a Panasonic NV-G10, annoying. In the J30 series of machines the problem was corrected by including a scart socket. In devising a modification (see Fig. 1) it was necessary to find a solution to two problems: how to switch between the internal and external signals and how to drive the switching. To keep things simple and cheap, a relay was used for signal switching. This keeps the circuit modifications to a minimum, as the relay contacts replace the switching contacts in the sockets.

The neatest way that I could think of to drive the relay was to use the tuning voltage. This enables the external inputs to be switched in and out even when in the timer mode, as selection is just like that of a u.h.f. channel. The very simple drive circuit consists of a comparator, using half an AN6914/μPC358 operational amplifier chip. An 0·6V reference voltage is applied to the non-inverting input while the tuning voltage is connected via a 270kΩ resistor to the inverting input. Thus when the tuning voltage is below 0·6V the chip's output (pin 1) is high: conversely the output is low when the tuning voltage is above 0·6V. This circuit works well, being able to distinguish between an external input and channel 22. The tuning voltage feed couldn't be taken straight from the tuner's BT terminal as the 10kΩ series resistor present resulted in slight tuning drift. It was taken from a point farther back in the circuit therefore.

The components are mounted on a small piece of stripboard. Most of them came from the PCBs in a scrapped NV333. The relay is the capstan motor direction switching one while the chip is half of IC6006. The transistor was found in the reel motor drive area. Diodes

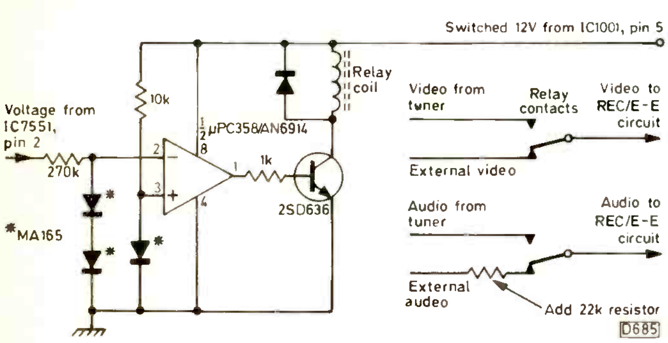

Fig. 1: AV switching circuit for the Panasonic NV-G10.

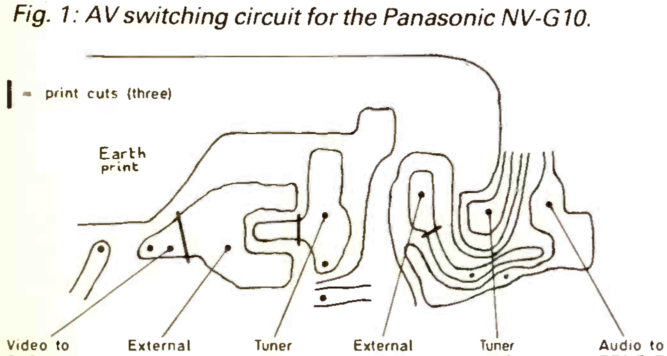

Fig. 2: Connections to the main PCB, at the right rear.

and resistors, also short lengths of screened lead to connect the small piece of stripboard to the main PCB, were also taken from the panels. I insulated the relay board and fitted it below the main PCB, with the connecting leads taken up through the gap around the right-hand edge of the main board for connection to the top. **I.B.**

Panasonic NV-L28B

This fault was a real headache – it had been with the machine from new. In cases like this there's always the suspicion that there could have been a production error. These are very rare, but you occasionally find that there's an omitted resistor or a stray jumper lead. The result is some real problems for the poor old service engineer.

The fault was no operation via any of the front panel buttons, though the clock was lit and all the voltage rails were correct. If a prerecorded tape was inserted the machine went into the play mode as it should do, because of the auto-play function, and played perfectly. But the only way in which it could be stopped was by disconnecting the mains supply. Suspicion fell on the microcontroller chip, as the servo system was clearly working correctly, but the fault was still present after fitting a replacement. The crystal oscillators and the reset line were then checked and found to be o.k. The serial data and clock lines were next scoped. Something was clearly amiss here. Digital data was present, but the pulses were at half the correct amplitude of 5V peak-to-peak. Well these lines go all over the place, so they were disconnected at various points to try to isolate the source of the fault. The pulses returned to normal amplitude when the disconnection was made at the digital PCB. After dismantling and examining the digital can the fault had cleared permanently. Our conclusion was that the can had been shorting the data and clock lines to deck. Definitely a "one in a million" fault. **S.C.**

Toshiba V83

The display was very dimly lit, with all functions showing. We checked at pin 42 of the clock chip ICX01 – this is called the back-up +B line. It should be at 5V permanently, but there was no voltage. We traced the line back to the Selector Timer 2 board (the tuning control board to you and me) and checked the ever 12V line here. This line feeds a 5.6V zener diode via a 390Ω resistor and was correct. Aha I thought, a short-circuit zener diode. Nine times out of ten it probably would be, but I always seem to get the odd time. The zener diode turned out to be o.k. A PST520C chip (ICL10), the reset generator, is also connected to this line. The resistance between its input and deck read about 20Ω. Fitting a replacement cured the problem. **S.C.**

ITT VR3918

This machine came in dead shortly after the guarantee ran out. When we powered it the mains transformer rapidly heated up and produced a terrible smell. A replacement from a stock machine was fitted but when we switched on the mains fuse blew. After disconnecting the secondaries we tried again. This time there were no signs of distress. When the bridge rectifier D5001-4 was reconnected the fuse blew, but there were no measurable shorts. So we changed the STK7226 power supply regulator. This time at switch on there was no fuse blowing but there was still no 13V line as protection diode D5009 had failed. It seems strange that there's no fusible protection for the transformer's secondaries, as the transformer gets very hot under fault conditions before the mains fuse fails. **M.D.**

Sharp VC8300

The complaint was no record or playback colour. After a number of initial checks I got round to scoping the playback chroma signal and noticed that the channel two chroma was excessively noisy. This made the colour-killer operate. If you looked carefully you could pick out the noise on the channel two f.m. signal, so I carried out checks in the f.m. and head areas, all to no avail.

I then recalled a similar fault with a VC7700, where a d.c.-d.c. converter in the power supply was defective, radiating noise along the chassis lines. But in that instance the noise had affected both f.m. channels. Nevertheless I followed up the hunch and disconnected the chassis earth lead near the full erase head. Colour was immediately restored.

When the now floating earth lead was scoped a 45kHz spike waveform at about 2V peak-to-peak was seen. Comparing this signal with the d.c.-d.c. chopper converter (Q905) signal confirmed that the chopper was indeed the source of the noise. When I scoped the converter's outputs I found that the noise was on the 15V line. Replacing C929 (330μF) provided a complete cure.

The lesson is that for no colour with these older Sharp machines, i.e. Models VC7700, VC381 and VC8300, the chroma signal should be checked to see whether it's noisy. If it is the chopper circuit is suspect. **J.C.**

Tuner Transplant for Early Hitachi CTVs

Roger Jones

During the early Seventies Hitachi released a number of small-screen colour TV models in the UK. They were competitively priced and proved to be extremely reliable when compared with many other designs around at the time. In fact they were the type of receiver that would virtually guarantee satisfaction to even the most discerning or fussy customer. Some of the models included a tint control, a feature found in KB/ITT models but very few other makes at that time. The receivers also had an isolated chassis, something that UK manufacturers didn't want to know about then.

Service History

The early Hitachi models had an eight-way, turret-style tuning selector coupled to a mechanical tuner. Callouts to these sets were minimal and often for very trivial things. I recall only one case of tripler failure, when a complete transformer assembly had to be ordered. More often than not the problem was that the aerial flylead had become stretched and had ruptured the aerial socket at the back of the receiver. It was easy to repair the socket by soldering the body to its base and then checking that no internal disconnection had occurred. Occasionally the mains fuses would go open-circuit, but this was usually due to tiredness rather than a fault condition.

Horizontal and vertical shift controls were not fitted, and at first it seemed tough luck if a customer produced a pair of callipers to prove that the test card wasn't quite in the middle of the screen. Fortunately horizontal positioning could be shifted by tweaking the line oscillator coil slightly: the pull-in range of these receivers was excellent and no line-slip problems were ever experienced after making such an adjustment. For vertical shift the purity rings could be moved ever so slightly without any detriment to the purity.

Occasionally C853 (3·3μF) on the convergence panel would go open-circuit, the result being blue misconvergence. Lack of colour was usually due to C535 or C538 (both 22μF) in the ident circuit. Only once did I hear of one of these receivers having to be set-up from scratch. It transpired that this was because of an extremely fussy customer who had no intention of keeping the receiver anyway after its week's free trial – it was commandeered to impress some foreign relatives.

After ten or more years a few of these receivers were coming back off the patch, not because of reliability problems but because of the economic situation at the time and also because of customers wishing to update generally. It was company policy to scrap such receivers, but I managed to rescue a couple from my own patch, knowing their history. One was a CNP190, which had a smart teak cabinet and an 18in. tube. The other was an earlier model, an elegant looking CSP680. Its dark wood cabinet was reminiscent of those you see in American films – nice sturdy solid-wood cabinets with shiny chrome knobs!

Unfortunately the CSP680 developed tuner troubles, not electrical but mechanical. A small piece of metal dropped

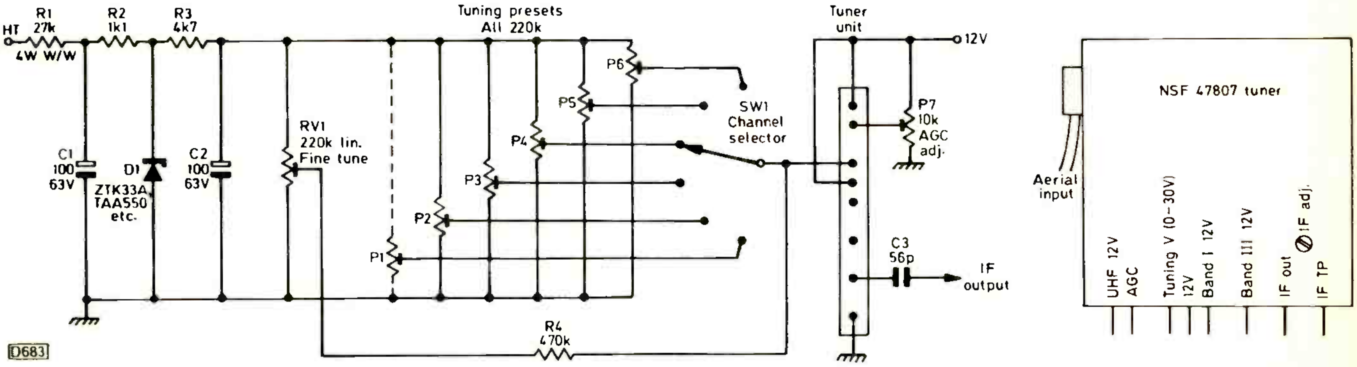

Fig. 1: The tuning supply circuit and pin connections for the NSF 47807 multiband tuner.

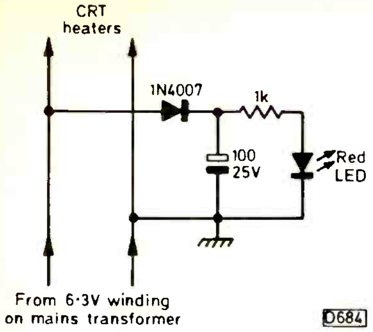

Fig. 2: (left): The LED standby indicator circuit.

off in the mechanism, with the result that the selector assembly jammed. The set remained out of use for a year, after which I began to consider the possibility of fitting a varicap tuner and a multiway channel selector switch – in the same position as the original mechanical one to maintain the set's good looks.

Modification Details

I happened to have a spare multiband NSF 47807 tuner to hand. The v.h.f. section was duff but the u.h.f. side worked all right, so I decided to attempt the life-saving modification. The mechanical tuner assembly was removed from the cabinet, noting the various connections. The old tuner had a small i.f. preamplifier mounted inside a can, so this was removed and the input and l.t. feeds were identified. It was eventually soldered to the varicap tuner's body.

To mount the multiway switch in the same position as the original tuner a metal plate with a hole drilled to accept the switch had to be made up. I found that the original tuning selector knob fitted nicely on the end of the switch's spindle. H.T. for the tuning supply was obtained from the large electrolytic capacitor that's mounted horizontally on the left-hand side at the top of the chassis, when viewed from the rear.

Fig. 1 shows the tuning voltage circuit. The regulator D1 and the feed resistors R1/2 were mounted on a piece of tagstrip attached to the tuner's body. The tuner itself was eventually fastened to the inside of the cabinet with the aid of a bracket. To avoid mounting problems, I decided to fit the tuning presets internally. The presets chosen were standard-size horizontal ones which were soldered to a piece of tagstrip. To counteract any slight tuning drift, as there's no a.f.c., a fine tuning control was included. This was fitted above the "instant on-off switch". Conveniently, there's a cutout hole already in the control panel metalwork.

The circuit worked first time and has been in daily use for about four years. Surprisingly, the fine-tuning control rarely needs adjustment as the tuning drift is minimal.

The "instant on" facility does however have one disadvantage when this modification is undertaken. As the main h.t. rails are deprived of voltage until switch-on, the tuning voltage takes a few seconds to build up fully because C1 has to charge. The effect is quite interesting to watch: the stations appear in ascending order before your very eyes as the tuning voltage increases!

Another modification I made was to fit an LED to indicate that the main side-mounted on-off switch is in the standby mode, thus providing a reminder that the receiver isn't fully off. The c.r.t.'s heaters are supplied from a winding on the mains transformer, and it's a simple matter to provide a rectified supply for the LED from this winding, see Fig. 2.

Book Reviews

Servicing Audio and Hi-Fi Equipment, by Nick Beer, published by Newnes, an imprint of Butterworth-Heinemann Ltd., Halley Court, Jordan Hill, Oxford OX2 8EJ at £25. 210 pages.

This book has been published as a companion to Eugene Trundle's well known *Servicing TV and Video Equipment*. Its main concern is therefore with the sorts of things that can go wrong and how to go about fault diagnosis. In addition there's guidance on correct repair procedures and workshop techniques. The audio field today is a surprisingly wide one, and as a result the various items covered in this book are quite diverse. In addition to basic audio amplifiers it covers radio including even the radio data system, portable audio equipment, noise reduction techniques, compact disc players, digital audio tape players, servo systems and microcomputer control arrangements; there's also a short chapter on graphics equalisers. Thus those thinking of getting seriously involved in this sort of work certainly require a guide to the multiplicity of equipment they are likely to encounter. The diagnostic advice given tends to be rather generalised, but this is inevitable considering the vast number of diverse models that have been released by audio manufacturers. A careful selection of circuits illustrates the techniques in use, and some excellent photographs show mechanical arrangements. There's a special pre-publication offer from one of our advertisers: see page 677.

Modern Television Systems to HDTV and Beyond, by Jim Slater, published by Pitman Publishing, 128 Long Acre, London WC2E 9AN at £39.95. 308 pages.

PAL and SECAM have served us well for almost a quarter of a century. One consequence of this static situation is that few books on TV systems have been published in recent years. There has nevertheless been a great deal of development work, and the advent of satellite TV broadcasting has opened up all sorts of opportunities. Hence the need for a new book describing the current situation. This one does the job excellently. To provide a complete picture, it starts with the NTSC, PAL and SECAM systems. Having clearly explained their principles and the compromises adopted, it soon goes on to MAC, HDTV and digital TV systems. The system descriptions are clear and well illustrated, with all relevant information on parameters included. The work is surprisingly up-to-date, covering the various digital TV proposals at present being assessed by the FCC. A good read and a valuable reference source.

Wireless, the Crucial Decade, a History of the British Wireless Industry 1924-34, by Gordon Bussey, published by Peter Peregrinus Ltd., on behalf of the Institution of Electrical Engineers, Michael Faraday House, Six Hills Way, Stevenage, Herts SG1 2AY at £29. 125 pages.

This book was published at about the same time as *The Setmakers*, a rather larger book that covers from the early Twenties to the present – see review in our March issue leader. It is nevertheless a worthwhile book that provides a deep insight into the subject of radio from 1924-34. In fact the coverage is somewhat wider than the title suggests, with a good introduction to technical developments from 1888 to 1924 and a chapter on receiver developments in America, Germany and France. In addition the social background is not overlooked. The decade 1924-34 takes us from the era of crystal sets with headphones to quite sophisticated valve designs, i.e. the development of the circuit concepts we still use. Home construction and kits were a major feature of the period and have a chapter to themselves. There are numerous illustrations, mainly period advertisements that show you exactly what was on offer.

Servicing Electronic Systems, Volume 1 and Volume 2 Part 1, by Ian R. Sinclair, B.Sc., M.I.E.E. and Geoffrey E. Lewis, B.A., M.Sc, published by Avebury Technical, The Academic Publishing Group, Gower House, Croft Road, Aldershot, Hants GU11 3HR. Vol. 1 £9.95, 225 pages. Vol 2. Part 1 £11.95, 334 pages.

These books are a completely revised edition of *Electronics for the Service Engineer*, forming a textbook for the City and Guilds of London Institute Course No.224 as revised in 1989, also covering the equivalent BTEC course. They have been written with the special needs of those studying at home in mind. Volume 2 Parts 3 and 4, covering television and radio reception and control system technology respectively, are in preparation.

These clearly written and well illustrated books should be of great benefit to those studying for the CGI Course 224 examination. They can also be recommended to those who simply want to go through the basics of electronics in order to obtain a proper understanding of the subject. Little that could be of help seems to have been left out: you are even told how to wire a fuse and use a calculator. By the time you've got through Vol. 2 Part 1 you'll be familiar with such things as chopper power supplies, microprocessors and simple computing systems.

The Maplin Electronic Circuits Handbook, by Michael Tooley, published by Heinemann-Butterworth Ltd., Halley Court, Jordan Hill, Oxford OX2 8EJ at £10.95. 288 pages.

This book serves as an introduction to electronic circuit design: in fact it's all you need for most circuitry. To start off with the characteristics of the various types of resistors, capacitors etc., are laid out so that the appropriate component for a particular application can be selected. Subsequent chapters deal with the various types of power supplies, amplifiers, filters, logic circuits, timers, etc., all with practical examples. Test equipment, stripboard layout techniques, soldering and desoldering are all covered. An excellent book for anyone who needs to devise circuits for various applications from time to time. It's also a good guide to circuit operation.

Modern Electronic Test Equipment, Second Edition, by Keith Brindley, published by Heinemann Professional Publishing, Halley Court, Jordan Hill, Oxford OX2 8EJ at £12.95. 261 pages.

The publishers say that this book "describes in a down-to-earth manner how the main categories of test equipment work, allowing the reader to compare available instruments, make an informed choice and then use the equipment to best advantage". That sums it up in part, but there's quite a lot more. For example the chapter on measurands and measurement equipment describes measurement and testing techniques covering a wide range of applications starting with aerials through, in alphabetical order, to transmission lines. Just about every sort of amplifier measurement and measurements of basic electronic parameters are covered. Coverage of digital subjects includes a detailed section on data buses. Some quite sophisticated equipment is described, including logic analysers and time-domain reflectometers. Don't let such long-winded words put you off: the treatment is, as the publishers say, "down to earth".

TEST CASE

343

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

The Test Case workshop has gained a new recruit. We'll call him Sherlock because of his earnest and painstaking efforts at tracking down the causes of faults. Though not yet fully proficient he's learning fast: part of the learning process was provided by a Ferguson set fitted with the TX90 chassis.

The TX90 was amongst the last of the "traditional" British designs: easy to understand and easy to service. So we gave Sherlock the job of repairing one that came in with the complaint "bad picture". When it was tried out in the workshop the set had a bad picture indeed: there was lack of brightness and a total absence of colour. The sound was fine, the picture size correct and the grey scale looked all right. Off with the back then and out with the service manual.

There were several circuit diagrams in the manual, each slightly different to cater for various control options and tube sizes. In sorting out the correct one Sherlock came across a circuit with a pencilled ring around R231 and a little caption that read "dim picture". Good old Television Ted! Since R231 is part of the current sensing network in the beam limiter circuit it would indeed have this effect. Sherlock confidently fitted a replacement and switched on. But he was faced with the same dark, black-and-white picture as before. Oh well!

Most of the post-detector signal processing in this little chassis is carried out by the UPC1365C colour decoder chip. While studying the block diagram for this device Sherlock noticed that colour and brightness are controlled by the voltages applied to pins 4 and 8 respectively. So he used his shiny new digital multimeter to check the voltages and compare them with the figures given on the circuit diagram. They were correct, and responded to operation of the customer controls as they should. The chip's supply voltage was the next check. It was spot on at 12V.

If what's coming out of a chip isn't right it's a good idea to check on what's going in. So the oscilloscope was next brought into play to check the luminance and chrominance input waveforms at pins 5 and 11 respectively. With a colour-bar generator used to provide the signals the waveforms were seen to be perfect, text-book style. Why did Sherlock have to get two faults at once? Or were there two faults? He rang the customer to ask whether the brightness and colour problems had occurred simultaneously. Yes he was told: the picture had flickered and "mucked about" for a few minutes, then settled in the fault state permanently. Was it repaired yet? Was it a loose wire? No and no said Sherlock.

Back to the set then. Ideas were beginning to run out, but the tube's first anode voltage was checked and the 4·43MHz crystal was replaced. Neither step helped. Finally Sherlock decided to try a new UPC1365C chip and asked Television Ted where one might be found in the stores. But Ted knew that this chip is seldom the cause of such faults. He decided to check the situation for himself and, after a few minutes with the scope, he had a diagnosis that proved to be correct. It wasn't the chip!

Apart from the fact that they are dealt with in the same chip, though by separate sections, what else is common to the processing of the luminance signal and the decoding of the PAL colour? What had Sherlock overlooked in his investigations? The cost of the faulty item is measured in pennies rather than pounds. See next month for the answer and another diagnostic puzzle.

ANSWER TO TEST CASE 342
– page 591 last month –

Tape gobbling is a horrible fault, for both the customer and the technician, especially in the form described last month – a rare and intermittent loss of take-up in the reverse-search mode. The Panasonic NV370 behaved itself impeccably for most of the time, but each time it failed it ruined a tape. The biggest difficulty lay in attempting to diagnose the cause of a fault that occurred once in a blue moon and afford just a few seconds' investigation time before the deck shut down as a result of syscon action.

Following the detailed checks on the reel-drive system, and in view of the fact that the torque on the left-hand spool always measured correctly, Sage became convinced that the cause of the trouble lay elsewhere. If the capstan was reeling out tape and the correctly-powered spool couldn't take it up, there had to be some impediment between them. What's between the two? The head drum of course.

Sage discovered that even when the machine managed to work in the review mode the tape was as taut as a drumskin between the drum and the left-hand spool. The cause was excessive friction at the periphery of the lower section of the drum. It was sufficient almost to balance the torque at the spool. The cost of replacing the lower drum could not be justified in this seven year old machine, so the customer now avoids using the review mode.

Published on the third Wednesday of each month by IPC Magazines Limited, King's Reach Tower, Stamford Street, London SE1 9LS. Filmsetting by Trutape Setting Systems, 220-228 Northdown Road, Margate, Kent. Printed in England by the Riverside Press Ltd., St Ives plc. Distributed by IPC Marketforce, King's Reach Tower, Stamford Street, London SE1 9LS (071 261 5000). Sole Agents for Australia and New Zealand — Gordon and Gotch (A/sia) Ltd; South Africa — Central News Agency Ltd. "Television" is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to currency exchange fluctuations and VAT, and that it shall not be lent, resold, hired or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever. ISSN 0032-647X.

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TDA1510	£3.20
TDA1510A	£3.20
TDA1512	£1.00
TDA1515A	£2.50
TDA1520	£3.95
TDA1670A	£2.60
TDA1701	£3.00
TDA1770A	£3.00
TDA1870A	£2.60
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
TDA2190	£10.00
TDA2270	£2.20
TDA2320	£0.90
TDA2510	£4.30
TDA2521/3	£9.75
TDA2522Q	£10.75
TDA2530	£4.75
TDA2530Q	£4.25
TDA2532	£3.00
TDA2532Q	£3.00
TDA2540	£2.75
TDA2541	£2.00
TDA2543	£5.25
TDA2560	£3.75
TDA2560Q	£1.10
TDA2576A	£2.90
TDA25771	£2.80
TDA2578	£3.00
TDA2578A	£2.80
TDA2579	£3.50
TDA2581Q	£2.50
TDA2582	£2.55
TDA2590	£2.00
TDA2591	£2.70
TDA2593	£1.50
TDA2594	£3.00
TDA2600	£6.80
TDA2611A	£1.00
TDA2640Q	£3.50
TDA2653A	£2.75
TDA2822	£2.00
TDA3190	£0.95
TDA3303	£15.00
TDA3330	£5.50
TDA3540	£4.00
TDA3541	£2.25
TDA3560	£3.40
TDA3561	£2.50
TDA3562A	£5.00
TDA3565	£3.00
TDA3571BQ	£5.50
TDA3590	£3.00
TDA3651	£3.00
TDA3651AQ	£6.50
TDA3652	£7.50
TDA3653	£1.50
TDA3654	£2.80
TDA3810	£2.90
TDA3950	£3.00
TDA440	£2.00
TDA4420	£2.45
TDA4422	£3.95
TDA4500	£3.80
TDA4501	£4.00
TDA4503	£4.50
TDA4505	£3.95
TDA4510	£4.40
TDA4600	£2.60
TDA4600-2	£2.60
TDA4601	£2.10
TDA4610	£4.50
TDA5101	£2.00
TDA7250	£5.50
TDA7270	£6.00
TDA7607AP	£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	£4.10
TEA2018A	£4.10
TEA5101	£6.00
TL011CP	£2.00
TL072CP	£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
U410B	£1.60
U416B	£1.60
UA767PC	£1.20
UA78/10	£2.00
UA78M15	£2.00
UAA1008DP	£2.00
UC38445	£5.00
UPC1185H2	£2.50
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	£1.60
2SB819	£0.55
2SB965	£2.30
2SC1413A	£2.50
2SC1826	£1.80
2SC1942	£2.10
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	£0.60
2SC2958	£2.50
2SC2979	£3.00
2SC3153	£3.40
2SC3402	£0.40
2SC3519	£4.60
2SC3678	£1.25
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
2SD1391	£4.20
SDC1397	£3.75
2SD1398	£2.25
2SD1426	£4.50
2SD1453	£1.60
2SD1455/2SD1730	£3.10
2SD1496	£4.00
2SD1497	£2.60
2SD1497-02	£5.95
2SD1497-06	£5.95
2SD1650	£3.50
2SD1877	£2.30
2SD639	£0.35
2SD667	£1.00
2SD725	£3.70
2SD787E	£0.30
2SD811	£2.95
2SD836	£1.10
2SD837	£0.80
2SD845	£2.70
2SD868	£3.50
2SD869	£3.00
2SD870	£3.50
2SD871	£4.50
2SD895	£2.00
2SD898	£2.75
2SD898B	£2.75
2SD900B	£4.00
BC107B	£0.10
BC108	£0.10
BC108B	£0.10
BC115	£0.16
BC118	£0.12
BC147A	£0.07
BC159	£0.09
BC171	£0.09
BC172	£0.09
BC172C	£0.07
BC182L	£0.09
BC183	£0.09

A.Z. ELECTRICS

Stock items despatched by return — *Access & Visa Accepted*

TDA8180 ORIGINAL £9.50

TRANSISTORS

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

DIODES AND THYRISTORS

BA157	£0.07	BY206 (BYB96R)	£0.55	OA91	£0.20
BR100	£0.20	BY210/800/BYV96	£0.55	OT112	£2.20
BR101	£1.40	BY227	£0.20	RGP15G	£0.45
BR103	£0.75	BY228	£0.50	RGP15J	£0.55
BR303	£1.50	BY229	£1.15	RGP15K	£0.35
BRY56	£0.75	BY299	£0.50	RGP30K	£0.70
BT116	£2.50	BY96D	£0.30	RHI	£1.30
BT128P	£4.50	BYV96D	£0.55	RM11C	£0.45
BT129P	£4.50	BYW56	£0.50	SG264	£8.50
BT151/800R	£1.75	BYW96E	£0.50	SG613	£12.00
BY126	£0.20	BYX10	£0.50	SKB/02	£0.60
BY127	£0.08	BYX55/600	£0.55	SKB/08	£1.20
BY133	£0.20	FB2506	£1.50	SKB2/02	£0.90
BY164	£0.90	IN4001	£0.06	SKB2/08	£1.10
BY164/SKB2/02	£0.90	IN4002	£0.06	SKE1/02	£0.60
BY179	£1.10	IN4004	£0.10	SKE1M15	£0.65
BY179/SK2/08	£1.10	IN4005	£0.10	SKE2G2/02	£0.75
BY184	£0.65	IN4006	£0.08	SKE2G3/04	£1.30
BY189	£2.00	IN4007	£0.08	SKE4F1/04	£0.45
BY190	£2.00	IN4148	£0.10	SKE4F1/06	£0.45
BY223	£2.00	IN5408	£0.25	SKE5F3/10	£2.20
		KBL08	£1.95	SR2M	£0.75
				T9053V	£1.40
				T9064V	£2.28

ASK FOR SEMICONDUCTORS NOT LISTED

VIDEO HEADS

AMSTRAD
- 3HSSR-VCR7000 (Saisho/Orion) £18.00
- PSF1-VCR4500,5200,9000 £15.00
- PSF2-VCR4600,4700 £15.00
- PSF3-VCR6000 £21.50

FERGUSON
- 3HSSV-2 Head universal £7.50
- 3HSSVA-3V42,44,45,46 etc £20.00
- 3HSS4VB-3V32/HR7655 £25.00
- 3HSS4VC-3V48/HRD565 £26.00
- 3V48,58,59,65,FV10,11,12,13,14,20,21,26 And most other Fergusons POA

HITACHI
- 3HSSHA-VT8000,9000 series £17.00
- 3HSSHB-VT11,33 etc £17.00
- 10082-VT120,220 £29.00
- 10081-VT130,135 £30.50

PANASONIC
- 3HSSN-2 Head universal £7.50
- 3HSSU1N-NV100,370,380/Philips VR6460 £11.00
- 3HSSU2N-NV230,470,480,G9,10,11,15PX £21.00
- 3HSSU3N-NV430,460 £16.00
- 3HSS3N-NV777,330 £18.50
- 3HSS4NB-NV730 £26.00
- 3HSS4NA-NV366 £24.00
- NVG30,33,40,45,46,130, & most other Panasonics POA

SANYO
- 3HSSSY-VHR1100,1110,1300 £20.00
- 3HSS3SY-VHR1500 £34.00

SHARP
- 3HSSSP-VC9300,9500,9700,381,481,482,483,486 etc £17.00
- 3HSSSPB-VC581,583,651,670 etc £17.00
- VC7000,8000 series (Brass) £42.00

OTHER MAKES
- Alba 4000, Goldstar 8000, Sentra 8000, Solavox 1000 £22.50
- Fisher FVHP510,520,530,615,710 etc £18.00
- Fisher VBS7000,9000 etc £25.00
- Hinari VXL2,4,3,20,25 £18.00
- Hinari VXL5,6,20H £15.00
- Mitsubishi HS306,710 £30.00
- Orion VC150,180,VH1,2,3 etc £18.00
- Saisho VR100,605,705,805,905 £18.00
- Samsung Universal 2 Head £24.25
- Toshiba V71,73,74,75,81,82,83,84,85,87 £20.00
- Toshiba V93 £21.00

ASK FOR VIDEO HEADS NOT LISTED

The above heads are new and replacements.

BELT KITS

AKAI
- VS1,2,5 1.20
- VS4,6,9,15 1.10
- VS9300,9500,9800 1.60

AMSTRAD
- 7000 2.00
- VCR4600,5200 1.90
- VCR4500,9000 2.00

FERGUSON/JVC
- 3V00/16/22 Mechanical Models 1.60
- 3V23 1.00
- 3V29/30 1.20
- 3V29/30 Loading Belt 0.35
- 3V31/32 1.00
- 3V35/36/38/39 1.10
- 3V42/43/44/45/48/54/55 1.00
- 3V58/59/64/65/8950/51/FV10/11/12/13/14 1.60

FISHER
- FVHP520/530 1.70
- FVHP615/710/715/716/722/725/830 1.00
- FVHP905/906/907/908/910/911/915/916 1.20

HITACHI
- VT11/14/17/19/33/34/35/38/39/88 1.30
- VT52/61/62/63/64/65/85/86 2.10
- VT100/110/111/113/115/118/120/125/130/135/145/150/175 2.50
- VT8000/8500 1.70
- VT9300/9500/9700 1.50

PANASONIC
- NV230/250/280/370/380/430/450/460/465/485/630/810/830/850/870/890 1.90
- NV300/333/340/366 1.60
- NV600/777/788 1.50
- NV2000/3000 1.50
- NV7000/7200/7500/7800 1.40
- NV8600 2.20
- NV730 0.60

PHILIPS
- VR63676467/6561/6751/6760/68SB4 2.25
- VR6460/6920/6520 2.40
- VR6580/6581 2.50
- VR6362/6367/6470/6467 2.25
- VR6542/6843 2.00

SANYO
- VTC5000/6500 0.65
- VTC5300/5350 1.00
- VHR1100/1300/1500 1.00
- VHR2300/2500/2700 2.90

SHARP
- VCF3/VC402/500/571/581/582/583/584/585 1.10
- VC6F3/6V3/VC600/651/681/682/683/684/685/693/700/7832.10 2.10
- VC200/381/384/385/386/390/9300/9500/9700 1.95
- VC300/387/388/481/483/486/488/496 1.20
- VC7300/7700/7750 1.95
- VC8000/8300 1.95

TOSHIBA
- V8700/9600 1.05
- V55/57 1.10
- V66/67 2.80
- V31/33 2.30
- V73/81/83/85 2.30
- V8600 4.10

Belt kits for Funai, GEC, Goldstar, Grundig, Hinari, ITT, Mitsubishi, NEC, Orion, Saisho, Samsung, Schneider, Sony and Tensai also available.

LINE OUTPUT TRANSFORMERS

- Decca 100 9.50
- ITT CVC20 12.50
- ITT CVC25/30/32 9.50
- ITT Compact 80 Series 110 16.75
- ITT Compact 80 Series 90 19.75
- ITT CVC45 18.00
- ITT 1109F 14.00
- ITT CVC1204 11.50
- ITT CVC800/1/3 21.50
- ITT CVC1100 16.50
- ITT CVC1150/1175 20.00
- ITT 6325 18.50
- ITT 3546 18.50
- ITT 1200/1 20.00

Other ITT transformers available

- Fidelity all models up to 20" ZX3000 10.50
- Fidelity Panel for ZX2000 1.00
- Fidelity 22" ZX3000 24.50
- Hinari CT4/5 & TVA1 14.75
- Philips KT3 12.95
- Rank Bush T20A 11.50
- Thorn TX100 Green Spot 110 16.75
- Thorn TX90 Mains Trans 18.85
- Ferguson TX90 LOPT 17.75
- Ferguson 3V35/36 Mains Transformer 23.00
- Ferguson 3V44/44/45 Mains Transformer 18.85
- Sony – Please state model for price
- Universal Tripler 4.75
- Universal Tripler with focus unit 9.50
- Decca 120/130 series tripler 8.50
- Thorn TX10 Focus Unit Kit 9.00

VIDEO MOTORS

REEL MOTORS
- Ferguson 3V29/30 £20.00
- Ferguson 3V58,59,65,FV10,11,12,13,14,20,21,22 £17.25
- Ferguson FV26D £14.50
- Sanyo VTC5000,5150,5400,5300,6500 £7.50
- Sharp VC9300,9500 etc, Original £15.90
- Panasonic NV333,366 Original £13.20
- All other Panasonics POA

DRUM MOTORS
- Ferguson/JVC (Mechanical models) £23.00
- Sharp 7000 series Original £24.63
- All Panasonic Original POA

CAPSTAN MOTORS
- Ferguson 3V35,36 Original £22.50
- Ferguson/JVC (Mechanical models) £20.00
- Hitachi VT11 Original £30.00
- Hitachi VT33 Original £32.00
- Hitachi VT64 Original £19.75
- Hitachi VT8000 series Original £34.50
- Hitachi VT9000 series Original £34.50
- Sharp VC7000 series Original £30.50

MODE CONTROL MOTORS
- Ferguson 3V42,43,44,45,48,49,52,53 £6.00
- Ferguson 3V58,59,65,FV10,11,12,13,14,20,21,22,26 £4.50

IDLER ASSEMBLIES

FERGUSON
- Take up Clutch (Mechanical models) £5.00
- 3V29/30 Take up Idler £2.00
- 3V29/30 Take up Clutch £2.85
- 3V29/30 Reel Idler £3.00
- 3V35 Reel Idler £3.00
- 3V35,36,38,39 Take up Clutch £2.85
- 3V58,59,64,65,FV10,11,12,13,14 Idler Arm £1.80
- Clutch Assembly 3V44,45,48,49,52,53,54,55 £14.00
- Clutch Assembly 3V42,43 £14.00

FISHER
- FVHP615,905,910, Idler Assembly Original £5.00
- FVHP615 Gear Idler Assembly £4.35
- FVHP905,910 Gear Idler Assembly £5.00
- FVHP520,530 Idler £3.00
- FVHP520,530 Pulley £0.70

HITACHI
- VT11,33 etc. Original Idler Arm £2.50
- VT11,33 etc. Idler Arm Replacement £1.75
- VT9300,9500 etc. Play Idler £3.65
- VT9300,9500 etc. F/F Idler £2.95
- VT9300,9500 etc. Idler £2.95
- VT8000,8500 etc. F/F Rew Idler £2.95
- VT8000,8500 etc. Play Idler Assembly £3.00
- VT8000,8500 etc. FF/Rew Pulley £0.70
- VT11,33 etc. Clutch Assembly £8.00

PHILIPS
- VR6460,6920 Idler Arm (original) £3.00
- DV464,6462,6463,650 etc. Idler Mod. Kit £4.50
- VR6542,6843 Reel Idler £6.50
- VR6542 Reel Drive Pulley £7.75
- VR6843 Reel Drive Pulley £9.50

PANASONIC (All Original)
- NV370 Idler Arm Unit VXP0521 Gen. £3.00
- NV8600,8610 Play Idler VXP0243 £0.95
- NV332,777,788 Idler Unit VXP0463 £3.00
- NV600,688 Idler VXP0515 £3.00
- NV333,366 Idler Arm 2 Unit VXL0997 £10.50
- NV8400,8600,8610 etc. VXP0245 £0.95
- NV333,366 etc. Idler VXP0401-NV700,7200, 7800 Idler VXP0344 £0.90
- NV2000,3000 Play Idler VXP0331-NV2000,3000 Idler Unit VXP0329 £1.10
- Back Tension Bands From £1.50
- All Panasonic Maintenance Kits POA

QUOTE PANASONIC PART No. FOR PARTS NOT LISTED

SANYO
- Idler VHR1100,1300,1500 £5.50
- Idler VHR2100,2300,2500,2700 £5.50
- Reel Drive Pulley Unit VTC5000,5150,6500 £5.00
- Idler Roller Assembly VTC5000,5150,6500 £2.25

SHARP
- Idler VC9300,9500 etc. £1.75
- Idler VC481,581 etc £1.95
- Idler (original) VC9300,481,581 etc. £3.50
- Idler Assembly (original) VC651,681,685 £6.50
- Idler Assmbly (original) VC780,781,785,787,793,VCT72 £6.50

AMSTRAD
- 4500,4600 MOD KIT INCLUDES PINCH ROLLER AND IDLER CLUTCH £5.00

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

REMOTE CONTROLS

Ferguson, Grundig, ITT, Philips, Pye, Sony, Hitachi, Matsui, Logik, Panasonic, Saisho, Salora, Samsung, Tashiko, Tatung, Toshiba. Various models TV & Video From £14.50

Many Hitachi TV remote controls now in Stock.

SONY REMOTE CONTROL RUBBER PADS. STATE MODEL FOR PRICE.

TV ON/OFF SWITCHES

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

PINCH ROLLERS

Pinch Rollers for Akai, Amstrad, Ferguson, Fisher, Furai, Goldstar, Grundig, Hinari, Hitachi, JVC, Mitsubishi, Orion, Panasonic, Philips, Samsung, Sanyo, Sharp, Sony, Toshiba available. Prices start from £2.80.

OTHER SPARES

- Universal Video Copying Kit £4.25
- Universal Copying Kit (Scart) £5.20
- Universal Camcorder Kit £6.90
- Video Cassette Lamps from £0.50
- CRT Anode Caps £0.60
- Video Tape Splicing Kit £6.95
- Hitachi TV Frame Module HM6251 £5.50
- Hitachi TV Frame Module HM6232 £5.50
- Cassette Housing Assembly Ferguson 3V35, 36, 38, 39, 42, 43, 44 £25.25
- Cassette Loading Roller Assembly 3V23, 3V31, 3V32 £3.50
- Philips 1.2V Back up Battery £1.75
- Philips 2.4V Back up Battery £2.80
- 5.5V Back Up Cap £1.85
- Degaussing Positor Blue £1.55
- Degaussing Positor White £1.30
- Cassette Housing Assembly Hitachi VT11 £19.50
- End Sensor for Hitachi VT63, 64, 65 (Pair) £2.75
- Cassette LED Sensor for Panasonic etc. £1.60
- I.C. Circuit Protectors £0.60
- Clear Service Cassette £5.90
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Fits model number: NV366
3HSS(4NB) £26.25
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3HSS(V) £9.95
Fits model numbers: 3V00, 3V16, 3V22, 3V29, 3V30, 3V31, 3V35, 3V36, 3V38, 3V39, HR2200 HR3300, HR3330, HR3360, HR7200, HR7300, HRD120, HRD130.
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3V44, 3V45 .... £22.50
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Toshiba
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Hitachi
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Fits model numbers: VT8000, VT9300 etc.

Sony
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NV366 .... £67.28
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Ferguson
3V32 .... £66.95
3V35, 3V36, 3V38, 3V39 .... £31.95
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Sharp
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VC8300 .... £70.25
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VC482 .... £65.50
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Sanyo
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VTC9300 (equiv only) £35.02

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Hitachi
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VT8500, VT8700 .... £49.50
VT9300, VT9500, VT9700 .... £49.50
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VT17E, VT19E £56.60
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NV730 .... £1.90
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Ferguson
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3V29, 3V30 .... £4.90
3V35, 3V36, 3V38, 3V39 .... £3.90

Sanyo
VTC5000, VTC5150 .... £1.99
VTC5300, VTC5400 .... £4.50
VTC9300 .... £6.50

Sony
SLC5, SLC7 .... £6.50
SLC6 .... £7.50
SL8000, SL8080 .... £6.50

Sharp
VC7300, VC7700, VC7750 .... £6.50
VC8300 .... £6.50
VC9100, VC9300, VC9500 .... £6.50
VC381, VC383, VC386 .... £6.50

Hitachi
VT5000, VT5500 .... £6.50
VT8000, VT8300, VT8500 .... £2.90
VT9300, VT9500, VT9700 .... £3.30
VT11E, VT14E, VT17E, VT19 .... £6.50
VT33E £6.50

Akai
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AMSTRAD
VCR 5200 .... £6.95
VCR 4500, 4600, 4700 .... £4.95
VCR 7000 .... £2.98

REPLACEMENTS

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NV7000, NV7200 .... £3.00
NV333,NV366 .... £3.00
NV8600, NV8610 .... £3.95

Ferguson
3V00, 3V16, 3V22 .... £3.50
3V23 .... £2.90
3V29, 3V30 .... £3.50
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SLC6 .... £4.95
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Sharp
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VC8300 .... £3.90
VC9100, VC9300, VC9500 .... £3.90
VC381, VC383, VC386 .... £3.90

Hitachi
VT5000, VT5500 .... £4.50
VT8000, VT8300, VT8500 .... £1.50
VT9300, VT9500, VT9700 .... £1.50
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3V35, 3V36, 3V38, 3V39 HRD120 .... £4.95

Sanyo
VTC9100, VTC9300 .... £4.95
VTC5000, VTC5150, VTC5300, VTC5400 .... £4.95

Sony
SLC5, SLC7 .... £5.95
SLC6 .... £5.95
SL8000, SL8080 .... £5.95

Sharp
VC7300, VC7700, VC7750 .... £4.95
VC8300 .... £4.95
VC9100, VC9300, VC9500 .... £4.95
VC381, VC383, VC386 .... £4.95
VC651 etc. £4.95

Hitachi
VT5000, VT5500 .... £5.95
VT8000, VT8300, VT8500 .... £4.95
VT9300, VT9500, VT9700 .... £4.95
VT11E, VT14E, VT17E, VT19 .... £4.95
VT33E £5.95

Akai
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VS9300, VS9500, VS9700 .... £4.95

Amstrad
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VHR3100 .... £6.90

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Sharp
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VC381, VC383, VC386 (Genuine) £3.90
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Akai
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Amstrad
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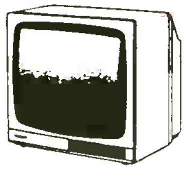

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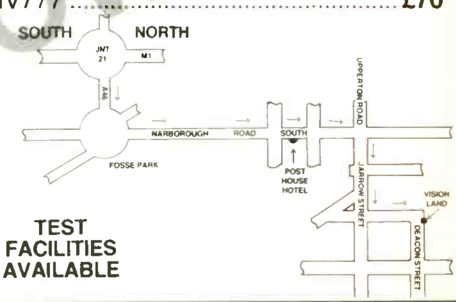

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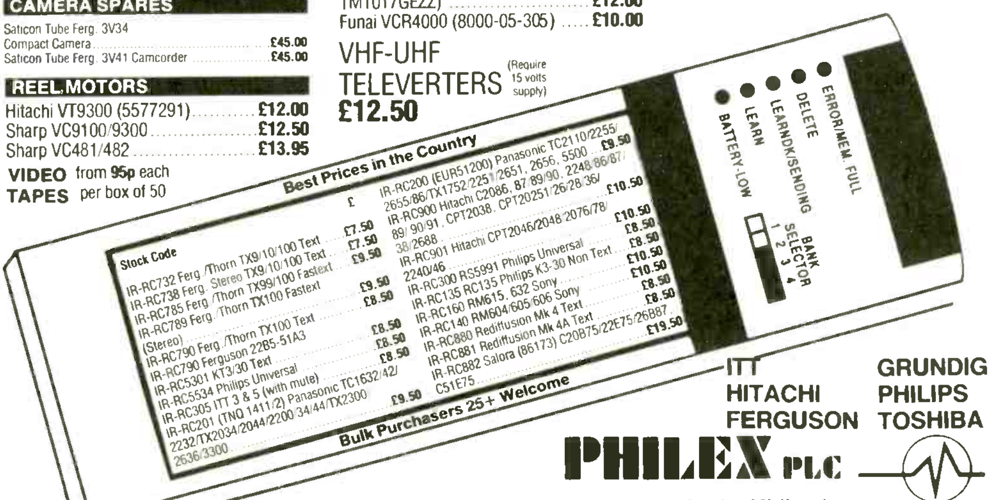

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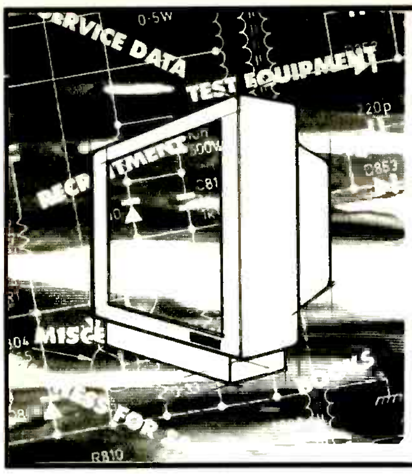

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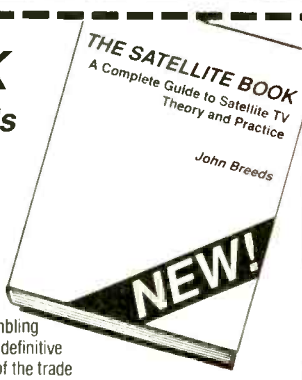

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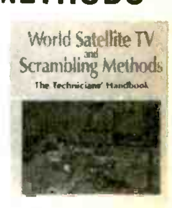

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Hills HD5000 Digital Meter 1000V DC 750AC 10 Amp 20 MRG Rangers £28.00

HT100 Multimeter £6.75
HT300 Multimeter £7.75
HT500 Multimeter £9.00
HT700 £15.00
HD1000 Digital £20.00
HD1200 Low Cost Digital £13.00
HD2500 £18.00
HD3000 Digital £25.00
HD5500 Digital £29.00
HD6000 Digital £32.00
HD8000 Digital £35.00
HD9500 Digital with capacity Temp Trans Volts Ohms and Amps ranges £60.00

Infra Red
Hanset Tester
Works at 24 feet – Sound repeater.
Works off 9 volt battery £8.00
Fits in top pocket.

Handset Tester with LED £4.50

Repaired Handsets

Philips K4-K35, RC5350-RC5300, RC5370, RC5375, repaired same day £10.00

RC4001 Full Remote KT3 K30 Teletext Handsets exchanged £15.00

GEC Full Remote Infra-red, 1983 models £15.00

TOSHIBA HAND SETS
CT9185 CT9176 CT9133 CT938
CT995 CT9144 CT9185 CT9193
CT9383 CT9384 £4.00 each

Rediffusion MK3 £5.00

TOSHIBA
HAND SETS
24 Button CT938 Fuliremote £5.00
32 Button CT983 Videotext £6.00

THORN
VCR Front Display Panel £7.00

Large type ITT TV and V.C.R. Handset £15.00

GEC Ultrasonic 8CH Full Remote £10.00

G11 Full Remote Ultrasonic £10.00
G11 Ultrasonic Teletext Handset £10.00
8 C.H. Ultrasonic GEC Full Remote C2014H/C2219H £15.00
New Replacement for G11 Ultrasonic Full Remote £12.00
Thorn 4000 insert with 7 buttons £5.00
Decca RC 11 £14.00
Decca RC 12 £14.00
G11 Infra-red full teletext £20.00
Dynatron-Full remote CTV 62, 63, 64 £19.00
Hitachi infra red handset £18.00
Philips full remote KT3, 16C928/20C934; 722/7324; K12 26C 797/1ST 66K 1826 £12.00
GEC infra red full remote 8 channel (I.C.SAA1250) £14.00
Philips infra red full remote 9 channel for 60 CP2605 £6.00
Philips infra red full remote 12 channel for 60 CP2605 £12.00
K35
KT3/K30 T/Text £12.50
KT3/K30 Full remote £15.00
KT3 Power supply £4.00
GEC infra-red 2236-2026 £4.00
GEC 8 button full remote £14.00
GEC push pad handset button blobs 10p each

Pye & Philips handset KT3-K30 chassis. No RC5150-RC5176-RC5171-RC5177.
Special Price £13.00
RC4001 KT3 and Teletex £14.00
IT CVC 32 handset repaired £15.00
CVC 32 Hand Set £15.00
CVC 45 3 and 2 Pin
TX10 Hand Set Text £12.50
TX9 with Text £12.50
TX9 & TX10 button print £2.00
TX10 Focus Pots £5.50

ITT
T/V & Video Processor. 1200 Type £10.00

PHILIPS
UNIVERSAL HAND SET £12.00 RC5 KT3 – K45

We have all parts for Philips Handsets

RC5353 £15.00
RC5300 £12.00
Philips RC5 £15.00

TEXT-TYPE
Replace Hand Set for Philips KT3-K30, K4 etc £12.30

THORN HAND SETS
9000 – 9600 – TX9 – TX10 – TX100
Text and Non-Text £10.00

PHILIPS
RC5171 £12.00

K35-K4 HAND SET
Repaired for £5.00