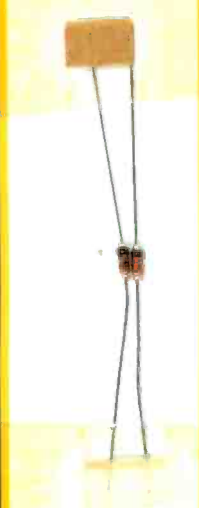
FEBRUARY 1992 £1·95

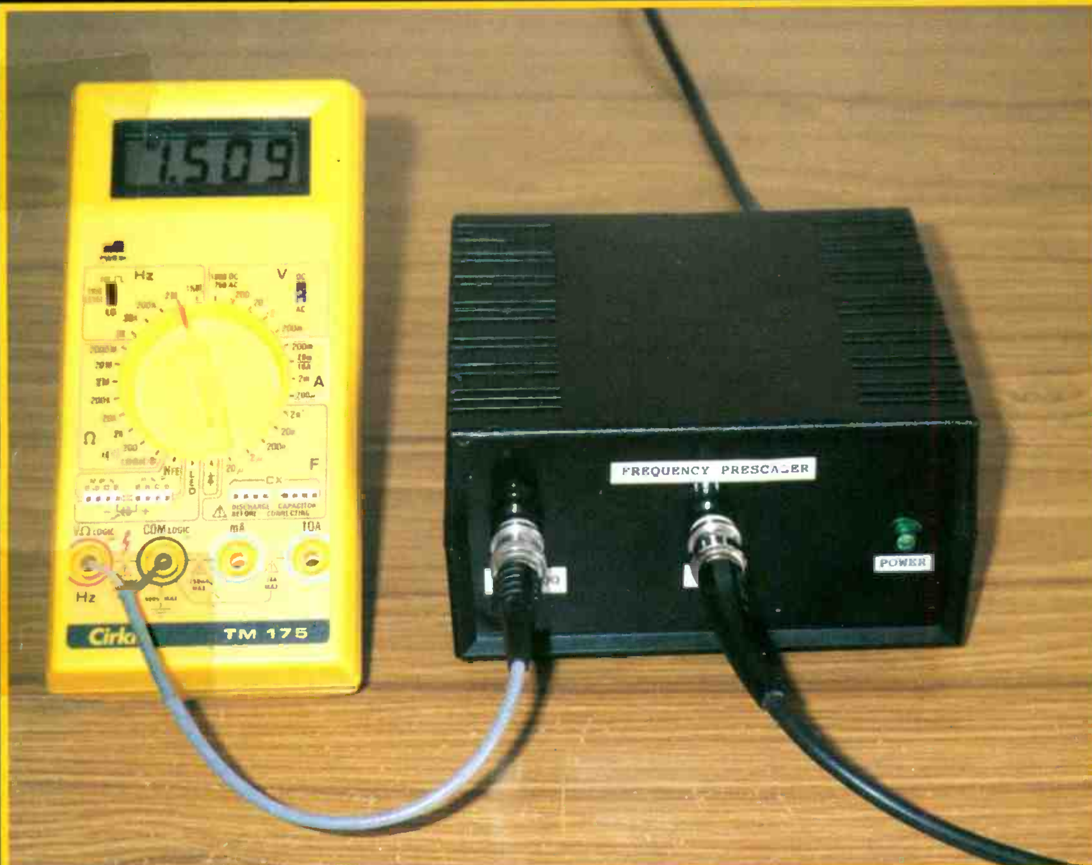
TELEVISION

SERVICING·VIDEO·SATELLITE·DEVELOPMENTS

FREE SIGNAL DIODES


UK & Eire copies only

Kindly supplied by GRANDATA Ltd



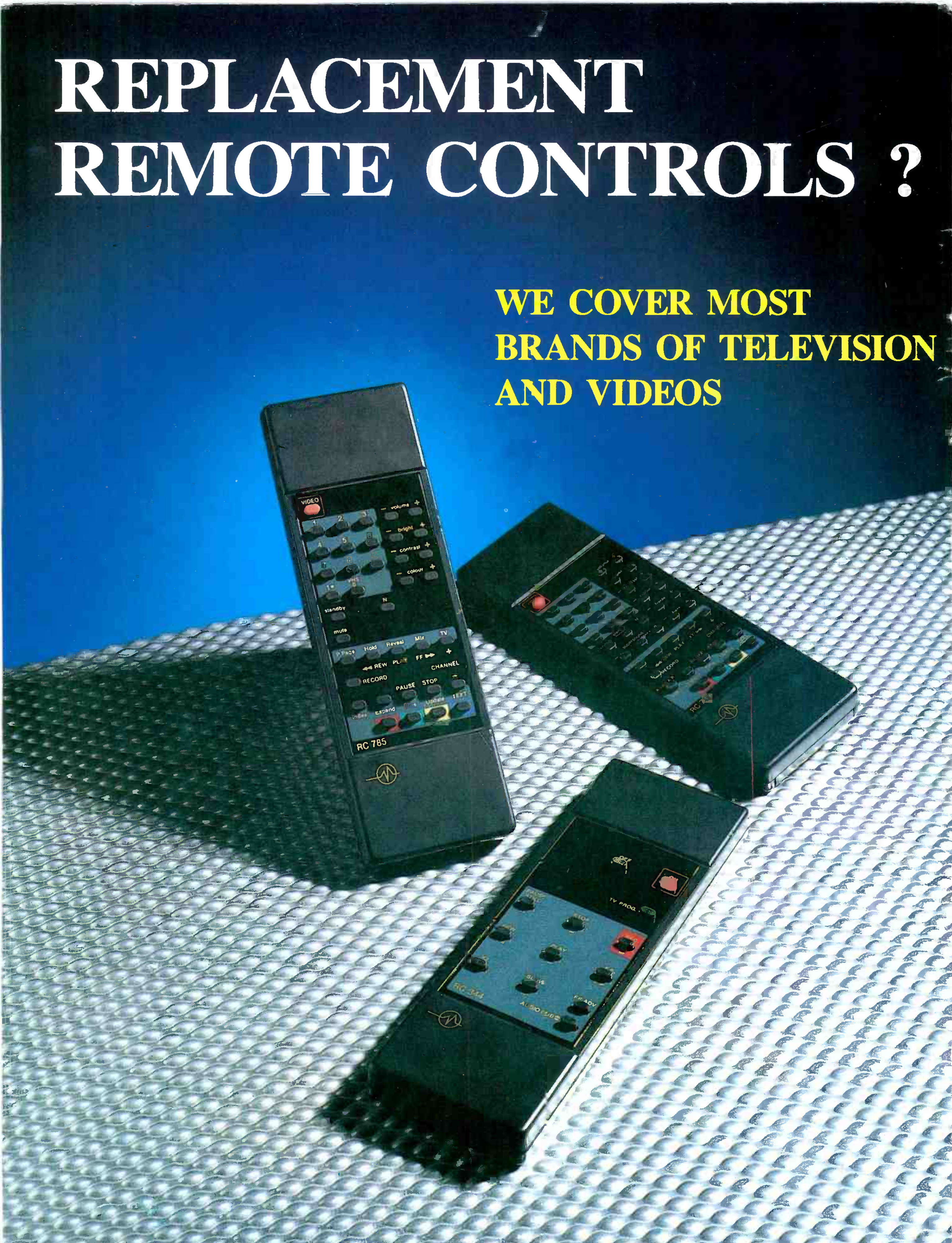
150MHz Frequency Prescaler

Ferguson 3V29 Series Fault Guide

TV Fault Finding • VCR Clinic

Switch-mode PSU Developments

Long-distance TV • Nostalgia


REPLACEMENT
REMOTE CONTROLS ?
WE COVER MOST
BRANDS OF TELEVISION
AND VIDEOS
RC 785

TELEVISION

February 1992

Vol. 42, No. 4
Issue 496

On sale January 15th

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

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. Make cheques etc. payable to Reed Business Publishing Ltd.

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".

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An annual subscription costs £23 in the UK, £28 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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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 published designs nor comment on alternative ways of using them.

this month

OUR NEXT ISSUE DATED MARCH WILL BE PUBLISHED ON FEBRUARY 19

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
BA148	10p
BA145	6p
BA157	12p
BB105B	18p
BB205B	24p
BC107	8p
BC108	8p
BC109	8p
BC109C	10p
BC118	11p
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BFY90	45p
BLY48	85p
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BR103	37p
BR303	85p
BRY49	38p
BRY56	33p
BSS74	33p
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BSX26	18p
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BT106	180p
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2N5386	25p
2N5401	12p
2N5448	12p
2N5496	30p
2N6107	40p
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
16.0	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
79L12	35p
79L15	35p
7818KC	100p
7824KC	100p
LM309K	100p
LM317K	200p
LM317T	100p
LM323K	360p
LM723	35p
78H08KC	800p
78H12KC	700p
79HGKC	800p

VALVES

DAF96	100p
DAF96	80p
DL92	80p
DY86	70p
DY87	80p
DY802	90p
EABC80	85p
EB91	60p
EBF80	60p
EBF89	90p
ECC82	80p
ECC83	120p
ECC84	80p
ECC85	80p
ECH81	100p
ECH84	90p
ECL80	65p
ECL82	80p
ECL84	90p
ECL85	80p
ECL86	80p
EF80	80p
EF85	80p
EF89	85p
EF183	75p
EF184	85p
EL34	280p
EL36	90p
EL84	80p
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	50p
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	180p
AN612	160p
AN3215K	650p
AN3310	350p
AN3312	350p
AN3320K	800p
AN3331K	900p
AN3792	400p
AN3794	450p
AN3795	500p
AN3821	800p
AN3821K	800p
AN3822K	900p
AN3830K	800p
AN3990K	300p
AN3991K	400p
AN5010	450p
AN5011	400p
AN5015	350p
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AN5030	550p
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AN5034	500p
AN5111	550p
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AN5135	600p
AN5138	450p
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AN6359	810p
AN6360	400p
AN6362	480p
AN6371	810p
AN6387	560p
AN6811	130p
AN6884	240p
AN7105	210p
AN7110	130p
AN7114	150p
AN7115	150p
AN7116	130p
AN7120	130p
AN7130	110p
AN7140	450p
AN7145	195p
AN7148	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
BA514	160p
BA516	150p
BA521	160p
BA524	240p
BA526	180p
BA527	95p
BA532	140p
BA534	290p
BA536	180p
BA546	160p
BA612	160p
BA656	150p
BA658	380p
BA684	400p
BA685	400p
BA1310	160p
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
BA6304	190p
BA6305	200p
BA6309	125p
BA6410	220p
BA6411	250p
BA6993	150p
BA7001	150p
BA7004	200p
BA7007	200p
BA7021	180p
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BA7751LS	150p
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BA7755	150p
BA7767AS	200p
BA8500	800p
BA8504	500p
CA3011	110p
CA3012	150p
CA3028A	95p
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CA3052	190p
CA3054	95p
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CA3065	210p
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CA3085	135p
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CA3089E	150p
CA3090Q	250p
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
CX139A	750p
CX141	750p
CX143	800p
CX143A	1250p
CX145	725p
CX150B	325p
CX158	825p
CX175	325p
CX186	750p
CX187	825p
CX804A	775p
CX832	825p
CX867	675p
CX868	525p
CX877	300p
HA1125	150p
HA1137W	135p
HA1144	380p
HA1156	110p
HA1166	150p
HA1197	145p
HA1199	240p
HA1319	240p
HA1338	300p
HA1339A	300p
HA1367	180p
HA1368	180p
HA1372	300p
HA1377	160p
HA1388	320p
HA1389	210p
HA1392	280p
HA1394	280p
HA1397	250p
HA1398	240p
HA1457	120p
HA11219	280p
HA11221	180p
HA11225	150p
HA11235	148p
HA11251	240p
HA11423	210p
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HA13001	170p
HA13002	250p
HA13006	400p
HA13007	400p
HA13108	350p
HA13412	600p
HA13432	400p
HA17524	250p
HA17805	100p

ICL7106	650p
ICL7611	90p
ICL7660	240p
ICM7555	80p
ICM75556	80p
KA2101	100p
KA2102	150p
KA2130	150p
KA2206	150p
KA2209	125p
KA2210	230p
KA2212	80p
KA2213	130p
KA2214	150p
KA2261	100p
KA2263	100p
KA2264	100p
KA2284	100p
KA2401	150p
KA2412	350p
KA2912	125p
KA2914A	300p
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LA1201	75p
LA1210	140p
LA1222	80p
LA1230	130p
LA1231	210p
LA1364	200p
LA1365	120p
LA1368	220p
LA1385	170p
LA1460	220p
LA2000	150p
LA2101	270p
LA2200	190p
LA3101	150p
LA3160	120p
LA3201	80p
LA3210	65p
LA3220	100p
LA3300	140p
LA3301	110p
LA3350	110p
LA3361	100p
LA3375	300p
LA4030	180p
LA4031	140p
LA4032	140p
LA4051	160p
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LA5112	120p
LA5523	150p
LA5527	150p
LA5700	300p
LA6324	200p
LA6358	100p
LA7011	220p
LA7031	250p
LA7033	400p
LA7040	280p
LA7042	280p
LA7046	300p
LA7224	150p
LA7505	250p
LA7507	250p
LA7520	200p
LA7620	500p
LA7800	160p
LA7801	280p
LA7802	300p
LA7806	260p
LA7808	260p
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LA7910	150p
LA7940	200p
LC7131	260p
LC7132	400p
LC7137	450p
LF347	110p
LF351	45p
LF353	48p
LF355	60p
LF356	60p
LF357	60p
LF398	300p
LM301	26p
LM307	42p
LM311	35p
LM318	120p
LM319	165p
LM324	30p
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LM348	50p
LM358	45p
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LM381	150p
LM382	120p
LM384	130p
LM386	60p
LM387	100p
LM392	100p
LM393	45p
LM709DIL	35p
LM710	45p
LM723	30p
LM741DIL	18p
LM741MET	45p
LM747	58p
LM748	30p
LM1458	30p
LM1889	300p
LM3900	40p

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LM3911	160p
LM3914	160p
LM3915	160p
LM3916	270p
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M54563P	200p
M54564P	200p
M54566P	200p
M54567P	200p
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M58487P	450p
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M58655P	400p
M58657P	300p
M58658	450p
M58725P	500p
M51102	290p
M51516	260p
M51518	200p
MAB8400B	650p
MAB8420P	650p
MAB8440P	650p
MAB8441P	650p
MB3615	240p
MB3614	180p
MB3712	140p
MB3713	130p
MB3714	270p
MB3715	260p
MB3722	280p
MB3730	160p
MB3731	300p
MB3756	230p
MB3759	200p
MB8719	360p
MC1456	45p
MC1458	30p
MC1469	290p
MC1488	50p
MC1489	50p
MC1496	65p
MC3302	70p
MC3401	45p
MC3403	60p
NE555	20p
NE556	40p
NE565	110p
NE566	130p
NE567	115p
NE571	290p
NE592	85p
NE5532P	140p
SAS560	110p
SAS570	110p
SAA1006	300p
SAA1008	450p
SAA1010	400p
SAA1020	450p
SAA1024	250p
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SAA1272	280p
SAA1274	280p
SAA3004	400p
SAA5000	200p
SAA5010	220p
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SAA5020	350p
SAA5030	440p
SAA5040A	280p
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SAA5050	650p
SAB3013	200p
SAB3035	600p
STA301A	200p
STA401A	220p
STA403A	270p
STA404	290p
STA405A	280p
STA431A	250p
STA432A	220p
STA434A	270p
STA435A	270p
STA441C	250p
STA456C	240p
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STA901M	280p
STA8012	260p
STK0025	420p
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STK0039	380p
STK0040	520p
STK0049	510p
STK0050	440p
STK0059	620p
STK0060	620p
STK0070	1100p
STK0080	580p
STK011	370p
STK015	490p
STK016	800p
STK025	700p
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STK080	600p
STK082	580p
STK084	660p
STK085	1050p
STK086	870p
STK420	400p
STK430	500p
STK433	400p
STK435	400p

STK436	490p
STK437	500p
STK439	550p
STK441	680p
STK443	740p
STK457	500p
STK459	560p
STK460	720p
STK461	620p
STK463	780p
STK465	720p
STK501	580p
STK561	550p
STK563	480p
STK583	600p
STK734B	510p
STK745	600p
STK760	600p
STK770	750p
STK772B	480p
STK780	650p
STK1039	550p
STK1040	700p
STK1049	800p
STK1050	750p
STK1060	760p
STK1070	940p
STK1080	990p
STK2025	700p
STK2028	560p
STK2029	480p
STK2038	900p
STK2048	950p
STK2110	680p
STK2120	820p
STK2125	650p
STK2129	610p
STK2139	800p
STK2155	950p
STK2230	470p
STK2240	820p
STK2250	760p
STK3041	460p
STK3042	490p
STK3044	575p
STK3062	600p
STK3082	700p
STK3083	550p
STK3102II	600p
STK3152II	990p
STK3156	560p
STK4017	450p
STK4019	600p
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STK4025	600p
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STK4048	1280p
STK4060	580p
STK4101	650p
STK4111	650p
STK4112	950p
STK4121	600p
STK4131	650p
STK4132II	750p
STK4141II	420p
STK4142	800p
STK4151	680p
STK4152	950p
STK4161	800p
STK4162	800p
STK4171	850p
STK4172II	800p
STK4181	820p
STK4182II	800p
STK4191	1000p
STK4192	1000p
STK4231II	990p
STK4272	720p
STK4273	650p
STK4301	700p
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STK4362	600p
STK4372	570p
STK4392	690p
STK4432	900p
STK4773	900p
STK4793	1100p
STK4803	720p
STK4813	950p
STK4833	810p
STK4843	720p
STK4853	900p
STK4863	850p
STK4873	990p
STK4893	1400p
STK4913	1180p
STK5314	550p
STK5316	600p
STK5322	620p
STK5324	820p
STK5325	580p
STK5331	400p
STK5332	220p
STK5333	700p
STK5335	450p
STK5337	600p
STK5338	350p
STK5339	500p
STK5342	300p
STK5361	420p
STK5372	300p
STK5412	650p
STK5421	625p
STK5422	650p
STK5431	650p
STK5434	650p
STK5436	500p
STK5441	500p
STK5451	480p
STK5457	425p
STK5461	700p
STK5462	500p
STK5466	850p
STK5467	400p
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STK5730	600p
STK6431	850p
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STK6732	1500p
STK6822	1200p
STK6922	600p
STK6932	600p
STK6962	320p
STK6972	630p
STK6981B	850p
STK6982	800p
STK7216	600p
STK7217	560p

STK7226	800p
STK7308	410p
STK7309	450p
STK7310	850p
STK7348	410p
STK7356	650p
STK7358	650p
STK7402	660p
STK7404	400p
STK7406	800p
STK7408	880p
STK7410	1200p
STK7554	1000p
STK7561	700p
STK7563	950p
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STR380	500p
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STR384	570p
STR440	520p
STR441	440p
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STR452	680p
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STR454	470p
STR455	500p
STR456	600p
STR457	680p
STR470	680p
STR1096	380p
STR1195	450p
STR1229	450p
STR2005	580p
STR2012	650p
STR2013	460p
STR2024	650p
STR2105	680p
STR3113	300p
STR3115	580p
STR3123	490p
STR3125	580p
STR3135	300p
STR3212	330p
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STR50213	650p
STR53041	650p
STR53043	650p
STR54041	500p
STR55041	650p
STR58041	480p
STR59041	650p
STR60001	650p
STR61001	750p
STR80145	700p
STRD1806	800p
STRD1816	800p
T2800D	52p
TA7054	190p
TA7061	115p
TA7063	70p
TA7066	120p
TA7073	200p
TA7089	300p
TA7119	150p
TA7120	55p
TA7130	80p
TA7137	83p
TA7140	130p
TA7157	140p
TA7176	240p
TA7193	400p
TA7200	200p
TA7203	180p
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TA7267	290p
TA7269	850p
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TA7271	400p
TA7272	260p
TA7273	380p
TA7274	260p
TA7280	330p
TA7281	270p
TA7282	260p
TA7283	260p
TA7288	280p
TA7299	400p

TA7310	100p
TA7312	120p
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	520p
TA7622	420p
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TA7630	300p
TA7632	400p
TA7640	150p
TA7641	170p
TA7658	130p
TA7668	160p
TA7680	380p
TA7688	250p
TA7698	720p
TA7699	1200p
TA7705	300p
TA7750	200p
TA7757	250p
TA7769	300p
TAA550	25p
TBA120S	40p
TBA396	70p
TBA520	120p
TBA530	120p
TBA540	100p
TBA560	120p
TBA800	40p
TBA810AS	60p
TBA820	65p
TBA820M	40p
TBA920	120p
TBA950	100p
TBA990	80p
TC4621AF	225p
TC5020	220p
TC5054	280p
TC5065BP	150p
TC5081AP	180p
TC5082P	170p
TC5501P	550p
TC8565P	2400p
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
TC9157	375p
TC9164	300p
TC9172P	300p
TC9176P	500p
TC9178AF	1600p
TC9179F	2000p
TC9305	300p
TCA740	130p
TCA940	100p
TCEP100	100p
TD62308AP	200p
TD62381	200p
TD62382	200p
TD62506	200p
TD62705	250p
TD62781AP	250p
TD62795	200p
TD62803	150p
TD6304AP	300p
TD6306P	350p
TD6350P	200p
TD6359N	500p
TD6359P	300p
TDA1001	250p
TDA1002	200p
TDA1003	150p
TDA1005A	220p
TDA1008	350p
TDA1010A	100p
TDA1011	120p
TDA1012	120p
TDA1013A	120p
TDA1015	100p
TDA1016	200p
TDA1020	150p
TDA1022	350p
TDA1023	200p
TDA1024	200p
TDA1026	320p
TDA1028	220p
TDA1029	250p
TDA1035	120p
TDA1037	190p
TDA1044	250p
TDA1048	225p
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TDA1054	200p
TDA1059	80p
TDA1060	190p
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
TDA1235	350p
TDA1236	295p
TDA1270	150p
TDA1327	250p
TDA1330	150p
TDA1352	200p
TDA1410	219p
TDA1412	100p

LINEAR IC's — Cont.

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TDA1510	380p
TDA1512	200p
TDA1514A	450p
TDA1515A	200p
TDA1516Q	350p
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TDA1540	420p
TDA1541	1600p
TDA1596	260p
TDA1670A	300p
TDA1675	250p
TDA1701	320p
TDA1770A	300p
TDA1870A	300p
TDA1872A	450p
TDA1904	120p
TDA1905	150p
TDA1908A	90p
TDA1940	280p
TDA1941	300p
TDA1950	280p
TDA2002	70p
TDA2003	80p
TDA2004	90p
TDA2005	90p
TDA2006	70p
TDA2007	180p
TDA2008	175p
TDA2009	160p
TDA2010	100p
TDA2020	140p
TDA2030	80p
TDA2038	90p
TDA2040	200p
TDA2048	750p
TDA2054M	120p
TDA2151	300p
TDA2161	170p
TDA2170	300p
TDA2270	340p
TDA2320	80p
TDA2510	450p
TDA2524	120p
TDA2532	120p
TDA2540	90p
TDA2541	120p
TDA2542	150p
TDA2543	300p
TDA2545	200p
TDA2556	350p
TDA2560	120p
TDA2575A	100p
TDA2577A	160p
TDA2578A	200p
TDA2579	250p
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MITSUBISHI
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HS306/HS318/HS710 £23.00
HS307 £37.00
HS319 £37.00
HS330 £40.00
HS338 £30.00
HSE11 £37.00
HS300/HS301/HS302/HS310 £23.50
HS200 £6.50
HS337/HS347 £22.00

NATIONAL PANASONIC 4HSS-3HSSN
NV3000/NV300/NV7200/NV333/NV7500/
NV7800/NV7850/NV322/NV332/NV340/
NV390/NV2000/NV2010/NV7000/
NV8170/NV8200/NV8400/
NV8600/NV8610/NV8620 £6.50

NATIONAL
NV777/NV330 £17.00
NV430 £14.25
NV460 £16.50

NATIONAL
NV730/NV770 4 Head £18.50
NV366 £18.50
NV180 £25.00
NV370/NV380 £8.50
NV788 £43.50
NV810/NV830 £35.00
NV850/NV950 £38.00
NV870/NV890/NV970 £48.00
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
NVG50 £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 £45.00

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/VH655/VH600/VH700/VH844/VH900/
VH1000 (ALL MODELS) £13.00

PHILIPS
VR6460/VR6520/VR6920/64/VR60/
VR6420 £8.50
VR6711 4 HEAD £41.00
6920/VR6440 £68.00
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 £15.00
VR6004/VR6005/VR6011/VR6013/
VR6014/VR6020/VR6022/VR8014/
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/VVT510/VT320/
VT5600/VX510/VX511/VX520/VX616/
VX626/VX627/VX717 £19.00

SANYO
VTC5000/VTC5400/VTC6000/VTC6500/
VPR5000/VTC1300/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-T9ME) £39.00
DSR-35R (FOR C20C30C40/
SLF1UB/SLF1E) 2 PIN £15.00
DSR-43R (FOR SLC7 RANGE/SL5000/
SL5100/SL3000) 1 PIN £13.00
DSR-21R (FOR SLC8C9) £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, £1.20
FVHP905, FVHP906,
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 £0.50

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

SERVICE AIDS

SERVISOL PRODUCTS
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, HRO110, 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, HRO170, 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, HRD180, 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, HRO755, 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, HRD140, 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, HRO180, HRD370	£24.00

VIDEO LAMPS

UNIVERSAL VIDEO LAMPS 12V 60mA (300mm WIRES)	£0.30
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Part No.	Models	Price
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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, AOM-16B. KV-2092UB, 2096UB	£22.00

NATIONAL LINE OUTPUT TRANSFORMER

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TLF 15542F	£25.00
TLF 14568F	£26.00
TLF 14567F	£26.00
TLF 14715F	£27.00
TLF 14749B	£20.00

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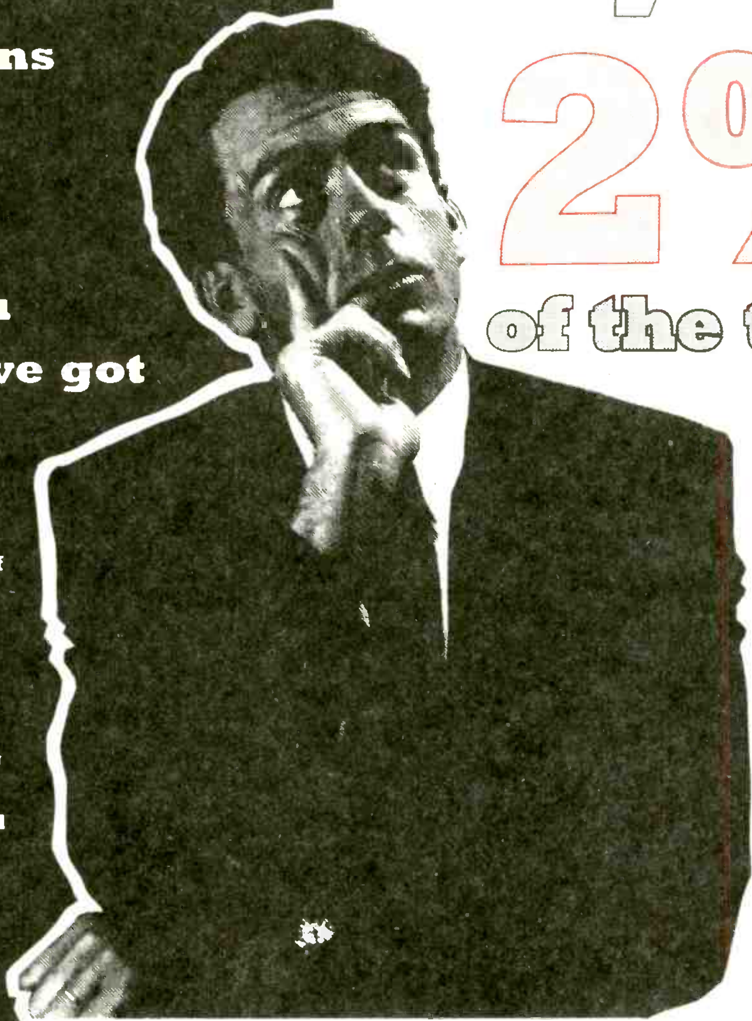

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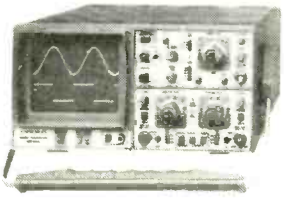
HM203-7 20MHz STANDARD

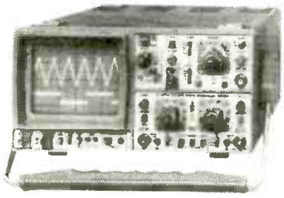


SPECIFICATION
* 2 Channels
* Bandwidth: DC - 20MHz
* Sens: Ch.!, Ch.2, 1mV/cm
* Timebase: 0.1s - 20ns/cm
* Triggering: DC - 40MHz
* Active TV - Sync - Separator
* Variable hold-off
* Trigger LED indicator
* Calibrator: 1KHz Square wave
* Component tester
* Plus many features

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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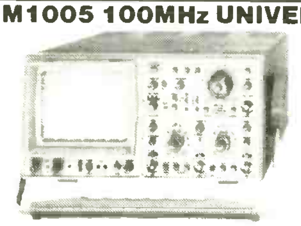
HM1005 100MHz UNIVERSAL

3 CHANNELS - UP TO 6 TRACES

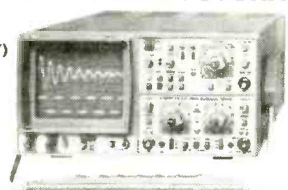


SPECIFICATION
* 3 Channels
* Bandwidth: DC - 100MHz
* Sens: Ch.1, Ch.2, Ch.3, 1mV/cm
* Timebase A: 2.5s - 5ns/cm
* Timebase B: 0.2s - 5ns/cm
* Triggering DC - 130MHz
* After delay trigger
* Delay line
* Trigger LED indicator
* Overscan LED indicator
* Active TV - Sync - Separator
* Calibrator: 1KHz &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



Price £610.00 + £106.75 V.A.T. **FREE Specialist Carrier Delivery**

B & K PRECISION CRT ANALYSER-RESTORER

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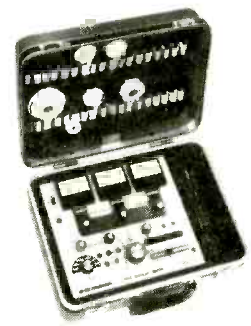


* All CRT's checked identically, including all in-line and one gun types * Tests all three guns of colour CRT's simultaneously under actual operating conditions (model 490) * Exclusive multiplex technique (model 490) * Measure true dynamic beam current that actually passes through G1 aperture to screen * 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 meter 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

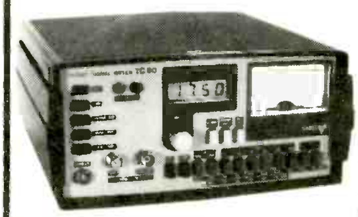
The Sadelta Field Strength Meters have been designed to facilitate the dish alignment of satellite TV systems and aerial alignment of VHF/UHF television and radio systems. Signal levels can be accurately measured on the TC402-C and the TC90, allowing the evaluation of signal conditions for satisfactory 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.

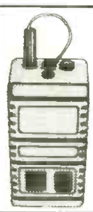
TC90 VHF-UHF- SAT.



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.

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.
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* 8 ranges.
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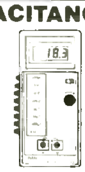
* Inc. protective case.



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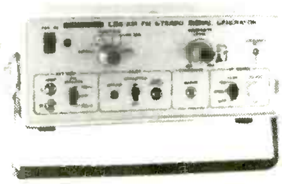
LEADER FM STEREO SIGNAL GENERATOR

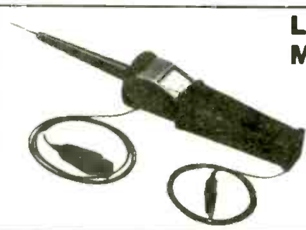
At last! A generator specifically designed for testing and fault finding on FM stereo and monaural VHF receivers including stereo multiplex circuits.

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 lest lead set included.
* Mains powered.
* Size: 80 x 200 x 250mm.



Price £299.00 + £52.33 V.A.T.

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.

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.

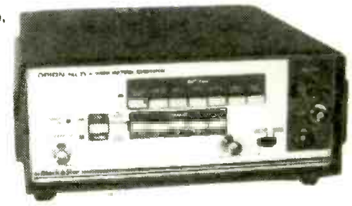
In addition to a switchable sound carrier facility which allows use with the majority of PAL TV systems, the Orion provides highly flexible RGB outputs, ensuring compatibility with most video monitors.

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.



Price £209.00 + £36.58 V.A.T.

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1uf at 400v	25
1uf at 400v	25
4.7uf at 250v	25
4.7uf at 400v	35
10uf at 250v	35
10uf at 400v	75
22uf at 250v	40
33uf at 250v	55
47uf at 250v	65
100uf at 250v	1.25

(All the above are pcb mounting)

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R2M	95
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BY227	20
BY229/800	95
BY299/800	35
1N4007	10
1N5408	20
BZX61C (1.3 Watt) 5v6, 6v8, 7v5, 9v1, 12v, 15v, 24v, 33v, 68v, 120v, 130v (5 per Value)	1.00

E.H.T. TRAYS

Continental 30AX Focus	8.95
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GRUNDIG CUC2410 18"/26"	19.95
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RBM T20/22A	7.95
THORN 9000	8.00
UNIVERSAL	5.95

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20mm A/S; (Pkts of 10) 250MA, 315MA, 500MA, 630MA, 800MA, 1A, 1.6A, 2A, 2.5A, 3.15A 4A, 5A, 6.3A, 8A	1.20
20mm Q/B; (Pkts of 10) 500MA, 630MA, 800MA, 1A, 1.6A, 2A, 2.5A, 3.15A	60

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CNX83A	3.95
HA1377	2.95
HA13001	4.50
HM6251	5.95
HM6232	5.95
LA4445	2.45
LA4460	2.45
LA4461	2.45
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M491BB1	14.75
M58401I/84RS	12.95
MC13002P	4.95
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SAA5012	4.95
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SL1432	1.95
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STK5332	6.95
STK5333	12.50
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STK5482	8.95
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TBA820M	1.75
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TDA1044	2.95
TDA1170S	1.95
TDA1510	3.80
TDA1512	3.50
TDA1515	4.50

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TDA1518	5.50
TDA1670A	4.50
TDA1770A	3.70
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TDA2005	2.95
TDA2030	1.95
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TDA3330	3.95
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TDA3561A	4.95
TDA3562A	5.50
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TDA4601	3.50
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TDA9503	3.75
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Ferguson TX90 (20")	21.50
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Fidelity ZX3000	11.50
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Hinari CT6/7	19.95
Hitachi CPT1446	22.95
ITT Compact 80	19.95
ITT CVC25/30/32	9.95
ITT CVC800/1/2/3	23.95
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ITT CVC1100	19.95
ITT CVC1150	21.50
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ITT CVC1204	14.75
ITT CVC1215	19.95
ITT Monoprint 110D	22.50
ITT Monoprint B	22.50
Matsui C1410/1420	26.95
Matsui C1480A	26.95
Philips CF1	23.50
Philips CP90	22.95
Philips CTX 14"/20"	21.50
Philips K30	23.75
Philips K35	22.95
Philips K40	23.75
Philips 2A	23.50
Saisho CT141X	26.95
Sharp C1410	24.95

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TX9/10 Standard	1.00
TX9/10 Remote	1.75
TX90/100 Standard	1.50
TX90/100 Remote	1.75
Fidelity CTV140	1.50
Fidelity CTV14R	2.95
Fidelity CTV14S	2.95
Grundig CUC731	3.50
Philips G11 Standard	1.35
Philips G11 Remote	1.75
Philips KT3 Remote	1.75
Philips KT4/CTX Remote	1.75
RBM T20A 3K3 Volume	3.95
Sony Universal	3.75
Sony KV1612 Remote	3.95
Sony KV2022 Remote	3.95
Thorn Universal	1.00

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Ferguson T725	12.95
Ferguson T734	14.95
Ferguson T742	14.95
Ferguson T785	12.50
Ferguson T789	12.50
Ferguson TX10 Non Text	12.95
Ferguson TX10 Text	12.95
Ferguson TX10 Stereo	12.95
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Ferguson 3V32	14.50
Ferguson 3V35	14.50
Ferguson 3V45	14.95
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Fidelity CTV22T	14.95
Granada Universal	12.95
Grundig TP400 Text	13.95
Grundig TP650	14.95
Hitachi CPT2038	15.95
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ITT RG305	12.95
ITT RG306	12.95
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Philips KT3/30 N/Text	12.95
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TYPE	PRICE
BC307	10
BC327	10
BC337	10
BC547/8	10
BC557/8	10
BC639	20
BC640	20
BD238	40
BD677	65
BF337	30
BF422	35
BF423	35
BF458	35
BF460	95
BF757	70
BF871	95
BR103	75
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BU126	1.95
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BU208D	1.95
BU326A	1.95
BU426A	1.45
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BU807	1.75
BU826A	2.95
BU907	2.95
BU908	2.95
BUT11AF	2.75
BUT12A	2.95
BUT56A	2.75
BUX84	80
R4050	2.95
T9053V	3.50
T9054V	3.50
T9064V	1.95
TIP29E (TO168V)	75
TIP41C	50
TIP42C	50
TIP112H (TO167V)	75
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2SC1942	2.95
2SC3156	2.95
2SD725	4.95
2SD1398	2.50
2SD1453	2.95
7805	50
7812	50

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Amstrad 7000	19.95
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Ferguson 3V43	32.50
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Hitachi VT17/19	34.95
Hitachi VT63/64	22.50
Hitachi VT65	34.95
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Hitachi VT130E	29.95
JVC HRD250	29.95
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Matsui VX735A	22.95
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Mitsubishi HS303/305	24.95
NEC 9034/9053	22.50
Panasonic NV230	22.50
Panasonic NV333	9.50
Panasonic NV366	24.95
Panasonic NV370	12.50
Panasonic NV430	19.95
Panasonic NV688	33.50
Panasonic NV730	23.95
Panasonic NV777	27.50
Panasonic NV788	38.50
Panasonic NV2000/7000	9.50
Panasonic NVG7/9	19.50
Panasonic NVG10/12	19.95
Panasonic NVG18	29.95
Panasonic NVG20/21	29.95
Panasonic NVG30/40	24.50
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Philips 6467	37.95
Philips 6760 Genuine	39.95
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Sanyo VHR1100/1300	19.50
Sanyo VHR2300/3200	19.95
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Sharp VC581/681	17.50
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Toshiba V73/83B	21.50
Toshiba V93B	23.95

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Reel Idler	3.95
Reel Pulley	1.95
Video Head	21.50
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Pinch Roller	3.95
Reel Idler	3.95
Reel Pulley	1.95
Video Head	21.50

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Belt Kit VCR4500	1.95
Belt Kit VCR4600	1.95
Modification Kit	6.95
Video Head VCR4500	18.75
Video Head VCR4600	18.75

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Belt Kit	2.50
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Take-Up Clutch (Small)	5.95
Video Head	9.50
3V29/30	
Repair Kit	12.95
Belt Kit	1.80
Capstan Motor	32.50
Cassette Lamp	80
Loading Belts (5)	1.95
Pinch Roller	3.95
Reel Idler	2.95
Take-Up Clutch	2.95
Take-Up Idler	1.85
Tension Band	2.45
Video Head	9.50
3V35/39	
Repair Kit	12.95
Belt Kit	1.95
Capstan Motor	22.95
Cassette Housing	25.95
Cassette LED	1.95
Loading Belts (5)	1.95
Mains Transformer	23.95
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Repair Kit	14.95
Belt Kit	1.50
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Clutch Assembly	12.95
Pinch Roller	3.95
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Belt Kit	1.75
Capstan Motor	27.50
Cassette Housing	29.95
Pinch Roller	3.95
Reel Idler	2.75
Reel Motor	15.95
Video Head	23.50

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Pinch Roller	4.50
Reel Idler	5.95
Video Head	17.50
FVH905/910	
Belt Kit	1.95
Clutch Assembly	19.95
Reel Idler	5.95
Video Head	17.50

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VT8000/8700E	
Belt Kit	1.95
FF/REW Idler	2.95
FF/REW Pulley	95
Play Idler	3.95
Video Head	17.50
VT9300/9700E	
Belt Kit	1.95
Capstan Motor	31.95
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FF/REW Pulley	95
Play Idler	3.95
Remote Control	15.95
Video Head	17.50
VT11/33E	
Repair Kit	17.95
Belt Kit	1.95
Capstan Motor VT11E	26.95
Capstan Motor VT33E	29.95
Clutch Assembly	7.95
FF/REW Idler	2.50
Pinch Roller	3.95
Tension Band	2.95
Video Head	17.50

HITACHI VIDEO SPARES

VT63/64E	
Belt Kit	1.95
Capstan Motor	27.50
Clutch Assembly	7.95
FF/REW Idler	2.50
Pinch Roller	3.95
Repair Kit	17.95
Video Head VT63/64E	22.50
Video Head VT65E	34.95
VT120/130E	
Belt Kit	1.95
Clutch Assembly	7.95
FF/REW Idler	3.75
Pinch Roller	3.95
Repair Kit	18.50
Video Head VT120E	24.95
Video Head VT130E	29.95

PANASONIC VIDEO SPARES

NV230/430	
Repair Kit (Genuine)	12.95
Belt Kit	1.95
Mode Switch	3.95
Pinch Roller	3.95
Reel Idler (Genuine)	2.95
Tension Band	2.45
Video Head NV230	22.50
NV333/366	
Repair Kit (Genuine)	13.75
Belt Kit	1.95
Pinch Roller	3.95
Play Idler (Genuine)	4.95
Reed Idler (Genuine)	1.25
Reel Motor	17.95
Tension Band	2.45
Video Head NV333	9.50
Video Head NV366	24.95
NV370	
Repair Kit (Genuine)	12.95
Belt Kit	1.95
Mode Switch	3.95
Pinch Roller	3.95
Reel Idler (Genuine)	2.95
Tension Band	2.45
Video Head	12.50
NV730	
Repair Kit (Genuine)	12.95
Belt Kit	1.95
Mode Switch	3.95
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Reel Motor	29.95
Remote Control	15.75
Tension Band	2.45
Video Head	23.95

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NV777	
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Belt Kit	1.95
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Video Head	23.95
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Repair Kit (Genuine)	21.50
Belt Kit	1.95
Pinch Roller	3.95
Play Idler (Genuine)	1.25
Reel Idler (Genuine)	1.25
Video Head	9.50
NV7000/7200	
Repair Kit (Genuine)	17.50
Belt Kit	1.95
Pinch Roller	3.95
Play Clutch (Genuine)	4.95
Reel Idler (Genuine)	1.25
Video Head	9.50
NVG7/10/12	
Repair Kit (Genuine)	12.95
Belt Kit	1.95
Mode Switch	3.95
Pinch Roller	3.95
Reel Idler (Genuine)	2.95
Video Head (NVG7/9)	19.50
Video Head (NVG10/12)	19.95

PHILIPS VIDEO SPARES

VR6460/6520	
Repair Kit	12.95
Belt Kit	1.95
Pinch Roller	3.95
Reel Idler	2.95
Video Head	12.50
VR6462/6560	
Repair Kit	14.50
Cassette Housing	17.50
Pinch Roller	4.50
Reel Idler (Genuine)	4.95
Video Head (Genuine)	42.95
VR6467	
Repair Kit (Genuine)	21.50
Belt Kit	1.95
Cassette Housing	19.95
Pinch Roller Arm Assy	12.95
Reel Idler Assy	11.95
Video Head (Genuine)	37.95
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Repair Kit (Genuine)	21.50
Belt Kit	1.95
Cassette Housing	19.95
Pinch Roller Assy	12.95
Video Head (Genuine)	39.95

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Reel Pulley (Genuine)	5.95
Video Head	27.50

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Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Reel Motor (Genuine)	12.95
Video Head	17.50
VC481/482	
Belt Kit	2.50
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Reel Motor (Genuine)	14.95
Video Head	17.50
VC581/582	
Belt Kit	2.50
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Reel Motor (Genuine)	18.95
Video Head	17.50
VC681	
Belt Kit	2.50
Pinch Roller	3.95
Reel Pulley (Genuine)	7.95
video Head	17.50
VCA140/VCT72	
Belt Kit	2.95
Pinch Roller	3.95
Reel Pulley (Genuine)	7.95
Video Head	17.50

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C5/6/7	
Belt Kit C5/7	2.50
Belt Kit C6	1.95
Pinch Roller	4.50
Rewind Kit C5/7	4.95
Rewind Kit C6	3.95
Video Head	14.95

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Akai VS1/3/5	1.95
Mitsubishi HS302	1.95
Sanyo 1100	1.95
Sharp 7300	2.50
Sharp 8300	2.50

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Ferguson 3V00/22	50
Ferguson 3V29	80
Panasonic NV2000	95
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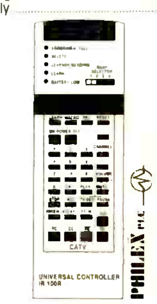

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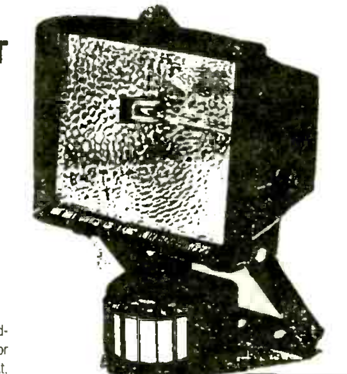

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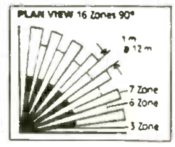

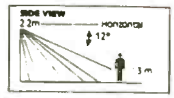

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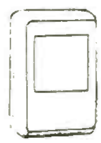

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ECL80	0.90
ECL82	1.35
ECL84	1.30
ECL85	1.30
ECL86	3.10
EF37A	4.60
EF80	0.60
EF85	0.60
EF86	2.50
EF95	0.90
EF183	0.75
EF184	0.75
EH90	0.60
EL34	4.55
EL36	1.60
EL81	8.65
EL84	2.50
EL86	1.35
EL509	9.50
EL519	9.50
EM84	1.35
EM87	2.35
EY86/87	0.75
EY88	1.00
EY500A	3.35
EZ41	3.65
GY501	1.80
GZ32	3.15
GZ34	4.55
KT66	24.20
KT88	17.35
KT88 G/L	61.68
PC86	0.60
PCC84	0.60
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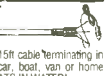

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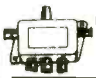

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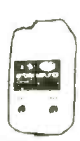
ONE TV



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75 ohms, 240V a.c.
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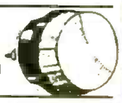

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COVER PHOTO
This month's cover photograph shows the 150MHz prescaler described on pages 258-261 linked to a DMM with frequency scales.

REED BUSINESS PUBLISHING GROUP

TELEVISION

WHAT LIES AHEAD?

Due to the delays caused by printing and distribution, January 1st usually sees me passing the February issue for press. So it is that at this time one tends to look back at the year just gone by and think a bit about what lies ahead. By now you don't need me to tell you that the economy, and hence business generally, has stalled. An upturn is promised during 1992, but no one is at present keen to suggest when it will occur. It must, eventually, as the debt associated with the last boom is paid off. But therein lies one of the causes of the prolonged recession. The extent of the debt taken on during the boom of the late Eighties was unprecedented, following as it did the measures taken in the early Eighties towards financial deregulation and hence a vast increase in the encouragement to borrow. The other main restraint at present is the difficulty in lowering interest rates due to international constraints.

While the UK consumer electronics market remained flat throughout 1991, there were one or two encouraging features. Camcorders sold well – some half a million compared with 375,000 in 1990. Nicam also started to catch on, accounting for thirty per cent of large-screen set sales during the year and now running at an even higher rate. The other prospering area was satellite TV, with installations at the end of the year running at over 100,000 a month.

It's debatable whether economic moves on their own – tax cuts and interest rate reductions – would get the brown goods sector moving again, since with products other than those just mentioned market saturation has long been established. So what's needed is new technology to tempt the punter. Fortunately it looks as if traders will not be disappointed in this respect in the early Nineties. Naturally the Japanese manufacturers have seen the need for this and have been beavering away at new products. But they are not the only ones.

The immediate prospects in 1992 are DCC in the audio field and CD-I in the AV field. In both these fields Philips has been a prime mover. The digital audio cassette will be a welcome product, but is coming at a time when the compact disc has established itself as the basic audio storage medium. Tape and discs have long co-existed in the audio field however, so DCC should have little difficulty in gaining a market for itself. CD-I is a rather different proposition. It's an excellent idea that will be well within consumers' affordability range. But it will need to be suitably marketed. It asks of users that they take a different approach to consumer electronic product use, so persuasion will be necessary. What will in particular be required is programme material that catches on.

Farther ahead, multimedia devices look set to provide market regeneration. It's a question of what to combine with what to produce something that consumers will respond to. One interesting product is the multimedia computer, which is being developed by Sony and Apple Computer. Motorola is also involved, and other leading consumer electronics manufacturers are negotiating with the present consortium. The idea is to combine pictures, text, numbers, sound and telecommunications in a palm-sized communications unit with digital audio and video display capability. It seems that the development programme aims for the product to be ready for marketing at some time during 1994, presumably in the USA and Japan initially.

Still farther ahead lies "virtual reality". This enables the user to immerse himself in an AV created world which he can manipulate at will. Video goggles and earphones present the AV virtual reality to the user. Computer capability linked to special gloves enable him to move objects and use items in his new-found world. The possibilities seem to be endless. But with present technology cost is the limiting factor – a domestic VR system would set you back around £40,000. If you want to experience this, you can have a go on W. Industries' Virtuality machine at the Trocadero, London, for £2 a time.

All this is not to suggest that conventional products are without development potential. Far from it. Philips for example has been developing chips for TV IPQ – improved picture quality – modules. Once you convert the video signal to digital form and add memory there's no end to what can be done. Picture-in-picture and zoom for example. But more to the point the Philips chips will provide greatly improved pictures. A full-option IPQ module would include an SAA4950 advanced memory control chip, an SAA7158 chip for line flicker reduction, improved digital colour transient improvement and luminance peaking, and an SAA4940 chip for noise and cross-colour interference reduction, all under the control of an I2C system and with the field rate doubled by the memory and its control chip. The IPQ modules are 16:9/4:3 and HDTV compatible. Clearly we're no where near the end of the road with TV development.

READER HELPLINE

We are all too well aware of the difficulties that some readers encounter in obtaining their copies of *Television*. When you consider the vast range of magazines on general sale to the public today, it is inevitable that a small, technical journal such as *Television* will find it hard to secure for itself shelf space at retail outlets. Newsagents asked to obtain copies sometimes meet frustration due to the distribution chain – most retail copies are distributed via wholesalers. The best ways of securing regular copies are to take out a subscription or to place an order with a local newsagent. To assist anyone experiencing particular problems we have established a reader helpline. Phone 081-661 8620 for help if you find it hard to obtain your copy of *Television*.

TV Fault Finding

Reports from Philip Blundell, AMIEIE, Brian Storm, Chris Avis, Ed Rowland, John Edwards, Graham Richards, Mick Dutton, Bob McClenning, S. Pearson and Steve Cannon

Grundig CUC3400 Chassis

This set was dead, with a buzzing noise coming from the Ipsalo transformer. The +M supply was correct at 11V when the set was switched to standby, but when it was brought on this voltage fell instead of increasing to 20V. The difference between standby and on is that in the latter condition drive is applied to the line output transistor. As there didn't appear to be any shorts across the supply lines, and the line drive waveform was correct, it seemed likely that the chopper and line output sections of the Ipsalo circuit were not synchronised. The basic frequency of the power supply is set by C653, with fine adjustment by means of the feedback applied to pin 12 of the TDA3640 chopper control chip. Replacing C653 had no effect, so the components in the network connected to pin 12 were checked. C630 (0·68μF) was leaky. **P.B.**

Toshiba C1400RB

The search tuning didn't stop when a station was found. This was because the a.f.t. input to ICA01 (pin 8) didn't go low. Diode DA34 (1N4148) was leaky. **P.B.**

Sharp C1431

This set was dead. The power supply was working, but the line oscillator didn't start. There was no 12V supply at pin 8 of X0712. The start-up supply for the line oscillator comes via transistor Q610, which wasn't being turned on. R679 (100kΩ) was open-circuit. **P.B.**

Panasonic Alpha 2 Chassis

The complaint was of erratic colour. When we switched the set on there was no colour at all, though the colour was perfect once the back had been removed. The set was put on the soak bench and minutes later the picture flashed orange, green then blue. The colour-killer finally put a stop to the colourful display. Checks on the 8·86MHz crystal X601 and its associated trimmer capacitor were fruitless. The chroma chip IC601, the delay line DL601 and the matching coil L603 were also innocent. Voltage checks were then carried out around IC601. A fluctuating voltage at pin 5 led to a check on C612 (0·01μF). It read about 5kΩ on my meter. A replacement cured the problem. **B.S.**

Philips NC3 Chassis

This set looked more like a defunct oscilloscope – it displayed a single green spot in the middle of the screen. The actual fault was no field scan: the picture was blanked out as usual, but not the vertical green tuning line which thus appeared as a spot! Resoldering dry-joints around the field output transistors Q551/2 restored a spotless picture. **C.A.**

Philips GR1-AX Chassis

The report said "sound but no picture". When the first anode control was turned up we found that the problem was in fact field collapse, brought about by failure of the TDA3653B chip IC7500. When this was replaced the set failed to come on at all. We discovered that there was a loose wire in the mains plug. Had this been the cause of the i.c. failure? Shades of the G11. **E.R.**

Hitachi CPT2176 (G6P Chassis)

This set was dead with a high-pitched whistle coming from the vicinity of the line timebase. We'd experienced the fault many times before and had no hesitation about replacing the line output transformer which once again restored normal operation. **E.R.**

Matsui 1420

Intermittent failure to start from cold was the complaint with this 14in. colour portable. Visual checks revealed several dry-joints at the pins of the chopper transformer T501. Resoldering these cleared the trouble. **E.R.**

Bush 2520

The problem with this Turkish-made set was sound but no picture. On investigation we found that the line timebase was inoperative – there was no e.h.t. and the tube's heaters were out. As we had no circuit diagram we used an Avo to check the resistors in the line timebase. This revealed that R605 (5·6kΩ) had gone open-circuit. A replacement restored normal operation. **E.R.**

Amstrad TVR3

We've repaired quite a few of these TV/VCR combinations in the past. Frequently the dead set condition means that R301 (10Ω, 7W) has gone open-circuit. This seemed to be the case with the latest TVR3 to come along, but after fitting a replacement there was a cloud of smoke from C310 (3,300pF, 1kV) at switch on. R301 then promptly burnt out again. We consulted the circuit diagram then removed and checked IC301 (STK7348). There was a short-circuit between pins 8 and 10. Replacing IC301, R301 and C310 restored normal operation. **E.R.**

Contec KTN3732

This portable colour set suffered from severely distorted sound and low volume. It's the third time we've had this fault within a few weeks. In each case the cause has been R125 (36kΩ) going open-circuit. It's situated next to the audio output transformer. **J.E.**

Philips CTX-E Chassis

When the set was switched on the tube's heaters glowed and the e.h.t. came up. There was no raster however, while a loud hum came from the speaker. Safety resistor R3585 (2·2Ω) was open-circuit, removing the 12V supply to the signal circuits. **J.E.**

Matsui 1465

The job card told us that the channel indicators worked and flashed when tuning, but stations couldn't be tuned in – there was just snow. A scope connected to the tuner's VT

pin showed that a tuning voltage was applied when the auto-search button was depressed, so we didn't have a tuning problem. A voltage check at the 12V supply pins BM and BU then showed that this supply was missing. L126 (100mH) was open-circuit. **J.E.**

Salora J Chassis

The complaint with this set was that it sometimes didn't come on. Sure enough just the standby indicator stared at me. The problem was solved by replacing CB712 and CB726 (both 4·7μF, 63V). **J.E.**

Sony KV2029

This set was dead. I found that the section of PCB beneath the two power resistors R621/2 was blackened and charred. Their leadouts had been severely weakened – in fact they fell away when the resistors were removed. In addition Q602 (2SD1497-02) was short-circuit. Replacing the resistors and transistor and a board clean brought the set to life. Fit only genuine Sony parts and use high melting-point solder on the resistors. **J.E.**

Ferguson TX90 Chassis (20 in)

The line output transistor TR112 and line output transformer T102 were both short-circuit. After fitting replacements, along with a new 1·6AT mains input fuse, we switched on. The result was a pulsating picture, with low h.t. and incorrect line frequency. TR107 (BD839) and D109 (BYD33G) in the regulator circuit were both leaky. Failure of the line output transformer always seems to damage these two components. After replacing them we had good pictures and sound. All that was left to do was to check and adjust the h.t. (115V with a 20in. tube). **G.R.**

Sony KV2202

When this set was cold the top third of the picture was blanked out: there was a slow improvement over several minutes. A squirt of freezer on the 4·7μF, 250V electrolytic C818 proved that it was the cause of the trouble. It's mounted on the line board. **G.R.**

Huanyu 37C-3

As there was no load the power supply was whining. The line output transistor had 110V at its collector but there was no line drive. Drive was present at the secondary winding of the driver transformer. It was lost due to a print fault between the transformer and coil L781 in the output transistor's base circuit. The print looked to be intact and had to be bridged to provide a cure. **G.R.**

Decca 100 Chassis

Line sync jitter with the horizontal phase not working was, after eliminating the field/line timebase panel, traced to C403 (10nF) in the line output stage. It's part of the flyback tuning network, along with C402 and C404 (both 100nF). We changed all three capacitors as a precaution.

We had a number of these sets that all required a replacement line output transformer. We also had a number of surplus transformers for the ITT CVC25/30 chassis. These appeared to be suitable replacements. On investigation we found that the pin configuration is the same, but unless a slight modification is carried out the c.r.t. will have a short life. The original Decca transformer has a coil in the heater supply, mounted beneath the transformer. Reposition this beneath the line output stage PCB by cutting the print between pin 3 of plug PLA and pin 2 of the transformer. Also remove the line shift winding at the top of the transformer, otherwise it gets in the way of the screening can. **G.R.**

Philips K40 Chassis

We've had this one twice now: when you switch on the power supply trips and you hear a fading whistling sound. The culprit is C2128 (100μF, 63V). It seems to upset the mark-space ratio of the chopper drive, causing excessive h.t. at switch on. **G.R.**

Grundig CUC60 Chassis

This set was dead. There was h.t. at the collector of the chopper transistor and we couldn't find any fault in the primary side of the circuit. Using a bulb as the load proved that the fault wasn't on the main chassis. After a lot of component replacement we found that the cause of the problem was diode D661, though it read perfectly out of circuit.

Another of these sets had a history of field problems. The output chip had recently been replaced and had failed again. When another one was fitted the set worked but the chip seemed to run warmer than usual. Checks on the pin voltages showed that the only incorrect voltage was at pin 8, which was 1V low. After replacing the electrolytic capacitor (C2758, 100μF) connected to this pin the voltage was correct and the chip ran cooler. It has not failed since. **M.D.**

Sony KV2212

No teletext was the complaint with this set. When text was selected there was just a blank screen. If mix was selected the text came up in monochrome. An empty box was displayed when time was selected. Since monochrome text was present in the mix mode the decoder was obviously working. It seemed likely that the RGB drives were incorrect and a scope check showed that there was no activity at any of the outputs. The manual shows the collectors of the three buffer transistors Q5/6/7 connected to chassis, which caused us some confusion until we followed the print paths and found that they are supplied from a 5V line via the level set potentiometer RV3. This was open-circuit. **M.D.**

Grundig CUC220 Chassis

The owner complained that a singing noise came from the back of this set. He said that it had started suddenly and that the picture had gone pink at the time but later reverted to normal colouring. When we checked we found that the power supply choke was indeed singing, but what the customer hadn't mentioned was that the picture was excessively large, with the h.t. at 140V instead of 119V. Our first suspect was the 119V supply reservoir capacitor C657 (100μF) which can cause problems like this when it falls in value, but a replacement made no difference. Checks around the TDA4600 chopper control chip failed to reveal anything that was obviously amiss, so we went back to our original theory of a low-value capacitor. C647 (1μF, 63V) looked a likely suspect as it's close to a hot wirewound resistor. Replacing this did the trick.

Incidentally the chassis incorporates auto grey-scale correction: we suspect that this is why the screen went pink when the power supply's outputs rose. **M.D.**

Philips TX Chassis (14 in)

The complaint was field collapse. There was no supply to the field output stage because R529 (33Ω) was open-circuit. Before switching on we checked the resistance from the mid-point of the output stage to chassis and obtained a reading of 50Ω. The lower output transistor was the obvious suspect but in fact the 100μF scan coupling capacitor C527 was dead short. **M.D.**

ITT CVC1110 Chassis

The complaint was of intermittent sync. The set was on for several days before we noticed that there was anything wrong: the picture began to jitter vertically and after a time line sync was lost. A scope check showed that there was an appreciable loss of video signal amplitude via the emitter-follower T860. Replacing this cured the sync problem. The odd thing is that the picture content didn't appear to be affected despite the fifty per cent loss of video signal amplitude. **M.D.**

Schneider 1500

This set came in dead. Replacing the power chip restored it to life but the tuning didn't work. A defective pair of tantalum capacitors, C008/9, pulled the tuning line down. On top of this the drive transistor Q004 was leaky. **B.McC.**

Philips G11 Chassis

The power supply still dead after replacing the mains fuses and the bridge rectifier diodes was eventually traced to the trigger pulse generator SCS, circuit reference 4061, being faulty. The cause of line wobble was traced to C2019 in the flywheel sync filter circuit being extremely leaky. This 47μF electrolytic has only about 0·6V across it – obviously not sufficient to ensure that it acts as a capacitor in the long term! **S.P.**

Philips KT3 Chassis

This set was tripping. Not much of a problem here I thought. But after disconnecting the line output transistor, the tripler and the line output transformer to no effect I was beginning to feel rather discouraged. The set continued to trip even with a dummy load connected to the power supply, the h.t. voltage pulsing. After a lot of checking in the power supply I happened to scope the voltage across the mains bridge rectifier's reservoir capacitor. I was surprised – and highly delighted! – to find that a 100V ripple was present. In went a new electrolytic block, off came the dummy load and the rest of the set was reconnected. Thankfully it was now working normally. **S.C.**

Finlux 1000 Chassis – Teletext

Most of the teletext faults we've had with these sets have been repaired in the field by panel replacement. The faulty panels are brought back for repair at a later date. Well, this was the later date – we were getting short of working panels! There were about seven to be repaired. Most of them were dealt with by repairing broken print, regulator replacement or resoldering the leadthrough pins. I finally found myself with a no red fault. As the SAA5050 video character generator chip is in a holder the simplest course was to fit a replacement. Unfortunately the fault was still present, and voltage checks didn't reveal anything amiss. The scope was next brought into action. Data was present at the red output pin of the SAA5050 chip. The signal was traced right through to the red buffer transistor, which had a perfect waveform at its emitter. So the fault had to be after this component. I was now looking for a print crack, since there was nothing else left to check. As I was inspecting the copper side of the PCB I spotted the cause of the trouble. It wasn't a crack, and the fault must have been there from new. The red pin on the panel's socket didn't protrude from the print. In fact it was bent over under the socket's plastic cover. Removing the socket and bending the pin back to its proper position put matters right. **S.C.**

Salora H Chassis (Ipsalo 2)

This set had a number of faults that at first sight didn't seem to be related. First the tube looked soft, secondly a low-frequency humming came from the loudspeaker, and finally and most curiously the field folded over when the aerial was disconnected. Where to start? Well the tube is as good a place as any, so a check was made on its voltages. We found that the e.h.t. was low at 20kV, so the tube was all right. We then checked the secondary supplies derived from the Ipsalo transformer and found that these were also low. The set-e.h.t. potentiometer RTB700 was adjusted to see whether we could get the correct voltages, but the slightest tweak was all that was required to send the e.h.t. sky high. A replacement preset didn't help matters at all. What did restore everything to normal operation was a new LF0034 Ipsalo control chip. **S.C.**

Sony KVX2521

A motorboating noise could be heard from the loudspeaker when standby was selected. It didn't take us long to find that the audio output chip's mute pin was negative in standby instead of being high. The cause of this was a dry-joint at the output chip's heatsink chassis connection. Resoldering provided a complete cure. **S.C.**

Sony KV2096

Several calls had been made to this set because the picture went off, but the fault never occurred when an engineer was present. We took it back to the workshop for a soak test and after a couple of days the fault developed: instead of a picture there was a dark, blank raster. Unfortunately as soon as the back was removed the picture returned. No amount of tapping around or heating/freezing would bring on the fault. So we waited. After a couple of brief appearances we were still clueless as to the cause of the fault. Then on its third return we were provided with a major clue as to where the cause of the fault might lie. The screen went black as before, but a slight coloured shimmering and, occasionally, a few teletext characters were seen. This time the fault remained when the back of the set was removed. By this time everyone was walking on tiptoe. Several components were lightly pressed or tapped. Only when the SAA5050 text chip was lightly touched did the fault clear. As this chip is in a holder we unplugged it and soldered it directly to the PCB. We haven't seen the set since. **S.C.**

Long-distance Television

Roger Bunney

November was a decidedly quieter month than October. There was much less F2 layer reception, though a number of DX-TV enthusiasts received exotic signals around the middle of the month. Otherwise, there was a sprinkling of Sporadic E signals and also an intense tropospheric opening.

The short-lived tropospheric opening occurred on the 22nd, with reception in all bands from the Benelux countries, Denmark (both the DR and TV2 networks), Sweden, Norway, eastern Germany and the various west German regions (including a SAT 1 terrestrial relay on ch. E52). RTL+ was noted on ch. E36. Reception was reported from the south east, the east and the north east, spreading into the hillier parts of the Midlands and Wales.

The SpE log is hardly exciting this month:

5/11/91 TSS (USSR) chs. R1, 2; JRT (Yugoslavia) E3; RAI (Italy) IA, B; TVE (Spain) E2, 3, 4.
6/11/91 RAI IA; SVT (Sweden) E3.
13/11/91 DR (Denmark) E3; TVE E2.
17/11/91 DR E3; TVE E2, 3.
18/11/91 RAI IA; NRK (Norway) E2; +PTT (Switzerland) E2, 3.
23/11/91 DR E3; TVE E2.
28/11/91 RUV (Iceland) E4.
29/11/91 DR E3; TVE E2.

There was an interesting auroral event during the evening of the 8th, with strong reflected signals being noted throughout Bands I and III. Simon Hamer received RTE (Eire) from Gort on ch. IB and in Band III and many unidentified European signals including two System M signals on chs. A2 and A3.

The F2 log is as follows:

5/11/91 Unidentified ch. E2 signal; NTV (Nigeria) E3.
6/11/91 Unidentified ch. E2 signal.
7/11/91 TSS R1; three unidentified ch. E2 signals.
8/11/91 TSS R1; Thailand E2 (3 caption).
10/11/91 ZTV (Zimbabwe) E2 (1100-1500).
12/11/91 TSS R1; Irib (Iran) E2.
13/11/91 Irib E2; DDQ (Australia) ch. 0; New Zealand ch. 1; ZTV E2; Thailand E2; RTM (Malaya) E2; TSS R1; Dubai E2; China C1; unidentified 525-line signal on ch. R1!
14/11/91 Similar to the 13th.
15/11/91 Irib ch. E2 twice.
16/11/91 Dubai E2.
17/11/91 TSS R1.
20/11/91 Dubai E2.

Our thanks to Cyril Willis (King's Lynn), David Glenday (Arbroath), Tim Anderson (St. Leonards), Roger Fussell (Torpoint), Simon Hamer (Powys) and Ryn Muntjewerff (Holland) for sending in reception reports.

Anthony Mann (Australia), who predicted the F2 opening on the 13/14th, points out that it showed a 27-day repeat pattern following the geomagnetic storms on October 16/19th. Anthony reports that Norway ch. E2 with the PM5544 pattern was received in Australia on October 17th, followed by very strong European ch. E2 signals on the 18/19th. The Thailand ch. E2 vision carrier has been measured at 48·251MHz, having drifted slightly high in frequency.

Hugh Cocks, now in the Algarve, Portugal, has been receiving Brazilian ch. A2/3 stations from about 2100 to 2400 nightly, also an African Band I signal. Hugh is active professionally in the satellite TV field. He reports that the Scandinavian channels via Intelsat at 1°W are visible with a 1m dish. RTL4, Teleclub and Screensport via Astra are poor, with MTV/Filmnet only just detectable.

News Items

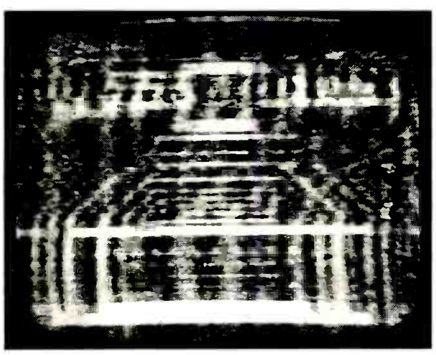
Australia: Robert Copeman has written explaining the current situation with ch. 0, which has been received in the UK recently during good F2 conditions. RTQ-0 at Toowoomba, Queensland was formerly known as DDQ-0: it now uses the WIN Queensland identification with a square of dots – previously it used the "Star" logo and earlier the identification "Vision-TV". The ABMN-0 Wagga Wagga transmitter is an ABC network outlet. NNEN-0 Tamworth, New South Wales, uses "PRIME" as a logo. For scanner enthusiasts, RTQ-0's vision carrier is at 46·17185MHz.

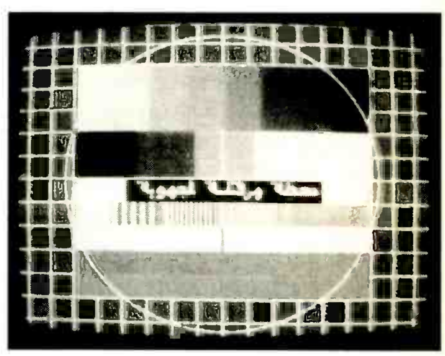
Argentina: The Federal Broadcasting Committee has at last agreed to the use of u.h.f. TV frequencies, with the offer of six channels per franchise. All u.h.f. channels within a franchise grouping must be scrambled. Decovision SA is already using chs. 32, 34, 36, 38 and 40: at present the first three are scrambled with the others clear for demonstration purposes.

Trinidad: TTTV now has two commercial rivals, Channels TV6 and TV 18. The transmitters are at Port of Spain.

Spain: An Aragon regional TV service is to start at the end of 1992.

Cyprus: It has been reported that all transmissions have changed from SECAM to PAL.





Left: F2 reception of Dubai ch. E2 by Ryn Muntjewerff in Holland (14th November 1991). Centre: Turkish Mega 10 channel received by Peter de Jong in Holland via Eutelsat II F1 at 13°E. Right: Algerian test pattern received by Ian Waller, Lincoln, via the Intelsat craft at 1°W (3·97GHz).

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Iceland: The RUV network now carries teletext, called Textavarp. The Icelandic text characters caused problems initialy: these have been resolved using modifications similar to those used in Hungary. Philips has developed a dedicated Icelandic teletext decoder.
USSR: According to the BDXC the Russian news programme now carries the caption "RTV" on Russian TV proper, with "CT" on the main network first programme.
Finland: NICAM stereo TV is now being transmitted by the more remote stations at Ahtari, Haapavesi, Oulu and Tervola. News teletext (YLE Teksti-TV) is being transmitted with YLE-1, some 700 pages being available on a 24-hour basis. During non-programme hours YLE-1 transmits the test pattern.
Poland: A 1kW e.r.p. transmitter is now in operation at Wrocklaw, on ch. R28 (SECAM).
Czechoslovakia: Slovak TV (Slovenske Televize) has been testing in PAL for up to fifteen minutes before programmes start. Last October Czech TV (Ceska Televize) started a PAL programme test (Kutaly Stul).
USA: At mid-Summer 1991 there were 201 v.h.f. and 694 u.h.f. LPTV (low-power TV) stations in operation (at up to 10W v.h.f. and 1kW u.h.f.). The operators of these services have made a joint complaint to the FCC on various restrictions and limitations.

Satellite TV

It seems that there has now been successful pirate decoding of Sky Movies Videocrypt scrambling and that the subscriber smart card can be modified for continuous decoding of Sky transmissions.

Brightstar has booked transponder facilities with Intelsat K at 21·5°W to link Europe with both North and South America in the Ku band. Multiple downlinking on a regional basis will be available from June. The Eastern beam covers the whole of Europe, into east Poland and Greece.

The Australian Ministry of Communications has given permission for a Pay-TV service to be started via the Aussat craft. The single licence will allow a four-channel service. Two further channels will be available.

Three transponders aboard the Scandinavian Tele-X satellite at 5°E are now in use. Test transmissions have been seen at 12·475, 12·61 and 12·66GHz. Note that polarisation is circular, not linear.

While supporting the principle of the D2-MAC standard Canal Plus has opted for scrambled SECAM via the Telecom 2A satellite. Canal Plus gives as the reason for this the increased transmission and receiving costs with D2-MAC.

A new Kopernikus satellite, DFS-3, is to be launched in 1994 to supplement the two present craft.

A reader at Maidenhead reports that BBC World Service TV has been seen via Intelsat VA F11 at 65°E. Transmissions are at 4·1875GHz with right-hand circular polarisation. This on-horizon satellite provides a weak signal, but it's not scrambled.

Band I Aerial Filter

Details of an interesting Band I filter have been sent in by Brian Williams (Penarth, South Wales) who uses it to improve signals and remove out-of-band birdies and wordprocessor hash. Fig. 1 shows the circuit. The input from the aerial is coupled in at 75Ω. A tightly coupled coil, L2, links the two tuned circuits L1/Ct and L3/Ct. L1 and L3 consist of twelve turns of 26g enamelled wire close wound on a ¼in. coil former with dust core. L2 consists of two turns over the centre of L1. Ct is a miniature trimmer with a maximum value of 25pF.

Depending on the aerial in use, the filter also acts as an aerial tuning unit (ATU) and will correct mismatching, offering an improved signal level. With a good match between the aerial and the receiver's input circuit, the slight insertion loss introduced by the filter is 0·5-1dB. Brian has constructed several of these filters and says that there's only a slight loss at the l.f. end of the coverage while the h.f. end (ch. E4) has in all cases been improved.

The filter must be connected between the aerial system and the first stage of amplification, i.e. before any signal preamplifier used.

We would be interested in hearing of any other circuits devised to reduce interference at v.h.f.

News Letter

David Thorpe is now producing a twice monthly satellite newsletter called *Transponder*. This A4 format publication is an excellent way of keeping up-to-date with the latest

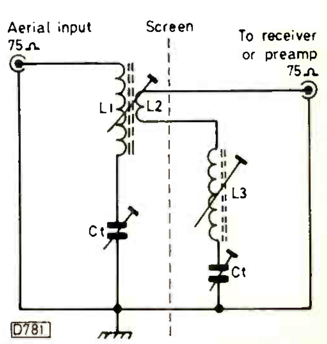


Fig. 1: Brian Williams' Band I channel-pass filter. Bandwidth is 5-6MHz, but stagger tuning will increase this. The filter can be tuned across Band I (45-70MHz).

satellite activities, including reception reports. For £1·75 you can obtain a sample copy from David at PO Box 112, Crewe, Cheshire CW2 7DS.

World Satellite Almanac

The Third, 1992 edition of the *World Satellite Almanac*, just published, is the largest so far, running to nearly 1,100 pages. It contains everything you need to know about any given satellite, including the uplink/downlink frequencies, types of downlinking beams, polarisation, power, footprint maps, etc.

Between pages 293-756 the book is divided into three ITU sections, covering progressively satellites from 66·5°E westwards around the globe until you return to 66°E. Apart from occasional non-TV satellites such as the Immarsats, all the satellites are TV downlinkers in either the L, C or Ku band.

Arthur C. Clarke provides the foreword, after which the basics of radio communications theory, the global satellite network, transmission standards, scrambling, voice and data transmission techniques, basic theory of signal transmission/reception as it relates to satellites, the various types of satellite craft and their on-board facilities and numerous other relevant subjects are covered. After page 756 there are transponder loading tables for most of the main craft now in operation, followed by glossaries, addresses, terminology, DBS assignments, world TV systems and standards and a section on solar and rain disturbances.

Mark Long is to be congratulated on his compilation of this essential reference book, which is printed on good quality paper with clear typesetting and a mass of diagrams. The book is 8·5 × 11in., weighs 4·25lb and has a gloss soft cover.

The UK price is £59 inclusive of mainland postage. For Europe add 10 per cent and for other parts of the world 20 per cent – carriage is by air mail. The almanac is available from J. Vincent Technical Books, 24 Riverside Gardens, Purley, Reading, Berks RG8 8BX (phone/fax 0734 414 468). You can examine a copy at The Modern Book Company, 19-21 Praed Street, Paddington, London W2 – this company also has all the Baylin, Breeds and McCormac satellite books available. My thanks to J. Vincent Technical Books for providing a review copy. Note that those in the trade should be able to gain 100 per cent capital expenditure relief.

Micro Clinic

Commodore C64

The complaint with this fairly early C64 was that it locked up, with garbage on the screen. On starting it up nothing worked at all except that there was a blank, synchronised raster on the screen. The owner had reported that before the final breakdown it would sometimes lock up after about half an hour to an hour, displaying whatever was on the screen with the addition of random characters.

On opening it up I found that the main 5V supply was at about 12V. The power supply arrangements are a bit obscure. There are two 5V supplies, a 12V supply and an unregulated 9V supply – the latter feeds the tape recorder. The 12V supply is used by the 6567 display chip, the 6581 audio chip and the audio amplifiers. The small 5V supply, which is on the main baseboard, feeds the video and clock circuits while the main 5V supply feeds the rest of the chips. It was this latter supply that was causing the trouble as the regulator had failed. It's located in the power supply, which is potted, so the only solution is to discard the old one and get a replacement.

When this was obtained and fitted the display became a border containing garbage, so further investigation was needed. On this machine the memory consists of four 4164 chips, each holding one bit of each byte in the memory. Little further hunting was required to find the defective chip here. Had there been more than one defective chip the pattern would have changed.

The machine's owner was very lucky, but would have been luckier still had the power supply not been potted, as a repair would have been cheaper than a new supply. I speak with feeling about this: as the machine belongs to one of my grandchildren the eventual cost fell on me!

M.C. Matthews, B.Sc.

CD Player Casebook

Reports from Mike Leach and P.J. Roberts

JVC XLE34

This machine took us a while to sort out. It came in with the complaint of occasional skipping and jumping and not finding tracks properly. But it wouldn't show us these faults. It seemed to play all our discs all right despite a lengthy soak test. At a third attempt at giving it a soak test however we found that it wouldn't read some discs. Sometimes the turntable would spin but the machine didn't read the disc. As cleaning and setting up made no difference we came to the conclusion that the laser unit was faulty. A new Optima-5S was obtained from JVC and fitted. When set up the machine worked perfectly. **M.L.**

Sony CDP-M35

It's all lasers this month! I wasn't too sure about this Sony player until after it had been returned to the customer and given a thorough soak test at his home. The complaint was of the usual skipping and jumping, but in the workshop the machine played our discs with no problems. As we know by now, faults like this can be a real problem. Setting up and cleaning made no difference in terms of the r.f. waveform. We wondered whether the laser had just been dirty and would now be o.k. It wasn't. After fitting a replacement and setting the machine up it worked perfectly. **M.L.**

Grundig CD9000

The complaint was that the display didn't light up. Checks showed that the a.c. filament voltage and the supply to the driver chip were present, but the −4V that should have been present at pin 4 of this chip was missing. The voltage is derived from the −24·6V rail via transistor T2 and the 68kΩ resistor R205 which is connected between pins 4 and 5 of the chip. R205 had risen in value. A replacement resistor of the correct value restored the −4V and normal operation of the display. **P.J.R.**

150MHz Frequency Prescaler Project

David Botto

Older types of frequency counter are in wide use. They are often well made and accurate, and many incorporate high-stability quartz oscillators. These otherwise excellent instruments commonly suffer from one major drawback – they have a limited upper frequency range, extending to only around 30MHz or in some cases 10MHz. Since modern TV/VCR/microcomputer servicing calls for a frequency counter with a minimum range of up to around 80-100MHz you may be thinking of obtaining a new one, but the considerable expense may make you hesitant. The frequency prescaler described in this article is inexpensive, simple to build and will save you the cost of replacing an old frequency counter. It uses only a few readily obtainable components and will extend the range of almost any frequency counter to an upper limit of at least 150MHz.

Many top-quality multifunction digital multimeters, such as the Fluke Model 85 and the BK Precision Model 388HD, have frequency ranges with an upper limit of 200kHz. The Beckman DM27XL digital multimeter, another excellent instrument, can handle frequencies as high as 20MHz. A useful feature of the prescaler is that it extends the upper frequency coverage of such instruments by a hundred times, with an upper limit of 150-200MHz. Thus an instrument with an upper limit of 200kHz can be used at up to 20MHz while one with an upper limit of 15-20MHz will in effect have an upper limit of 150MHz or greater.

I've also found that the prescaler can be used to extend the input frequency response of some older types of oscilloscopes. Because the prescaler's output consists of digital pulses, it can be used with these scopes only when you are checking digital circuitry.

The instrument also operates as a 5V d.c. 950mA precision power supply. This is especially useful when you need to supply test and power voltages to TTL circuitry.

Basic Principles

As experienced service engineers will agree, to get the best from any instrument you need to know how it works. The frequency prescaler is no exception to this rule. The basic principle is simple: a series of frequency dividing flip-flops is used to reduce the input frequency to a hundredth of its original value.

The flip-flop is a digital logic circuit whose basic function is to store a single bit of binary data. It has two stable states, and will remain in either state until a pulse comes along and makes it change state. The digital logic flip-flop is similar to, but not the same as, the well-known bistable circuit.

The JK flip-flop is the most versatile type in common use. It usually consists of two latch flip-flops. Fig. 1 shows the symbol used in circuit diagrams. When the output waveforms at A and /A are as shown, the flip-flop is said to be set. If the J and K inputs are left open-circuit or kept in the logic high (H) state, then each time a pulse arrives at the clock/toggle (T) input the outputs at A and /A change state. This change of state occurs on the falling edge of each input pulse, see Fig. 2. Thus the flip-flop will, when fed with a train of toggle pulses, be continually set and reset.

When the J input is high and the K input is low, the flip-flop will be set on the falling edge of an input pulse and will stay set until the K input is driven high and the next toggle input pulse arrives.

Fig. 2 shows the toggle input waveform at (a) and the A output at (b). Notice that the output frequency is half that of the input frequency.

Fig. 3 shows how a divide by one hundred frequency prescaler can be made using a number of separate JK flip-flop chips. The input signal is fed to a Modulo 5 counter that consists of three JK flip-flops and an and gate (and gate 1). Initially all three flip-flops are in the reset state (see Fig. 4), with binary zero (L) signals at outputs A, B and C and binary one (H) signals at /A, /B and /C. When digital pulse number one is applied to all three toggle inputs, only flip-flop one changes state on the falling edge of the pulse. This is because only flip-flop one has its J and K inputs at binary one (H). The truth table, see Fig. 5, shows the outputs at A, B and C after each falling edge of a series of nine toggle input pulses.

The falling edge of input pulse number one makes flip-flop one's A output change to binary one (H), the set state. Because the J and K inputs of flip-flops two and three were at zero (L) these two didn't change state. Now that flip-flop one is set, flip-flop two's J and K inputs are at one (H). Thus the falling edge of toggle input pulse number two sets flip-flop two and resets flip-flop one.

Pulse number three sets flip-flop one again and leaves flip-flop two's B output at one (H). And gate one now has a one at each input. Thus a one (H) appears at flip-flop three's J input.

The falling edge of input pulse number four toggles all three flip-flops, producing a one (H) at output C. The K input of flip-flop three is now at one while zero signals (L) appear at A and B. When the falling edge of input pulse number five arrives, flip-flop three is reset. Flip-flops one and two remain reset. Thus the initial conditions are restored. Pulses 6-9 repeat the process.

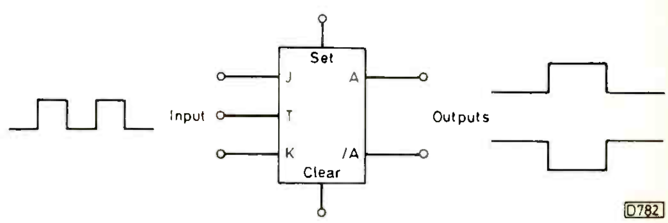


Fig. 1: Circuit symbol/logic diagram for a JK flip-flop.

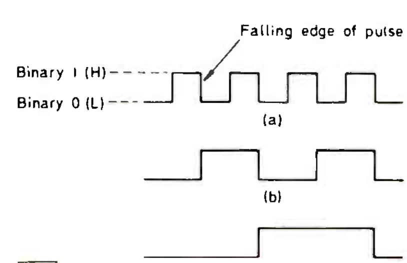


Fig. 2: JK flip-flop waveforms. (a) Toggle/clock input. (b) Output waveform at A with the input as shown at (a). (c) Output waveform obtained from a second JK flip-flop whose toggle input is fed from A.

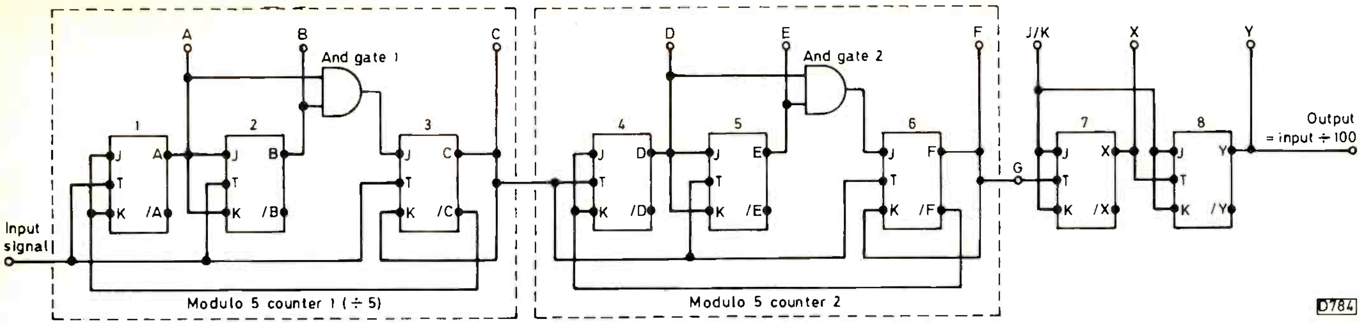


Fig. 3: Divide by 100 prescaler using eight JK flip-flops and two and gates.

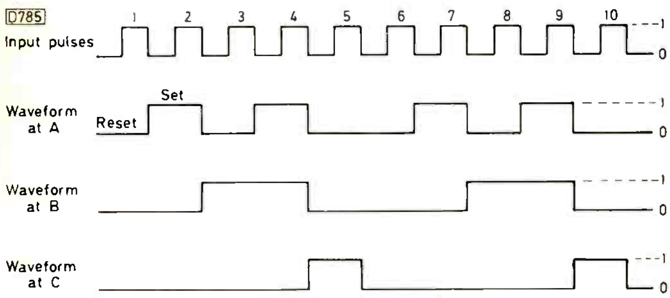


Fig. 4: Modulo 5 counter waveforms.

		A	B	C
All flip-flops reset to 0		0	0	0
Input pulses	1	1	0	0
	2	0	1	0
	3	1	1	0
	4	0	0	1
	5	0	0	0
	6	1	0	0
	7	0	1	0
	8	1	1	0
	9	0	0	1

Signal recycles

D786

Fig. 5: Truth table for a Modulo 5 counter.

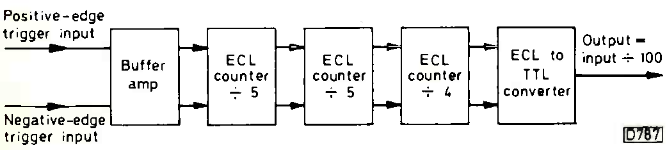


Fig. 6: Block diagram for the SP8629 prescaler chip.

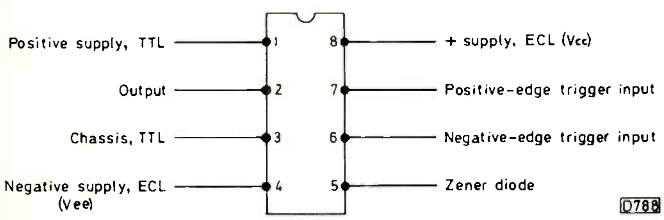


Fig. 7: SP8629 pin connections, viewed from above.

From Fig. 4 you will see that the Modulo 5 counter's output, C, is at a fifth of the input frequency. Thus with a 100Hz input the output will be at 20Hz. This output is fed to a second Modulo 5 counter which provides a further division by five, reducing the 20Hz signal to 4Hz. Two further JK flip-flops each divide by two so that the final output is at 1Hz, i.e. division by one hundred has been achieved by the eight JK flip-flops and two and gates.

Practical Circuit

To build the circuit in the form shown in Fig. 3 would call for a number of chips plus an input buffer amplifier and circuitry to handle non-digital input signals. Fortunately all the hard work can be done for us since the SP8629 chip incorporates all the necessary circuitry in a single eight-pin package. Fig. 6 shows a block diagram of this useful device while Fig. 7 shows its pin connections.

The SP8629 incorporates ECL counters and a buffer amplifier that enables it to handle sinewave and other waveforms. ECL logic circuits are used because they produce high-quality outputs and the propagation delay is typically only two nanoseconds. Thus the operating speed is very fast and internal transistor saturation doesn't occur. The final ECL-TTL converter gives a TTL output that's ideal for driving almost any frequency counter or DMM with frequency ranges.

The complete prescaler circuit is shown in Fig. 8. As the SP8629 has a consumption of about 36mA, which is rather a lot for a small battery to supply, a mains-operated power supply is used. The two 4·5V secondary windings of an RS Components mains transformer are connected in series to provide a 9V a.c. input to the bridge rectifier BR1, which produces approximately 12V d.c. across its reservoir capacitors C1/2. IC1 provides a regulated output of exactly 5V at 1A. The internal circuitry of this regulator incorporates automatic thermal overload protection: in addition safe operating protection makes the regulator virtually damage proof. R1 acts as a load for IC1 which supplies pins 1 and 8 of the SP8629 chip IC2 and also provides a 5V, 950mA regulated output.

The prescaler input is fed via a BNC socket and C5 to pin 7 (the positive-edge triggering input) of IC2. R2 slightly reduces the sensitivity but prevents the circuit oscillating when no input is present. Sinewave as well at TTL input signals can be handled. If you intend to use the frequency prescaler purely for TTL work the input circuit can be modified as shown in Fig. 9. The negative-edge triggering

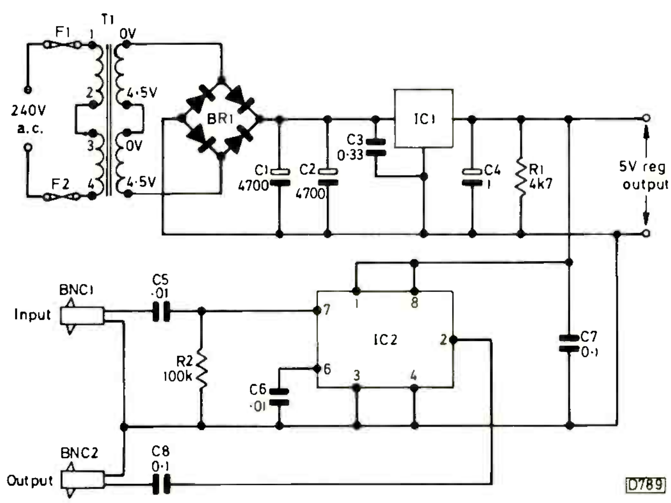
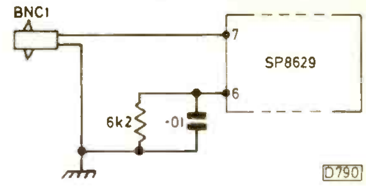


Fig. 8: Complete frequency prescaler circuit.

input pin 6 is decoupled to chassis by C6.

IC2's output is taken via C8 to a second BNC socket. C8 serves to protect IC2 in case of an accidental short-circuit of BNC2's connections. The frequency at BNC2 is always exactly a hundredth of that at BNC1.

Fig. 9: Circuit modification for direct coupled input with TTL signals only. Not necessary for general use.



Construction

The accompanying photograph shows the internal layout of the unit. Construction is straightforward because virtually everything happens within the two chips. Fig. 10 shows the front panel hole positions and lettering while Fig. 11 shows the rear panel details. There's a ready-drilled hole in the rear panel for the mains supply lead and grommet. It's best to follow the tested layout shown in the photograph. The mains transformer is raised a little off the bottom of the case, using spacing pillars or additional washers, to ensure that the connections clear the PCB.

Before you drill the case to mount the transformer and the universal PCB, make sure that the PCB is facing the correct way. The number 276-168A on the board should be towards the back of the case. This is important, because the black plastic panel of the Tandy case fits into the slots at the front and the metal panel into the slots at the rear: these two panels are not interchangeable.

Drill two holes in the bottom of the case to match the holes in the top right-hand and bottom left-hand of the universal PCB. These holes accept 4BA or equivalent-sized metric nuts and bolts. Use two small rubber grommets to space the board slightly away from the bottom of the case. It's preferable to use nylon nuts and bolts to secure the PCB as these will save you work. If metal screws are used you'll have to coat the metal screwheads on the underside of the case with insulating compound, then neatly seal them over with small pieces of tough plastic insulating tape.

The case has a plastic section that raises the front slightly for easier viewing of the panel. Fit two adhesive feet at the rear underside corners to prevent the instrument sliding about on the bench.

Mount the bridge rectifier directly on to the transformer's secondary winding connections, with the a.c. input leads soldered across the 9V a.c. output. Solder two lengths of wire, black and white, to the rectifier's positive and negative connections. These go to the positive and negative lines on the PCB. Allow a little extra length for these two wires in case you should need to remove the PCB from the case.

Wiring on the PCB is simple – the copper track connections of the universal PCB save work because one strip can be used as the positive and the other as the negative rail. Do not omit the heatsink that clips over IC1.

After wiring the PCB carefully, check your connections and ensure that all is in order. Connect an ohmmeter between the positive and negative rails to check that no short-circuits are present. For long-term reliability, spray or paint the PCB with circuit varnish – but be careful not to spray the area around pins 6 and 7 of IC2.

After fixing the PCB and mains transformer to the case, insert the front and back panels. Wire the green neon light across terminals 1 and 4 of the mains transformer (you'll have to lengthen one lead slightly). Connect the lead from C5 on the PCB to the input BNC connector. C8 is soldered directly to the output BNC connector on the left-hand side of the panel, with a lead going to pin 2 of IC2. Finally connect the leads to the rear panel mounted fuse-holders and the 5V insulated supply sockets.

Dry-transfer white lettering can be used for the front panel lettering. Alternatively – this is the method I used – a computer with a daisy wheel or laser printer can be used to print out the wording in heavy shadow-print on good quality white paper. Then cut out the words and gum (not glue) the letters to the front panel. When the gum is completely dry apply a coat of Pelikan Klarlack clear varnish over each letter, using a tiny brush, to prevent them being rubbed off. Transfer letters and varnish can be obtained from a local art shop. Don't use cellulose varnish because this will remove the letters and the surface of the front panel. Be sure to wear a pair of BEAB approved safety goggles when applying circuit varnish or Klarlack clear varnish: both are deadly to the eyes and can cause permanent damage.

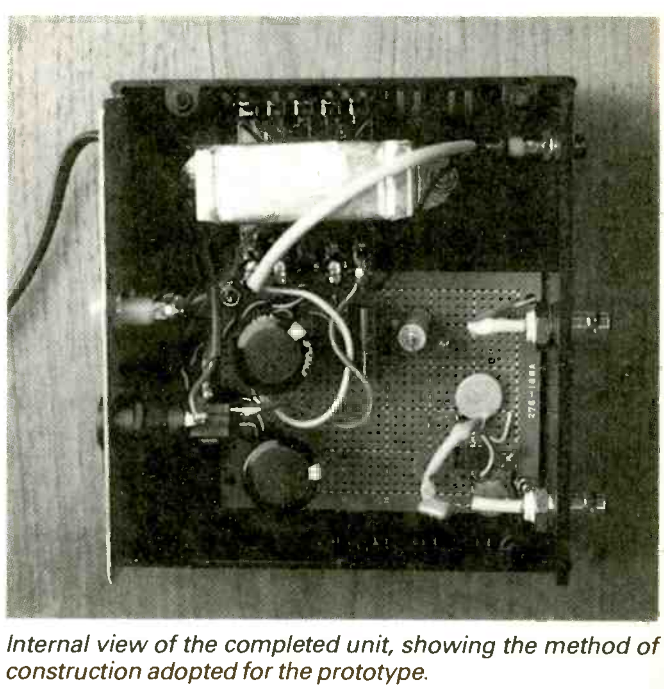
Test Leads

You can make your own test leads for the frequency scaler but it's almost as cheap and certainly much easier to buy ready-made test leads (see components list). A BNC plug to crocodile clips lead is ideal for the input connector. A BNC plug to BNC plug lead will probably be needed to connect the output to the frequency counter. Most counters have BNC input connectors. If yours doesn't, you'll need a BNC connector to you counter's type of input connector. Use a BNC plug to 4mm plugs lead to connect the prescaler to a DMM with frequency ranges.

Testing

No setting up or calibration is required. All you need to do to test the prescaler is to follow the procedure as described below.

First connect a digital voltmeter to the 5V d.c. output sockets. Connect the prescaler to the a.c. mains supply. The DMM should read exactly 5V d.c. and the green lamp should light.



Internal view of the completed unit, showing the method of construction adopted for the prototype.

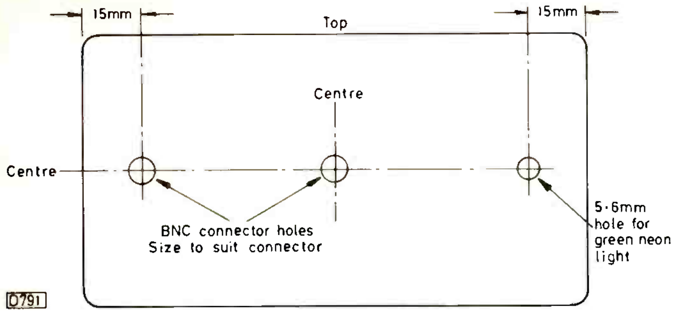


Fig. 10: Hole spacings for the plastic front panel.

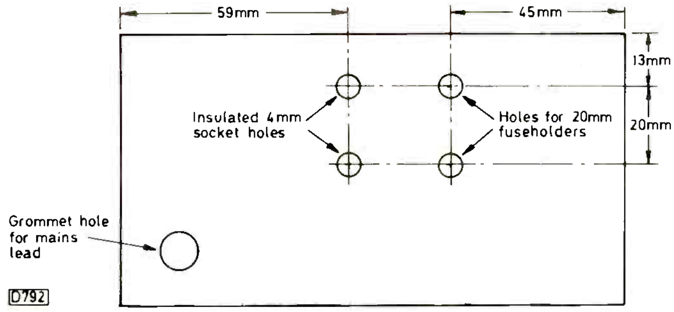


Fig. 11: Hole spacings for the metal rear panel. Hole sizes depend on parts used.

Disconnect the prescaler from the mains supply. Connect a frequency counter, or a DMM with frequency ranges, to the output BNC connector. Reconnect the power supply and feed an h.f. test signal not exceeding 5V in amplitude to the input BNC connector. The frequency readout should be a hundredth of the input frequency.

If all is in order, disconnect the mains supply again. Use a tiny brush to apply a little circuit varnish to the mains transformer connections, the fuseholder connection lugs and the 5V output connection lugs.

Finally fit the top of the case with the four self-tapping screws provided.

Parts List

IC1 MC7805CT. RS Components stock no. 641-617.
IC2 SP8629. RS Components stock no. 307-474.
Heatsink clip. RS Components stock no. 263-245.
BR1 1·6A bridge rectifier. RS Components stock no. 261-491 or similar.
Miniature green 240V a.c. neon light. Tandy stock no. 272-708A
12VA surface-mounting 240V mains transformer with 0-4·5V/0-4·5V secondary windings. RS Components stock no. 207-627.
4BA bolts, nuts, spacers and washers to secure transformer.
R1 4·7kΩ, 0·5W. R2 100kΩ, 5/8W. C1 and C2, 4,700μF, 30-35V PCB mounting electrolytics.
C3 330nF, 100V wkg. C4 1μF 100V electrolytic.
C5 and C6 0·01μF, 50V disc.
C7 0·1μF, 50V disc. C8 0·1μF, 100V.
Two 50Ω BNC panel-mounting insulated sockets. RS Components stock no. 456-706 or similar.
Two banana jack sockets, one red one black. Tandy stock no. 274-725A or similar.
Two 20mm fuseholders. RS Components stock no. 414-134, Tandy 270-362 etc.
F1/2 20mm 500mAT fuses.
Universal PCB. Tandy stock no. 276-168A.
Two small rubber grommets. One rubber grommet to fit mains lead hole.
Archer ventilated instrument case. Tandy stock no. 270-250 or similar.
Two self-sticking cushion feet. Tandy stock no. 64-2346 or similar.
1m black twin 5A flexible mains lead.
13A mains plug with 3A fuse.
Circuit varnish and Pelikan Klarlack clear varnish.
Test leads. Input 1·2m 50Ω BNC lead with crocodile clips. RS Components stock no. 488-523.
Output to counter 0·6m 50Ω BNC plug to BNC plug. RS Components stock no. 488-309.
Output to DMM 50Ω BNC plug to 4mm plugs. RS Components stock no. 488-595.

Use

There are no input sensitivity controls as these would tend to limit the instrument's upper input frequency response. You can however make use of the frequency counter's input gain control(s).

In practice virtually all the h.f. signals you need to measure will be of less than 5V a.c. amplitude. If you do need to check signals in excess of 5V but not exceeding 50V, a 10:1 scope probe can be used. This probe must have a frequency response of at least 150-200MHz.

Performance

The prescaler was tested using a sine/square-wave signal generator and a digital pulse generator. The highest frequency my generator produces is 155MHz, which resulted in a reading of 1·55MHz on my Heath frequency counter (the suppliers of the SP8629 say that its response is typically to 200MHz).

The prescaler worked well with a Cirkit TM175 DMM. As an example, on the TM175's 2MHz range 155MHz could be easily read as 1·550MHz.

An oscilloscope with a top Y channel input response of 5MHz performed well with 100MHz digital signals (remember that whatever its input the prescaler's output is always a digital signal). This combination of the prescaler and an old scope won't do in place of a modern 100MHz analogue/digital scope of course, but it's nevertheless surprisingly effective.

Regulated 5V Output

The regulated 5V d.c. output is convenient when microcomputers are being repaired. For example a BBC Model B microcomputer failed because one of the 5V supplies was defective – a stock fault with the BBC B. Was this the only fault I wondered, or did further nasty things lie in wait? Temporary use of the prescaler's 5V output restored operation – a new regulator chip in the microcomputer cured the fault.

In Conclusion

The prescaler is small enough to be carried on outside calls with a DMM that has frequency ranges. It's a useful addition to the test bench to give your frequency counter a capability of 150MHz or greater.

Fault Guide for the Ferguson 3V29

John Coombes

The following fault-finding list summarises our experiences with the Ferguson 3V29/30 and their JVC equivalents Models HR7200/7300. It supplements Joe Cieszynski's outline of basic overhaul procedures last month.

Electronic Faults

No results: First checks should be on the sensor lamp, the mains switch and the 1·25AT mains fuse F1. The latter may have failed due to age. If it has blown, check the filter capacitor C1 (0·022μF). The mains transformer T001 could have shorted turns or its internal thermal fuse might be open-circuit. Next check F3 (2·5AT) in the feed to bridge rectifier DS1 (D5FB10-1). If this fuse has blown, check the bridge rectifier diodes for shorts, also if necessary the protection capacitors C2-6 (all 0·01μF) and the reservoir capacitor C7 (4,700μF, 35V). If the regulated 12·5V supply is still missing, check the regulator driver transistor Q1 (2SD639R) which tends to go short-circuit.

If the problem is that the front panel buttons and/or the remote control unit, also the timer start, is/are inactive, check that data information is present at pin 39 of the UPD553C-164 microcomputer chip IC2. This chip could be responsible for the lack of response but in practice rarely fails. Check the d.c. conditions carefully before condemning it. The clock oscillator is connected to pins 1 and 42. No clock operation could be due to the crystal CF1 and/or the tuning capacitors C2 (100pF)/C3 (470pF) which can become leaky – IC2 could also be responsible. Check also that the reset pulse is present at pin 26. If not, suspect IC3 (UPC339C).

If the buttons work but there's no remote control operation, check IC3 (UPC339C) which contains a series of comparators.

If there's no mechanical operation through the clock display is present, the play button light is on and the E-E mode is working, check F4 (2·5A). It may simply have gone open-circuit. If it has blown, check bridge rectifier diodes D7-10 (type V03E), the 0·01μF protection capacitors C13-17, the reservoir capacitor C18 (4,700μF) and Q5 (2SD637R) for shorts. Relay RY1 could be responsible for the fault.

No E-E signals, all mechanical functions operational: Check fuse F5 (315mAT). If this has not failed due to age, check D11 (V03E), C19, (0·01μF) and C20 (100μF) for shorts. If all is o.k. here, check for shorts at Q8 (2SB644) and IC3 (UPC574J) on the tuner/i.f. panel.

No clock display: Check F6 (315mAT). If blown, check D12 (10E2), C21 (0·01μF) and zener diode D13 (HZ22-3L) for shorts. Q7 (2SD880) and Q8 (2SB642Q) can also go short-circuit.

If the −23V supply is present at pin 71 of the power supply/regulator panel, check the following items on the timer/display panel: zener diode D418 (RD6·2EB2); the heater transformer T401 which can be dry-joined or have an open-circuit winding; and the UPD552C-060 chip IC401. If these are all o.k., replace the fluorescent display.

No mechanical operation, sensor light out, clock display o.k.: Check F8 (1·25A). If it has blown, check Q4 (2SA1020O) on the tuner/i.f. panel for shorts.

Incorrect drum speed: A check on the conditions around IC3 (HA11711) will usually reveal the cause of this fault. There should be a trapezoid waveform and a squarewave sampling pulse at TP4. If these waveforms are correct check at the input (pin 3) of IC7 (UPC1458C) where a 6·2±0·2V d.c. drum phase error signal should be present. If not, return to IC3 and check associated components. If the input to IC7 is correct check its drum phase output at pin 1, where the drum phase error signal should be 6·1V. Replace IC7 if there is no output at pin 1 – but first check that the 12·5V supply is present at pin 8. If necessary check IC202 (UPC1458C) then trace through to the drum motor.

The next thing to check is that the frequency pulses are correct from the drum motor. If so, turn to IC201 (VC1029). If the 12V supply is correct at pin 7, there should be a regulated 6V output at pin 9. If any voltage around IC201 is incorrect, check associated components and if necessary fit a new VC1029 chip.

Incorrect capstan speed: The first thing to check is that the supplies to the chips in the capstan servo are correct. Next check for the FG signal at TP1. If missing, check that the signal is entering IC1 (VC1029) at pin 2 and if not trace back to source. An input at pin 2 of IC1 but no output at pin 3 should lead to a replacement check on this device.

If everything is o.k. in this area, check the capstan phase control output at pin 25 of IC3 (HA11711). The voltage here should be 6·3V±0·2V. If it's missing, check that the 32kHz oscillator signal is present at pin 28 and if so replace the chip.

If necessary move on to IC7 (UPC1485C). Check the input at pin 6 and the output at pin 7. If the output is all right, check the input at pin 5 and the output at pin 7 of IC204, another UPC1458C chip. The output at pin 7 goes to pin 2 of the second comparator in this chip which receives the speed error control voltage at pin 3, the combined capstan servo output being at pin 1. If any of these waveforms/outputs are missing, replace IC204. If necessary trace through from pin 1 of IC204 via the drive amplifier Q235/6 to the capstan motor.

Intermittent noise bars on playback: A quick servo check is to select the still mode. If this is o.k. the drum servo is operating correctly.

If the capstan servo is at fault, check the waveform at TP5. There should be a trapzoidal waveform and sampling pulses here. If the trapezoid is missing, check that the 32kHz reference signal is present at pin 28 of IC3. If the pulses are missing, trace back to source at the CTL head. If both signals are present at TP5 but the sample pulses won't lock on to the trapezoid, check the setting of the capstan discriminator control R10, also the condition of its track. If R10 won't lock the sampling pulses on the trapezoid, check the capstan speed servo.

Check the operation of the tape transport system if the capstan servo circuits are all right.

No horizontal sync and/or horizontal sway on playback: With the VCR in the playback mode, check that the drum trapezoid is present at TP4. There should also be sampling pulses here: if these are missing check the 32kHz waveform at pin 28 of IC3. If the trapezoid is missing, check that the drum phase control pulses are present at TP6. If both waveforms are present at TP4, adjust R207 to lock the sampling pulses on to the trapezoid. Should this not be possible, check the drum speed servo.

If the problem persists, select the playback still mode. While the machine is in this mode touch the upper cylinder lightly: the d.c. voltage at pin 10 of IC201 should vary. If not, ensure that the FG pulses are correct. Trace back to source if necessary.

If still in trouble, check IC201 (VC1029) by replacement.

If playback of a prerecorded tape is all right but playback of the machine's own recordings is incorrect, check the playback CTL signal. Ensure that the CTL pulses are being recorded – check at pins 41/42 of the plugs/sockets on the servo board. Absence of signal here means that the control head is dirty or faulty – check by replacement.

Cuts out after short playback: Failure of the drum to rotate will produce this fault. The cause can be on the servo or mechacon board. Another cause is loss of the unregulated 22V supply to the mechacon board. In this event it's worth checking Q5 (2SD637R) and zener diode D14 (HZ12C3L).

Failure to record: Can be caused by failure of Q209 (2SC2021Q) and/or zener diode D208 (RD4·3/5·6EB) on the audio/video board.

E-E stuck on one channel: Can be caused by dry-joints on Q207 (2SD637R). Remove it and carefully clean the leads.

Hum bar on E-E: Check whether Q8 (2SB644) on the tuner/i.f. board is short-circuit. If it is, IC3 (UPC574J) may have been damaged by excessive current.

Goes to pause during record: Can be caused by IC4 (TMS1025N2LL) on the mechacon panel – check the data input and output lines – but is usually caused by failure of IC2 (UPD553C-164).

Tuning drift: First check that the unregulated 40V supply at plug/socket 83 of the power supply panel isn't varying. If it is, check back to source (D11/C20). Next check Q8 (2SB644) and/or the UPC574J 33V regulator IC3 by replacement. The other possibility is a faulty tuner.

Snowy E-E and TV vision: Check the aerial booster/mixer by replacement.

Snowy E-E vision: The aerial booster/mixer can again be responsible. Other causes are a faulty tuner or i.f. amplifier. The latter is in the AN5111 chip IC1. Check the d.c. conditions here, or by signal injection – input at pins 1/28, output at pin 7.

Loss of luminance: Make a recording to check whether the problem is in the record or playback circuitry. If the recording plays back satisfactorily on a known good machine, trace the playback signal from the video output socket back to source as a playback f.m. signal.

If there's no record luminance signal, check the video waveform at pin 26 of IC201 (HA11728). Check back to source if this is missing.

If the E-E luminance signal is missing, check through the a.g.c. feedback path via Q203 and Q204 (both type 2SC2021Q). Check these transistors by replacement.

No colour or poor colour: Make a recording and check the tape in a known good machine. If the colour is o.k. the fault is in the a.p.c. loop. First things to check are Q410 (2SC2063Q) and crystal 402. Next check IC403 (AN6371), then Q409 (2SC2063Q), IC401 (AN6360) and that C472 in the subcarrier oscillator circuit is set correctly.

If the recording doesn't play back o.k. on a good machine the fault is in the a.f.c. circuitry. Set the machine in the record mode with no signal – this can be done quickly by placing the AUX/TV switch in the AUX position. Connect a frequency counter to TP402 and adjust R451 for 15·625kHz. Reposition the AUX/TV switch to TV and check that an incoming signal is present. The a.f.c. circuit should now lock to 15·625kHz. If it doesn't, check the luminance input to the sync separator at pin 6 of IC402 (AN6362) and the burst gate output at pin 18. If necessary check that the 5·06MHz signal is present at pin 14 of IC401. If not, check the voltage-controlled crystal oscillator in IC403 (AN6371).

Colour playback o.k. with own recordings but poor/no colour when recording is played back on another VCR: Check that the drum flip-flop input is present at pin 11 of IC402 (AN6362). Check IC402 by replacement if necessary. Also check crystal 401 for dry-joints or by replacement. If the frequency (4·43557MHz) is incorrect check IC403 (AN6371) by replacement.

No reel motor operation: Check whether the 10Ω fusible resistor R48 is open-circuit. If so, the reel motor or the associated circuitry may be at fault.

Mechanical Faults

No play: First check whether the sensor lamp is open-circuit. If the tape isn't moving check the take-up idler assembly for wear. If the machine only partly loads and the pinch wheel isn't engaged, check for faulty loading belts. The loading motor can be at fault, but this is very rare. Check whether the capstan belt is worn or stretched.

No play: If you find that the drum and capstan motors continue to rotate even in the stop mode, it's likely that the after-load switch S002 is faulty. It may be sticking or have faulty contacts. Replacement is the best course.

No fast forward/rewind: Check the reel idler assembly, then if necessary the reel motor. Check whether the reel motor pulley is dirty or damaged. Also check that the plate spring is fitted correctly and that the brakes are not clamped on due to a bent or damaged mechanism.

Bent verticals: Can be caused by incorrect back tension, which should be between 30 and 40g. Excessive back tension can also lead to early failure of the video heads. If the tension is incorrect, replace the tension band and/or the tension arm.

Chewed or tangled tape: Check for a worn or missing brake shoe at the supply spool.

Reel motor rotates for a short time when the VCR is switched on then stops: The unload switch S003 is faulty.

VCR threads up but there's no play: The usual cause is that the pinch roller doesn't engage. Check the pin that links the mechanism to the play solenoid. Refit the pin and seal it to prevent further trouble.

Tape creasing or pleated: The pinch roller assembly probably needs to be replaced.

Noise bar on prerecorded tapes: Check that the tape transport system is operating correctly and that the guide poles are correctly aligned – do this while watching the f.m. signal envelope. Also ensure that the poles are loadin fully at both sides.

No colour: Can be caused by the channe set/black/white/colour switch.

Component Reference Numbers

Note that all component reference numbers in the abov notes relate to the original version of these machines.

What a Life!

Donald Bullock

Some days I'd do better if I pulled on my old clothes and slunk off to fish for tench. Anyone who's done as much of it as I have knows instinctively when they'll be biting. You can smell it in the air.

The feeling came over me the other morning, but when the postman arrived with a packet of Sharp idlers I decided instead to have a go at Mr Twopp's VC9100. Then something about the postman struck me. Wasn't he old Ribby Ellis, the company debt collector I'd worked with years ago at the multiple TV firm where I spent my salad says? I asked him and he immediately became the bouncy joker I'd then known, with a thousand ways of repossessing sets from bad payers. We swapped yarns for half an hour before be chortled his way from the drive, leaving me with fond memories and Mr. Twopp's VCR.

Mr Twopp's Sharp VC9100

I pulled it on to the bench. The ticket said no play, fast forward or rewind. It was right, though I could hear the reel motor singing. Now I like these quick money makers, so I unpacked the idlers and got to work. The approved way of replacing them is something I don't know. What I do is to fold the bottom board open, drop out the motor, change the idler then do battle, wishing I had three hands or multi-jointed arms, until I've got it all together again. Whilst I was so engaged the phone rang. Greeneyes answered it in the house, then brought me the message.

"Mr. Wheeze phoned about his B and O teletext set. Said you'd had it a month and wants you to phone him. Sounded nasty."

"Later" I said, turning back to the Sharp. What worried me as I worked was that I could remember neither Mr. Wheeze nor his B and O. Then I finished fitting the idler and tried the machine with a cassette. It was just the same. I concluded that there had to be grease on the spool platforms or the motor drive. So I cleaned them, also the new idler. For good luck I changed the idler spring. When I tried the machine again it worked, but in a faltering way. I tried a stronger spring, then cut it short. Results were eventually much better but not right, and I knew that my doctoring of the spring wasn't acceptable. In desperation I went through the palaver of fitting another idler. It was no better, and I then spent a long time looking for obscure reasons for the trouble. A glance at my watch brought Mr. Wheeze's B and O back to mind, and I reluctantly left the bench to look for it before he phoned again. I couldn't see it anywhere. Just as panic was beginning to set in Mr. Twopp called about his Sharp VCR.

"Still on it" I said. "It's proving a bit tricky."

"Can't you mend it?" he growled. "Trust you won' charge any more than you said. I'll be back in an hour." S I put the B and O out of my mind and went back to th Sharp video. Feeling stumped, I fitted another reel moto just in case. But it was still no better. Let's see, new motor new idler, everything degreased – why wasn't it working Then I noticed that the idlers I'd bought were unbranded Could there be something wrong with them? After all, I' tried everything else. I grubbed about in my waste bin an recovered the original idler. Using the workshop vice as gauge, I compared the new ones with the original one. Th new ones were undersized – and I had only this batch Then I remembered the idler tyres I'd recently bough from J. J. Components, looked out a suitable one an fitted it to the body of the original idler. When it was fitte it worked a treat. Still in shock, I finished the job just a Mr. Twopp called back.

"Took you long enough" he said. "Been doing this jo long?"

I thought about Mr. Wheeze's lost B and O. What wit the teletext and all, it must have cost him plenty. He' expect it to be replaced if I'd lost it. Then he telephoned. was desperate. Perhaps he had the make wrong, o Greeneyes had got his name wrong? I groped for a way c asking a few tactful questions.

"Er . . . are you certain it was a B and O set?"

"I certainly am" he rasped.

"It's Mr. Wheeze now, isn't it?"

The earpiece produced a strangulated cry. "Are yo trying to be funny? I want that set and I'm on my way t see you."

Salora J Chassis

Oh dear. I hoped he wasn't as big as his voice. Half a hour passed, and no Mr. Wheeze appeared. So I wer back to an Hitachi CPT2060 (Salora J chassis) with horizontally frilled picture and a whining note from th speaker. I'd no circuit and wondered whether there was decoupling fault in the supply to the line oscillator c driver. There was a 1,000μF, 35V electrolytic near th Ipsalo transformer. When I took it out and checked it discovered that it had zero capacitance and a resistance c 0·8Ω. Also it had been hiding a burnt out fusible resisto When these two items had been replaced there was a excellent picture and no whining note. Something ha gone well at last. And although over an hour had now gon by, there was no Mr. Wheeze. Perhaps he'd confused m with another dealer? It's happened before.

Ted Bright's Nikkai Portable

Then my neighbour Ted Bright brought in a Nikk colour portable. It was an MG002R and was dead. As h waited I opened it and found a chassis I'd never see before. I tried it again with my ear close to the chassis. There was no degaussing clunk, in fact no life at all. I saw that there was a small power/degaussing panel beneath the mains switch, and noticed that R801 on this panel was baked and cracked. It's a 1·5Ω, 5W resistor and when taken out for test was open-circuit. A replacement was soon fitted and the set was then switched on again. Up came an excellent picture.

Tamira's Panasonic NV370

As Ted left, Tamira from Honolulu swayed in with her Panasonic NV370 VCR. " 'E keeps flashing at me" she said. The clock did the flashing but the on (VTR) LED wasn't lit, nor was there any channel display. The only other sign of life was a to-and-fro movement of the idler. A quick check showed that the 12V supply was missing – because R1101, a fusible resistor on the power panel, was open-circuit. A replacement provided a cure and made Tamira think I'm very clever. A bonus, that.

A Dead Fidelity CTV140

The Scratchers arrived shortly after with a dead Fidelity CTV140. He looked glum while she beamed.

"We think the tube's gone Mr. Bookie" she chortled. "I think we'll have to have a new set."

"Not so fast, Mavis" her spouse said, "new sets cost money."

I slipped the back off and saw that the negative tags of the mains switch sat in little carbonised holes. Shorting them together brought the set to life with an excellent picture. Mrs. Scratcher's face fell, but her husband beamed. "Fit a new 'un please" he said. It didn't take long. "Twelve pounds to you" I said, passing the set back to him. He handed me a fiver and a tenner. "Keep the change" he said, "that's saved me a lot."

Matsui 1440A

A Matsui 1440A had been waiting a while. It was dead. I reached for a 5·6Ω, 5W wirewound resistor, an STR50103A power chip and a BY127 rectifier. Then I removed the back and replaced R501, IC501 and D508. I checked fuse F501 which was all right – sometimes it blows as well. This repair is becoming routine.

Mr Wheeze Revealed

By now over two hours had passed and there was no sign of Mr. Wheeze. Suddenly I thought of Ribby Ellis. Tricks were his stock-in-trade. I recalled that one of his wheezes when repossessing a set was to press a pin through the aerial downlead before be knocked on the door for the arrears. It always worked.

So I phoned Ribby and said "what's all this about your B and O Mr Wheeze?" There were peals of delighted laughter. "Good, wasn't it?" he wheezed, "what a scream. Do you remember the night I got you to push a pin through that downlead at Swamp Meadow whilst I banged at the door for the arrears, and you got the mains to earth 'cos their isolation condensers had failed? What a laugh that was. Then to cap it . . ." I put the phone down. We could send him the deaf-aid man, the maternity wear woman and the wig people. But I'd rather not bother. I'm not up to it now.

Teletopics

HDTV LATEST

In the USA, Zenith and American Telephone & Telegraph have been joined by Scientific-Atlanta in developing a digital HDTV system. Scientific-Atlanta will contribute a conditional access system. The FCC is due to begin testing the Zenith/AT&T digital spectrum compatible and other HDTV systems early this year. Zenith and Scientific-Atlanta are also developing a system that compresses a number of conventional TV signals into a single channel for satellite and cable transmission. The system would be able to deliver both conventional and HDTV signals in compressed form over cable and satellite TV networks. Zenith contends that digital receivers for its digital HDTV system would be far cheaper than current Japanese Muse HDTV receivers.

Although the Japanese Muse HDTV system, Hi Vision, is now in operation with eight hours of transmissions daily, production of the expensive sets required is running at a trickle. Toshiba for example is said to be producing only around ten sets a month, depending on trade orders received. To reduce the price of receivers a compromise system known as Wide Vision has been adopted by some setmakers. With this, the Muse signal is converted to 525-line NTSC form then stretched to the wide-screen format while the number of lines is doubled by interpolation. As all this costs much less than a full Muse decoder, the price of Wide Vision sets is about a quarter of that of Hi Vision sets. The results are almost as good, as the Muse system introduces some signal degradation. JVC, Mitsubishi and Toshiba are producing Wide Vision sets.

The debate over a new EC directive on HDTV continues. Just before Christmas European telecommunications ministers unanimously agreed to a compromise deal setting out an obligatory transmission standard (D2-MAC) for satellite TV services starting after January 1st 1995 while dropping the previous insistence that existing satellite TV services should from that date be simulcast in D2-MAC form.

SATELLITE TV

The medium-power Eutelsat II F3 satellite was successfully launched on December 7th. It should reach its orbital position at 16°E three weeks later and be in full commercial operation by the second week in January. Its 16 transponders will be used for TV and other purposes. Concern has been expressed because, with Astra at 19.2°E, Eutelsat II F3 will be only just outside the minimum 3° orbital spacing for European satellites. Interference is a distinct possibility with the use of 60cm dishes, and to this end the European Telecommunications Standards Institute has issued a draft technical standard specifying 90cm as the minimum size for receiving dishes.

According to the *Financial Times* satellite TV monitor November was another good month for UK satellite TV receiver installations, with the number estimated to have been some 108,000. Continental Research, which carries out the monitoring, expects the number of dish installations to rise rapidly to reach 6.8m by 1996, the rate of increase then slowing.

Longreach Marketing Ltd., Riverside Business Park, Lower Bristol Road, Bath, Avon BA2 3DW (phone 0225 444 894, fax 0225 448 676) has been appointed distributor of the new Technisat flat-plate aerial manufactured in the UK by STC/Northern Telecom. In its previous 45cm form it was designed for use with BSB transmissions. The new 47cm version provides a high-performance alternative to a 60cm dish for Astra reception. It can be used with any voltage-switching (Marconi type) receiver. The LNB noise figure is quoted as 1·2dB, and tests indicate that the gain is equal to that of a 60cm dish.

Philips and FilmNet have signed a long-term agreement to introduce wide-screen 16:9 D2-MAC broadcasts to the Benelux and Scandinavian areas. Philips will provide FilmNet with D2-MAC/Eurocrypt decoders and both companies plan to establish subscription and marketing services. Philips is also negotiating with several other broadcasting companies.

CD-I LATEST

Philips Interactive Media America (PIMA) and Hanna Barbera Home Video have announced the world's first CD-I title with full-motion video. Hanna Barbera's "Happy Birthday To Me" includes cartoon characters such as Fred Flintstone and Yogi Bear, video footage and interactive material. No price details have been released. PIMA is also producing a CD-I version of Compton's Multimedia Encyclopaedia. It will include over 15,000 pictures, animation and an hour of sound.

WHAT NEXT?

Sony, Apple Computer and Motorola are developing a hand-held multimedia device that combines a computer, a cordless telephone, an LCD video player and high-quality digital sound. It's expected to be on the market in a couple of years' time. The companies hope that this "multimedia computer" will regenerate growth in the consumer electronics field now that TV and video products have largely reached market saturation levels. Other firms understood to be holding talks about joining the consortium include Toshiba, Matsushita and AT&T.

MISCELLANY

Matsushita is setting up a plant at East Kilbride, Lanarkshire to manufacture line output transformers for use in computer monitors and TV sets.

Datatech Publications, Shaftesbury Centre, Percy Street, Swindon SN2 2AZ has published a useful pocket Video Fault Guide listing hundreds of symptoms and remedies relevant to a wide range of VCRs. It's available through HRS Electronics and other distributors.

The Vintage Wireless Company Ltd., Tudor House, Cossham Street, Mangotsfield, Bristol BS17 3EN has introduced a new range of electrolytic capacitors for direct replacement in vintage valve equipment.

Ash Television Ltd., Caledonia House, Longford Avenue, Kilwinning, Ayrshire KA13 6EX has introduced a stand-alone Nicam tuner/amplifier that features four times oversampling, a unique i.f. circuit free from video noise (patent pending), minimum drop-out on Nicam, 8W r.m.s. per channel output and an eight-way push-button channel selector with presets.

VIDEO NEWS

Ferguson has added to its VCR range an S-VHS machine, Model FV59S, that can record and play back either 4:3 or 16:9 wide-screen pictures. Other features include a Nicam decoder, hi-fi stereo sound, long play, a one year/eight event timer and a remote control handset with a sophisticated jog/shuttle control to ensure precise frame control when editing.

Mitsubishi began marketing an ultra-compact light-weight S-VHS-C camcorder, Model MV-S30, in Japan last October. Price is Y168,000. The camcorder has hi-fi stereo sound and weighs just 590g, the lightest ever made in Japan. Its "high picture quality event position" provides an optimum camera setting automatically: the user can select particular settings such as ski, events or sunset, thus taking perfect pictures in situations that are difficult for a conventional full-auto camcorder. "High picture quality camera shake compensation" uses a twin-gyro sensor to detect shake and wobble by measuring divergence along the horizontal and vertical axes.

Also in Japan, Toshiba has launched two VCRs with a new twin-cassette changer mechanism. Unlike Amstrad's double-deck VCR the Toshiba decks have a single pair of video heads and thus cannot be used for cassette copying. One tape is inserted into the machine while a second one sits on a small loading platform. The first machines with the new mechanism are the VHS A-BS84TC and the S-VHS A-BS34TC. UK equivalent prices would be around £480 and £740 respectively, but no details of a UK launch have so far been released.

Sanyo has launched a replacement for its VM-D6 budget Video 8 camcorder. The new Model VM-D66 includes a 7-56mm ×8 zoom lens, several fast shutter speeds and fuzzy logic focus, exposure and white balance control. Price is £549.

Sony has discontinued production of metal-powder Hi-8 tape. According to Sony this type of tape was introduced as a stop-gap while the production of metal evaporation tape was being improved. In addition Sony points out that its Hi-8 camcorders are optimised for ME tape. It's not clear whether other tape companies will follow suit: TDK says that it plans to continue producing Hi-8 MP tape. BASF has introduced VHS and S-VHS cassettes that use a record protection system similar to that employed with Video 8 cassettes. The company's Hi-Fi professional and S-VHS cassettes have a small reversible slider on the spine for recording protection.

Book Review

TV and Video Engineer's Reference Book, published by Butterworth-Heinemann, Halley Court, Jordan Hill, Oxford OX2 8EJ at £125.

George Newnes Ltd. published the first edition of the *Radio and Television Engineers' Reference Book* in 1954. Several editions appeared during the following ten years, then in 1977 it was reborn as the *Radio, TV and Audio Technical Reference Book*, a 2·5in. thick tome edited by S.W. Amos and published this time under the Newnes-Butterworths' imprint. The latest book in this series, the *TV and Video Engineer's Reference Book*, has just been published by Butterworth-Heinemann. It's written by no fewer than sixty two authors, British, European, Japanese and American, each a specialist in his own field. The editors are K.G. Jackson and G.B. Townsend. Their book contains 850 closely-printed 9·5 × 7in. pages and tips the scales at just 4·5lb/2kg. A mighty work indeed!

The book is divided into sixteen parts thus: basic reference material; materials, components and construction; fundamentals of colour TV; broadcast transmission; distribution of broadband signals; direct broadcasting by satellite; TV studios and equipment; mobile and portable TV equipment and operations; television sound; television receivers; television installation and servicing; video and audio recording and playback (domestic); teletext and similar technologies; high-definition television; industrial, commercial and medical TV; performance measurements and electromagnetic technology.

Each of these parts is subdivided, typically into six sections by different authors. To give just one example, Part 6, Direct Broadcasting by Satellite, contains chapters on planning and fundamentals; transmission systems; uplink terminals; and DBS receivers. These are variously written by staff of the EBU, Japanese broadcaster NHK, and the Toshiba Corporation. In total there are over sixty chapters and around 3,000 entries in the index, many of which have multiple references.

I can't pretend that I read the book throughout for the purposes of this review! But my impression after many hours' study is that it's the most comprehensive and deep book on the subject ever published, with very wide coverage. It's authoritative and up-to-date, and provides a complete and wide-ranging account of all aspects of TV and video. There's a strong leaning towards broadcasting technology, though this takes in just about every technique and artifice used in the TV and video fields.

Even a book on this grand scale cannot go into full and minute detail on every subject it takes in, so each chapter is provided with an up-to-date bibliography listing sources of information for further study. The basics are fully covered however, especially in terms of reference material like TV standards, broadcasting spectra, quantities, units, formulae and calculations.

As an indication of the topicality of the coverage, I found details of MAC receiver design, fast-shutter operation of CCD image sensors, computer fault diagnostics, the Nicam sound system, advanced LCD display technology, computerised animation and a great deal of information on the developing technology of HDTV.

The book is clear and easy to read throughout, which is a tribute to the editors in dealing with over sixty different contributors. The hundreds of diagrams and illustrations are clear and well reproduced, and I could find very few errors – though one that threw me for a few seconds was the transposition of two illustrations. Print, paper and binding quality are excellent, as one would certainly expect at this price.

The high price reflects not only the size and comprehensive nature of the book but also the fact that the sales of such a specialist work are bound to be low in comparison with more "mainstream" books. This is why a financial or business research report can cost £500 or more, and why medical and legal textbooks are so expensive.

While the book would be useful to those in the service and repair business, one could hardly expect its cost to be justified for the average practical service engineer. It's more something to refer to as necessary in your local library. The book is in fact targeted more at practising engineers and managers in the broadcast, cable and satellite services, at the television equipment industries, television training organisations and at colleges and universities that provide relevant courses. To these people the book will undoubtedly prove to be good value for money. **P.R.**

Nostalgia

George Wilding

Harold Peters' engrossing series on fifty years in radio and TV (January-September 1991) recalled many nostalgic memories.

Early Round Monochrome Tubes

Take for example the early round monochrome tubes that dominated the scene for many years. Mullard was always the front runner. The majority of setmakers used Mullard tubes which could be expected to give upwards of five years' excellent service. Next in quality, being used by Ekco, Murphy and Ultra, were Mazda tubes. They had a shorter life expectancy – after about three and a half years many of the owners of these sets would complain about reduced picture brightness and the need to draw the curtains during daylight viewing! These tubes also had an above average tendency to develop heater-cathode leakage, the resultant increased capacitive loading across the video output valve's anode load resistor reducing the h.f. resolution. Depending on the severity of the leak, the main complaint and symptom was often that bands of picture information that terminated in white would shift sideways.

The reason for this was that in the early days direct rather than flywheel line sync was used. As with the tube, the input to the sync separator valve was taken from the anode of the video output valve. If a line terminated at white level, the output valve's anode voltage had to rise from peak white to the blanking level and then to the peak of the positive-going sync pulse. With the extra capacitive loading this rise in anode voltage was delayed, and in consequence the line timebase triggering was also delayed. The effect was very noticeable with test card reception when the central circle would take on a cogwheel appearance, the cogs lining up with the black and white castellations along the side borders. An inexpensive cure for this problem was to disconnect the tube's heater from the end of the heater chain and instead feed it from a step-down mains transformer with minimum primary/secondary capacitance. These transformers would have a twenty or twenty-five per cent tapping point on the secondary winding so that, if required, the tube could also be boosted. Many, many sets had a transformer of this type fitted for either or both of these purposes.

Sometimes there was no suitable mounting place on the chassis for the transformer. So it would have to be screwed to an internal side of the cabinet. This didn't exactly make one popular with whoever next had to service the set. For an inexpensive boost, a wirewound power resistor of about 5kΩ was sometimes connected from a live mains point to the non-earthed heater pin, thus adding to the normal 300mA supply.

In those days the UK mains supply was not always 240V. So sets had a double voltage adjusting arrangement, one for the heater supply and the other for the h.t. circuit, tappings being provided to cater for 200V, 220V and 240V supplies. When the tube's emission in an old set fell, it was often the practice of both rental and retail films to boost the emission simply by altering the heater chain tapping point, leaving the h.t. tapping unaltered to avoid stress to the line output transformer. This increase of about eight per cent in the tube's heater current produced a very worthwhile improvement in picture brightness. If this condition was maintained for any length of time however and the tube was then replaced the majority of the valves would also have to be replaced.

You might think that when a Mazda tube was due for replacement an electrically similar Mullard type would be used, but this was impossible. The neck diameter of a Mazda tube was fractionally less than that of a Mullard tube, and no matter how hard you tried you could never get the scan coils from a Mazda tube over the neck of a Mullard one.

Tube/valve boosting could also occur, sometimes inadvertently, when one or two sections of the multiple resistors used for mains voltage adjustment had to be replaced. If the original values were known, they would probably be far removed from standard high-wattage resistor values. Quite likely you wouldn't be able to match the value even by using a pair of series or parallel connected resistors. If the original value was unknown, the procedure was to scrape the insulation from the winding at the centre, measure the resistance between that point and one end tag, then multiply by two. Sometimes, due to the non-availability of stock and the need to get a set working as soon as possible, resistors under the tolerance limit were used – obviously you couldn't use resistors that were in excess of the original value or the set's performance would be degraded all round.

Since tubes were expensive, reguns were rarely of today's quality, and really effective reactivators were not available, also in view of rapidly changing receiver design – flatter, rectangular tubes were coming in, cabinets were becoming shallower and Band III capability was required – it was often best simply to run an old set to the end of its useful life with as little expense as possible.

Brimar/KB

Another tube manufacturer was Brimar, whose tubes were very good in all respects, as were the under-valued KB receivers in which they were used. KB never attained the very high production levels of the giants of the industry, Ferguson and Philips, with their large rental operations. For this reason plus the extreme reliability of KB sets and the longevity of Brimar valves only a small number came in for service. I never encountered line output transformer trouble in a KB set, though this was a common complaint with other makes. The most common fault with KB sets was loss of height due to an increase in the value of the field oscillator's anode load resistor.

Instead of the usual ring magnet for focusing, rotated by a handle that protruded through the back, all the KB sets I encountered used electromagnetic focusing. As a result, the pictures they produced had especially good definition. The limiting factor with resolution is of course spot size and constancy. Probably due to a combination of factors – tube design and thus electron trajectory, possibly higher than usual e.h.t. plus good e.h.t. regulation and focus current/h.t. voltage tracking – pin sharp focusing could always be achieved with these KB sets. The focus knob was at the front of the set as a user control, along with the contrast, brightness and volume controls.

The Metal-cone Tube

An interesting tube was the round type manufactured by English Electric and used in this company's sets. Receivers fitted with these tubes were on sale for a period of just over three years. The tubes had two unique features. First, the entire cone was made of metal which was thus at e.h.t. potential. Though the cone was fitted with a thick plastic insulating sheath, service engineers were unenthusiastic about such a large area being at e.h.t. potential, particularly as the e.h.t. was relatively high at 14kV, being produced by a voltage doubler using two EY51 rectifiers. The second feature was the geometry of the mask aperture, horizontal at the top and bottom while being almost semi-circular at the sides – the mask was referred to as the double-D. Although some corner information was lost, this arrangement was quite effective.

Later Heater Arrangements

As the 240V mains supply became universal, voltage adjusting arrangements were dispensed with. In the Thorn 1400 chassis however a 128Ω resistor which could be shorted out where the mains input voltage was consistently below 200V was included in the heater chain.

By the early Seventies about the only sets that had an in-built opportunity for tube boosting were those fitted with the Thorn 3000/3500 chassis. In these, the tube's heaters were supplied from a secondary winding on the mains autotransformer, see Fig.1. The heaters of an optional valve v.h.f. tuner could also be supplied from this winding, which had a tap. By using the whole winding for the heater supply the voltage was increased slightly – tags were there to make this easy. Though I never measured the voltage increase I found that with many sets over many years an ideal amount of boost, sufficient to increase picture brightness significantly, was provided without unduly curtailing tube life. This tip was originally given to me by a DER service engineer. Though there was no reference to the possibility in the service manual, it must have been common knowledge in the very many Ferguson outlets. Tens of thousands of these sets must have been given this free boost when tube emission began to fall significantly.

To limit the peak voltage difference between the tube's heaters and cathodes, one side of the heater supply was connected to a 90V source provided by a potential divider (R603/4). This point was decoupled by C604. In the event of slight heater/cathode leakage developing in any gun it was best to disconnect C604.

The Worst Job

Going back in time, before the advent of twin-panel tubes about the worst job in TV servicing was cleaning the tube face and protective screen when the dust sealing failed and the screen couldn't be removed through a slit beneath the cabinet. This operation necessitated removing the tube and chassis from the cabinet. Every speck of dust then had to be removed from the tube, the screen and the cabinet interior, otherwise in the course of handling the set a spot or two of dust could reach the tube face after boxing up again. Most cabinets were lined with tin foil to minimise line timebase radiation. This was curved around the corners and could hold an ample supply of dust to trickle down.

Ekco 12in Sets

No recall of the days of early round tubes would be complete without reference to the 12in. Ekco sets of the period. Their line output transformer had a semi-circular plastic moulding mounted above the windings and core.

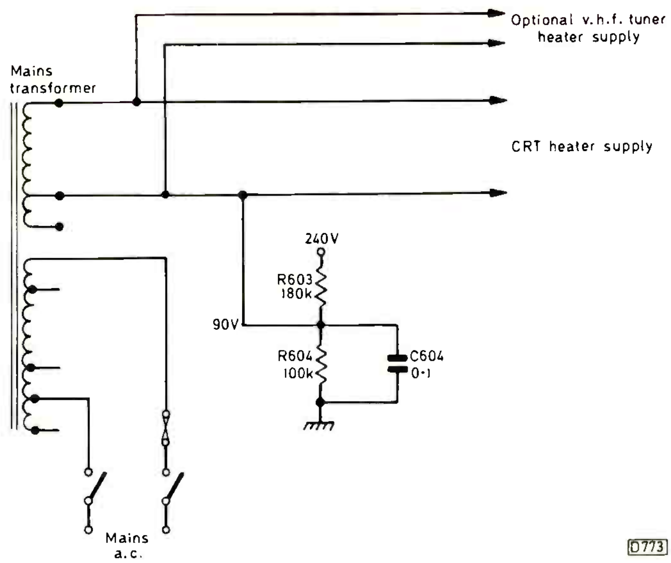


Fig. 1: The c.r.t. heater supply circuit used in the Thorn 3000/3500 chassis – the 6·3V feed was obtained from one end and a tapping point on the mains autotransformer's low-voltage secondary winding.

Three anti-corona soldering rings for the wire-ended U25 e.h.t. rectifier were embedded in this moulding. Following a complaint of no picture or "arcing noises" you would sometimes find that up to fifty-sixty per cent of the Perspex moulding had simply vanished, leaving an irregular skeleton. The weight of the U25 and the pull of the leads often led to the overwinding output lead breaking from its anti-corona ring or alternatively bringing the ring close to an earthed point. This naturally lead to severe sparking. Most transformers were not affected by this problem. On occasions we came across instances where the deterioration was just starting – you would usually see discolouration around the anti-corona rings. It would seem that while the effect of the e.h.t. was the principal cause of the phenomenon, Perspex of sub-standard quality could contribute to it and possibly also high internal working temperature due to a set's room location and long working hours.

Self-healing Capacitors

This self-destructive action is matched in surprise by the self-healing characteristic of the mains filter capacitor in the ITT CVC5-9 series chassis. On two occasions I've known this metallised paper capacitor develop a leak, run warm, emit a smell like burning wood, then produce clouds of smoke and drip grease on to the cabinet base. On switching off then trying the set next day it would work perfectly for several days before the performance was repeated. In one case I found that the set was in perfect working order though the smoke emitted during the previous evening had been so bad that all the windows had had to be opened!

It was easy to diagnose the cause of the trouble even when no symptoms were present – you just had to feel for a small amount of congealed wax on the cabinet base under the small control panel on which the capacitor was mounted. I never came across one of these capacitors that was actually shorted, undoubtedly because the set would be switched off as soon as the smoke or smell became apparent. The capacitor's a.c. voltage rating was 264V, which was perhaps sometimes a little on the low side.

Few modern sets give us the fun and games of days gone by.

Service Bureau

FERGUSON TX90 CHASSIS

The picture lacks "punch", being rather low in contrast. It's a bit like a low-emission tube, but there's not the flaring, loss of focus etc. that's normally experienced with a flat tube. A tweak to the sub-contrast control potentiometer improves matters slightly, but I mean only slightly. I'm also told that the picture occasionally grows darker and can be restored only by switching off and then back on.

The cause of this fault is likely to be in the beam-limiter circuit. A very common culprit is R231 (150kΩ). If this resistor is o.k. check R233 (470kΩ), C196 (47μF), D116 (1N4004GP) and if necessary TR114 (BC307B).

HITACHI CPT1556 (SALORA L CHASSIS)

When this set is switched on only the middle segment of the channel display lights and a faint high-pitched whistle can be heard. The tube's heaters do not light and there's no sound. There's obviously a power supply problem – can you suggest suitable checks?

We suggest that you first check for a short-circuit across the 170V line. If there is, check DN10. If not, check the tripler by disconnecting it from the transformer, then LN02 and the secondary rectifiers DN09 and DN11. The MC7812 chip IN02 is also worth checking in case it has gone short-circuit. If all these items are in order IN01 (LF0059C) and transistor TN03 (S2000AF) are suspect.

MITSUBISHI HS310

There's a drum speed problem with this machine. Sometimes it works perfectly but on other occasions there's a sudden dramatic increase in the drum motor speed and normal operation can be restored only by switching the machine off for a while. On occasions the drum rotates fast at switch on. The fault occurs in both the playback and record modes.

A common cause of this problem is a faulty reference oscillator crystal, X6A1. If replacing this fails to provide a cure check the progress of the drum motor FG pulses into the servo system.

FERGUSON TX10 CHASSIS

This is a remote control model with teletext. The problem is that the remote control brightness up/down function doesn't operate. It doesn't seem to be a handset fault as the receiver LED lights when the relevant buttons are pressed. The preset control on the remote receiver panel (515-161) has a very limited range. On the whole the picture is very good, but the beam limiter seems to work early leaving the picture not quite bright enough.

First check that the 12V line voltage (pin 2 of IC621) is correct. If so check D657 on the tube base panel – it should glow moderately brightly. If this is in order check R732 which could be high in value or open-circuit.

GRUNDIG VS200RC

The problem is that the clock cannot be set. You can punch in say 09·30, but when clock set is pressed there's no display.

Check that the voltage at pin 28 of IC201 (keyboard unit) is correct at 18V and that the ripple level here is no more than 30mV. If this is o.k., confirm that a negative-going reset pulse appears at pin 33 of IC201 at power on. If so IC201 is suspect. Before replacing it however try this modification: fit a 680Ω resistor between the anode of D434 and the junction of L426/C425.

SONY SLC7

The switch-mode power supply failed, transistors Q101/2 going short-circuit. I obtained and fitted a 2SC2335 kit, which includes these transistors and several resistors, but at switch on Q101/2 again went short-circuit, with a loud bang, after about ten seconds.

We've had this problem on more than one occasion and have found that the usual cause is the electrolytic capacitors C110 and C111. You may well see corrosion at their leadouts when they are removed. To be sure, we usually replace IC1 as well.

PANASONIC NV-G10

Playback of this machine's own recordings is unsatisfactory, with horizontal white flashes and a tendency to field slip. With prerecorded tapes the playback is good.

Check the tape back-tension and the setting and condition of the entry guide. If these are o.k., check/adjust the luminance writing current, then suspect a problem with the heads. We've known a dry-joint at pin 1 of the AN3215 chip IC301 to be responsible for similar problems, so it would be worth checking this first.

FERGUSON 3V55

The problem is no rewind or fast forward operation. At switch on the reel motor rotates for a moment, which I think is normal at start up. When a cassette is inserted however and rewind or fast forward is selected the LED lights and the solenoid under the deck pulls in but the reel motor won't turn. The machine goes back to stop after a short time. If play is selected the tape laces up in the normal way, the drum and capstan operate normally, but after a few seconds the machine unlaces, leaving a large loop of tape out of the cassette. At this point the stop LED flashes, the run LED lights and no other functions can be made to work. To restore key function control the machine has to be switched off then on again.

In this machine the reels are driven from the capstan motor, which must be rotating in the play mode to produce the tape loop. First check that the loading belt (top deck) isn't slipping, i.e. that the mode motor does not run on when the mechanism has stopped. If the loading belt is o.k. but the capstan motor doesn't run when fast forward or rewind is keyed, suspect the mode switch (optical). If on inspection the fault proves to be mechanical in origin, check that the reel brakes are coming off, then suspect the clutch mechanism assembly.

SONY SLC6 Mk II

After about thirty seconds you get interference across the centre of the screen, with noise, at five second intervals. It's as though the tracking is going out of lock. Otherwise the picture is faultless. When the problem starts the sound goes slow for the two-second interference periods every five seconds. It occurs with both prerecorded tapes and own recordings.

This is quite a common fault with these machines. To cure, remove the bottom cover and adjust RV1 on board SS9 for 5·5V at TP5, using a high-impedance meter or a d.c.-coupled oscilloscope.

Punkie's Laws

Steve Cannon

You all know the situation, I'm sure. The customer wants his new set to be installed but is going out in half an hour's time. Is there any chance of it being installed right away? The shop staff will undoubtedly say yes, especially when ten and twenty pound notes suddenly appear from the customer's wallet. A quick call from the shop to the service department to confirm that we have that particular model is all that's needed for the customer to be sent happily on his way home in anticipation of his new set arriving.

So why is it that in cases like this, when the heat is on just a little bit, that out of the four sets in stock you pick the faulty one? Now it's rare for a brand new set of any make to be faulty, but faults do occur and can be real nasties. When we unpacked this set, fitted a plug and switched on we didn't of course know that we had a problem. But the set remained lifeless, with only the red standby LED giving any indication that power was actually getting there. No messing about however. By now we'd wasted ten minutes. Another set was brought along and run up. The customer was highly delighted with his new set and our prompt service. This was no consolation for me however: I was still stuck with a brand new set that clearly didn't want a home. So up on the bench it went.

As the standby light lit some voltage was present in the set, an Hitachi C25P228 (G8Q chassis). I assumed that the power supply must be working, as the microcontroller chip gets its supply from the chopper circuit. A quick check on the power supply's outputs confirmed that it was operational, so it was goodbye power supply, hello micro – a logical step that's becoming ever more common when fault finding in a modern set.

Over to the Micro

The microcontroller is IC1501. A quick check at the standby pin 10 showed that the voltage here was high, thus shutting down the line generator chip via transistor Q1510, the standby switch transistor. I thought that it would be a good idea to remove this transistor in the hope that the set would start up and maybe give us a few more clues as to where the fault could be. I'm full of 'em at times you know. Sure enough the set responded, with e.h.t., scanning, etc. In fact the only things that were missing were the picture and sound. This was again due to the microcontroller chip, as it wasn't generating any control voltages. So it was time for a detailed check around this chip. The 5V supply at pin 42 was present and correct. So was the momentary 5V at pin 1, from the remote contacts on the on/off switch. I next checked the clock oscillator signal, at pins 31 and 32. It was missing. The only thing here is the 8·86MHz crystal, so I thought simple, fit a new one. I couldn't have been more wrong of course: the set was as ill as before. It's got to be the micro I said in dismay, so one was ordered. Thanks to Hitachi's excellent viewdata and despatch service it arrived next day.

Punkie's Two Basic Laws

I soon had the new micro installed, but this was where Punkie's Law struck. Now we've all heard of Murphy's Law. So here are Punkie's two laws relating to electronic fault diagnosis:

(1) The probability that a component is faulty is inversely proportional to the number of connections to the component, or the more legs it has the less is the chance that it's faulty. In other words if you're pretty sure that a 42-pin microcontroller chip is faulty you're probably mistaken.

(2) The probability that a set has been fully repaired is directly proportional to the number of screws, metal screening cans, cable ties etc. left on the bench after the repair. Thus if everything that was removed has been replaced in its original place and no bits are left over, in all probability the set is still faulty. This second law relates mainly to intermittent faults.

The law that applied in this case was number one of course. It's not the first time that a VLSI chip has convinced us that it's faulty, then after replacement has stuck two fingers up at us. This law has applied time and time again. In fact it's a fundamental law of workshop repair.

Where to check next? The circuit diagram isn't too helpful, as a lot of tracing from the microcontroller's pins is required to see what they do. Reset, clock, data, 5V etc. labelling is most welcome at the pins of such a chip, but it's not shown here.

What about a component loading the chip's crystal oscillator via one of its pins? This seemed to be a reasonable conclusion. After making d.c. checks at only a couple of pins I knew I was on the right lines. The chip's serial clock and data lines are at pins 39 and 40 respectively. When clock and data signals are present the voltage readings should be between 2V and 3V. The pins are at 5V when no signals are present, because of the pull-up resistors R1543/4. There was 5V on the data line while the clock line was at zero.

So it seemed that there was a short somewhere linked to the clock line. This was confirmed when I unsoldered the chip's clock and data pins, as the 8·86MHz oscillator started and the set perked up. It was now going to be a simple case of tracing back from pins 39 and 40 of the chip to find the offending component. If only life was that simple! A look at the circuit showed that the only chip connected to these lines is the EEPROM chip IC1502. A resistance check from this chip's clock line to chassis was carried out but wasn't conclusive. So the chip's data and clock lines were unsoldered in the hope that the set would then start up, proving that the memory chip was the cause of the trouble. A good theory, but so much for theory. The chip wasn't guilty, m'lud. So it was back to the by now well worn circuit diagram.

The Cause at Last

The lines from the microcontroller chip fly off the control panel to the main PCB, where they are renamed "BUS" lines. Surprise, surprise, they go to the tuner and i.f. can. Which one first? For some reason I plumped for the tuner first. Would you believe it, when the BUS pins were disconnected the set got going with a raster full of snow. I removed the tuner from the PCB and dismantled it, but couldn't see any solder splash or obvious fault. A new tuner was ordered and when this was fitted the problem had been cured. Punkie's second law now applied. After reassembling the set two chassis screws and a cable clip were left over. The final step was to remove the back again and put back these parts in their correct places.

VCR Clinic

Reports from Eugene Trundle, Steve Cannon, Stephen Leatherbarrow, Nick Beer, J. Edwards, Paul Hardy and Michael Dranfield

Sony EVS700

Fortunately audio PCM faults are rare – the circuits are very complex! The right-hand audio channel playback signal was grossly distorted with this Video-8 machine. The f.m. audio playback was fine. Scope checks proved that the trouble was associated with the noise-reduction chip IC601. To cut a very long story short, C417 which is connected to pin 17 was responsible. It had a leakage resistance of 200kΩ or so. **E.T.**

Sharp VC9300/9700 and clones

These machines are now quite elderly. It's important to check the reel motor thoroughly when replacing the reel idler. The job will bounce back (our score is two recently) unless the motor is above reproach. To test the motor, hook a scope across it then run it in all modes, particularly in the fast forward and rewind modes with a heavy mechanical load. If you see needle pulses on the screen the motor is duff. **E.T.**

Ferguson 3V56

The basic fault here was no capstan rotation following tape lace up. Selection of rewind produced the correct result, but when fast forward was selected the result was rewind. I decided to look into the first problem, and went in search of a sloppy loading belt or missing after-load signal. No such luck. As all the supplies were present and correct I decided to monitor the FF/rewind drive output from IC601 (M50730-614SP). All was normal here as well. The drive is applied to the capstan motor via Q603/4. Checks here revealed that while Q603 was switching normally Q604 wasn't. A TIP41 proved to be a suitable replacement. **S.L.**

Panasonic NV-J35

This machine was dead and checks in the switch-mode power supply showed that D1113 was short-circuit. It's the 20V protection zener diode connected across the 14V line. So it seemed that the 14V line was going way above its normal level, well above 20V in fact. We suspected a fault on the primary side of the circuit and started to check the components here. This paid off: when C1114 was checked it was found to have fallen in value from 47μF to 0·5μF. It's a decoupling capacitor that's connected between the chopper transformer and the regulation control pin of the chopper chip. A new 47μF, 16V capacitor enabled the VCR to breathe again. **S.C.**

Panasonic NV-L20B

A few of these machines have come in completely dead. They have those nice switch-mode power supplies that are, arguably, neither use nor ornament as far as a domestic VCR is concerned. It's nice to see that some manufacturers, e.g. Ferguson, have returned to good old mains transformers and low-voltage series regulators after making a move to SMPSs. However that may be, this SMPS had to be fixed. A full, rectified mains supply was being delivered to the chopper chip, but no voltages were being generated on the secondary side of the chopper transformer. Back to basics, and back to thinking about SMPSs in TV sets. This situation can arise when, as in the Ferguson TX100 and Finlux 1000 chassis, one of the rectifier diodes on the secondary side of the transformer is short-circuit. So checks were made here and sure enough the 14V rectifier D1109 was short-circuit. **S.C.**

Hitachi VTM820

Due to lack of a test signal and a playback picture this machine couldn't be tuned to a TV set. All other functions worked correctly. The test signal is generated by the on-screen character generator chip IC1401. We checked the 17MHz crystal here and found that the clock frequency was missing. A new 17·73MHz crystal restored normal operation. **S.C.**

Salora SV8710

This machine was accused of chewing tapes, which was not surprising since the reel belt was off. What was interesting was that the rubber had decomposed to form a very sticky substance that was all over both of the pulleys on which the belt sits. There was no evidence of any spillage in the machine. A bad belt, or something in the atmosphere? **N.B.**

Panasonic NV-MC20B

The viewfinder picture in this C-format camcorder was very dim and defocused. When the output was viewed on a monitor however it was perfect. I've had various Panasonic camcorders in which the diode that feeds the focus and brightness voltages to the viewfinder from the line output transformer has gone virtually open-circuit, producing exactly this symptom. It wasn't the cause this time however. There was over 1,200V at the viewfinder tube's cathode because the 33MΩ focus potentiometer VR803 was open-circuit. The brightness control in older models suffers from a similar affliction when its rivets become loose. **N.B.**

Panasonic NV-MC30B

There was intermittent over exposure of the image with this camcorder. The auto iris was on, but when the fault occurred the iris didn't move. When the fault finally showed up after dismantling the unit I found that the drive was working correctly despite the lack of physical activity. To cure the fault we had to replace the iris. I suspect that one of its leafs had become distorted. Maybe the unit had been dropped or subjected to shock. **N.B.**

Philips VR6180/Pye DV186

A word of warning with this one. The problem was excessive wow and flutter because of a worn capstan bearing, which is not uncommon. But it took us a long time to get the correct replacement because the mechanism is not the same as that referred to in the Willow Vale catalogue. I believe it's called the DMP4: the capstan assembly 262 is neither the 4822 520 10635 nor the 4822 520 10559 but the 4822 535 92909, which Willow Vale supply under code 164467CP though it's not listed in the catalogue. The problem is that this mechanism has the capstan FG head mounted on the exterior of the flywheel, so the magnetic area has to be on the outside. The other types supplied by Willow Vale have the magnetic area on the inner edge of the flywheel, the result being that there are no FG pulses when they are fitted in this machine. Thus the cassette is ejected whichever deck function is selected. **N.B.**

Panasonic NV-L20/5/8

A fault I've had a couple of times recently has been no vision. The fault tends to be exceptionally intermittent and affects only the r.f. output. This is the big clue, but it takes some time to establish this when the fault occurs for only two-three minutes a week! The exact symptoms are akin to a TV set being off tune – the output seems to move through the tuning point but won't lock. The raster is dark or affected by hum, with exaggerated chroma present and distorted sync. The cause of the trouble is the ENC17952 r.f. modulator. **N.B.**

Hitachi VT9300

Playback was good but there were no E-E signals and no recordings could be made. A colleague told me that soldering any suspect joints in the i.f. unit would provide a cure. This was done and didn't, though there were some really bad joints on the screening plate. Changing the tuner didn't help either. A scope check on the i.f. unit's video output showed that the tuner and i.f. strip were working and that, with a colour-bar u.h.f. input, the i.f. box produced a nice staircase waveform. The video signal arrived at the video board but didn't leave it again. I eventually found that the PB9V line was permanently present – disabling this line got record and E-E working again. The fault was in the TA4349 chip IC909. **P.H.**

Sony SLC6

The job card said "rolling noise bars and sound varies". When play was selected, every two seconds a noise bar filled the screen and the sound slowed down. Obviously a capstan servo fault. The pulses from the control head are amplified to 7V peak-to-peak and should be present at test point 7 on board SS9. A scope check showed that they were o.k. at this point. Voltage checks around the servo chip then suggested that everything was in order here. A cure was provided by slight adjustment of the capstan free-run preset RV001. **J.E.**

Amstrad VCR4500

The job card said "no clock display and weird operation". There was indeed no clock display, although the channel indicators worked. The machine accepted a cassette but when fast forward was selected it entered the stop mode after a few seconds. When rewind was selected the rewind indicator came on and a clunk was heard from the mechanism, but there was no operation and again it went to stop. I decided not to bother about checking the play mode as without any rewind function I would probably have ended up with a chewed tape. Eject worked o.k.

A syscon or power supply fault was suspected. So checks were made on the supply lines. This showed that the 12V supply to the timer board, at pin 5 of plug CN16, was missing. Hence no clock display. This feed is tapped from pin 1 of plug CN15 via a 27Ω resistor which was open-circuit. As no short to chassis could be measured the resistor, circuit reference R662, was replaced. Normal functioning was then restored.

A long soak test revealed that there was tape chewing. So in went the pinch wheel modification kit and the waste bin received another tape. In future, no matter what the problem, we are going to change the pinch wheel kit before returning the machine to its owner. **J.E.**

Matsui VCP500

This playback only machine would accept a tape. Rewind and fast forward were normal, but when play was selected the picture and sound were at twice the normal speed. Scope checks around the servo chip showed that the capstan FG pulses at pin 36 were missing. We traced back to the capstan motor unit, where the pulses should have been present at pin 5 of plug CD2003. As only noise was present here we ordered a new capstan unit. Fortunately this cured the problem. The new unit produced 2V peak-to-peak sinewave FG pulses. **J.E.**

Saisho VR3300X/Matsui VX735A

As the manual gives no information whatsoever on the mode switch it's important to make a plan of the positions of the old one before fitting a replacement.

One of these machines came in with the loading arms jammed. While we were checking the deck we found that the limiter post arm's pin was missing. When the deck was stripped down we found the pin stuck in the underside of the master cam.

Note that if the carriage is not fitted to the deck it won't accept a cassette and the machine will switch off, i.e. the infra-red end sensor must shine on the carriage end sensors before a cassette can be loaded. **M.Dr.**

Ferguson FV21

This machine came in dead. Now we've had so many of them in with the STK5481 hybrid regulator chip faulty that I didn't bother to carry out any checks, I simply fitted a new STK5481. Guess what? The machine was still dead! Checks around the STK5481 regulator then showed that the voltage at pin 5 of connector CN801 was missing. This voltage is applied via resistors to pins 7 and 10 of the chip. When the source of this voltage was traced back to the mains transformer PCB we found that R4 and D9 were o.k. but the 10Ω surge limiting safety resistor R1 was open-circuit. Replacing this restored full operation. Maybe the STK5481 had been the cause of this, but I wasn't going to find out and left the new one in! **M.Dr.**

Panasonic NV7000

There was a very strange fault with this old machine. The symptoms were no clock display and stuck on channel one. Everything returned to normal when the machine warmed up. It didn't take us long to find out that the 6V regulator chip IC1501 in the power supply was sensitive to freezer. Although it's a 6V regulator the output was found to be 5V. Cooling it down made the clock go off but there was no change in its output voltage. A scope connected to the output also confirmed that there was no difference between the fault and working states. In fact we could find no reason for the clock going off when IC1501 was cooled down, but replacing it cured the fault. **M.Dr.**

ECONOMIC DEVICES 32 TEMPLE STREET, WOLVERHAMPTON, WV2 4AN

1560H	3.72
1585R	3.72
17052	4.50
17053	2.31
17074	9.30
17089	3.28
17127	1.88
17376	1.58
1N4001	0.03
1N4002	0.06
1N4003	0.03
1N4004	0.05
1N4005	0.05
1N4006	0.08
1N4007	0.05
1N4148	0.03
1N4448	0.03
1N5401	0.13
1N5402	0.13
1N5403	0.18
1N5404	0.11
1N5408	0.11
1N914	0.03
1S1555	0.03
1S44	0.10
1S921	0.05
2N2219A	0.29
2N3053	0.28
2N3054	0.99
2N3055	0.74
2N3442	1.12
2N3702	0.10
2N3703	0.18
2N3705	0.15
2N3706	0.14
2N3707	0.11
2N3711	0.24
2N3771	1.55
2N3772	1.40
2N3773	1.38
2N3819	0.46
2N3823	1.17
2N3904	0.09
2N4101	1.73
2N4240	2.68
2N4444	2.85
2N4905	9.99
2N5293	0.50
2N5294	0.82
2N5296	0.74
2N5297	0.50
2N5298	0.61
2N6109	1.58
2N6130	0.85
2N6133	1.25
2N6292	0.60
2SA202A	0.65
2SA1208	0.24
2SA769	1.17
2SA771	0.96
2SA968	2.44
2SA1006	0.79
2SA1011	0.99
2SA1015	0.08
2SA1020Y	0.29
2SA1027R	0.45
2SA473	0.49
2SA766S	4.95
2SC1173Y	0.99
2SC1474	1.25
2SC1509	1.25
2SA1095	5.50
2SA1103	5.74
2SA329	0.40
2SA489	1.17
2SA490	0.66
2SA493	2.25
2SA562	0.13
2SA564	0.97
2SA614	4.35
2SA628	0.37
2SA639S	0.62
2SA659	0.49
2SA673	0.08
2SA684	0.28
2SA697	0.77
2SA699	1.18
2SA748	1.95
2SA836	2.50
2SA835	0.49
2SA844	0.24
2SA872	0.13
2SA884	2.15
2SA937R	0.97
2SA940	0.47
2SA950	0.50
2SA951	1.70
2SA966-Y	0.28
2SA999	0.75
2SB186	0.40
2SB688	1.23
2SB774	0.44
2SB185	1.13
2SB400	0.40
2SB405	1.03
2SB511	0.99
2SB54	1.38
2SB546	0.51
2SB56	2.64
2SB618A	5.82
2SB631	2.00
2SB643	0.19
2SB681	1.79
2SB695	3.43
2SB774	0.44
2SB819	0.60
2SC1089	1.45
2SC1101	3.22
2SC1128	0.66
2SC1307	5.06
2SC1449	0.41
2SC1941	0.56
2SC558	3.69
2SC1096	0.47
2SC1114	1.12
2SC1116	3.02
2SC1129	1.65
2SC1131	0.72
2SC1158	3.33
2SC1162	0.29
2SC1172	2.55
2SC1195	2.72
2SC1213	0.13
2SC1226	0.90
2SC1306	1.12
2SC1317	0.16
2SC1364	0.28
2SC1383	1.20
2SC1391	2.45
2SC1398	0.41
2SC1413A	1.96
2SC1447	1.07
2SC1475	0.60
2SC1505	1.00
2SC1514	1.76
2SC1573Q	0.24

2SC1583	0.28
2SC1617	3.89
2SC1678	1.98
2SC1741	0.21
2SC1810	2.06
2SC1815	0.20
2SC1826	0.69
2SC1829	4.14
2SC1875	3.71
2SC1893	3.85
2SC1921	1.37
2SC1923	0.13
2SC1929	2.35
2SC1942	0.56
2SC1959	0.13
2SC1957	0.49
2SC1953	1.93
2SC1962	1.61
2SC1969	1.79
2SC1983	0.99
2SC1985	0.60
2SC2009	0.33
2SC2029	0.33
2SC2028	2.11
2SC2063	0.99
2SC2078	0.57
2SC2073	0.49
2SC2085	1.65
2SC2091	1.30
2SC2141	1.30
2SC2166	0.92
2SC2216	0.69
2SC2233	0.74
2SC2236	0.24
2SC2278	1.14
2SC2314	0.44
2SC2335+Kit	14.93
2SC2551	0.29
2SC2565	3.54
2SC2570	0.46
2SC2577	1.50
2SC2578	5.24
2SC2671	0.62
2SC288A	1.70
2SC3153	2.21
2SC372	0.28
2SC373	0.09
2SC383	1.33
2SC388	0.57
2SC394V	0.16
2SC403C	0.60
2SC458	0.08
2SC495	0.41
2SC515A	1.85
2SC536	0.13
2SC537	0.54
2SC605L	1.16
2SC620	1.46
2SC643A	1.54
2SC668	0.67
2SC681	3.30
2SC682	1.88
2SC684	1.65
2SC693	0.63
2SC710	0.11
2SC711A	0.25
2SC717	0.19
2SC734	0.20
2SC783	1.35
2SC790Y	3.65
2SC828	0.28
2SC867A	5.52
2SC876	0.96
2SC930	0.30
2SC935	1.15
2SC940	4.68
2SD299	9.47
2SD355	0.64
2SD467	0.55
2SD869	2.47
2SD1128	0.94
2SD1138	0.71
2SD1273	0.79
2SD1453	1.48
2SD152K	2.64
2SD198	1.84
2SD234	0.90
2SD235	0.51
2SD24	2.29
2SD257	1.98
2SD313	0.41
2SD325D	2.26
2SD350	2.72
2SD401	1.40
2SD414	1.98
2SD471	0.85
2SD560	1.50
2SD600	1.55
2SD601R	0.65
2SD613	0.61
2SD636	0.13
2SD639-R	0.24
2SD655	0.19
2SD657	2.80
2SD661A	0.80
2SD731	1.95
2SD773	0.21
2SD811	6.84
2SD837	0.74
2SD841	1.23
2SD856	0.64
2SD857Q	1.84
2SD882	0.29
2SD894	0.38
2SD898	1.93
2SK105H	0.24
7805-T022	0.23
7808	0.44
7812-T022	0.35
7815	0.64
7905	0.41
AD142	2.03
AD143	1.93
AD145	1.60
AD161	0.99
AD162	0.92
AF114	2.47
AF115	5.94
AF118	1.20
AF127	0.57
AF139	0.28
AF178	0.41
AF179	0.36
AF180	0.55
AF181	0.33
AF186	1.32
AF239	0.36
AF279	0.33
AN115	3.98
AN155	1.89
AN206	2.58
AN208	3.55
AN210	1.56
AN211	3.25

AN2140	1.13
AN235	4.65
AN236	3.03
AN240P	0.99
AN241	1.23
AN245	5.77
AN253	1.80
AN262	1.37
AN271	1.79
AN295	8.28
AN301	5.26
AN302	3.99
AN305	4.10
AN315	1.30
AN316	4.95
AN318	7.42
AN320	1.65
AN321	1.27
AN322	7.62
AN337	3.71
AN340P	1.53
AN355	1.65
AN362	1.50
AN370	3.95
AN5111	3.43
AN5120N	4.50
AN5132	5.08
AN5250	5.04
AN5256	1.02
AN5612	3.18
AN5613	4.20
AN5630	3.53
AN5701N	1.66
AN6250	1.75
AN6300	3.91
AN6310	4.54
AN6340	5.62
AN6341	2.22
AN6363	16.00
AN6531	2.17
AN6551	0.69
AN6552	0.68
AN6610	1.79
AN7111	1.14
AN7115	1.45
AN7145	2.17
AN7146	2.06
AN7151	2.37
AN7156	2.70
AN7158	2.65
AN7218	0.79
AN7223	4.99
AU107	7.72
AU110	5.69
AU113	14.63
AY106	2.80
BA524	1.02
BA301	0.54
BA1310	1.50
BA1320	1.38
BA1332	4.14
BA1330	0.79
BA145	0.19
BA148	0.11
BA154	0.03
BA155	0.12
BA156	0.05
BA159	0.09
BA182	0.19
BA222	1.15
BA302	1.24
BA311	0.57
BA312	1.48
BA313	0.76
BA317	0.04
BA318	0.03
BA328	2.22
BA333	1.37
BA335	0.69
BA5102A	1.23
BA511	1.43
BA514	1.00
BA521	1.20
BA524	1.02
BA526	0.79
BA527	1.55
BA532	1.20
BA536	1.51
BA6209	1.34
BA656	0.79
BA7100	1.79
BA841A	9.27
BA843	1.10
BA854	5.76
BAV18	0.06
BAV19	0.24
BAV20	0.36
BAV21	0.10
BAW62	0.11
BAX12	0.49
BAX13	0.11
BAX18	0.94
BC107B	0.19
BC108B	0.37
BC109B	0.14
BC113	0.14
BC119	0.36
BC126	0.11
BC132	0.14
BC135	0.14
BC137	0.29
BC138	0.08
BC139	0.31
BC140	0.30
BC141	0.24
BC142	0.26
BC143	0.34
BC147	0.14
BC148B	0.03
BC148C	0.11
BC149B	0.13
BC153	0.14
BC154	0.14
BC159	0.09
BC160	0.39
BC161	0.28
BC168	0.03
BC169C	0.16
BC170	0.09
BC171	0.07
BC172B	0.18
BC173	0.07
BC174B	0.27
BC177	0.35
BC178	0.26
BC179	0.17
BC182	0.07
BC182LB	0.14
BC183LB	0.09
BC184	0.09
BC184LB	0.13
BC186	0.19
BC187	0.28
BC204	0.35

BC207	0.19
BC212B	0.26
BC213L	0.03
BC214	0.10
BC225	0.40
BC237	0.03
BC238	0.10
BC238B	0.08
BC239B	0.03
BC251A	0.33
BC294	0.50
BC300	0.38
BC301	0.35
BC302	0.34
BC303	0.26
BC307A	0.13
BC308A	0.11
BC309	0.03
BC317A	0.13
BC327	0.09
BC328	0.11
BC337	0.09
BC338	0.12
BC368	0.08
BC440	0.09
BC441	0.39
BC454	0.36
BC460	0.33
BC461	0.47
BC462	1.12
BC463	0.30
BC478	0.16
BC479	0.41
BC532	0.28
BC546	0.08
BC547	0.07
BC548	0.10
BC549	0.05
BC550	0.12
BC556	0.13
BC557	0.05
BC558	0.08
BC559	0.14
BC560C	0.20
BC635	0.22
BC637	0.24
BC638	0.20
BC639	0.16
BC640	0.05
BCX34	0.55
BD115	0.36
BD116	0.70
BD124	1.31
BD131	0.26
BD132	0.19
BD133	0.53
BD135	0.24
BD136	0.36
BD137	0.43
BD138	0.28
BD139	0.39
BD140	0.35
BD144	0.51
BD150	1.12
BD157	0.19
BD160	1.60
BD163	0.71
BD166	0.69
BD175	0.28
BD179	0.30
BD181	0.99
BD182	0.47
BD183	0.79
BD184	1.20
BD187	0.80
BD189	0.65
BD190	0.55
BD201	0.38
BD202	0.60
BD203	0.44
BD204	0.45
BD207	1.73
BD222	0.52
BD225	0.48
BD228	0.63
BD229	0.80
BD231	0.50
BD232	0.49
BD234	0.43
BD237	0.09
BD238	0.09
BD239	0.45
BD240	0.57
BD241	0.39
BD242	0.37
BD243A	0.62
BD243C	0.38
BD244	0.42
BD244C	0.58
BD245	0.67
BD246	0.77
BD253	0.99
BD278A	0.70
BD317	1.40
BD318	2.72
BD375	0.42
BD380	0.39
BD410	0.33
BD433	0.26
BD434	0.28
BD435	0.47
BD436	1.14
BD437	0.29
BD438	0.52
BD441	0.69
BD442	0.39
BD509	1.64
BD510	1.08
BD519	0.78
BD529	0.93
BD530	1.00
BD533	0.67
BD534	1.40
BD535	0.38
BD536	0.46
BD537	0.40
BD538	0.75
BD544B	0.75
BD677	0.55
BD679	0.43
BD680	0.49
BD681	0.45
BD696	2.47
BD699	0.80
BD700	3.70
BD707	0.49
BD709	0.80
BD710	0.80
BD809	0.52
BD810	0.45
BD879	0.74
BD895	2.22
BD901	0.44
BD902	0.58
BDW83C	1.20
BDW84C	1.34
BDX32	1.65
BDX53A	0.46
BDX53B	3.35

BDX54B	0.33
BDX63A	1.45
BDX63A	1.96
BDY20	1.98
BDY81	1.18
BF115	0.39
BF117	0.66
BF118	0.67
BF121	0.25
BF123	0.16
BF127	0.13
BF137	0.29
BF153	0.58
BF154	0.24
BF157	0.33
BF158	0.09
BF159	0.18
BF160	0.31
BF167	0.38
BF173	0.05
BF177	0.55
BF178	0.39
BF179	0.29
BF180	0.36
BF181	0.64
BF182	0.34
BF183	0.38
BF184	0.39
BF185	0.39
BF194	0.14
BF195	0.06
BF196	0.14
BF197	0.24
BF198	0.17
BF199	0.03
BF200	0.37
BF218	0.36
BF224	0.19
BF237	0.65
BF240	0.09
BF241	0.17
BF245	0.50
BF245B	0.49
BF246A	2.67
BF255	0.09
BF256	0.28
BF257	0.34
BF258	0.33
BF259	0.30
BF262	0.57
BF263	0.57
BF271	0.34
BF273	0.20
BF274	0.34
BF324	0.32
BF336	0.29
BF337	0.31
BF338	0.38
BF355	0.46
BF362	0.99
BF363	0.24
BF371	0.50
BF391	0.25
BF419	0.62
BF422	0.13
BF423	0.33
BF435	2.61
BF450	0.18
BF451	0.11
BF457	0.41
BF458	0.29
BF459	0.66
BF460	1.24
BF469	0.33
BF470	0.26
BF471	0.21
BF472	0.23
BF479	0.62
BF480	0.89
BF491	0.50
BF506	0.43
BF532	0.45
BF596	0.18
BF597	0.14
BF694	0.22
BF757	0.26
BF759	0.29
BF761	0.43
BF762	0.42
BF869	0.09
BF870	0.30
BF960	0.26
BF966	0.56
BF970	0.68
BFR39	0.35
BFR61	0.92
BFR62	0.49
BFR79	0.37
BFR81	0.29
BFR89	1.63
BFR90A	0.63
BFX29	0.33
BFX84	0.37
BFX85	0.31
BFX86	0.36
BFX87	0.55
BFX88	0.34
BFY50	0.30
BFY51	0.33
BFY90	1.16
BLY49	2.20
BR100	0.23
BR101	0.78
BR103	1.03
BR303	1.20
BRC84	2.08
BRX44	0.60
BRX45	0.71
BRX46	0.30
BRX49	0.29
BRY39	1.13
BRY44	0.34
BSS38	0.17
BSTB0140G	4.93
BSTC0246	6.99
BSTC0233	1.71
BSTC1233	0.66
BSTD1043	2.85
BSV57B	1.04
BSW68	0.60
BSX19	0.34
BSX20	1.12
BSY52	0.50
BT106	1.15
BT108	1.45
BT119	1.65
BT120	1.23
BT121	2.48
BT123	1.86
BT151-800R	1.10
BTT6018	1.36
BU106	2.48
BU110	2.57
BU111Y	4.16
BU124	1.48
BU125	2.48

BU126	1.10
BU204	1.58
BU205	1.15
BU206	1.18
BU207	0.72
BU208	1.13
BU208	1.13
BU208A	1.12
BU208D	1.38
BU209	1.75
BU226	1.07
BU326A	0.99
BU406	0.42
BU406D	1.24
BU407	0.54
BU412	8.97
BU426A	0.64
BU500	1.53
BU508A	1.50
BU536	1.53
BU608	1.54
BU705	2.67
BU806	0.79
BU807	0.49
BU826A	1.86
BUW84	0.68
BUX84	0.50
BUX85	0.74
BY126	0.74
BY127	0.09
BY133	0.06
BY164	0.64
BY176	0.93
BY179	0.85
BY182	0.54
BY187	0.79
BY189	1.76
BY198	0.16
BY207	0.17
BY208	1.86
BY210-400	0.18
BY210-600	0.35
BY210-800	0.19
BY223	1.98
BY224-600	4.95
BY226	0.15
BY227	0.20
BY228	0.36
BY229-600	1.20
BY229-800	0.87
BY255	0.11
BY295-600	1.28
BY298	0.11
BY299	0.11
BY407	0.90
BY409	1.49
BY448	1.40
BY713	1.12
BYW56	0.19
BYX55-600	0.19
BYX71-600	0.77
BYX71-350	0.88
BYY56	1.48
C20	1.95
C106M	0.66
CA3046	0.82
CA3089	1.24
CA3090AO	1.98
CA3094	1.72
CA3131EM	3.12
CD4001	0.13
CD4002	0.24
CD4008	1.35
CD4011	0.20
CD4012	0.16
CD4013	0.33
CD4016	0.25
CD4017	0.30
CD4020	0.75
CD4021	0.39
CD4023	0.16
CD4025	0.28
CD4028	0.84
CD4040B	0.29
CD4047	0.75
CD4049	0.21
CD4052	0.35
CD4066	0.29
CD4069	0.16
CD4070	0.24
CD4081	0.14
CD4093	0.40
CD4511	0.38
CD4528	0.52
CD4556	1.47
CRO2AM-8	1.70
CV12E	2.68
CX095D	3.14
CX104	8.77
CX108	5.52
CX109	6.84
CX130	8.76
CX135	7.50
CX136	11.49
CX139	11.17
CX157	5.52
CX158	10.45
CX177	8.80
CX187	5.26
CX755	12.95
CX885A	6.85
E1222	0.40
E5024	0.28
E5386	0.25
GD243	5.03
GF758	1.07
HA11215	1.75
HA11211	2.53
HA11225	1.12
HA11229	2.15
HA11235	1.73
HA11244	3.71
HA1125	4.29
HA1137W	1.38
HA1138	2.88
HA11414	2.25
HA1156	0.54
HA1160	5.77
HA1166X	6.73
HA1167	6.60
HA11706	3.61
HA11705	8.00
HA11703	3.45
HA11701	2.98
HA11710	3.45
HA11713	3.35
HA11711	9.90
HA11715	10.19
HA11714	7.76
HA11716	6.10
HA11725	18.26
HA11756	13.50
HA11781	18.95
HA1180	5.15

HA1196	0.66
HA13001	1.30
HA1306	2.26
HA13402	7.06
HA13403	11.86
HA1342A	8.98
HA1364	12.25
HA1367	2.73
HA1368R	4.95
HA1368	1.95
HA1374A	2.88
HA1377	1.59
HA1388	1.87
HA1389R	2.05
HA1389	2.47
HA1392	4.38
HA1394	2.55
HA1397	2.55
HA1398	2.55
HA1406	2.07
HA1452	0.85
HA1457W	2.23
HD38702-A23	4.76
HD38750A53	5.77
HD38750A-78	8.53
HD38800A50	14.12
HD44801A05	14.07
HISH1010	14.60
HISH1002	9.50
HM6211	14.55
HM6231	12.30
HM6232	7.20
HM6251	5.69
HM7103	2.97
HM9032	4.00
HM9012	3.22
HT4207	11.99
ICH28I	1.20
KA2101	0.57
KC581C	7.92
KC582C	4.85
L200CV	1.27
LA1201	0.75
LA1210	1.04
LA1230	1.18
LA1231	1.07
LA1357N	3.06
LA1363	1.05
LA1364	3.02
LA1365J	0.70
LA1385	1.53
LA1387	3.18
LA3350	1.43
LA3361	0.71
LA3390	5.52
LA4032P	2.35
LA4100	0.87
LA4101	0.82
LA4102	0.75
LA4112	0.94
LA4125	2.21
LA4138	3.10
LA4140	0.70
LA4192	1.32
LA4220	1.25
LA4420	1.72
LA4422	1.07
LA4430	1.41
LA4440	1.51
LA4445	1.25
LA4460	1.30
LA4461	1.25
LA5112N	1.38
LA7020	3.41
LA7025	11.97
LA7027	10.92
LA7040	1.32
LA7042	2.47
LA7800	1.23
LA7801	1.23
LA7820	1.51
LB1274	1.90
LC7800	1.55
LD3120	1.12
LD3150	2.75
LM383	1.10
LM1017N	1.81
LM1877	1.97
LM2808	5.94
LM2877	7.75
LM324N	0.36
LM339N	0.43
LM340K	11.85
LM348N	2.15
LM380N	1.50
LM6402A093	10.15
LM6416	11.08
LM748	0.71
LM8360	3.54
LM8361	2.67
LR3419	9.37
LR3471	9.37
LU1141	7.27
LU52012	19.75
LU52011	15.65
LU03112	12.37
M21C	1.32
M23C	1.98
M192B1	2.37
M293	4.98
M51102L	1.71
M5115P	5.24
M51203L	3.15
M51231P	1.68
M51301P	4.53
M51353P	6.93
M51381P	5.98
M51393AP	4.50
M51394P	3.77
M5142P	6.84
M5144P	8.25
M51515BL	2.54
M51516L	1.88
M51521L	0.54
M5192	3.13
M5194AP	6.27
M5231L	0.52
M53274P	1.23
M54532P	1.12
M54544L	1.46
M58478P	8.77
M58485P	5.77
MA8001	0.82
MAA4004	11.46
MB3705	1.98
MB3712	1.85
MB3713	1.69
MB3730	1.76
MB3731	1.98
MC13002	2.47
MC1310P	1.95
MC1327P	0.41

MC1330P	1.75
MC1350P	1.56
MC1351P	1.25
MC1352P	1.40
MC1357P	0.57
MC1358P	1.48
MC14493P	3.64
MC14497	7.10
MC14511BCP	1.10
MC1458P	5.18
MC1712	3.88
MC3340	1.40
MC5192	21.94
MC7724CP	3.49
MCR106-5/6	1.56
MCR220/7	1.25
ME0411	0.75
ME6002	0.26
ME6102	0.28
ME9002	0.45
MEA2901	2.74
MEM4956	1.65
MJ2501	1.40
MJ3000	2.36
MJE2955	0.66
MJE3055	1.15
MJE340	0.38
MJE520	0.49
ML231	0.99
ML232B	1.65
ML237B	1.95
ML238	5.65
ML923	3.30
ML926	3.45
MM5314N	8.99
MM5316N	3.50
MM5318N	3.11
MM5369N	2.01
MM5387AA/N	1.20
MM5841N	6.93
MN1400VL	14.68
MN1435VX	13.20
MN1455	14.04
MP1192	15.55
MP2794	4.00
MC1355C	1.98
MPF256C	0.60
MPS6570	0.48
MPSA42	0.22
MPSA55	0.15
MPSA56	0.11
MPSA92	0.15
MPSU05	0.86
MPSU10	2.84
MPSU56	1.25
MPSU60	2.21
MR818	0.33
MR854	0.75
MR914	0.80
MRF477	24.77
MSM5840H	14.91
MVS460-02	0.61
NE542	2.75
NE555	2.01
NE556	0.41
NE565N	1.18
OA202	0.11
OA47	0.24
OA91	0.14
OA95	0.16
OC28	9.07
OC35	1.05
OC36	7.52
OC44	1.95
OC45	0.18
OC72	0.44
OC75	0.29
ON236	1.06
ON782	1.65
OT121	1.45
PT6042	3.58
PT8504	5.65
R1038	1.81
R1039	2.19
R2008B	1.33
R2009	1.98
R2010B	2.98
R2029	1.33
R2030	1.33
R2257	2.38
R2265	1.49
R2306	0.75
R2322	0.67
R2323	0.24
R2354A	0.59
R2354B	2.01
R2441	1.36
R2461	0.95
R2540	1.65
R2540X	1.86
R2615	0.67
RCA2060	2.00
RGP01-15	0.70
RGP10	0.27
RGP30M	0.29
RM11C	0.85
RT905A	3.28
S1299	5.34
S2055AF	3.41
S2802	2.90
S2818	0.85
S3702S	5.21
S6080B	10.46
SA8063	15.55
SAA1006	3.34
SAA1020	5.77
SAA1025	0.90
SAA1024	2.50
SAA1075	1.55
SAA1121	9.23
SAA1124	2.60
SAA1130	9.90
SAA1174	5.99
SAA1250	4.12
SAA1251	3.20
SAA1351	7.98
SAA3027P	6.18
SAA5000	3.30
SAA5010	3.53
SAA5012	5.50
SAA5020	5.78
SAA5030	6.33
SAA5050	4.53
SAB1009B	5.98
SAB3011	4.15
SAB3013	3.62
SAB3021	10.19
SAB3024	6.36
SAB3209	5.82
SAB3210	3.21
SAF1032P	4.27
SAF1039	1.95
SAS5010	8.39
SAS560S	1.91

SAS560T	2.06
SAS570T	2.06
SAS570S	1.95
SAS580	2.87
SAS6600	1.33
SAS660	2.97
SAS6700	1.33
SAS670	3.96
SAS6710	2.21
SBA750	1.61
SC84203	19.35
SDA2006	11.76
SDA2010	20.50
SDA2112/2	12.96
SG264A	9.37
SG613	12.37
SG629	1.81
SG6533	16.45
SI1630HD	20.62
SKE2F1/04	1.25
SKE2G3/04	0.73
SKE4F1/06	0.30
SKE4F2/08	0.89
SKE4F2/06	0.85
SKE4F2/10	0.99
SKE5F3/10	0.89
SKE4G1/04	0.54
SKS1/10	2.15
SL1310	3.14
SL1430T	2.31
SL414	3.69
SL432A	3.44
SL439	2.48
SL471	4.45
SL480	7.24
SL490	1.15
SL901B	2.06
SL918A	9.07
SN16861ANO	1.61
SN16966N	11.07
SN29715N	6.04
SN29717N	7.19
SN29716N	3.66
SN29715N	6.04
SN29722	11.95
SN29723AN	14.46
SN29764AN	2.60
SN29767	4.55
SN29770BN	7.71
SN29772BN	5.75
SN29771BN	5.59
SN29773	2.58
SN29791	1.67
SN29798N	5.56
SN7400N	0.61
SN7401N	0.36
SN7402N	0.64
SN7404N	0.52
SN7410N	0.27
SN74121	0.29
SN74141N	0.16
SN74151AN	1.51
SN74154N	1.27
SN74175	1.52
SN74190	1.35
SN7420N	1.51
SN7430	0.49
SN7440N	0.27
SN7442	0.74
SN7472	1.53
SN7474N	0.44
SN7490AN	0.75
SN74LS26N	1.45
SN76001N	0.45
SN76013ND	7.45
SN76023ND	2.57
SN76033N	2.68
SN76110N	0.49
SN76115AN	0.41
SN76131	0.66
SN76227N	2.45
SN76226DN	2.17
SN76228N	3.27
SN76242	5.23
SN76243	5.23
SN76396	2.90
SN76533N	1.75
SN76532N	3.03
SN76545	1.65
SN76549	2.37
SN76570	3.08
SN76611	2.59
SN76620	2.59
SN76630	2.55
SN76660N	2.48
SN76666N	1.20
SN76708	4.86
SN76709N	9.63
SN76707N	3.69
SN76705N	2.97
SN76730	5.54
SN76810N	0.60
SN76832N	1.35
SN94042	4.35
SP5422	1.83
STA401	2.22
STA441C	2.22
STA471C	2.22
STK0029	5.70
STK0039	5.21
STK0040	7.17
STK0050	7.83
STK011	4.48
STK014	12.25
STK031	12.95
STK040	13.34
STK054	9.35
STK058	27.50
STK077	9.27
STK1039	5.29
STK2110	15.47
STK2145	13.77
STK2240	10.94
STK2250	18.80
STK3042	4.81
STK3044	5.67
STK4019	13.87
STK433	6.18
STK4332	5.37
STK435	6.02
STK4352	1.65
STK436	7.26
STK437	9.50
STK4372	5.42
STK460	9.85
STK466	10.10
STK501	6.32
STK502	8.53
STK5314	9.48
STK5333	7.70
STK5730	4.55
STK7216	5.19
STK772	3.71

STR1096	3.94
STR4090	14.60
STR440	6.18
STR451	5.77
STR454	6.68
STR50103A	3.71
STR6020	6.16
T6016V	1.08
T6021V	0.40
T6036	0.67
T6037	2.11
T6044V	0.97
T6045	1.20
T6049	1.45
T6052V	0.87
T6058	4.95
T6059	4.22
T9003V	1.25
T9013V	4.95
T9014V	2.42
T9016	1.02
T9017V	1.25
T9019V	1.00
T9034V	1.34
T9035V	1.49
T9051	9.32
T9054V	0.99
T9057V	3.44
T9064	2.40
T9065V	3.86
TA7027	4.80
TA7050	1.74
TA7051	1.74
TA7054	2.55
TA7060AP	0.71
TA7061AP	0.64
TA7069	3.13
TA7070P	1.83
TA7072P	2.57
TA7074P	1.98
TA7076P	7.50
TA7089P	3.10
TA7092P	8.63
TA7093P	3.99
TA7108P	1.61
TA7109	1.78
TA7120P	0.64
TA7122B/P	0.59
TA7124P	2.34
TA7129P	1.90
TA7130P	0.62
TA7136AP	1.89
TA7137P	1.21
TA7146P	5.87
TA7149P	2.31
TA7152P	3.16
TA7161P	16.54
TA7169	4.53
TA7172P	1.41
TA7176P	1.75
TA7193P	5.05
TA7204P	1.95
TA7205P	1.05
TA7207P	1.63
TA7208P	2.15
TA7210P	1.45
TA7214P	3.63
TA7215P	1.98
TA7217AP	1.40
TA7222	1.23
TA7226	4.22
TA7229P	4.66
TA7230P	1.30
TA7233P	1.71
TA7240AP	2.14
TA7245P	1.78
TA7310P	1.10
TA7313AP	0.60
TA7314	3.50
TA7323P	3.15
TA7325P	1.63
TA7339P	2.50
TA7340P	5.95
TA7607AP	1.95
TA7609	1.89
TA7611AP	2.34
TA7616P	5.25
TA7622AP	2.92
TA7628P	1.45
TA7629P	2.51
TA7630P	1.81
TA7640AP	1.04
TA7672P	2.75
TA7676P	4.12
TA7726P	10.25
TAA320A	1.27
TAA350A	6.59
TAA550	0.25
TAA570	1.85
TAA661B	0.95
TAA691	8.58
TAA700	2.37
TAA930	4.36
TAA970	2.83
TAG626-600	1.34
TBA120AS	1.45
TBA120SB	0.40
TBA120T	0.57
TBA120U	0.46
TBA120A	1.05
TBA1440	1.46
TBA1441	2.55
TBA395	0.66
TBA396	0.41
TBA400	2.26
TBA440C	2.34
TBA480Q	1.07
TBA510	2.50
TBA520	1.20
TBA530	2.45
TBA540	1.72
TBA560C	1.40
TBA570Q	1.60
TBA570A	1.71
TBA673	5.94
TBA700	0.66
TBA720	4.32
TBA730	3.55
TBA750Q	4.95
TBA800	1.08
TBA810P	1.61
TBA810S	1.61
TBA810T	1.71
TBA820	0.52
TBA820M	0.41
TBA890	3.50
TBA920	1.65
TBA940	3.30
TBA950	1.55

TBA970	3.86
TBA990	0.57
TCA270S	1.00
TCA270SQ	0.80
TCA290A	2.39
TCA420A	2.14
TCA440	1.89
TCA640	1.65
TCA650	3.05
TCA660B	0.41
TCA730	6.50
TCA750	2.17
TCA800O	1.60
TCA830S	2.37
TCA890	5.44
TCA900	1.99
TCA910	1.65
TCA940	3.30
TCA940E	2.93
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TD3F800R	6.51
TD3F900H	6.37
TD6361N-DS	5.25
TDA1001B	2.31
TDA1003A	1.34
TDA1005A	2.02
TDA1006A	7.00
TDA1011	0.95
TDA1010	1.04
TDA1011A	1.36
TDA1028	2.40
TDA1034B	2.17
TDA1035T	1.70
TDA1036	2.64
TDA1037	2.68
TDA1037D	2.05
TDA1044	2.03
TDA1047	2.78
TDA1059B	0.33
TDA1060	2.39
TDA1082	4.51
TDA1151	0.49
TDA1190	1.27
TDA1190Z	3.96
TDA1200	0.87
TDA1235	4.15
TDA1236	3.60
TDA1270	1.73
TDA1327A	6.93
TDA1412	0.74
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TDA1470	2.45
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TDA1512	2.47
TDA1515	2.88
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TDA1670	2.47
TDA1770	2.31
TDA1905	0.90
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TDA1950	2.34
TDA2005	1.24
TDA2006	0.95
TDA2004	1.23
TDA2002	0.90
TDA2003	0.62
TDA2030	1.23
TDA2140	5.16
TDA2150	4.48
TDA2151	4.18
TDA2160	1.98
TDA2161	4.78
TDA2170	3.21
TDA2270	2.06
TDA2520	2.37
TDA2522	14.78
TDA2524	0.41
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TDA2532	0.41
TDA2530	0.41
TDA2541	2.14
TDA2540	1.07
TDA2545A	2.15
TDA2560	2.50
TDA2575A	3.63
TDA2578A	2.95
TDA2576A+Kit	12.35
TDA2581	1.60
TDA2582	1.98
TDA2591	2.15
TDA2594	2.45
TDA2593	1.23
TDA2595	2.29
TDA2600	4.12
TDA2611AQ	1.30
TDA2611A	0.62
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TDA2620	1.66
TDA2630	4.55
TDA2631	2.24
TDA2640	3.80
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TDA2795	1.43
TDA2791	4.43
TDA2910	13.25
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TDA3592A	4.53
TDA3650	13.01
TDA3651AQ	1.98
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TDA3651A	1.81
TDA3950	3.30
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TDA4290	2.95
TDA4400	2.06
TDA4420	2.30
TDA4422	3.51
TDA4427S	2.65
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TDA4440	1.65
TDA4442	3.18
TDA4500	4.75
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TDA4610	5.99
TDA4620	7.75
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TDA8190	3.24
TDA9403	1.50
TDA9503	1.56
TDA9513	2.09
TDD1613S	1.22
TDE1081	7.24
TEA1002	4.93
TEA1009	1.65
TEA1014	1.48
TEA1020SP	4.93
TEA2018A	1.83
TIC106M	0.67
TIC44	0.72
TIC45	0.55
TIC47	0.77
TIP120	0.55
TIP110	0.28
TIP112	0.38
TIP117	0.95
TIP121	0.40
TIP126	0.38
TIP132	0.41
TIP137	0.96
TIP29	0.84
TIP2955	0.79
TIP29A	0.28
TIP29B	0.62
TIP29C	0.33
TIP29D	0.75
TIP3055	0.69
TIP30A	0.41
TIP30C	0.40
TIP31A	0.34
TIP31B	0.28
TIP31C	0.39
TIP32A	0.35
TIP32B	0.46
TIP32C	0.54
TIP33	0.63
TIP33A	0.89
TIP33C	0.95
TIP34	1.20
TIP41A	0.29
TIP41B	0.29
TIP41C	0.31
TIP42A	0.29
TIP42B	0.79
TIP42C	0.35
TIP47	0.65
TIS43	0.64
TIS90	0.28
TL011CP	1.65
TL494CN	1.12
TL072CP	0.41
TMP4320	9.50
TMS1024NLL	13.93
TMS1025N	14.60
TMS3720ANS	2.06
TMS3748NS	10.95
TMS3755	9.66
TMS4034	1.00
TUA2000	9.33
TV106	2.97
TY6010B	2.97
ULN2204	8.50
UPC1360C	2.30
UPC1366	1.48
UPA81C	0.64
UPC1003	5.85
UPC1025H	2.90
UPC1028H	0.97
UPC1032H	0.82
UPC1043C	4.29
UPC1158H	0.63
UPC1161C	4.68
UPC1182H	2.19
UPC1186H	0.71
UPC1181H	0.95
UPC1185H	4.12
UPC1188	2.06
UPC1212C	0.80
UPC1225H	1.89
UPC1230	2.14
UPC1238	1.38
UPC1278H	1.89
UPC1351C	1.81
UPC1350C	1.38
UPC1353	2.60
UPC1363	1.02
UPC1362	1.68
UPC1365C	1.65
UPC1360C	2.30
UPC1378H	1.07
UPC141C	0.95
UPC1458	0.66
UPC151C	2.95
UPC2002	1.08
UPC30C	2.51
UPC324C	0.99
UPC32C	4.94
UPC339C	2.95
UPC41C	2.99
UPC4558C	0.41
UPC474	5.11
UPC554C	1.43
UPC575C2	1.55
UPC580C	2.73
UPC587C2	1.34
UPC592H	2.01
UPC595	1.15
UPC596	2.31
UPD1514C	4.76
UPD2819C	4.98
UPD553-164	18.43
UPD8049C-1	11.50
XO022CE	5.75
XO029CE	7.09
XO031CE	6.38
XO035TA	7.27
XO040TA	5.52
XO042CE	3.19
XO043CE	2.75
XO055GE	5.02
XO057GE	6.00
XO065CE	6.35
XO074GE	18.93
XO077GE	6.35
XO079CE	4.95
XO092CE	10.31
XO096CE	6.60
XO109CE	13.61
XO113CE	10.97
XO195CE	9.60
XO204CE	11.96
XO261CE	8.98
2PY120	5.94

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DECLARATION OF QUALITY

AS DISTRIBUTORS OF QUALITY VIDEO SPARES FOR THE LAST TEN YEARS, WE FULLY UNDERSTAND THE REQUIREMENTS OF THE REPAIR TRADE. THERE IS A CERTAIN QUALITY WHICH MUST BE MAINTAINED IN ORDER TO EXECUTE HONEST, RELIABLE REPAIRS. THEREFORE, WE GUARANTEE THAT ALL VIDEO SPARES SUPPLIED BY US ARE OF THE FINEST QUALITY AND WE CAN ASSURE YOU THAT ALL STOCKED ITEMS WILL BE DISPATCHED THE SAME DAY.

	Part No.	Price
AIWA		
AV-66		
Video Head	VID 2546	£16.95
Pinch Roller	VID 1755	£3.76
Belt Kit	VID 7519	£1.65
Idler Replacement Set	VID 1001	£4.04
Idler	VID 1005	£1.65
Capstan Motor	VID 2160	£22.81
Tension Band	VID 1423	£3.22
Reel Table Rubber Tyre	VID 1335	£0.90
CTL Unit	VID 2637	£59.75
AV-77		
Video Head	VID 2546	£16.95
Pinch Roller	VID 1755	£3.76
Belt Kit	VID 7509	£1.95
Idler Replacement Set	VID 1000	£5.62
FWD Limiter	VID 1002	£3.37
Idler	VID 1004	£1.27
Idler	VID 1005	£1.65
Capstan Motor	VID 2118	£28.50
Tension Band	VID 1423	£3.22
CTL Unit	VID 2567	£46.43
AKAI		
VS-9800		
Video Head	VID 2511	£9.95
Pinch Roller	VID 1756	£2.95
Belt Kit	VID 7506	£1.65
Take Up Idler	VID 1025	£4.65
REW Idler	VID 1026	£5.92
Unloading Idler	VID 1027	£9.30
FF Rubber Tyre	VID 1029	£0.78
FF Rubber Tyre	VID 1030	£0.82
Unloading Idler Rubber Tyre	VID 1207	£0.82
Capstan Motor	VID 2119	£42.31
Drum Motor	VID 2120	£18.73
Cassette Lamp	VID 1943	£0.35
Tension Band	VID 1391	£3.54
Repair Kit	VID 7911	£13.08
Take Up Rubber Tyre	VID 1028	£0.75
ALBA		
VCR-4000		
Video Head	VID 2713	£22.31
Pinch Roller	VID 1787	£3.50
Belt Kit	VID 7596	£3.30
Idler	VID 1049	£3.75
Cassette LED	VID 1981	£1.35
Tension Band	VID 1399	£2.40
AMSTRAD		
VCR-4600		
Video Head	VID 2676	£19.68
Pinch Roller	VID 1758	£2.95
Belt Kit	VID 7593	£1.95
Clutch	VID 1226	£4.32
Gear Holder	VID 1227	£11.70
RF Clutch	VID 1231	£6.52
Cassette LED	VID 1981	£1.35
VCR-9000		
Video Head	VID 2502	£14.72
Pinch Roller	VID 1758	£2.95
Belt Kit	VID 7592	£1.05
RF Clutch	VID 1225	£3.82
Clutch	VID 1226	£4.32
Gear Holder	VID 1227	£11.70
Cassette LED	VID 1981	£1.35
BANG & OLUFSEN		
VHS-65		
Video Head	VID 2506	£16.08
Pinch Roller	VID 1788	£2.95
Belt Kit	VID 7538	£1.23
FF/REW Idler Arm	VID 1020	£1.65
Clutch Plate	VID 1211	£8.92
Capstan Motor	VID 2147	£18.02
Cassette LED	VID 1981	£1.35
DECCA		
VRH-8300		
Video Head	VID 2511	£9.95
Pinch Roller	VID 1814	£2.77
Belt Kit	VID 7812	£1.22
Reel Idler	VID 1036	£2.80
Take Up Clutch	VID 1037	£2.86
Take Up Idler	VID 1038	£1.55
Brake Pad	VID 1361	£0.36
Reel Motor	VID 2169	£28.12
Capstan Motor	VID 2164	£37.18
Loading Motor	VID 2168	£9.30
Cassette Lamp	VID 1947	£0.50
Tension Band	VID 1389	£1.60
Repair Kit	VID 7913	£18.52
Take Up Reel Table Rubber Tyre	VID 1080	£0.60
Supply Reel Table Rubber Tyre	VID 1080	£0.60
FERGUSON		
3-V-30		
Video Head	VID 2647	£9.81
Pinch Roller	VID 1814	£2.77
Belt Kit	VID 7812	£1.22
Reel Idler	VID 1036	£2.80
Take Up Clutch	VID 1037	£2.86
Take Up Idler	VID 1038	£1.55
Brake Pad	VID 1361	£0.36
Reel Motor	VID 2169	£28.12
Capstan Motor	VID 2164	£37.18
Loading Motor	VID 2168	£9.30
Cassette Lamp	VID 1947	£0.50
Tension Band	VID 1389	£1.60
Repair Kit	VID 7913	£18.52
Take Up Reel Table Rubber Tyre	VID 1080	£0.60
Supply Reel Table Rubber Tyre	VID 1080	£0.60
3-V-36		
Video Head	VID 2647	£9.81
Pinch Roller	VID 1813	£3.05
Belt Kit	VID 7543	£0.99
Take Up Clutch	VID 1031	£3.00
Take Up Idler	VID 1038	£1.55
Reel Idler	VID 1039	£3.07
Brake Pad	VID 1361	£0.36
Capstan Motor	VID 2165	£22.87
Loading Motor	VID 2168	£9.30
Front Loading Motor	VID 2168	£9.30
Cassette LED	VID 1981	£1.35
Tension Band	VID 1389	£1.60
Remote Control	IR 9100	£11.92
Repair Kit	VID 7918	£18.09
Mains Transformer	VID 2223	£20.38
Take Up Reel Table Rubber Tyre	VID 1080	£0.60
Supply Reel Table Rubber Tyre	VID 1080	£0.60
Cassette Housing	VID 1099	£21.33
3-V-57		
Video Head	VID 2573	£16.50
Pinch Roller	VID 1813	£3.05
Belt Kit	VID 7540	£0.80
Clutch Mechanism	VID 1083	£13.97
Capstan Motor	VID 2188	£44.62
Loading Motor	VID 2167	£13.69
Front Loading Motor	VID 2168	£9.30
Cassette LED	VID 1981	£1.35
Tension Band	VID 1388	£1.95
Repair Kit	VID 7920	£17.58
Cassette Housing	VID 1315	£21.33
FV-10B		
Video Head	VID 2580	£25.68
Pinch Roller	VID 1817	£11.25
Belt Kit	VID 7564	£2.50
Idler Arm	VID 1091	£2.88
Reel Motor	VID 2193	£15.04
Capstan Motor	VID 2190	£25.53
Loading Motor	VID 2412	£6.18
Front Loading Motor	VID 2412	£6.18
Cassette LED	VID 1981	£1.35
Tension Band	VID 1386	£1.65
Repair Kit	VID 7921	£14.16
FV-12L		
Video Head	VID 2581	£37.81
Pinch Roller	VID 1817	£11.25
Belt Kit	VID 7564	£2.50
Idler Arm	VID 1091	£2.88
Reel Motor	VID 2193	£15.04
Capstan Motor	VID 2190	£25.53
Loading Motor	VID 2412	£6.18
Front Loading Motor	VID 2412	£6.18
Cassette LED	VID 1981	£1.35
Tension Band	VID 1386	£1.65
Repair Kit	VID 7921	£14.16
FIDELITY		
VCR-100		
Video Head	VID 2502	£14.72
Pinch Roller	VID 1758	£2.95
Belt Kit	VID 7593	£1.95
Clutch	VID 1226	£4.32
Gear Holder	VID 1227	£11.70
RF Clutch	VID 1231	£6.52
Cassette LED	VID 1981	£1.35
FINLUX		
VR-1030		
Video Head	VID 2558	£40.95
Pinch Roller	VID 1803	£3.99
Idler	VID 1006	£2.88
Tension Band	VID 1432	£5.17
Remote Control	IR 9034	£13.46
Repair Kit	VID 7930	£12.76
VR-2010		
Video Head	VID 2578	£56.31
Pinch Roller	VID 1827	£8.15
Belt Kit	VID 7588	£1.42
Idler	VID 1252	£3.97
Loading Gear	VID 1253	£6.37
Modification Set	VID 1254	£10.35
Tension Band	VID 1431	£4.27
Remote Control	IR 9034	£13.46
FISHER		
FVH-P520		
Video Head	VID 2500	£21.95
Pinch Roller	VID 1788	£2.95
Belt Kit	VID 7532	£1.99
Take Up Idler	VID 1015	£4.87
FF/REW Pulley	VID 1016	£0.78
Idler	VID 1023	£2.88
Tension Band	VID 1378	£2.10
Take Up Reel Table Rubber Tyre	VID 1293	£0.60
Supply Reel Table Rubber Tyre	VID 1293	£0.60
FVH-P530		
Video Head	VID 2500	£21.95
Pinch Roller	VID 1788	£2.95
Belt Kit	VID 7532	£1.99
Take Up Idler	VID 1015	£4.87
FF/REW Pulley	VID 1016	£0.78
Idler	VID 1023	£2.88
Tension Band	VID 1378	£2.10
Take Up Reel Table Rubber Tyre	VID 1293	£0.60
Supply Reel Table Rubber Tyre	VID 1293	£0.60
FVH-P720/720K/721		
Video Head	VID 2500	£21.95
Pinch Roller	VID 1810	£3.30
Belt Kit	VID 7532	£1.99
Gear Idler	VID 1013	£4.65
Idler	VID 1014	£2.80
Loading Gear Set	VID 1230	£1.50
Cassette LED	VID 1981	£1.35
Tension Band	VID 1376	£2.10
Take Up Reel Table	VID 1295	£7.12
Supply Reel Table	VID 1294	£5.77
FVH-P722/725		
Video Head	VID 2501	£21.95
Pinch Roller	VID 1810	£3.30
Belt Kit	VID 7813	£1.05
Gear Idler	VID 1013	£4.65
Idler	VID 1014	£2.80
Loading Gear Set	VID 1230	£1.50
Cassette LED	VID 1981	£1.35
Tension Band	VID 1376	£2.10
Take Up Reel Table	VID 1295	£7.12
Supply Reel Table	VID 1294	£5.77
FVH-P980K/KV		
Video Head	VID 2501	£24.43
Pinch Roller	VID 1818	£3.05
Belt Kit	VID 7568	£2.40
Idler	VID 1093	£4.20
Clutch	VID 1094	£13.52
Cassette LED	VID 1981	£1.35
Tension Band	VID 1377	£2.10
Supply Reel Table	VID 1296	£9.97
FUNAI		
VCR-4600		
Video Head	VID 2676	£19.68
Pinch Roller	VID 1758	£2.95
Belt Kit	VID 7593	£1.95
Clutch	VID 1226	£4.32
Gear Holder	VID 1227	£11.70
RF Clutch	VID 1231	£6.52
Cassette LED	VID 1981	£1.35
VCR-5843		
Video Head	VID 2708	£24.31
Pinch Roller	VID 1758	£2.95
Belt Kit	VID 7615	£3.67
Idler	VID 1364	£2.25
Cassette LED	VID 1981	£1.35
GEC		
V-4004		
Video Head	VID 2506	£16.08
Pinch Roller	VID 1788	£2.95
Belt Kit	VID 7538	£1.23
FF/REW Arm	VID 1020	£1.65
Clutch Plate	VID 1211	£8.92
Capstan Motor	VID 2148	£25.20
Cassette LED	VID 1981	£1.35
Tension Band	VID 1379	£2.10
Repair Kit	VID 7922	£16.50
GOLDSTAR		
GHV-8000/8200/8210/8215		
Pinch Roller	VID 1815	£4.72
Belt Kit	VID 7585	£2.39
Idler	VID 1052	£1.98
Bracket Centre	VID 1223	£25.81
Clutch Gear	VID 1228	£2.02
Limiter Roller	VID 1440	£1.20
Cassette LED	VID 1981	£1.35
Tension Band	VID 1399	£2.40
VCP-4100/4130		
Video Head	VID 2645	£63.81
Pinch Roller	VID 1815	£4.72
Belt Kit	VID 7585	£2.39
Idler	VID 1052	£1.98
Bracket Centre	VID 1223	£25.81
Clutch Gear	VID 1228	£2.02
Limiter Roller	VID 1440	£1.20
Cassette LED	VID 1981	£1.35
Tension Band	VID 1399	£2.40
VCP-4200/4326		
Video Head	VID 2645	£63.81
Pinch Roller	VID 1815	£4.72
REW Belt	VID 7234	£0.37
Cassette LED	VID 1981	£1.35
GRANADA		
VHS-EY1/EY2		
Video Head	VID 2539	£16.35
Pinch Roller	VID 1822	£3.45
Belt Kit	VID 7605	£2.25
Reel Drive Unit	VID 1255	£7.09
Loading Gear A	VID 1268	£1.72
Loading Gear B	VID 1271	£1.20
Capstan Motor	VID 2404	£39.37
Cassette LED	VID 1981	£1.35
Tension Band	VID 1414	£6.18
GRUNDIG		
MVS-400		
Video Head	VID 2596	£18.28
Pinch Roller	VID 1757	£3.00
Belt Kit	VID 7567	£1.87
Idler	VID 1052	£1.98
Loading Gear	VID 1222	£2.25
Clutch Gear	VID 1228	£2.02
Limiter Roller	VID 1440	£1.20
Cassette LED	VID 1981	£1.35
Tension Band	VID 1400	£2.32
Remote Control	IR 8965	£20.56
VS-520 GB		
Video Head	VID 2595	£29.00
Pinch Roller	VID 1821	£12.12
Timing Belt	VID 1482	£7.20
Centre Pulley	VID 1482	£7.20
Cassette LED	VID 1981	£1.35
Tension Band	VID 1401	£3.37
HINARI		
VXL-30/354		
Video Head	VID 2518	£21.00
Pinch Roller	VID 1815	£4.72
Belt Kit	VID 7566	£2.10
Clutch	VID 1316	£5.47
Idler	VID 1317	£3.22
Loading Motor	VID 2167	£13.69
Cassette LED	VID 1981	£1.35
HITACHI		
VT-11		
Video Head	VID 2504	£19.94
Pinch Roller	VID 1788	£2.95
Belt Kit	VID 7538	£1.23
FF/REW Idler Arm	VID 1020	£1.65
Clutch Plate	VID 1211	£8.92
Capstan Motor	VID 2147	£18.02
Cassette LED	VID 1981	£1.35
Tension Band	VID 1379	£2.10
Repair Kit	VID 7922	£16.50
VT-16 S		
Video Head	VID 2505	£23.18
Pinch Roller	VID 1788	£2.95
Belt Kit	VID 7538	£1.23
FF/REW Idler Arm	VID 1020	£1.65
Clutch Plate	VID 1211	£8.92
Capstan Motor	VID 2147	£18.02
Cassette LED	VID 1981	£1.35
Tension Band	VID 1379	£2.10
Repair Kit	VID 7922	£16.50
VT-33/330		
Video Head	VID 2504	£19.94
Pinch Roller	VID 1788	£2.95
Belt Kit	VID 7538	£1.23
FF/REW Idler Arm	VID 1020	£1.65
Clutch Plate	VID 1211	£8.92
Capstan Motor	VID 2148	£25.20
Cassette LED	VID 1981	£1.35
Tension Band	VID 1379	£2.10
Repair Kit	VID 7922	£16.50
VT-61/62/63/64		
Video Head	VID 2628	£24.25
Pinch Roller	VID 1818	£3.05
Belt Kit	VID 7583	£3.52
FF/REW Idler Arm	VID 1020	£1.65
Clutch Plate	VID 1211	£8.92
Capstan Motor	VID 2154	£17.20
Cassette LED	VID 1981	£1.35
Tension Band	VID 1379	£2.10
Repair Kit	VID 7924	£15.81
VT-8000/8500		
Video Head	VID 2509	£15.96
Pinch Roller	VID 1788	£2.95
Belt Kit	VID 7803	£0.99
Take Up Idler	VID 1015	£4.87
Wind Roller	VID 1016	£0.78
FF/REW Idler	VID 1023	£2.88
Capstan Motor	VID 2155	£50.50
Tension Band	VID 1381	£1.80
Remote Control	IR 9097	£12.63
Repair Kit	VID 7928	£14.79
Take up Reel Table	VID 1302	£11.47
Supply Reel Rubber Tyre	VID 1300	£0.67
VT-9300/9500/9700		
Video Head	VID 2509	£15.96
Pinch Roller	VID 1788	£2.95
Belt Kit	VID 7802	£1.10
FF/REW Idler Arm	VID 1019	£2.62
Play Idler	VID 1075	£3.45
FS Brake	VID 1212	£2.25
Capstan Motor	VID 2156	£57.81
Cassette Lamp	VID 1951	£0.90
Tension Band	VID 1382	£1.80
Remote Control	IR 9096	£16.41
Repair Kit	VID 7927	£14.79
Take Up Reel Table	VID 1303	£8.32
ITT		
VR-3913		
Video Head	VID 2511	£9.95
Pinch Roller	VID 1814	£2.77
Belt Kit	VID 7812	£1.22
Reel Idler	VID 1036	£2.80
Take Up Clutch	VID 1037	£2.86
Take Up Idler	VID 1038	£1.55
Brake Pad	VID 1361	£0.36
Reel Motor	VID 2169	£28.12
Capstan Motor	VID 2164	£37.18
Loading Motor	VID 2168	£9.30
Cassette Lamp	VID 1947	£0.50
Tension Band	VID 1389	£1.60
Repair Kit	VID 7913	£18.52
Take Up Reel Table Rubber Tyre	VID 1080	£0.60
Supply Reel Table Rubber Tyre	VID 1080	£0.60
VR-3993		
Video Head	VID 2647	£9.81
Pinch Roller	VID 1814	£2.77
Belt Kit	VID 7523	£1.20
Reel Idler	VID 1036	£2.80
Take Up Clutch	VID 1037	£2.86
Take Up Idler	VID 1038	£1.55
Roller Bar	VID 1363	£3.86
Brake Pad	VID 1361	£0.36
Reel Motor	VID 2169	£28.12
Capstan Motor	VID 2187	£46.18
Loading Motor	VID 2168	£9.30
Front Loading Motor	VID 2168	£9.30
Cassette Lamp	VID 1946	£0.49
Tension Band	VID 1389	£1.60
Repair Kit	VID 7914	£19.12
Take Up Reel Table Rubber Tyre	VID 1080	£0.60
Supply Reel Table Rubber Tyre	VID 1080	£0.60
JVC		
HR-3300		
Video Head	VID 2511	£9.95
Pinch Roller	VID 1756	£2.95
Belt Kit	VID 7506	£1.65
Take Up Idler Large	VID 1025	£4.65
REW Idler	VID 1025	£4.65
Unloading Idler	VID 1027	£9.30
FF Rubber Tyre	VID 1029	£0.78
Unloading Idler Rubber Tyre	VID 1207	£0.82
Capstan Motor	VID 2119	£42.31
Drum Motor	VID 2120	£18.73
Cassette Lamp	VID 1943	£0.35
Tension Band	VID 1391	£3.54
Repair Kit	VID 7911	£13.08
Take Up Rubber Tyre	VID 1028	£0.75
HR-D110/111/120/121		
Video Head	VID 2647	£9.81
Pinch Roller	VID 1813	£3.05
Belt Kit	VID 7543	£0.99
Take Up Clutch	VID 1031	£3.00
Take Up Idler	VID 1038	£1.55
Reel Idler	VID 1039	£3.07
Brake Pad	VID 1361	£0.36
Capstan Motor	VID 2165	£22.87
Loading Motor	VID 2168	£9.30
Front Loading Motor	VID 2168	£9.30
Cassette LED	VID 1981	£1.35
Tension Band	VID 1389	£1.60
Repair Kit	VID 7918	£18.09
Mains Transformer	VID 2223	£20.38
Take Up Reel Table Rubber Tyre	VID 1080	£0.60
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Cassette Housing	VID 1099	£21.33
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Belt Kit	VID 7566	£2.10
Clutch	VID 1316	£5.47
Idler	VID 1317	£3.22
Cassette LED	VID 1981	£1.35
MITSUBISHI		
HS-307		
Video Head	VID 2606	£71.56
Pinch Roller	VID 1808	£2.77
Belt Kit	VID 7542	£1.50
Reel Idler Unit	VID 1040	£8.48
FF Idler Rubber Tyre	VID 1081	£0.67
Capstan Rubber Tyre	VID 1264	£1.32
Cam Gear A	VID 1274	£1.20
Gear 2	VID 1275	£1.20
Cam Gear B	VID 1276	£1.27
Gear 1	VID 1277	£1.27
Cassette LED	VID 1981	£1.35
Tension Band	VID 1393	£2.55
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Supply Reel Table	VID 1299	£2.70
HS-318		
Video Head	VID 2607	£42.37
Pinch Roller	VID 1808	£2.77
Belt Kit	VID 7559	£2.85
Reel Idler Unit	VID 1040	£8.48
FF Idler Rubber Tyre	VID 1081	£0.67
Capstan Rubber Tyre	VID 1264	£1.32
Cam Gear A	VID 1274	£1.20
Gear 2	VID 1275	£1.20
Cam Gear B	VID 1276	£1.27
Gear 1	VID 1277	£1.27
Cassette LED	VID 1981	£1.35
Tension Band	VID 1393	£2.55
Take Up Reel Table	VID 1307	£2.92
Supply Reel Table	VID 1299	£2.70
NEC		
N-830 EG/831/832/833		
Video Head	VID 2647	£9.81
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Belt Kit	VID 7543	£0.99
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Repair Kit	VID 7919	£22.18
Cassette Housing	VID 1315	£21.33
N-9013/9014/9033/9034/9053/9054/9055		
Video Head	VID 2695	£20.06
Pinch Roller	VID 1828	£8.00
Belt Kit	VID 7601	£3.13
Reel Drive Pulley	VID 1265	£6.52
Cassette LED	VID 1981	£1.35
PANASONIC		
NV-2000/2010		
Video Head	VID 2520	£9.95
Pinch Roller	VID 1757	£3.00
Belt Kit	VID 7800	£1.65
Idler	VID 1054	£0.85
Idler	VID 1055	£0.85
Cam Gear	VID 1221	£1.12
Intermediate Gear	VID 1216	£1.12
Driving Gear	VID 1217	£0.99
Cassette Lamp	VID 1948	£0.24
Tension Band	VID 1397	£3.38
Repair Kit	VID 7901	£18.47
Take Up Reel Table	VID 1312	£10.12
Supply Reel Table	VID 1310	£8.62
NV-300/333		
Video Head	VID 2520	£9.95
Pinch Roller	VID 1787	£3.50
Belt Kit	VID 7521	£1.63
Play Idler	VID 1048	£2.34
Idler	VID 1057	£0.85
Idler Arm	VID 1220	£3.82
Cam Gear	VID 1215	£0.99
Intermediate Gear	VID 1216	£1.12
Driving Gear	VID 1217	£0.99
Reel Motor	VID 2158	£18.95
Capstan Motor	VID 2421	£39.43
Cassette LED	VID 1982	£1.62
Tension Band	VID 1399	£2.40
Repair Kit	VID 7903	£10.42
Take Up Reel Table	VID 1312	£10.12
PHILIPS		
Video Head	VID 2526	£11.96
Pinch Roller	VID 1757	£3.00
Belt Kit	VID 7530	£1.25
Idler	VID 1052	£1.98
Loading Gear	VID 1222	£2.25
Idler	VID 1370	£1.98
Idler	VID 1371	£5.40
Limiter Roller	VID 1440	£1.20
Cassette LED	VID 1981	£1.35
Tension Band	VID 1400	£2.32
Repair Kit	VID 7906	£8.92
VR-6540		
Video Head	VID 2537	£18.73
Pinch Roller	VID 1815	£4.72
Belt Kit	VID 7547	£0.90
Idler	VID 1060	£1.81
Master Cam	VID 1265	£6.52
Reel Motor	VID 2127	£26.06
Loading Motor	VID 2142	£14.35
Cassette LED	VID 1981	£1.35
Tension Band	VID 1420	£5.10
PYE		
DV-761		
Video Head	VID 2621	£82.18
Pinch Roller	VID 1827	£8.15
Belt Kit	VID 7588	£1.42
Idler	VID 1252	£3.97
Loading Gear	VID 1253	£6.37
Modification Set	VID 1254	£10.35
Tension Band	VID 1431	£4.27
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VR-2000/3800		
Pinch Roller	VID 1815	£4.72
Belt Kit	VID 7565	£1.07
Idler	VID 1060	£1.81
Reel Motor	VID 2121	£14.24
Cassette LED	VID 1981	£1.35
SALORA		
SV-8620		
Pinch Roller	VID 1808	£2.77
Belt Kit	VID 7600	£2.85
FF/REW Idler Arm	VID 1233	£2.70
FF/REW Idler Arm	VID 1234	£2.85
FF/REW Idler	VID 1235	£1.12
Cassette LED	VID 1981	£1.35
Tension Band	VID 1394	£2.92
Take Up Reel Table	VID 1308	£4.72
Supply Reel Table	VID 1305	£4.12
SAMSUNG		
VI-510/520/611/616/621		
Video Head	VID 2648	£24.62
Pinch Roller	VID 1815	£4.72
Belt Kit	VID 7598	£1.57
Idler	VID 1232	£1.35
Idler	VID 1346	£3.37
Reel Motor	VID 2407	£13.04
Capstan Motor	VID 2409	£25.06
Loading Motor	VID 2142	£14.35
Cassette LED	VID 1981	£1.35
VX-710/720/730		
Video Head	VID 2648	£24.62
Pinch Roller	VID 1759	£2.95
Belt Kit	VID 7608	£4.12
Cassette LED	VID 1981	£1.35
SANYO		
VHR-1100 EX/EE/G		
Video Head	VID 2583	£25.68
Pinch Roller	VID 1787	£3.50
Belt Kit	VID 7558	£2.49
Reel Drive Roller	VID 1076	£5.70
Reel Motor	VID 2198	£13.04
Cassette LED	VID 1981	£1.35
Tension Band	VID 1411	£2.40
VHR-1500 EX/G		
Video Head	VID 2585	£46.87
Pinch Roller	VID 1787	£3.50
Belt Kit	VID 7558	£2.49
Reel Drive Roller	VID 1076	£5.70
Reel Motor	VID 2198	£13.04
Cassette LED	VID 1981	£1.35
Tension Band	VID 1411	£2.40
VTC-M10/11/20/21		
Video Head	VID 2530	£23.75
Pinch Roller	VID 1758	£2.95
Belt Kit	VID 7809	£0.45
Reel Drive Pulley	VID 1079	£6.95
Idler	VID 1219	£1.73
Reel Motor	VID 2179	£17.39
Tension Band	VID 1408	£1.87
Supply Reel Table	VID 1319	£8.62
SENTRA		
VX-5000/6000		
Video Head	VID 2713	£22.31
Pinch Roller	VID 1787	£3.50
Belt Kit	VID 7596	£3.30
Idler	VID 1049	£3.75
Cassette LED	VID 1981	£1.35
Tension Band	VID 1399	£2.40

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Switch-mode Power Supply Developments

Joe Cieszynski

Switch-mode power supplies have been with us for many years. Although the basic operating principles remain the same, new technology, devices and ideas have resulted in continuous evolution. Furthermore these power supplies are no longer found in only TV receivers: it's not unusual for them to be used in video and audio equipment, not to mention a vast range of applications in industrial equipment.

Advantages of Switch-mode PSUs

There are two main reasons why switch-mode power supplies are so widely used nowadays. First, with the emphasis on compact equipment, manufacturers are having to design small but very efficient/cool running power supplies. Secondly switch-mode power supplies are more economical to build than traditional mains transformer plus rectifier and series regulator types even though the circuitry is generally far more complex. In the present highly competitive market it's essential to reduce manufacturing costs as much as possible.

A number of useful articles on the operation and servicing of switch-mode power supplies have appeared in past issues of this magazine. In the present article we'll highlight some of the more recent developments and offer some explanations as to why they have occurred.

Chassis Isolation

By the early Eighties the domestic TV set was becoming more than just a means of viewing terrestrial transmissions. It was rapidly turning into a monitor for use with VCRs, home computers, electronic games, satellite TV receivers, laser video players and as a terminal for cable TV. Clearly it's not logical to modulate all these inputs on to u.h.f. carriers when composite video can be fed into the receiver directly. Only ten years ago however most receivers were still operating with their chassis at half mains potential, so some form of isolation was required for direct video input. Because of its size, weight and cost, a conventional mains isolation transformer is not a practical solution to the problem. This was demonstrated in the case of the Philips K35 chassis. Under pressure to introduce a TV set with monitor-style inputs in the early Eighties, Philips modified the K30 chassis by installing a mains isolation transformer. It was the size of a house brick, only heavier! In response to the need for chassis isolation from the mains supply, most manufacturers have opted for a switch-mode power supply that makes economical use of the chopper transformer by also employing it as an isolation transformer.

The principle is shown in Fig. 1. As a result of the action of the full-wave bridge rectifier the chassis on the live side of the circuit is at half mains potential. This is often indicated on circuit diagrams by use of a different chassis symbol. The h.t. and l.t. outputs are isolated from the half-mains chassis by the chopper transformer. The control circuit has its own l.t. supply derived from a winding on the primary side of the chopper transformer. A problem with a power supply with isolated output(s) is the provision of feedback for regulation purposes. Clearly any direct connection between the primary and secondary sides of the chopper circuit defeats the whole object of the design, as there is the possibility of the chassis becoming live under peculiar fault conditions. For many years the solution was to apply the feedback via a second isolating transformer. Nowadays however optocouplers are frequently used for this purpose. An alternative scheme, used for example with the TDA4600 series of chopper control chips, is to obtain the feedback from a separate winding on the chopper transformer.

Optocoupler Operation

Fig. 2 shows the basic optocoupler operating principle when used for feedback in a chopper circuit. The intensity of the LED's light output, and hence the conduction of the phototransistor, depends on the h.t. voltage. Thus the control circuit receives a feedback voltage that's proportional to the h.t. voltage. Modern optocouplers are very sensitive and respond to minute voltage changes, giving an accurate control action. From the safety aspect the optocoupler is better suited to this application than a transformer as there's no way in which the device can break down in such a manner that a direct connection can occur through it. In addition, from the manufacturers' point of view an advantage is its cheapness. From a

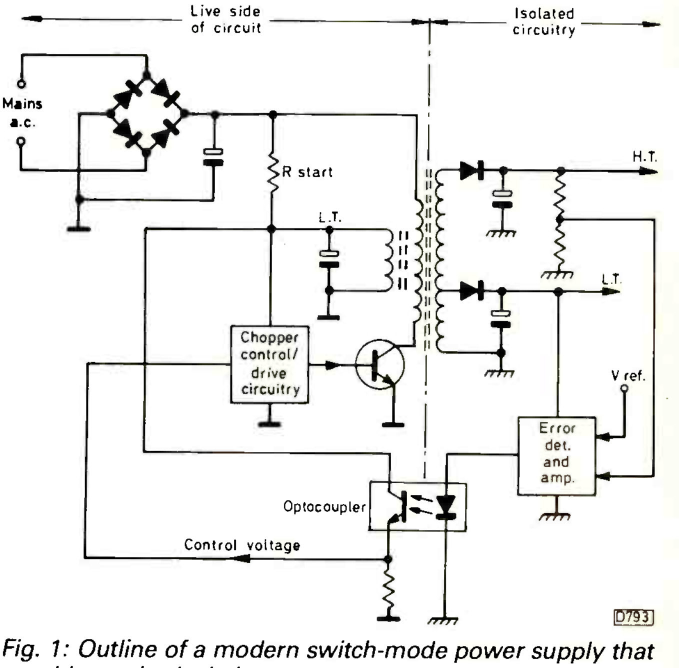

Fig. 1: Outline of a modern switch-mode power supply that provides mains isolation.

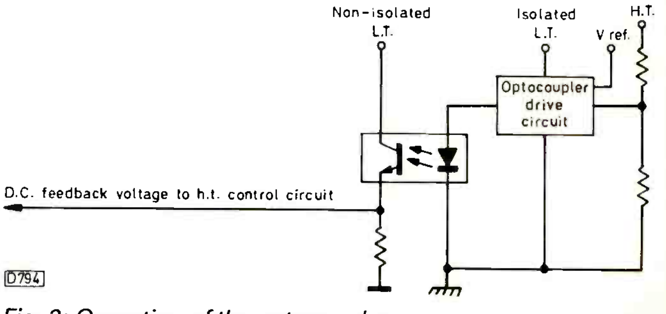

Fig. 2: Operation of the optocoupler.

practical point of view however optocouplers have proved to be far less reliable than a transformer. We have come across a number of dead sets where the cause was an open-circuit diode or transistor in the optocoupler. By comparison, a defective transformer with a feedback winding is fairly uncommon.

Standby Facility

In many modern receivers the standby condition is achieved by open-circuiting the h.t. control feedback loop. This sounds simple enough, but let's look into it in a little more detail. With the arrangement shown in Fig. 1, should the h.t. voltage fall the phototransistor will conduct less and the control voltage will fall. This fall is used in such a way that the chopper transistor conducts for longer periods when it switches on, thus producing the required rise in the h.t. voltage. It follows that an open-circuit in the feedback loop, due say to an open-circuit photodiode, would result in such a decrease in the control voltage that the chopper would pass excessive current and be almost instantly destroyed. Additionally, at the instant when the chopper transistor dies the output voltages will rocket upwards, taking the rest of the receiver circuitry with them. Thus the open-circuit condition is dangerous and is not suitable for the purposes of standby operation.

To avoid the danger, manufacturers generally incorporate a fail-safe circuit in the control block. This circuit monitors the output from the pulse-width modulator and will inhibit this output should the on period of the chopper drive pulse become dangerously long. Where this feature is included the manufacturer can opt to make use of it for standby purposes. There are several ways of open-circuiting the feedback loop: the simplest is to include an electronic switch in series with either of the devices in the optocoupler, on the chassis side.

So much for the theory. There's a practical side to all this. Anyone who has worked on switch-mode power supplies knows that one of the main difficulties with them is their readiness to go into the trip condition as soon as a fault occurs. In this condition it's difficult to take reliable d.c. voltage readings or look at scope waveforms. Where the standby circuit operates via an optocoupler however a useful test is simply to remove this device. The receiver will then be in its standby condition, which in many cases means that the control circuit continues to operate and generate waveforms, albeit at a higher frequency. In this condition only the output to the chopper transistor is inhibited.

This test applies with many of the control chips in current use, for example the TDA4600 series, the TDA1060 and the TDA8380. A word of caution however. Don't attempt to carry out this test until you've first ascertained that the circuit design permits it, otherwise you may spend the next few hours scraping the power supply (and other boards) off the ceiling! As a guideline, if standby doesn't operate in the manner described, that is by inhibiting the optocoupler action, beware.

Chopper Control Chips

A number of chopper control chips have been developed by both European and Japanese manufacturers. They contain features such as h.t. control, over-voltage and excess-current protection and slow start. A typical example of one of the earlier control chips is the TDA2581, which was much used by European setmakers. It had its drawbacks however, these being its relatively low operating frequency (at line rate) and the fact that an external driver stage is required. By comparison, modern control chips run at frequencies in excess of 30kHz and can drive a chopper transistor directly.

It's an interesting fact that a considerable number of modern receivers don't use an i.c. in the chopper control section, discrete component circuitry being employed instead. Cost is the usual explanation for this. Manufacturers who don't produce their own chips may find it more economical to devise a circuit using transistors such as the BC546 than to buy in chips from their competitors. This doesn't apply just to East Asian producers of budget receivers.

Chopper Frequency

The earliest switch-mode circuits operated at 50Hz, using a thyristor that acted as a switched half-wave rectifier. Well-known examples are the Rank A823 chassis and the Philips G8 chassis. A few later chassis, such as the Philips G11, used full-wave versions. At these frequencies it continued to be necessary to employ large capacitors and chokes for smoothing and filtering – and there was no effective method of chassis isolation.

Subsequently setmakers moved towards high-frequency choppers, starting with control chips like the TDA2581 which runs at line frequency. From a design point of view, for optimum efficiency and reduced size/cost the chopper should operate at the highest possible frequency. Increased chopper frequency reduces the size of the chopper transformer and the reservoir/smoothing capacitors. This alone gives the setmaker what he wants.

Two factors limit chopper frequency. One is the problem of hysteresis in the transformer's core, the other is switching speed limitations with bipolar power transistors. With respect to transformers, component manufacturers such as Philips have invested large sums in the development of ferrite cores whose hysteresis characteristics are optimised to meet the requirements of modern switch-mode power supplies: small high-power capability transformers that can operate at frequencies in excess of 150kHz are now available. Once the problem of transformer size has been solved, what can be done about the transistor? Current bipolar switching transistors limit the chopper frequency to around 40kHz, but manufacturers would like to at least double if not treble this in order to produce compact, efficient power supplies. The answer this time could be to use power MOSFETs instead of bipolar transistors.

Power MOSFETs

Some manufacturers have been experimenting with power FETs for many years. But apart from the use of a few "vertical FETs" in audio power amplifiers during the mid-Seventies the domestic electronics market has seen little practical application of these devices. It was the computer industry, with its demand for small, efficient 5V supplies with high current capability, that forced the pace with the development of power FETs. To this end Philips Components (then Mullard) developed the BUZ series of power MOSFETs. Their advantages over bipolar switching transistors include improved switching speed and losses, better over-current capability, ruggedness, ease of being driven, a good safe operating area and a low peripheral component count. Cost is one disadvantage, and there are also greater on-state losses. The improved switching speed and efficiency are particularly significant. And because the

MOSFET is a voltage-driven device (its gate is effectively open-circuit) only a very simple drive circuit is required.

For those who may be rusty on their FET theory, Fig. 3 shows the basic operating principle. A p-type gate is formed in a piece of n-type silicon. The gate-source junction is reverse biased, as a result of which a charge-depletion region is formed between the source and drain connections (the channel). The extent of the depletion region, which depends on the gate-source bias, determines the amount of current that can flow from the source to the drain. Because the gate is always reverse biased, no current is required to drive the device. In practice the physical construction is far more complex, and in the case of MOS devices there's a silicon-oxide insulating layer between the gate and the source-drain channel.

In the early days, one of the problems with the development of power FETs was current control. To put it simply, for a high current to flow the channel area must be large. But with a wide channel a depletion region that's wide enough to cut off source-drain conduction completely can't be formed. The power MOS device overcomes the problem by using a unique form of construction that was first devised many years back but became possible in practice only as a result of more recent advances in semiconductor production techniques.

In a power MOSFET a large number of MOSFETs are connected in parallel, their gate, drain and source terminals being made common. This sounds simple enough, but when you realise that a large device such as the BUZ90 has some 22,000 individual MOSFET cells, each one just 20 microns in size, you begin to appreciate the manufacturing difficulties. What's more, due to the complex structure if just one of these cells fails the entire device becomes effectively open-circuit. Power MOS devices with a drain/source voltage rating of around 1kV are currently available and are ideal for use in switch-mode power supplies. Their characteristics are such that a current of 10A can pass through the channel, the device impedance being only 10mΩ depending on the ambient temperature. This says a lot for their power-handling capability.

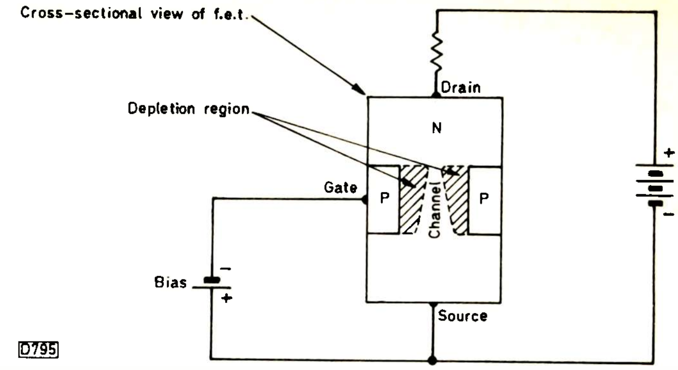

Fig. 3: Operating principle of an n-channel junction field-effect transistor.

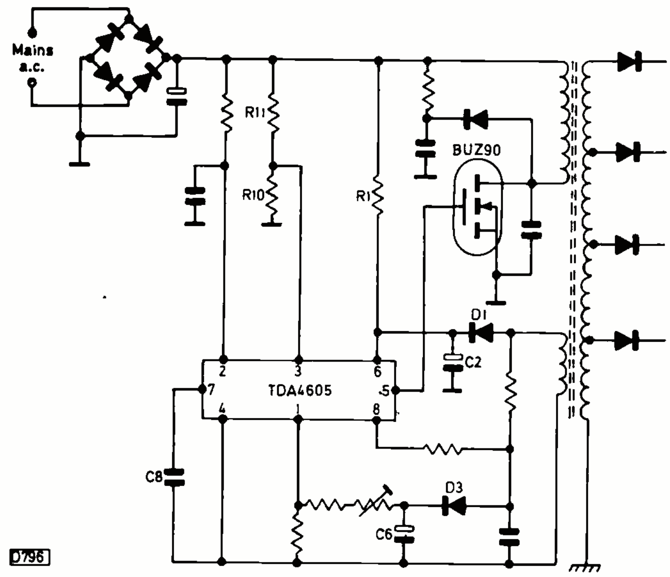

Fig. 4: Simplified circuit of the MOSFET chopper power supply used in the Grundig CUC4400 chassis. A type BUZ90 power MOSFET is used. The circuit operates in the region of 60kHz, trebling to 180kHz in the standby mode.

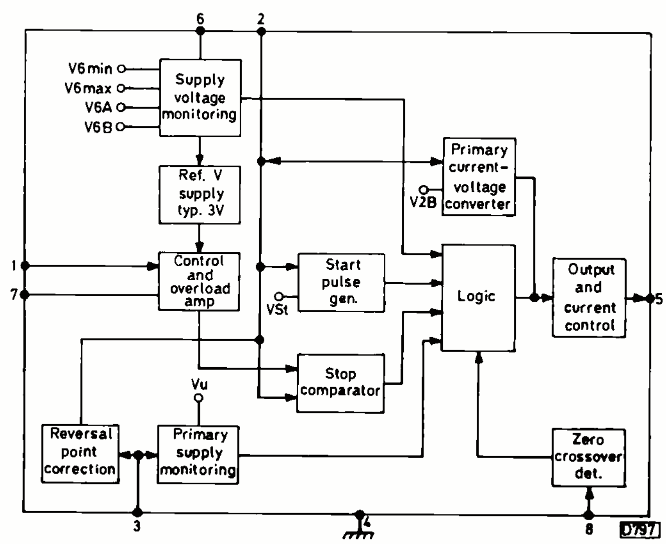

Fig. 5: Block diagram of the TDA4605 MOSFET chopper control chip.

Safe Operating Area

As previously mentioned the power MOSFET has a much improved safe operating area (SOAR) in comparison with a bipolar transistor. SOAR refers to the range of drain-source voltages and drain current values that can be used without the risk of secondary breakdown. This is a phenomenon common in bipolar transistors, in which a hot spot can occur in the crystal under high current conditions. It destroys the transistor. Since the channel of a power MOSFET has a positive temperature coefficient, hot spots are far less likely. When a hot spot does occur, the resistance in that part of the channel rises. As a result, the current is diverted to surrounding areas of the channel. This action stops the temperature of the hot spot rising any further, preventing breakdown.

Fault Finding

The circuits of switch-mode power supplies that use FET and bipolar chopper transistors are almost identical. It follows that in general the fault symptoms are also the same. If the primary fuse has blown violently, one of the most likely causes is the chopper transistor, whether it be a field-effect or a bipolar device.

The usual test is to measure the transistor's resistance, looking not only for a short-circuit but also for low resistance in the reverse bias mode, i.e. leakage. Experience with power FETs has shown that in general, unlike bipolar transistors, they go short-circuit. So diagnosis of a defective device is simple. Should a case arise where there's some doubt as to whether or not a

Table 1: Static resistance readings for an operational BUZ90.

Positive (black) lead to	*Negative (red) lead to*	*Reading (ohms)*
Gate	Source	Infinity
Source	Gate	Infinity
Gate	Drain	1kΩ
Drain	Gate	Infinity
Drain	Source	Infinity
Source	Drain	Infinity

power MOSFET is giving correct readings when its resistances are being checked, Table 1 provides sample readings. They were taken with a known good BUZ90 power MOSFET, using an AVO 8 on the normal-ohms range, i.e. a 1·5V battery.

Precautions with MOSFETs

Being a MOS device, there's the possibility of damage due to static, though the chance of this happening is slight in comparison with low-power devices. Philips Components advise that a power MOSFET should not be removed from its anti-static packaging until it's required, and that soldering-in should be done in an earth-free environment. Bearing in mind that these recommendations are made to setmakers rather than servicing personnel, where does this leave the service engineer?

It's good practice to keep modern MOS devices in anti-static packaging as long as possible – especially if the devices are riding around in the back of your van! As far as an earth-free environment is concerned, it should be possible to solder a power MOSFET safely in the customer's home when the normal precautions are taken. This should also be possible when carrying out repairs to boards that contain MOSFET devices.

MOSFET Circuitry

For those who have yet to come across a MOSFET chopper switch-mode power supply circuit Fig. 4 shows, in simplified form, the power supply used in the Grundig CUC4400 chassis. It employs the TDA4605 control chip, which is a modified version of the TDA4601, a device that should be familiar to anyone involved in TV servicing. The fairly recent TDA4605 was introduced to meet the drive requirements of a power MOSFET. Fig. 5 shows its block diagram: if you compare it with that for the TDA4601 you'll find that they are identical. Returning to Fig. 4, the MOSFET device used is a BUZ90. The circuit operates in the region of 60kHz, trebling to 180kHz in the standby mode. Because the FET requires no drive current, the coupling to its gate is much simpler than with a bipolar device – one pin is used instead of two.

R1 provides start-up bias while D1/C2 provide the chip's operating supply. C8 gives a soft-start action. A d.c. voltage for regulation purposes is produced by D3/C6 and applied to pin 1, where it's compared with an internally generated reference voltage – typically 3V. An a.c. voltage waveform is applied to pin 8, where the zero cross-over detector senses when the core of the chopper transformer is de-energised. This is the point at which the FET must be switched on again. In effect, the information applied to pins 1 and 8 determines the chopper's duty cycle, i.e. the pulse-width modulated output at pin 5. In some arrangements the feedback to pin 1 comes via an optocoupler.

Excessive mains input voltage is detected at pin 6. This condition cuts off the internal supply to the chip. If the mains input is too low, the potential at pin 3 will fall below 1·4V and the chip will shut down. A short-circuit on the secondary side of the circuit will be reflected in the feedback to pin 1. This condition produces a recycling trip operation.

So far, Grundig is one of the few manufacturers to exploit the merits of the power MOSFET, using these devices in many of the company's TV chassis and also in a number of its VCRs. For example the power supply used in the VS600 range follows the outlines shown in Figs. 1 and 4. Let's hope that when other setmakers come to adopt power MOSFETs they follow the same course and don't attempt ambitious new circuitry.

Acknowledgment

Finally, I'd like thank Alan Dyson of Grundig International for his help in the preparation of this article.

Letters

110V UNITS – AND IR HANDSET TESTS

Of late I've had an ever increasing number of 110V units in for repair with blown power supplies. On further investigation I discovered that they had not been plugged directly into the 240V mains supply but had been plugged into one of those little adaptors that convert 240V down to 110V – you know the ones! These adaptors use a thyristor rather than a transformer. This results in a very rough a.c. output that's unsuitable for driving any kind of electronic device. Also when they develop a fault, and they do, the output rises directly to 240V – bang! These adaptors are suitable only for shavers etc. Some manufacturers of these adaptors include a notice on the box warning not to use them with electronic devices, but I feel that such warnings are insufficiently prominent.

Here are yet more ways to test remote control handsets:

(1) Point the handset at a TV camera (hold it about 2-4in. from the lens), CCTV unit, camcorder etc. then, while watching the monitor screen, press a button. If the handset is working you should see in the display a flashing patch of bright light at the front of the handset.

(2) Using an amplifier with an optical input for a CD/DAT player, connect the optical fibre to the amplifier's input socket and leave the other end lying on top of the amplifier, pointing forwards. Plug in a set of headphones, select CD/DAT, turn the volume control to maximum, point the handset at the end of the optical fibre (at a distance of about two inches) and press any one of the buttons. If the unit is working you should hear a pulsing sound in the headphones.

What will we think of next to test handsets?!

P. J. Roberts,
Bristol.

ADVICE FROM TOSHIBA

As it's unusual to read of faults in Toshiba television receivers in your TV Fault Finding pages I was interested in Steve Cannon's comments on a 2805DBT field fault in the December issue (page 100). In our experience failure of the TA8739P chip IC371 usually results in field collapse with just a few lines of scan above the centre line. Details of this fault were published in Technical Bulletin CDH/39 and via our Viewdata system. Our Technical Advisors on 0276 694 555 would also have suggested this.

May I suggest that Steve and any other readers who are Toshiba account holders contact me to check that they are included on our mailing list for Service Manuals and Technical Bulletins.

Incidentally, if anyone is offered a Philips PM5518 pattern generator at a "good price", please advise me. It could be the one stolen from a TLO's car recently while he was on a visit to Purley, Surrey.

C. Harding, Technical Liaison Co-ordinator,
Toshiba (U.K.) Ltd., Technical Centre,
Units 6 and 7, Admiralty Way,
Camberley, Surrey GU15 3DT.

PANASONIC NV-MS1 CAMCORDER

In the October issue (page 887) Steve Beeching mentioned a pig of a fault with a Panasonic NV-MS1 camcorder. I first came across this fault about two years ago. The machine works perfectly with old recordings, the trouble being when you record then play back. There are no control track pulses, the index title blinks and pause doesn't work. When you move from camera-rec to VTR the index title remains on and no functions except off work.

The cause of the trouble is an unsoldered leg of D6012, a double diode in the system control section. The open-circuit diode is the one that's connected to the base of QR6024. When a cassette with a safety tab is inserted, the common leg of D6012 should go low. But with D6012 open-circuit QR6024 has 5V at its base and is thus on, earthing line E5 (D REC H) from IC6001. This is where all the trouble starts. Pin 22 of IC2001 is at the L level instead of H, while pins 23/5/6 get rec-mode information from IC6001. With pin 22 low, IC2001 can't decode this information. So IC2001 gives wrong orders and no CTL pulses are produced at pins 11 and 28 in the rec mode. IC6001 gets no CTL pulses from pin 28 of IC2001 and goes to a lock position until off is initiated. If you now play back your new recording the lack of CTL pulses causes capstan servo problems.

I've had this problem at least four times.

S. Hariman,
Israel.

FERGUSON'S POLICIES

I read with interest (Teletopics, December) that Ferguson is to cease manufacture of its products in the UK. Is it any wonder that fewer people are buying Ferguson products? As a small retailer/repair business we have in the past sold Ferguson TV and video equipment which we obtained from a local wholesaler. However when we had an item in for repair recently and needed technical information from Ferguson we were denied this on the grounds that we don't have an account. Many months ago we were denied a spares account because we don't buy the finished product directly from the company's sales division. This being the case, we no longer supply Ferguson TV and video equipment and have to explain to our customers that although we could supply it we might be unable to repair Ferguson equipment.

As a result we've found that most of our customers who had been considering the purchase of Ferguson equipment have chosen an alternative TV or video model for which we have a dealership and are therefore able to offer a one hundred per cent service back up in or out of warranty.

M. Fairfield,
Derbyshire.

GOOD SERVICE

I'd like to start by agreeing with John Edwards' letter (November) about time wasters and estimates. I've read with some irritation however various articles and letters that have had a go at manufacturers' technical departments.

To date I've had no problems. All my technical queries have been dealt with and spares don't seem to be a problem. Talking to other engineers on this subject, I find that the consensus of opinion is that please and thank you help, rather than demanding to have one's hand held while tracing the cause of some obscure fault. Engineers in larger firms may be in weekly or even daily contact with a manufacturer's technical department, and as a result can establish a good personal relationship with those at the other end. This can mean that information is passed on more freely.

The best approach is to write down what you need to ask, no more and no less. Have the relevant circuit diagram to hand and, most important, remember who is doing the asking and the fact that the other chap's time is just as important as yours.
M. Thomason,
Stretford, Manchester.

FINLUX 1000 SERIES CHASSIS

There was an inaccuracy in the article on the Finlux 1000 series chassis (December, page 122). As mentioned there are two types of SDA2010 microcomputer chip mask, coded A006 and A022. The microcomputer chips can be interchanged but the A022 version won't operate the earlier two-page teletext module. The A006 version will operate all versions of the teletext module, not as stated in your article.
Barrie Judge, Technical Services Manager.
Finlux Limited Consumer Electronics,
Valley Farm Way, Leeds LS10 1SE.

HELP WANTED

Can anyone supply A1102 and C2577 transistors for a Luxman L-113A hi-fi amplifier, or quote equivalents? If anyone is interested I have for disposal a complete but non-working Murphy V310 "beer barrel" 405-line receiver.
John Walker,
13 Orchard Road, Reigate, Surrey RH2 0PA.

Can anyone supply a line output transformer for the Rigonda Model VL100M?
W. Shorthose,
1 Barraclough Lane, Barton on Humber DN18 5BB.

Could anyone supply a circuit diagram for the Sharp C1410HW colour portable as Willow Vale no longer has this in stock? Also does anyone know of a source of mechanical parts (idler etc.) other than Comet for the Goodmans VCR2000 video recorder?
Philip Pick,
Sight and Sound, 1 Stonewall Cottage, Hill Top Farm, Caythorpe Heath, Caythorpe, Lincs. NG32 3EU
(0400 73 448).

Can anyone supply a main PCB for the audio tape deck of a Ferguson Studio 25D music centre? It's numbered PC781F/PC781L/PC841-021B.
Henry D. Richmond,
52 Thornhill Square, Islington, London N1 1BE
(071 700 4846).

PHILIPS CF1 CHASSIS

I feel that I must pay tribute to your magazine, and especially to your contributor Hugh MacMullen for his note on the Philips CF1 chassis. I had one of these 14in. horrors in for several weeks, causing an excessive amount of bad language. Several normally sane and definitely competent engineers said "dead? – give me ten minutes and I'll fix it". A couple of hours later they would slink out beaten and completely demoralised.

So it was with considerable interest that I saw the mention of D6310 and C2310 on page 101 of the December issue. On checking these items – it took a time to find them – D6310 turned out to be dead short. Replacing it with a

next month in TELEVISION

● **SERVICING THE PHILIPS DMP SERIES VCR DECK**
Philip Blundell, AMIEIE, provides a detailed guide to common problems experienced with the Philips DMP/IDM series VCR decks, which were used from 1986 onwards in many Philips models including the VR202/203/6180/6182/6185/6285/6290/6291/6362/6367/6390/6467/6468/6470/6561/6760/6761/6870. Various clones have appeared in the Pye, Pioneer, Tatung, Tashiko, GEC, B and O and Finlux ranges. The design is unlike anything that appeared before and is simple and robust, being designed specifically for automated production.

● **LOW-RANGE OHMMETER**
While the majority of multimeters are excellent in most respects they are often poor when it comes to measuring low resistances. The ohmmeter described by Ian Rees next month was designed specifically for checking tracks on broken PCBs. It's also useful in many other applications where unambiguous continuity readings are required (microwave ovens etc.). The meter measures from 0·1 to 100Ω in a single range. An audible tone can be switched in to enable fine print to be checked without the need to glance at the scale: the tone frequency falls as the resistance decreases. The low test voltage of 300mV prevents erroneous readings due to the presence of semiconductor junctions.

● **FOLLOW-UP ON THE FINLUX 1000 CHASSIS**
Following our recent feature on servicing these sets Chris Watton describes the test procedures he uses.

● **OVERHAULING VALVE RADIO RECEIVERS**
Many of today's technicians have never had to deal with equipment that uses valves, with their fault-prone heater arrangements. The rules that govern fault finding in such equipment are simple and easy to pick up. Stanley Jackson's short article outlines the checks to carry out for basic fault symptoms.

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suitable substitute provided a cure, at the expense of several red-faced and greatly deflated engineers. The basic comment, including my own, was "how on earth did I miss that one?" Anyway, thank you.
Edward W. Heron
Freshwater, Isle of Wight.

TEST CASE

350

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.

Workshop Sage had a Sony CCD-V50 camcorder in one hand and a surface-mounting transistor gripped by tweezers in the other. He was peering with his beady eye through a bench magnifying glass. The phone rang. Wishing, not for the first time, that there was no phone on his bench he carefully put everything down and picked up the receiver. "There's a man here wants to know if we mend old Luxor videos" said the receptionist. "Tell him we'll have a go" said Sage irritably. In the event, the Luxor was to give us infinitely more trouble than the little Sony camera...

The Luxor took its place on the bench next day. Its model number was 9253-97 – a Mitsubishi HS318 clone. At switch on it emitted a raucous clattering noise from amidships, a sure sign that the loading mechanism is in trouble. Failure of the mode switch is common with these machines, whereupon the loading motor (which seems to be unstoppable by mechanical means!) jumps the teeth of the worm over those of the plastic gear in an alarming way. So an estimate was prepared for replacement of the mode switch, the injured plastic cogs and sundry other bits that were tired and worn. It was grudgingly accepted. Since Sage had all the necessary bits in stock, he got to work right away.

With all the new parts in place and the mechanism mode switch carefully phased – he'd done it many times before – Sage switched on. There was a click and a whirr then the loading mechanism, mode switch and all, went into mechanical oscillation at a frequency of about 2Hz. Within a few seconds the machine cut out. Sage's jaw dropped. He unplugged the machine and hand wound the mechanics back to the reference point to recheck the mechanical alignment and mode-switch setting. Both were right, but on test the machine once more oscillated frantically before going back to sleep. The replacement mode switch had to be faulty!

But it wasn't, because another switch and then another one produced exactly the same results. Sage went and found a similar machine in the scrap pile. He compared the switch wire colour coding carefully and the alignment of the deck's every mechanical part, also its mode switch. The two machines were identical. Since the faulty deck seemed to want to drive its mechanism one way, Sage foolishly reset the mode switch the other way. He was rewarded for his trouble with a shower of broken teeth from gear one. In went a new gear one and on to the shelf went the machine while the accumulating pile of other repairs was dealt with.

Two days later Sage returned to the recalcitrant Luxor/Mitsubishi machine. He'd been studying the manual in the meantime. Since the deck components didn't seem to be the cause of the trouble Sage concluded that the problem must be an electrical one. How about the loading motor drive department? After checking that its supply was o.k. Sage replaced the drive chip IC5A1. Once again the mechanics danced a jig when tested. A double-beam scope was next hooked to the loading motor control port pins of the microcontroller chip IC5A0 – pins 57 and 58. The two traces see-sawed on the screen, indicating that the deck-dance choreographer was the microcontroller itself. What a pity that Sage didn't pursue his probing with the scope. Instead he replaced the microcontroller chip, to be greeted with exactly the same results as before.

If it wasn't either of the two chips involved in driving the motor, perhaps the fault was on the deck after all. You don't need a service manual to solve this one: just clearer thinking than Sage had on that day. See next month for the answer and another item in our test case series.

ANSWER TO TEST CASE 349
– page 207 last month –

The Test Case technicians always seem to be barking up the wrong tree, don't they? There they were last month fruitlessly investigating the output end of the PAL decoder in a Sony TV set when they should have gone straight to the field timebase department and found the cause of the fault in minutes. It was all to do with the black-level setting. As with most modern designs, the KV-M2120U has automatic grey-scale correction. This is built into the RGB drive chip. On or about line twenty, the three guns are in turn pulsed on for beam-current measuring purposes. Feedback then adjusts the bias at each cathode individually in order to maintain identical cut-off points. By this means compensation is provided for the effects of wear and drift in the tube and the RGB amplifiers.

Since the picture information starts on line 23 of the field, the bright-ups produced by the auto cut-off test pulses should be at the very top of the picture, hidden by the slight vertical overscan of a correctly adjusted set. There was nothing wrong with the height adjustment with this set. What was happening was that the offending lines were appearing in reverse order about an inch and a half down from the top of the picture. This occurred because the scanning beams were still on their way to the top of the screen when the pulses arrived: the basic trouble was slow field flyback. It can be caused by many things, but in this case pin 8 (boost supply) of the field output chip IC501 was open-circuit.

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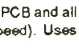

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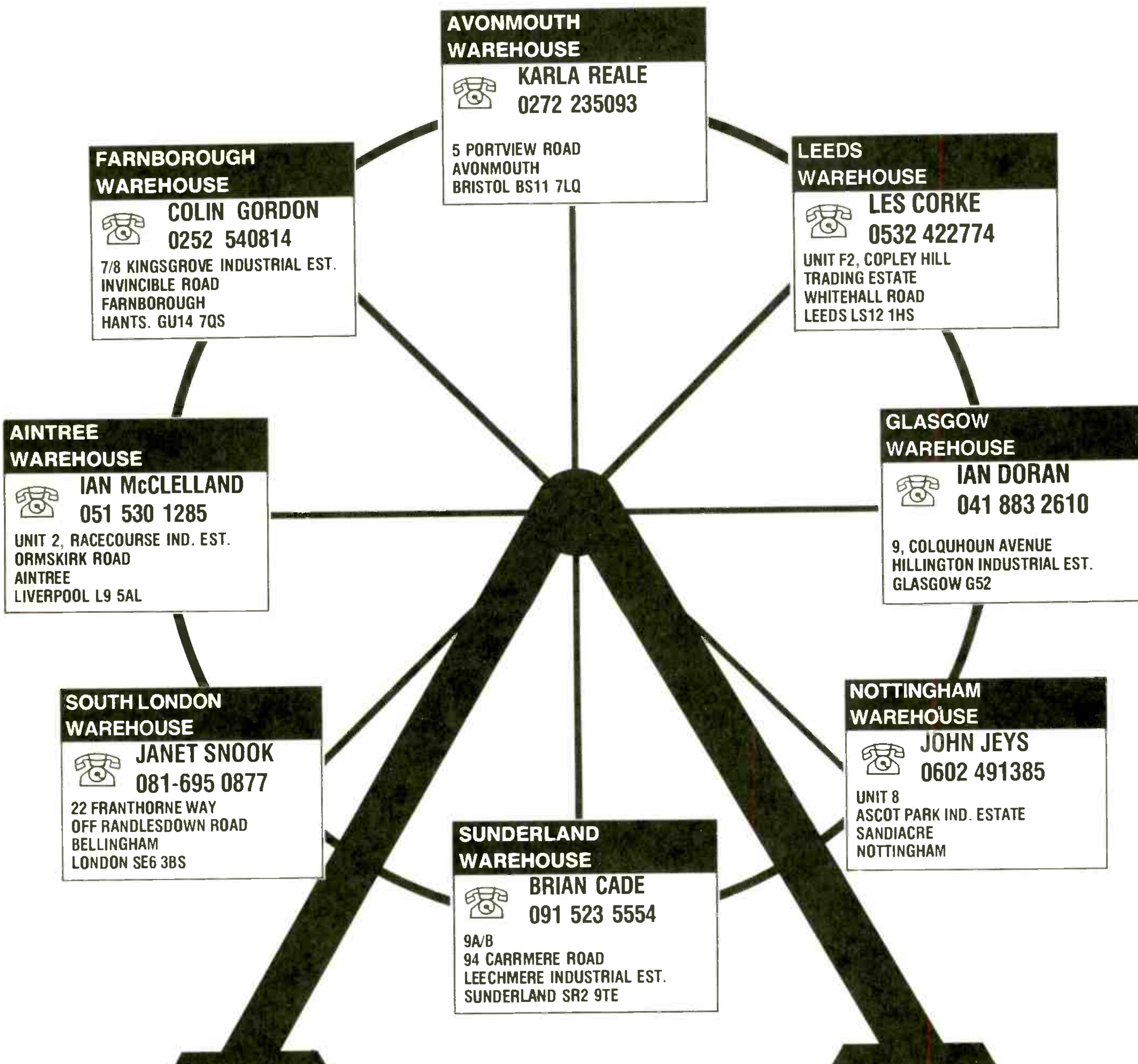

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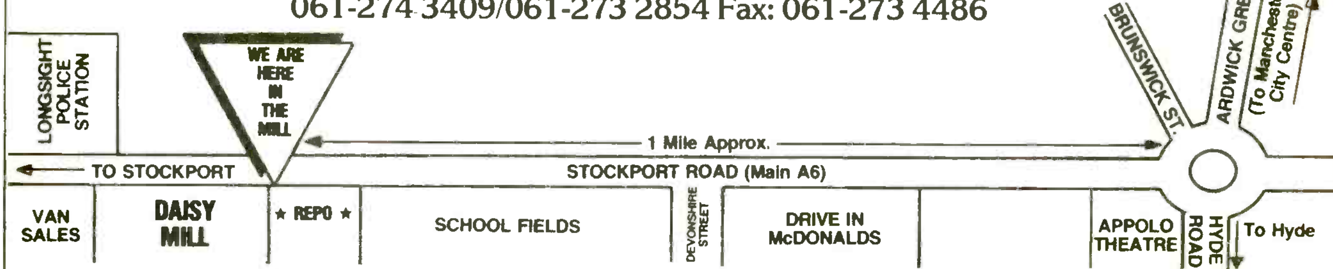

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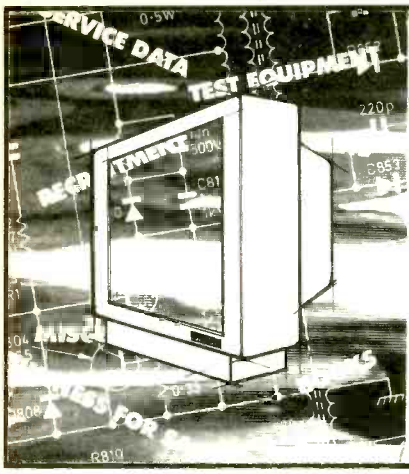

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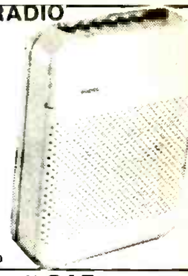
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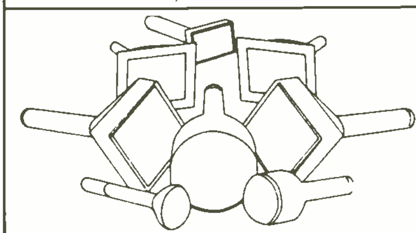

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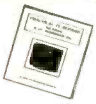

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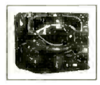

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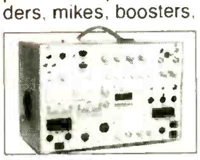

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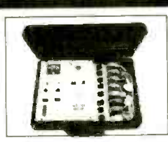

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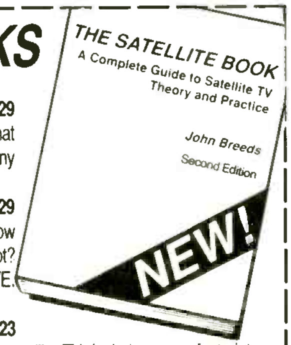

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GEC Portable G10T2041 £3.00
GEC Portable G10T2046 £3.00
EHT Split Diode Leads ITT £1.00
3500 L.O.P.T. & ITT Trans each £2.00
LOPT Rank Z763 £5.00

Universal Tripler
with small focus pot. Green type £7.00

Black Triplers
KT3 Triplers £6.00
S.T.C. Universal Tripler £6.00
ITT CVC 5-8-9 £3.50
Rank T25LE Tripler £2.00
Rank 11TCP A-823 £3.50
TU 25 30K Rank £3.00
11 TEZ Rank £3.00
G9 Philips £4.00
GEC 2110 £4.00
3500 Thorn £3.00
8500 Thorn £4.00
9000 Thorn £7.00
9500 Thorn £4.50
9600 Thorn £4.00
2040 GEC £3.50
GEC TVM25 Tripler £2.00
Universal Tripler £5.00
G8 Tripler £5.00
CVC20-32 £5.00
Decca 80 100 £4.50
Grundig TVK 52 £2.50
IITBQ Pye 731 £3.00
1ITHY £4.00
D22 for Pye 18" colour portable £4.00
LP 1193/63 £4.00
BG 100/41 £3.25
ERO Tripler print type with foacs PO7 BG2087 £5.00
T/text ultrasonic rec'r panel £14.00
12-14V. 20 for £5.00 200 for £25.00
GEC 8 touch unti assy complete with all I.C.'s + pots £4.00
G11 E.W. Transformer 50p
G11 E.W. coils £1.00
G11 Transient Suppressors 245V 20p
G11 Sean Coils £5.00
G11 100K tuner pots 12 for £1.00
KT3 IF panel £6.00
KT3 line OSc transformer £1.00
KT3/K30 infra-red receiver head £1.00
K30Drawer unit with IC's (home) £10.00
K30 drawer unit with IC's (export) £10.00
KT3 AE Sockets 50p
KT3 receiver panel £8.00
KT3 line driver transformer 50p
Oye, K30, GEC, etc. Pre-mains stand-by switch £1.00
Decca 80/100 IF panel £5.00
NPN PNP 80V 6 Amp TO66 O.P. Trans. pair 25p
5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 560T/570T £7.00
Control panel 5 sliders + mains lead £1.50
G11 8 touch button unit replaces old 6 P.B.U. £24.00
Tube base + base unit for 820 Euro chassis £4.00
CEC Line O/P Trans. & Rec Stick for Portable £3.00
CVC 20/25/30/35/40 decoder panel £10.00
CVC 20/25/30/35/40 decoder panel (untested) £5.00
CVC 40/45 IF panel £5.00
40K Transducer 50p
PHILIPS NE511N £1.20
LM337M Reg. 30p
20 GEC Black Spark Gaps £1.00
KT3 Front Panel Control Assy. £2.50
BTW 30/50 50p

Voltage Regulators
+5V/UA78PO5SC 30p
-8V/79M08c £30p
+6V/78M06c £30p
LM 317T 30p
LM 337 30p
LM 342/18 30p
LM 340T 5.0 50p
+12V/LM 340T12 50p
+18V/MC78M18 20p
+24V/78M24 £30p
MC 7724cp 40p
MC 7824 40p

Power Supply for Sinclair Spectrum +2 £5.00

U 19885 40p
U 3832 15p
U 3845 15p
MR 508 10p
MR 501 10p
MR 502 10p
BCW 71R 30p
BYF 1202 10p
BYF 1204 10p
BYF 3126 40p
BYF 3214 40p
BYX 10 10p
BYX 36/600 35p
BYX 38/300 25p
BYX 49/600R 75p
BYX 55/350 10p
BYX 55/600 (Bead) 10p
BYX 36/600 50p
BYV 95B 10p
BYV 95C 12p
BYV 96D 10p
BYZ 106 10p
BPW 41 15p
BYW 56 2A/1000v G11 8p
BYW 29/50 15p
BYW 95C 10p
BZU 15/24 54p
BZY 93c75 50p
BZW 15/18 30p
BZW 15/30 30p
BZW 70c6v2 10p
BZW 79.3v 10p

Bush Thyristor RCA 76122 £1.00
Transformer 240v/20v-500Ma 75p
Chassis type Transformer 240v/12 Volts 500mA 75p
CVC 20 tube base £2.00
Tube Base Rank & G11 £1.20

BRIDGES
KBL 005 30p
KBL 02 30p
KBP 04 30p
W02 15p
W004 15p
W005 20p
800V Bridges 2½ Amp 30p

G11 Drawer ASS 3 pots Mans Switch and Lead £2.00

K30 Drawer Ass with pots cable forme £1.00

TX10 Drawer with 8 way pots. ass £2.50

Hills 9 piece tool kit in case £5.00

Philips Coaxial Cable Stripper SBC325 £7.50

Self adjusting cutter stripper £5.00

10 mixed tube bars £4.00

5000 Diodes-Resistors £3.00 pack

'D/P push mains switch 20p each

Mains lead & two pin socket for radio cassette 35p

T/V loop aerial 75p

Radio Telescopic Aerial £1.00

Philips Silicon Grease £1.50 each

Freeze Philips £1.50 each

Foam Cleaner Philips £1.50 each

Contact Cleaner Philips £1.50 each

100 Coax Plugs EACH 14p

De-solder pump + 2 nozzles Philips £4.00

Flat Red LED and Green 5p

500gm 60/40 Solder reel £6.00

Dual v/u meter -20 — +10db £1.00

K30 Thermistor 23226629800 75p

De-solder Pump £2.50

Portasol Flameless Gas Soldering Iron ££16.00

Green and Red LED pack mixed 100 for £1.00

Hill Meter Leads, S/Rubber and Probes £4.00

CV 8617 10p
Y 716 10p
Y 729 30p
Y 730 10p
Y 827: 6A/1KV 20p
Y 860 30p
Y 933 5p
Y 969 50p
Y 997 30p
Min 12 volt Relays 75p
R 1038 40p
R 1039 40p
R 2009 80p
R 20106 £1.00
R 2029 50p
R 2210 60p
R 2257 60p
R 2265 50p
R 2305 50p
R 2306 30p
R 2322/2323 pair 80p
R 2323 15p
R 2396 50p
R 2461 80p
R 2030 50p
R 2433=BD124 30p
R 2540 £2.00
R 2737 40p
R 2738=TIP41 30p
R 2775=TIP41c 40p
R 3129=TIP47 40p
T 6068V 50p
R 4050 £1.00
S 2008b 80p
2SD898B £1.00
2SC1942 £1.00

Hitachi sets etc.
STR454 £2.00
STR6020 Kit £6.00
S 2000AF line o.p. £1.00
2SC940 £1.00
BU 105/04 80p
BU 108 £1.00
BU 124 50p
BU 126 80p
BU 180a £65p
BU 204 60p
BU 205 75p
BU 206 £1.00
BU 207 £1.00
BU 208 80p
BU 208A 75p
BU 208D 90p
BU 222 £1.00
BU 326 £1.00
BU 407 60p
BU 426A 45p
BU 500 £1.10
BU 500D £1.00
BU 508A 90p
BU 508AF £1.00
BU 508D 80p
BU 508V £1.00
BU 705 £1.00
BU 806A £1.00
BU 807 £1.00
BU 824 50p
BUT 11 50p
BUT 13 600V-28A £1.00
BUW 11 50p
BUW 84 60p
BYW 20-08-9 £1.00
BYW 95 10p
BUX 39 25A-150V £1.00
BUX 84 50p
BUX 85 50p
BUY 49 20p
TIC 106a 30p
TIC 116m 30p
TIC 116n/Y 1003 30p
TIC 126N 30p
TIC 225S 30p
TIC 226E 30p
TIC 226m 30p
TIC 236m 30p
TAG 226/600 30p
TICV 106D
(T092 case 2A/400V) 10p
TIP 29 25p
TIP 30 25p
TIP 30A 25p
TIP 30B 25p
TIP 30C 25p
TIP 31 25p
TIP 32 25p
TIP 33B 50p
TIP 33C 70p
TIP 34A 50p
TIP 34B 60p
TIP 34C 70p
TIP 35B 50p
TIP 35C 70p
TIP 35D 80p
TIP 36 50p
TIP 36C 70p
TIP 41 15p
TIP 41B 40p
TIP41D 70p
TIP 42 10p
TIP 42/BRC 6109 10p
TIP 48 40p
TIP 49 30p
TIP 57 30p
TIP 100 30p
TIP 102 30p
TIP 110 20p
TIP 115 50p
TIP 117 50p
TIP 125 35p
TIP 126 40p
TIP 127 40p
TIP 130 30p
TIP 131 6p
TIP 136 30p
TIP 140 50p
TIP 142 80p
TIP 640 50p
TIP 2955 35p
TIP L761A-1000V/4Amp 75p
T6032 30p
T6036 40p
T6040 40p
T6047 40p
T6049 40p
T6051 40p

Philips Handset IC £3.00
SAA3010P £3.00
MAB8461/WO63 £3.00

MAB 8420P-C031 £3.00
MAB 8400B-6 £3.00
MAB 8440P-D070 £3.00
MAB 8440P-D033 £3.00
MAB 8440P-D056 £3.00
MAB 8441P-T001 £3.00
MAB 8441P-T132 £2.00

M58484P £2.00

Hand Sets — Fidelity £15.00 to £35.00

ITT 8 and 6 Push Button £1.00
Pye 725 LOPTs £6.00
Pye 731 LOPTs £6.00
Thorn 8500-8800 LOPTs £5.00

CMC 301 front panel £5.00
CMC 303 front panel £5.00

CMC 302 Panel with TC mains switch etc £5.00

CMD 800 Decoder £8.00

C7 Hand Set £6.00

3 I.C. Power Supply G11 Full Remote Receiver Panel £3.00

Meters Hills 520 £17.00
Meters Hills 420 £10.00
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
CT9144 CT9185 CT9193 CT9393
CT9384 £4.00 each

Rediffusion MK3 £5.00

TOSHIBA HAND SETS
21 Button CT938 Fulremote £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 8C11 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 Intra-red full teletext £20.00
Dynatron-Full remote CTV 62, 63, 64 £19.00
Hitachi infra red handset £18.00
Philips full remote KT3, 16C92/20C934; 722R/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 hiobs 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

International Rectifier EHT Diodes G770/1V34 6KV 3 for 8p
6A/600V Stud Diodes 20p
6A/1000V Stud Diodes 20p
BTW 92/800R £3.00
25A473 PNP C/P 10p