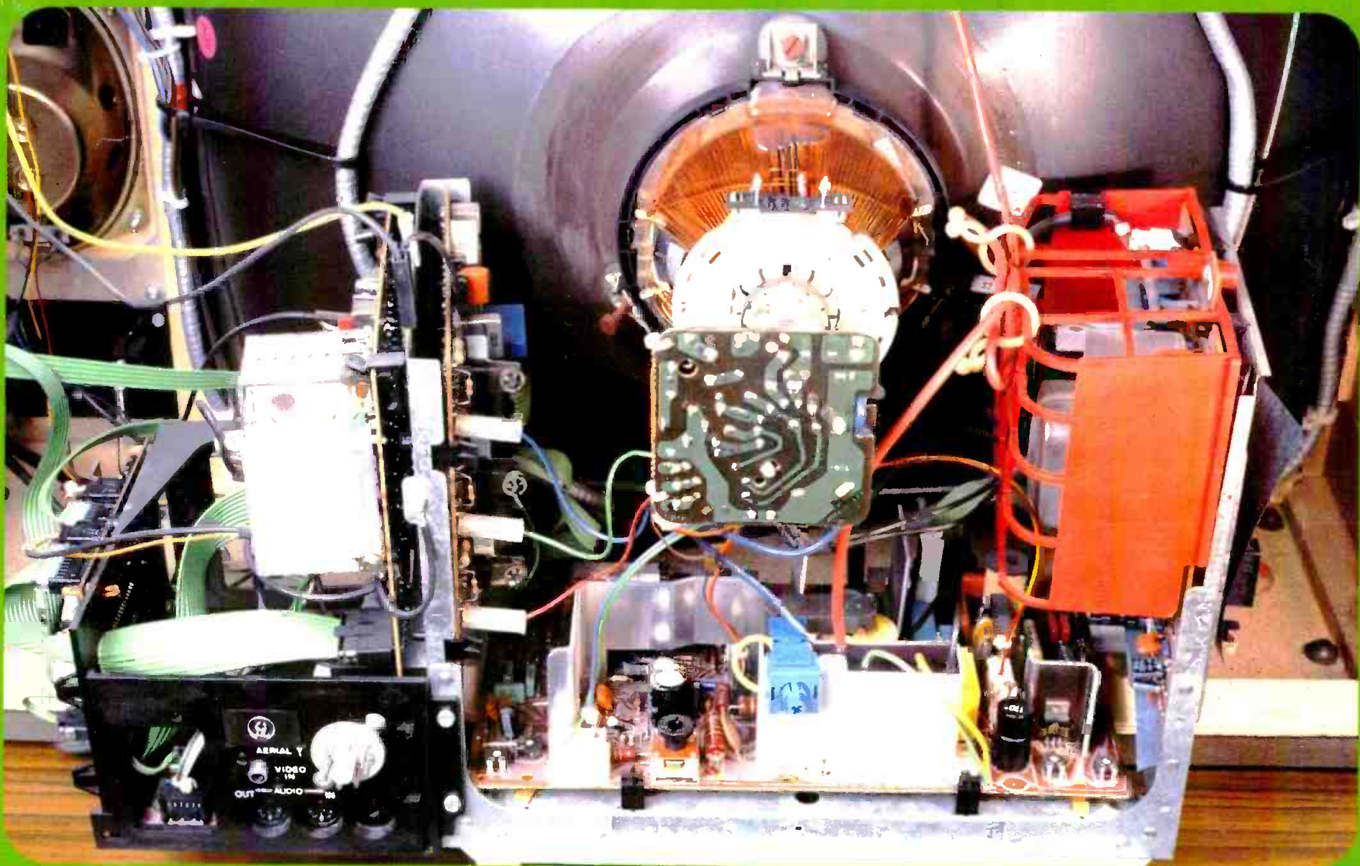
JANUARY 1994 £2.20

TELEVISION

SERVICING·VIDEO·SATELLITE·DEVELOPMENT



The Rediffusion Mk 4 Chassis

Power Supplies for TV Receivers

All about Fuses · UPS Review

Panasonic's Cardiff TV Chassis

Symptoms without Faults · DX-TV

VCR Clinic · TV Fault Finding

A REED BUSINESS PUBLICATION

THE EDITOR AND STAFF OF TELEVISION WOULD LIKE TO THANK OUR READERS AND ADVERTISERS FOR THEIR CONTINUED SUPPORT AND WISH THEM ALL THE VERY BEST FOR THE NEW YEAR.

TELEVISION

January 1994
Vol. 44, No. 3
Issue 519

On sale December 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 Department, Reed Business Publishing, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

INDEXES AND BINDERS
Indexes for Vols. 38 to 42 are available at £3.50 each from Video Interface Products Ltd., who can also supply a five-year consolidated index on computer disk. For further details see page 186.
Binders that hold twelve issues of *Television* are available for £5 each from Television Binders, 78 Whalley Road, Wilpshire, Blackburn BB1 9LF. Make cheques payable to "Television Binders".

SUBSCRIPTIONS
An annual subscription costs £26 in the UK, £37 for Eire/Europe airmail (postage included for all rates) Rest of the world airmail availabe upon request). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.
Subscription hotline for 24-hour ordering with Credit Card telephone 0622 721666 quoting INJ.

BACK NUMBERS
Some back issues are available at £2.75 each from Television Back Issues, Room L323, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Make cheques/postal orders payable to Reed Business Publishing Ltd. See box on page 203.

ISSN 0032-647X

OUR NEXT ISSUE DATED FEBRUARY WILL BE PUBLISHED ON JANUARY 19

BC107	8p
BC108	8p
BC109	8p
BC109C	10p
BC140	20p
BC141	20p
BC142	20p
BC143	20p
BC147	8p
BC148	8p
BC149	8p
BC157	8p
BC159	8p
BC160	30p
BC171	10p
BC172	10p
BC177	14p
BC178	14p
BC179	14p
BC182	7p
BC182L	7p
BC183	7p
BC183L	7p
BC184	7p
BC184L	7p
BC212	7p
BC212L	7p
BC213	7p
BC213L	7p
BC214	7p
BC214L	7p
BC237	7p
BC238	7p
BC239	7p
BC300	20p
BC301	20p
BC302	20p
BC303	20p
BC304	25p
BC327	7p
BC328	7p
BC337	7p
BC338	7p
BC441	28p
BC446	8p
BC449	15p
BC461	28p
BC477	18p
BC478	18p
BC516	22p
BC537	25p
BC546	8p
BC547	8p
BC548	8p
BC549	8p
BC550	8p
BC556	8p
BC557	7p
BC558	8p
BC559	8p
BC560	8p
BC637	20p
BC638	20p
BC639	20p
BC640	20p
BCY70	16p
BCY71	16p
BCY72	16p
BD115	30p
BD124P	50p
BD131	25p
BD132	25p
BD133	50p
BD135	20p
BD136	20p
BD137	20p
BD138	20p
BD139	20p
BD140	20p
BD144	90p
BD157	38p
BD166	30p
BD175	30p
BD177	30p
BD179	32p
BD181	45p
BD182	60p
BD184	60p
BD187	30p
BD201	33p
BD202	38p
BD203	42p
BD204	42p
BD222	31p
BD225	31p
BD232	31p
BD233	30p
BD234	32p
BD235	28p
BD236	30p
BD237	21p
BD238	24p
BD239	30p
BD240	40p
BD241A	40p
BD243A	50p
BD244	50p
BD245	50p
BD246A	50p
BD265	45p
BD267	45p
BD269	45p
BD278	50p
BD311	100p
BD314	100p
BD315	150p
BD317	150p
BD331	40p
BD332	40p
BD361	60p
BD362	60p
BD370	30p
BD371	30p
BD410	30p
BD433	28p
BD434	30p
BD435	31p
BD436	30p
BD437	28p
BD438	36p
BD439	40p
BD440	40p
BD441	40p
BD533	50p
BD534	38p
BD535	38p
BD536	38p
BD537	40p
BD538	40p
BD643	50p
BD645	50p
BD647	50p
BD649	50p
BD675	40p
BD676	40p
BD677	38p
BD678	40p
BD679	40p
BD680	40p
BD681	45p
BD682	45p
BD705	50p
BD707	50p
BD709	50p
BD711	50p
BD736	50p
BD826	50p

BD828	50p
BD897	50p
BD899	50p
BD901	50p
BD977	50p
BDX32	100p
BDX33	60p
BDX65	80p
BDW23	55p
BDW24	55p
BDW93	50p
BDW94	50p
BDY92	100p
BF137	35p
BF167	30p
BF180	16p
BF181	18p
BF183	20p
BF195	7p
BF199	8p
BF200	16p
BF225	30p
BF240	16p
BF245	25p
BF254	15p
BF255	12p
BF256	18p
BF257	18p
BF258	18p
BF259	18p
BF262	25p
BF263	25p
BF270	18p
BF273	15p
BF311	21p
BF336	20p
BF337	20p
BF338	20p
BF362	30p
BF367	13p
BF371	17p
BFR40	25p
BFR90	52p
BFR91	99p
BFT43	30p
BFX29	20p
BFX84	20p
BFX85	20p
BFX87	15p
BFX88	15p
BFX89	60p
BFY17	30p
BFY18	40p
BFY50	14p
BFY51	14p
BFY52	14p
BFY56	25p
BFY64	25p
BFY90	45p
BLY48	85p
BR100	14p
BR103	37p
BR303	85p
BRY49	38p
BSS74	33p
BSX20	15p
BSX26	18p
BT100A	70p
BT106	180p
BT109	90p
BT119	100p
BT146	99p
BT151	58p
BTY79	140p
BU100A	110p
BU104	80p
BU105	80p
BU108	100p
BU109	80p
BU110	110p
BU111	140p
BU124	60p
BU126	65p
BU180	150p
BU184	100p
BU204	75p
BU205	70p
BU206	100p
BU208	70p
BU208A	60p
BU208AT	90p
BU208D	130p
BU209	140p
BU225	190p
BU226	190p
BU312	120p
BU325	55p
BU326	75p
BU406	70p
BU406D	85p
BU407	55p
BU407D	80p
BU408	75p
BU408D	85p
BU409	95p
BU426A	70p
BU500	100p
BU508A	75p
BU508AF	95p
BU508D	80p
BU508DF	115p
BU526	75p
BU536	100p
BU546	140p
BU608	150p
BU626	150p
BU636	150p
BU801	80p
BU806	75p
BU807	70p
BU902	130p
BU903	130p
BU920	130p
BU922	130p
BU930	130p
BUT11AF	60p
BUT12	80p
BUT56A	150p
BUX80	180p
BUX84	50p
BUX85	50p
BU69A	200p
BUY71	300p
BUZ71	75p
C106D	28p
MJ1000	200p
MJ1001	200p
MJ10012	300p
MJ15001	325p
MJ15002	300p
MJ15004	370p
MJ2501	110p
MJ2955	55p
MJ3000	115p
MJ3001	115p
MJE29A	30p
MJE30A	30p
MJE340	25p
MJE350	80p
MJE520	30p
OC28	350p
OC29	250p
OC35	350p
OC36	250p
OC45	50p
OC72	50p
OC200	180p

R2008B	100p
R2010B	100p
S2800D	52p
S2800M	72p
T2800D	52p
T2800M	72p
TIP29	15p
TIP29A	22p
TIP29C	25p
TIP30	25p
TIP30C	30p
TIP31A	22p
TIP31C	30p
TIP32	24p
TIP32A	21p
TIP32C	28p
TIP33	50p
TIP33C	60p
TIP34	50p
TIP34C	60p
TIP35C	65p
TIP36C	65p
TIP41A	22p
TIP41C	22p
TIP42A	20p
TIP42C	22p
TIP47	40p
TIP48	40p
TIP50	60p
TIP51	120p
TIP52	120p
TIP53	120p
TIP54	140p
TIP105	65p
TIP106	65p
TIP107	65p
TIP110	40p
TIP111	50p
TIP112	40p
TIP115	45p
TIP116	45p
TIP117	50p
TIP120	37p
TIP121	46p
TIP122	47p
TIP125	47p
TIP126	56p
TIP127	58p
TIP130	39p
TIP131	30p
TIP141	90p
TIP142	90p
TIP145	65p
TIP146	90p
TIP147	100p
TIP150	90p
TIP151	90p
TIP2955	42p
TIP3054	45p
TIP3055	42p
TIS44	40p
TIS61	15p
TIS90	15p
TIS91	18p
TIS93	20p
VK1010	88p
VN10KM	60p
VN66AF	100p
VN88AF	115p
ZTX107	11p
ZTX108	11p
ZTX109	12p
ZTX212	27p
ZTX300	13p
ZTX301	15p
ZTX302	16p
ZTX303	24p
ZTX304	17p
ZTX320	29p
ZTX500	13p
ZTX501	13p
ZTX502	18p
ZTX503	18p
ZTX504	25p
ZTX550	24p
2N696	26p
2N697	22p
2N698	40p
2N706	22p
2N708	22p
2N914	28p
2N930	18p
2N1131	28p
2N1132	28p
2N1613	24p
2N1711	24p
2N1893	30p
2N2102	50p
2N2218A	24p
2N2219	24p
2N2221	23p
2N2222	23p
2N2369	15p
2N2484	20p
2N2646	40p
2N2904	20p
2N2905	20p
2N2906	18p
2N2907	18p
2N2926	8p
2N3019	28p
2N3053	18p
2N3054	40p
2N3055	38p
2N3055H	50p
2N3440	58p
2N3442	85p
2N3585	120p
2N3702	9p
2N3703	9p
2N3704	9p
2N3705	9p
2N3706	9p
2N3707	9p
2N3708	9p
2N3710	12p
2N3711	12p
2N3771	85p
2N3772	90p
2N3773	100p
2N3799	18p
2N3819	29p
2N3866	68p
2N3903	11p
2N3904	11p
2N3905	11p
2N3906	11p
2N4031	25p
2N4036	25p
2N4062	12p
2N4064	100p
2N4401	12p
2N4403	12p
2N4443	76p
2N5061	20p
2N5088	20p
2N5192	50p
2N5241	500p
2N5245	45p
2N5294	30p
2N5296	30p
2N5366	25p
2N5401	12p
2N5448	12p
2N5496	80p
2N6107	40p
2N6292	40p

2N6385	120p
2N6403	160p
3N143	65p
DIODES	
Rectifier Diodes	
BY127	8p
BY133	8p
BY164	40p
BY179	35p
BY184	32p
BY196	20p
BY206	11p
BY207	11p
BY210	22p
BY225	120p
BY227	19p
BY228	28p
BY296	20p
BY298	23p
BY299	22p
BYX10	15p
BYX55/350	30p
BYX55/600	25p
BYX70/500	32p
OA47	10p
OA90	10p
OA91	10p
OA200	10p
OA202	10p
IN914	2p
IN4001	3p
IN4002	3p
IN4003	3p
IN4004	3p
IN4005	3p
IN4006	3p
IN4007	4p
IN4148	2p
IN5400	9p
IN5401	8p
IN5402	8p
IN5403	8p
IN5404	8p
IN5405	11p
IN5406	12p
IN5407	12p
IN5408	12p
RGP15	15p
RGP30	16p
SKE4F2/06	60p
SKE4F2/08	80p
SKE4F2/10	100p
SR2M	60p
I.C. SOCKETS	
8PIN	5p
14PIN	6p
16PIN	7p
18PIN	10p
20PIN	12p
22PIN	13p
24PIN	14p
28PIN	16p
40PIN	18p
ZENERS	
400 MW	
BZY88 RANGE	
2V7 to 39V	5p
1.3W	
BZX61 RANGE	
2V7 to 39V	9p
CRYSTALS	
Freq In MHz	
1.0	260p
2.4576	180p
3.276	115p
4.0	110p
4.194	130p
4.43	95p
5.0	130p
6.0	115p
10.0	140p
11.0	250p
12.0	120p
14.756	200p
15.0	160p
18.0	130p
18.432	130p
24.0	250p
48.0	160p
VOLTAGE REGULATORS	
7805	25p
7806	25p
7808	25p
7812	25p
7815	25p
7818	25p
7824	25p
7905	25p
7906	30p
7908	30p
7912	30p
7915	30p
7918	30p
7924	30p
78L05	24p
78L08	24p
78L12	24p
78L15	24p
78L18	24p
78L24	24p
79L05	35p
79L08	35p
79L12	35p
79L15	35p
7818KC	100p
7824KC	100p
LM309K	100p
LM317K	200p
LM317T	100p
LM323K	350p
LM723	35p
78H08KC	800p
78H12KC	700p
79HGKC	800p
VALVES	
DAF96	100p
DY87	80p
EB91	50p
EBF80	60p
EBF89	60p
ECC84	80p
ECH83	100p
ECH84	90p
ECL80	65p
ECL82	80p
ECL84	100p
ECL85	80p
EF85	80p
EF183	75p
EF184	85p
EL34	300p
EL95	85p
EL500	100p

EY86	70p
EY87	70p
EY88	80p
PC97	100p
PCC85	60p
PCF80	100p
PCF801	110p
PCF802	80p
PCF806	115p
PCH200	100p
PCL81	65p
PCL82	80p
PCL84	60p
PCL85	80p
PCL805	80p
PFL200	110p
PL36	120p
PL83	60p
PL84	80p
PL95	180p
PL504	120p
PL508	200p
PL519	430p
PY81	100p
PY88	100p
PY500A	190p
LED's	
3mm	
RED	5p
YELLOW	8p
GREEN	8p
5mm	
RED	5p
YELLOW	8p
GREEN	8p
RECTANG. LED's	
5mm × 2.5mm	
RED	5p
YELLOW	8p
GREEN	8p
LINEAR IC's	
AN203	210p
AN210	165p
AN214Q	170p
AN228	280p
AN240P	130p
AN252	150p
AN259	250p
AN262	140p
AN271	230p
AN274	250p
AN301	330p
AN303	250p
AN304	360p
AN315	210p
AN316	350p
AN360	100p
AN362	140p
AN366	160p
AN610	160p
AN612	160p
AN3312	350p
AN3320K	800p
AN3331K	900p
AN3792	400p
AN3794	450p
AN3795	500p
AN3821	800p
AN3821K	600p
AN3822K	700p
AN3830K	800p
AN3990K	300p
AN3991K	400p
AN5010	450p
AN5011	400p
AN5015	350p
AN5020	200p
AN5025	250p
AN5030	160p
AN5033	400p
AN5034	500p
AN5111	550p
AN5132	250p
AN5135	600p
AN5138	450p
AN5150	600p
AN5151	600p
AN5215	100p
AN5250	150p
AN6256	150p
AN5260	350p
AN5262	175p
AN5265	150p
AN5352	600p
AN5355	450p
AN5410	375p
AN5411	450p
AN5421	150p
AN5429	430p
AN5431	300p
AN5440	400p
AN5510	400p
AN5512	250p
AN5516	200p
AN5520	550p
AN5521	250p
AN5612	400p
AN5613	200p
AN5615	300p
AN5620	330p
AN5622	350p
AN5625	400p
AN5712	350p
AN5722	140p
AN5730	160p
AN5732	160p
AN5753	170p
AN5763	450p
AN5790	300p
AN5791	350p
AN5836	450p
AN5862	300p
AN6135	150p
AN6238	400p
AN6247	200p
AN6270	400p
AN6300	600p
AN6306	550p
AN6307	250p
AN6320	300p
AN6328	400p
AN6332	390p
AN6337	420p
AN6341	550p
AN6344	440p
AN6350	610p
AN6359	500p
AN6360	320p
AN6362	480p
AN6371	470p
AN6387	560p
AN6811	130p
AN6884	240p
AN7105	210p
AN7110	130p
AN7114	150p
AN7115	150p
AN7116	90p
AN7120	130p
AN7130	110p
AN7140	450p

AN7145	195p
AN7146	210p
AN7154	180p
AN7156	240p
AN7168	260p
AN7178	270p
AN7222	180p
AN7254	150p
AN7256	250p
AN7310	90p
AN7311	90p
AN7410	250p
AY3-1015	290p
AY3-1270	800p
AY3-1350	450p
AY3-8910	360p
AY3-8912	400p
BA301	65p
BA311	80p
BA313	60p
BA333	100p
BA340	150p
BA401	60p
BA402	60p
BA511	160p
BA514	160p
BA516	150p
BA521	150p
BA524	240p
BA526	180p
BA527	95p
BA532	140p
BA534	290p
BA536	180p
BA546	180p
BA612	160p
BA656	150p
BA658	380p
BA684	400p
BA685	400p
BA1310	160p
BA1320	110p
BA1330	160p
BA1360	160p
BA4403	220p
BA5101	400p
BA5102	220p
BA5204	200p
BA5402	180p
BA5406	180p
BA5408	180p
BA6104	250p
BA6208	250p
BA6209	260p
BA6304	120p
BA6305	140p
BA6410	220p
BA6411	250p
BA6993	150p
BA7001	150p
BA7004	200p
BA7007	200p
BA7021	180p
BA7022	350p
BA7751LS	190p
BA7752	250p
BA7755	150p
BA7767AS	200p
CX108	950p
CX134A	950p
CX136	600p
CX139	1450p
CX139A	750p
CX141	750p
CX143	800p
CX143A	1250p
CX145	725p
CX150B	325p
CX158	825p
CX175	325p
CX186	750p
CX187	825p
CX804A	775p
CX832	825p
CX867	575p
CX868	525p
CX877	300p
HA1125	150p
HA1137W	135p
HA1197	150p
HA1199	145p
HA1319	240p
HA1338	300p
HA1339A	350p
HA1377	160p
HA1388	320p
HA1389	210p
HA1392	200p
HA1394	280p
HA1397	250p
HA1398	240p
HA11219	280p
HA11221	180p
HA11225	150p
HA11235	145p
HA11251	240p
HA11423	210p
HA11724	800p
HA12002	300p
HA12003	250p
HA12005	320p
HA12017	130p
HA13001	170p
HA13002	250p
HA13006	400p
HA13007	400p
HA13108	350p
HA13412	600p
HA13432	400p
HA17524	250p
HA17805	100p
ICL7106	650p
ICL7611	90p
ICL7660	240p
ICM7555	60p
ICM75556	80p
KA2101	100p
KA2102	150p
KA2130	150p
KA2206	150p
KA2209	125p
KA2210	230p
KA2212	80p
KA2213	150p
KA2214	150p
KA2261	100p
KA2263	100p
KA2264	100p
KA2284	100p
KA2401	150p
KA2412	350p
KA2912	125p
KA2914A	300p
LA1130	240p
LA1140	200p
LA1150	150p
LA1185	150p
LA1201	75p
LA1210	140p
LA1222	80p
LA1230	130p
LA1231	210p
LA1364	200p
LA1365	200p
LA1367	150p
LA1368	220p
LA1385	170p
LA1460	220p

LA2000	150p
LA2101	270p
LA2200	190p
LA3160	120p
LA3201	80p
LA3210	65p
LA3220	100p
LA3300	140p
LA3301	110p
LA3350	110p
LA3361	100p
LA3375	300p
LA4030	180p
LA4031	140p
LA4032	140p
LA4051	160p
LA4100	85p
LA4101	80p
LA4102	100p
LA4110	120p
LA4112	120p
LA4125	270p
LA4126	240p
LA4137	180p
LA4140	60p
LA4160	100p
LA4180	300p
LA4182	180p
LA4190	300p
LA4192	140p
LA4200	130p
LA4201	120p
LA4220	120p
LA4260	230p
LA4261	300p
LA4270	300p
LA4420	140p
LA4422	130p
LA4430	130p
LA4440	230p
LA4445	200p
LA4460	130p
LA4461	130p
LA4500	200p
LA4505	220p
LA4507	360p
LA4508	260p
LA4510	160p
LA4520	230p
LA4550	200p
LA4555	190p
LA4570	150p
LA5112	200p
LA5523	150p
LA5527	150p
LA5700	300p
LA6324	200p
LA7011	220p
LA7031	250p
LA7033	400p
LA7040	280p
LA7042	280p
LA7046	300p
LA7224	250p
LA7505	250p
LA7507	250p
LA7520	200p
LA7620	500p
LA7800	180p
LA7801	100p
LA7806	260p
LA7808	250p
LA7820	150p
LA7823	280p
LA7910	150p
LA7940	200p
LC7131	260p
LC7132	400p
LC7137	450p
LF347	110p
LF351	45p
LF353	48p
LF355	60p
LF357	70p
LF398	300p
LM301	26p
LM311	35p
LM319	165p
LM324	30p
LM335Z	120p
LM339	35p
LM348	50p
LM358	45p
LM380	80p
LM381	150p
LM382	130p
LM386	60p
LM387	100p
LM393	45p
LM709DIL	30p
LM710	45p
LM723	40p
LM741DIL	18p
LM741MET	45p
LM747	55p
LM748	30p
LM1458	30p
LM1889	300p
LM3900	40p
LM3909	80p
LM3911	160p
LM3914	160p
LM3915	160p
LM3916	270p
M50115P	320p
M50117P	500p
M50119P	525p
M50784	300p
M50786	500p
M50790	600p
M51181	300p
M51381P	200p
M51387P	900p
M51544	150p
M51848	150p
M54523P	200p
M54563P	200p
M58484	500p
M58655P	400p
M51516	260p
M51518	200p
MB3614	180p
MB3712	140p
MB3713	130p
MB3714	270p
MB3715	250p
MB3722	280p
MB3730	160p
MB3731	220p
MB3756	160p
MB3759	200p
MB8719	360p
MC1455	45p
MC1458	30p
MC1488	50p
MC1489	50p
MC1496	65p
MC3302	70p
MC3401	45p
MC3403	60p

NE555	20p
NE556	40p
NE565	110p
NE566	130p
NE567	115p
NE571	290p
NE592	85p
NE5532P	140p
SAS560	150p
SAA1006	300p
SAA1008	450p
SAA1010	400p
SAA1024	250p
SAA1025	250p
SAA1075	350p
SAA1124	200p
SAA1220	400p
SAA1250	280p
SAA1251	380p
SAA1272	280p
SAA1274	280p
SAA3004	400p
SAA5000	200p
SAA5010	220p
SAA5012	400p
SAA5020	350p
SAA5030	440p
SAA5040A	280p
SAA5040B	400p
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	220p
STA456C	240p
STA471	210p
STA901M	280p
STA8012	260p
STK0025	420p
STK0029	360p
STK0039	380p
STK0040	520p
STK0049	510p
STK0050	440p
STK0059	620p
STK0060	820p
STK0070	1100p
STK0080	580p
STK011	370p
STK015	490p
STK016	800p
STK025	700p
STK043	900p
STK050	2200p
STK056	820p
STK077	600p
STK078	620p
STK080	600p
STK082	580p
STK084	660p
STK085	1050p
STK086	870p
STK420	1800p
STK430	500p
STK433	490p
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	500p
STK1040	700p
STK1049	800p
STK1050	650p
STK1060	760p
STK1070	940p
STK1080	950p
STK2025	700p
STK2028	560p
STK2029	480p
STK2038	900p
STK2048	950p
STK2110	680p
STK2120	820p
STK2125	600p
STK2129	610p
STK2139	800p
STK2155	950p
STK2230	470p
STK2240	820p
STK2250	760p
STK3041	460p
STK3042	375p
STK3044	525p
STK3062	600p
STK3082	700p
STK3083	550p
STK3102II	600p
STK3152II	990p
STK3156	560p
STK4017	450p
STK4019	600p
STK4021	425p
STK4025	600p
STK4026	600p
STK4028	620p
STK4032II	650p
STK4036	500p
STK4038	680p
STK4042II	900p
STK4044	1000p
STK4046	1100p
STK4048	1280p
STK4060	580p
STK4101	650p
STK4111	650p
STK4112	950p
STK4121	600p
STK4122	560p
STK4131	650p
STK4132II	750p
STK4141II	420p
STK4142	800p
STK4151	680p
STK4152	750p
STK4161	700p
STK4162	650p
STK4171	850p
STK4172II	800p
STK4181	820p

STK4182II	800p
STK4191	850p
STK4192	800p
STK4231II	990p
STK4272	720p
STK4273	650p
STK4301	700p
STK4311	800p
STK4332	410p
STK4352	640p
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
STK5315	600p
STK5322	620p
STK5324	520p
STK5325	400p
STK5331	400p
STK5332	180p
STK5333	550p
STK5335	450p
STK5337	600p
STK5338	350p
STK5339	500p
STK5342	300p
STK5361	420p
STK5372	300p
STK5412	400p
STK5421	525p
STK5422	375p
STK5431	650p
STK5434	650p
STK5436	600p
STK5441	500p
STK5451	480p
STK5457	425p
STK5461	700p
STK5462	675p
STK5466	675p
STK5467	500p
STK5471	400p
STK5473	600p
STK5476	350p
STK5478	500p
STK5479	350p
STK5481	420p
STK5482	300p
STK5483	550p
STK5488	600p
STK5490	500p
STK5725	600p
STK5730	600p
STK6431	850p
STK6722	900p
STK6732	1500p
STK6822	1200p
STK6922	600p
STK6932	600p
STK6962	320p
STK6972	630p
STK6981B	850p
STK6982	800p
STK7216	500p
STK7217	560p
STK7226	800p
STK7308	410p
STK7309	450p
STK7310	550p
STK7348	280p
STK7356	500p
STK7358	500p
STK7402	660p
STK7404	400p
STK7406	800p
STK7408	800p
STK7410	1200p
STK7554	1000p
STK7561	700p
STK7563	950p
STK8050	880p
STK8250	550p
STK8260	1500p
STK8280	1850p
STK73410	350p
STR370	440p
STR371	450p
STR380	400p
STR381	450p
STR383	475p
STR384	400p
STR440	700p
STR441	440p
STR450	520p
STR451	600p
STR452	600p
STR453	600p
STR454	450p
STR455	500p
STR456	600p
STR457	600p
STR470	800p
STR1096	380p
STR1195	450p
STR1229	450p
STR2005	500p
STR2012	500p
STR2013	400p
STR2024	650p
STR2105	600p
STR3113	300p
STR3115	500p
STR3123	490p
STR3125	580p
STR3135	300p
STR3212	330p
STR3214	330p
STR3215	330p
STR3315	330p
STR4142	550p
STR4211	370p
STR4512	450p
STR5015	600p
STR5100	650p
STR5214	550p
STR5315	700p
STR5412	600p
STR6020	400p
STR9005	600p
STR9012	550p
STR10006	550p
STR11006	550p
STR12006	600p
STR13006	650p
STR15006	650p
STR16006	650p
STR20005	650p
STR20012	600p
STR20015	600p
STR30113	400p
STR30115	350p
STR30123	600p
STR30130	400p
STR30134	320p
STR40090	450p

STR41090	500p
STR44111	650p
STR44115	650p
STR45111	700p
STR50020	550p
STR50092	650p
STR50100	650p
STR50103A	260p
STR50113	650p
STR50115	650p
STR51041	650p
STR52041	650p
STR50213	650p
STR53041	650p
STR53043	650p
STR54041	400p
STR55041	650p
STR58041	400p
STR59041	600p
STR60001	650p
STR61001	750p
STR80145	700p
STRD1806	475p
STRD1816	475p
T2800D	52p
TA7054	190p
TA7061	115p
TA7063	70p
TA7066	120p
TA7089	300p
TA7119	150p
TA7120	55p
TA7130	80p
TA7137	83p
TA7140	130p
TA7157	140p
TA7176	200p
TA7193	320p
TA7200	200p
TA7205	80p
TA7207	150p
TA7208	145p
TA7214	260p
TA7217	145p
TA7220	220p
TA7222	120p
TA7223	210p
TA7225	300p
TA7226	290p
TA7227	190p
TA7229	300p
TA7230	120p
TA7232	120p
TA7233	150p
TA7237	400p
TA7238	140p
TA7240	180p
TA7241	190p
TA7242	250p
TA7243	320p
TA7245	350p
TA7267	290p
TA7269	600p
TA7270	200p
TA7271	250p
TA7272	260p
TA7273	350p
TA7274	250p
TA7280	250p
TA7281	220p
TA7282	200p
TA7283	200p
TA7288	220p
TA7299	300p
TA7310	100p
TA7312	120p
TA7313	110p
TA7314	210p
TA7315	200p
TA7317P	240p
TA7324	200p
TA7325	90p
TA7328	150p
TA7335	110p
TA7336	250p
TA7341	250p
TA7343	120p
TA7357	400p
TA7358	120p
TA7401	300p
TA7607	200p
TA7608	360p
TA7609	210p
TA7611	280p
TA7612	360p
TA7614	200p
TA7616	400p
TA7621	520p
TA7622	420p
TA7628	150p
TA7629	220p
TA7630	200p
TA7632	200p
TA7640	150p
TA7641	170p
TA7658	130p
TA7668	160p
TA7680	300p
TA7688	250p
TA7698	500p
TA7699	800p
TA7705	300p
TA7750	200p
TA7757	250p
TA7769	200p
TA7784	250p
TA8205	350p
TA8210	300p
TA8215	320p
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	120p
TC5020	200p
TC5081AP	180p
TC9106	500p
TC9109	450p
TC9122P	430p
TC9125BP	410p
TC9132	400p
TC9134	750p
TC9142	320p
TC9143	300p
TC9145	150p
TC9148	200p
TC149	225p
TC9150	425p
TC9152	425p
TC9153	300p
TC9156	300p
TC9163	375p
TC9164	400p
TC9172P	300p
TC9176P	500p
TCA740	150p
TCA940	100p
TCEP100	100p

TD62308AP	200p
TD62382	200p
TD62506	200p
TD62705	250p
TD6304AP	300p
TD6306P	350p
TD6350P	200p
TD6359P	300p
TDA1001	200p
TDA1002	200p
TDA1003	150p
TDA1005A	220p
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
TDA1053	400p
TDA1054	200p
TDA1060	190p
TDA1062	200p
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
TDA1410	219p
TDA1412	100p
TDA1510	380p
TDA1512	200p
TDA1514A	450p
TDA1515A	200p
TDA1516Q	350p
TDA1518	300p
TDA1520	350p
TDA1521	300p
TDA1522	200p
TDA1524	350p
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
TDA2020	140p
TDA2030	80p
TDA2040	200p
TDA2048	750p
TDA2054M	120p
TDA2151	300p
TDA2170	300p
TDA2270	340p
TDA2320	80p
TDA2510	450p
TDA2532	120p
TDA2540	100p
TDA2541	120p
TDA2542	150p
TDA2543	300p
TDA2545	200p
TDA2556	350p
TDA2575A	100p
TDA2577A	160p
TDA2578A	200p
TDA2579	250p
TDA2582	200p
TDA2590	170p
TDA2593	150p
TDA2594	300p
TDA2595	300p
TDA2600	350p
TDA2611A	100p
TDA2630	300p
TDA2640	220p
TDA2653A	250p
TDA2654	250p
TDA2670	150p
TDA2690	120p
TDA2730	250p
TDA2760	400p
TDA2780	600p
TDA2791	270p
TDA2795	250p
TDA2822M	60p
TDA3047	200p
TDA3048	250p
TDA3082	300p
TDA3083	250p
TDA3190	100p
TDA3300B	180p
TDA3301B	380p
TDA3310	120p
TDA3330	500p
TDA3410	170p
TDA3420	250p
TDA3501	400p
TDA3502	600p
TDA3505	400p
TDA3506	300p
TDA3507	400p
TDA3540	300p
TDA3541	200p
TDA3560	260p
TDA3561	200p
TDA3561A	220p
TDA3562	260p
TDA3563	350p
TDA3565	300p
TDA3566	330p
TDA3580	500p
TDA3586	750p
TDA3590	320p
TDA3591	450p

TDA3592A	350p
TDA3640	350p
TDA3651	200p
TDA3652	500p
TDA3653	150p
TDA3654	150p
TDA3710	320p
TDA3730	550p
TDA3740	600p
TDA3750	400p
TDA3760	470p
TDA3771	460p
TDA3791	400p
TDA3800	350p
TDA3803A	500p
TDA3810	300p
TDA3950	300p
TDA4050	250p
TDA4180	400p
TDA4190	250p
TDA4200	380p
TDA4280	400p
TDA4282	400p
TDA4290	250p
TDA4400	350p
TDA4420	180p
TDA4421	400p
TDA4426	250p
TDA4427	500p
TDA4431	200p
TDA4437	450p
TDA4439	300p
TDA4440	250p
TDA4442	320p
TDA4445	250p
TDA4480	280p
TDA4500	360p
TDA4501	450p
TDA4502	900p
TDA4503	300p
TDA4505	300p
TDA4510	300p
TDA4555	600p
TDA4556	650p
TDA4560	450p
TDA4600	160p
TDA4600-2	200p
TDA4601	160p
TDA4605	300p
TDA4610	400p
TDA4660	480p
TDA4950	180p
TDA5330T	380p
TDA5600	450p
TDA5660P	260p
TDA5700	200p
TDA5708	550p
TDA5709	560p
TDA5800	600p
TDA5820	480p
TDA5850	225p
TDA7000	200p
TDA7010T	120p
TDA7050	200p
TDA7052	150p
TDA7211	150p
TDA7220	150p
TDA7240	300p
TDA7241	250p
TDA7250	600p
TDA7255	600p
TDA7273	600p
TDA7274	100p
TDA7275	75p
TDA7284	100p
TDA8115	300p
TDA8140	300p
TDA8145	150p
TDA8153	370p
TDA8160	150p
TDA8170	300p
TDA8173	325p
TDA8190	280p
TDA8191	425p
TDA8196	150p
TDA8440	380p
TDA8442	280p
TDA8443	400p
TDA8451	600p
TDA8452	280p
TDA9403	250p
TDA9503	200p
TDA9513	350p
TEA1002	650p
TL061	40p
TL064	80p
TL071	38p
TL072	55p
TL074	80p
TL081	40p
TL082	46p
TL083	55p
TL084	70p
ULN2002	70p
ULN2003	69p
ULN2068	270p
ULN2804	170p
UPC20C	220p
UPC554	130p
UPC555	60p
UPC556H	80p
UPC571	220p
UPC574	60p
UPC575C2	90p
UPC576	200p
UPC577	64p
UPC580	300p
UPC592	95p
UPC595	100p
UPC596	190p
UPC1001	120p
UPC1018	170p
UPC1020	200p
UPC1023	60p
UPC1025	230p
UPC1026	95p
UPC1028	90p
UPC1031H	150p
UPC1032	60p
UPC1158H	70p
UPC1177H	250p
UPC1180C	200p
UPC1183	200p
UPC1186	80p
UPC1187	150p
UPC1188H	350p
UPC1197	140p
UPC1198H	200p
UPC1222	130p
UPC1225H	220p
UPC1230	150p
UPC1238	120p
UPC1252H	220p
UPC1263	230p
UPC1270H	250p
UPC1274V	260p
UPC1277	240p
UPC1278	240p
UPC1288V	230p
UPC1298V	320p
UPC1318	300p
UPC1335V	320p
UPC1350	115p
UPC1352	400p
UPC1358H	250p

LINEAR ICs – Cont.	
UPC1363	190p
UPC1363C	300p
UPC1364C	350p
UPC1366	250p
UPC1367	500p
UPC1370C	300p
UPC1373	85p
UPC1377C	200p
UPC1378	180p
UPC1382	110p
UPC1384	425p
UPC1387C	250p
UPC1394	120p
UPC1397	350p
UPC-1403CA	650p
UPC-1420CA	450p
UPC-1421CA	650p
UPC-1423CA	550p
UPC1470	200p
UPC1504C	400p
UPC1505C	400p
UPC-1514CA	200p
UPC-1515CA	250p
UPC1520CA	250p
UPC1536C	560p
ZN423	100p
ZN424	100p
ZN425	320p
ZN426	260p
ZN427	560p
ZN429	215p
ZN435	340p
ZN448	510p
ZN459	190p
ZN1040	640p
ZNA134H	2150p
ZNA234E	1250p
JAPANESE TRANSISTORS	
2SA473	35p
2SA490	60p
2SA505	120p
2SA509	120p
2SA550	150p
2SA562	50p
2SA603	100p
2SA606	300p
2SA608	15p
2SA634	50p
2SA636	50p
2SA640	60p
2SA673	20p
2SA684	60p
2SA699	100p
2SA708	300p
2SA715	60p
2SA720	20p
2SA725	80p
2SA726	25p
2SA733	30p
2SA747A	600p
2SA748	90p
2SA769	130p
2SA770	200p
2SA771	130p
2SA781	150p
2SA798	55p
2SA814	170p
2SA844	30p
2SA872	40p
2SA872A	50p
2SA886	90p
2SA899	60p
2SA907	650p
2SA909	500p
2SA913	120p
2SA916	30p
2SA921	50p
2SA933	40p
2SA934	40p
2SA935	40p
2SA937	40p
2SA939	140p
2SA940	50p
2SA950	25p
2SA952	50p
2SA953	60p
2SA954	75p
2SA958	70p
2SA965	60p
2SA966	70p
2SA968	70p
2SA970	50p
2SA979	85p
2SA984	50p
2SA992	30p
2SA1006	120p
2SA1008	125p
2SA1009	200p
2SA1010	225p
2SA1011	140p
2SA1012	100p
2SA1013	100p
2SA1015	20p
2SA1016	40p
2SA1018	100p
2SA1020	50p
2SA1021	80p
2SA1023	60p
2SA1026	90p
2SA1029	60p
2SA1036	60p
2SA1037	50p
2SA1038	40p
2SA1048	30p
2SA1051	300p
2SA1052	40p
2SA1060	150p
2SA1069	150p
2SA1076	280p
2SA1077	300p
2SA1081	80p
2SA1082	80p
2SA1084	100p
2SA1085	75p
2SA1091	100p
2SA1093	300p
2SA1094	190p
2SA1095	300p
2SA1096	80p
2SA1102	180p
2SA1103	200p
2SA1104	200p
2SA1105	250p
2SA1106	160p
2SA1111	120p
2SA1112	150p
2SA1115	40p
2SA1123	70p
2SA1124	80p
2SA1127	50p
2SA1133	200p
2SA1141	350p
2SA1142	150p
2SA1143	40p
2SA1145	50p
2SA1152	150p
2SA1156	150p

2SA1162	30p
2SA1169	500p
2SA1170	500p
2SA1175	40p
2SA1184	120p
2SA1186	500p
2SA1198	70p
2SA1206	100p
2SA1208	70p
2SA1209	100p
2SA1210	120p
2SA1215	600p
2SA1216	550p
2SA1217	100p
2SA1220	120p
2SA1227A	300p
2SA1232	250p
2SA1242	80p
2SA1244	120p
2SA1246	80p
2SA1249	100p
2SA1261	150p
2SA1262	160p
2SA1263	280p
2SA1264	280p
2SA1265	280p
2SA1283	60p
2SA1284	60p
2SA1285	60p
2SA1286	60p
2SA1290	150p
2SA1294	450p
2SA1295	500p
2SA1301	350p
2SA1302	300p
2SA1303	400p
2SA1304	110p
2SA1306	110p
2SA1307	160p
2SA1309	50p
2SA1315	100p
2SA1316	80p
2SA1317	30p
2SA1318	30p
2SA1321	80p
2SA1329	200p
2SA1346	30p
2SA1352	100p
2SA1353	100p
2SA1356	100p
2SA1358	130p
2SA1362	100p
2SA1370	100p
2SA1371	100p
2SA1380	100p
2SA1381	100p
2SA1382	120p
2SA1385	180p
2SA1386	400p
2SA1423	30p
2SA1442	200p
2SA1443	250p
2SA1489	300p
2SA1491	300p
2SA1493	500p
2SA1516	380p
2SA1535	175p
2SA1538	80p
2SA483	175p
2SA495	100p
2SA496	100p
2SA537	170p
2SA544	650p
2SA571	650p
2SA614	150p
2SA639	150p
2SA642	50p
2SA677	80p
2SA678	60p
2SA683	70p
2SA706	250p
2SA711	280p
2SA719	50p
2SA764	200p
2SA777	80p
2SA778	100p
2SA786	100p
2SA794	120p
2SA816	150p
2SA817	50p
2SA836	60p
2SA837	270p
2SA839	150p
2SA900	100p
2SA942	60p
2SA949	80p
2SA957	250p
2SA963	120p
2SA985	150p
2SA988	150p
2SA993	50p
2SA999	50p
2SB324	56p
2SB370	45p
2SB546	70p
2SB560	35p
2SB561	50p
2SB562	35p
2SB566	110p
2SB595	80p
2SB596	75p
2SB598	60p
2SB600	500p
2SB646A	90p
2SB647	30p
2SB648	50p
2SB649	40p
2SB688	120p
2SB703	125p
2SB705	200p
2SB707	200p
2SB718	30p
2SB718	70p
2SB727	200p
2SB754	80p
2SB755	310p
2SB772	45p
2SB774	50p
2SB775	160p
2SB791	280p
2SB795	60p
2SB825	135p
2SB861	160p
2SB882	180p
2SB886	225p
2SB950	180p
2SB951	190p
2SB1009	110p
2SB1077	180p
2SB1109	100p
2SC182	75p
2SC369	80p
2SC372	80p
2SC380	20p
2SC382	120p
2SC388A	60p
2SC394	60p
2SC403	80p
2SC454	45p
2SC458	15p
2SC460	10p
2SC461	30p
2SC491	200p
2SC495	60p
2SC496	80p
2SC497	150p
2SC515A	100p
2SC535	50p

2SC536	20p
2SC558	275p
2SC563	120p
2SC603	40p
2SC605	100p
2SC619	100p
2SC641	80p
2SC643	500p
2SC644	25p
2SC647	300p
2SC681	340p
2SC683	120p
2SC708	100p
2SC710	20p
2SC711	40p
2SC717	50p
2SC730	450p
2SC732	40p
2SC733	25p
2SC735	40p
2SC738	40p
2SC739	150p
2SC761	150p
2SC762	150p
2SC783	105p
2SC790	80p
2SC792	380p
2SC805	225p
2SC805A	250p
2SC828	25p
2SC829	20p
2SC839	25p
2SC869	120p
2SC870	100p
2SC898	275p
2SC900B	300p
2SC930	20p
2SC941	25p
2SC943	160p
2SC944	140p
2SC945	20p
2SC950	40p
2SC959	225p
2SC980	120p
2SC982	60p
2SC983	120p
2SC998	600p
2SC1000	60p
2SC1001	950p
2SC1008	50p
2SC1010	225p
2SC1012	75p
2SC1013	170p
2SC1014	140p
2SC1030	190p
2SC1047	60p
2SC1050	280p
2SC1060	90p
2SC1061	85p
2SC1070	65p
2SC1079	250p
2SC1096	60p
2SC1098	120p
2SC1103A	130p
2SC1106	180p
2SC1114	415p
2SC1115	280p
2SC1116	290p
2SC1124	270p
2SC1128	120p
2SC1150	400p
2SC1160	150p
2SC1161	110p
2SC1162	35p
2SC1164	600p
2SC1165	750p
2SC1166	100p
2SC1167	120p
2SC1170	300p
2SC1172	150p
2SC1173	45p
2SC1195	210p
2SC1212	120p
2SC1213	50p
2SC1214	40p
2SC1215	60p
2SC1216	200p
2SC1222	50p
2SC1226	75p
2SC1252	850p
2SC1275	700p
2SC1278	110p
2SC1279	30p
2SC1306	90p
2SC1308K	350p
2SC1312	40p
2SC1317	25p
2SC1318	25p
2SC1325	400p
2SC1327	20p
2SC1328	40p
2SC1342	90p
2SC1343	225p
2SC1345	60p
2SC1346	100p
2SC1358	350p
2SC1359	60p
2SC1360	70p
2SC1364	50p
2SC1383	35p
2SC1384	35p
2SC1390	55p
2SC1393	80p
2SC1394	50p
2SC1398	70p
2SC1400	50p
2SC1403	500p
2SC1407	550p
2SC1413	240p
2SC1419	150p
2SC1424	450p
2SC1426	700p
2SC1429	100p
2SC1444	275p
2SC1446	100p
2SC1447	130p
2SC1448	100p
2SC1449	120p
2SC1450	200p
2SC1454	320p
2SC1470	120p
2SC1471A	400p
2SC1472	40p
2SC1473	70p
2SC1474	125p
2SC1475	60p
2SC1505	80p
2SC1506	75p
2SC1507	140p
2SC1509	45p
2SC1514	65p
2SC1515	60p
2SC1520	60p
2SC1541	110p
2SC1545	120p
2SC1567	140p
2SC1568	75p
2SC1569	140p
2SC1570	40p
2SC1571	50p
2SC1573	50p
2SC1576	450p
2SC1580	600p
2SC1583	30p
2SC1585	270p
2SC1586	540p
2SC1617	340p
2SC1623	50p

2SC1624	140p
2SC1625	150p
2SC1626	75p
2SC1627	60p
2SC1628	75p
2SC1634	50p
2SC1664	300p
2SC1669	100p
2SC1674	50p
2SC1675	200p
2SC1678	120p
2SC1683	100p
2SC1684	45p
2SC1685	60p
2SC1729	900p
2SC1730	40p
2SC1735	70p
2SC1740	40p
2SC1741	45p
2SC1752	70p
2SC1755	90p
2SC1756	40p
2SC1758	30p
2SC1765	1000p
2SC1775	20p
2SC1781	65p
2SC1789	100p
2SC1809	40p
2SC1810	250p
2SC1815	15p
2SC1819	140p
2SC1826	40p
2SC1827	120p
2SC1829	500p
2SC1832	400p
2SC1833	40p
2SC1834	50p
2SC1844	50p
2SC1845	20p
2SC1846	100p
2SC1847	120p
2SC1855	85p
2SC1856	50p
2SC1861	400p
2SC1865	700p
2SC1870	700p
2SC1871	600p
2SC1875	260p
2SC1881	210p
2SC1890	45p
2SC1904	125p
2SC1906	30p
2SC1907	75p
2SC1909	250p
2SC1913	190p
2SC1921	60p
2SC1923	25p
2SC1929	180p
2SC1938	150p
2SC1940	110p
2SC1941	40p
2SC1942	350p
2SC1944	350p
2SC1945	350p
2SC1946	1500p
2SC1947	450p
2SC1955	900p
2SC1957	70p
2SC1959	20p
2SC1962	200p
2SC1966	1150p
2SC1967	1300p
2SC1969	160p
2SC1970	200p
2SC1971	400p
2SC1972	600p
2SC1973	150p
2SC1983	130p
2SC1984	150p
2SC1985	120p
2SC1986	160p
2SC2001	60p
2SC2002	40p
2SC2003	25p
2SC2004	60p
2SC2021	40p
2SC2022	200p
2SC2023	180p
2SC2026	60p
2SC2027	250p
2SC2028	75p
2SC2029	120p
2SC2037	100p
2SC2053	120p
2SC2055	150p
2SC2056	450p
2SC2058	40p
2SC2060	60p
2SC2061	75p
2SC2068	90p
2SC2071	140p
2SC2073	70p
2SC2075	80p
2SC2078	95p
2SC2081	950p
2SC2085	100p
2SC2086	60p
2SC2092	100p
2SC2094	1200p
2SC2097	2300p
2SC2098	600p
2SC2099	250p
2SC2102	1900p
2SC2118	1100p
2SC2120	50p
2SC2131	550p
2SC2139	350p
2SC2141	150p
2SC2149	500p
2SC2150	400p
2SC2153	70p
2SC2166	80p
2SC2168	175p
2SC2181	2100p
2SC2188	70p
2SC2199	600p
2SC2200	250p
2SC2221	650p
2SC2222	1350p
2SC2228A	50p
2SC2229	25p
2SC2230	80p
2SC2233	100p
2SC2235	60p
2SC2236	30p
2SC2237	600p
2SC2238	70p
2SC2240	25p
2SC2245	1050p
2SC2258	120p
2SC2259	80p
2SC2270	75p
2SC2271	60p
2SC2274	40p
2SC2275	50p
2SC2278	120p
2SC2283	800p
2SC2284	1200p
2SC2287	900p
2SC2290	1800p
2SC2291	125p
2SC2295	60p
2SC2298	120p
2SC2307	500p
2SC2308	40p
2SC2312	300p
2SC2314	70p
2SC2316	150p

2SC2320	40p
2SC2324	120p
2SC2329	480p
2SC2331	150p
2SC2333	200p
2SC2334	240p
2SC2335	120p
2SC2344	150p
2SC2347	60p
2SC2353	120p
2SC2360	120p
2SC2361	150p
2SC2362	50p
2SC2365	500p
2SC2363	6000p
2SC2369	100p
2SC2371	45p
2SC2373	210p
2SC2383	50p
2SC2389	45p
2SC2407	110p
2SC2408	120p
2SC2412K	50p
2SC2413	50p
2SC2429	900p
2SC2431	900p
2SC2437	1000p
2SC2440	350p
2SC2458	40p
2SC2459	50p
2SC2461	400p
2SC2462	50p
2SC2470	65p
2SC2481	120p
2SC2482	40p
2SC2483	120p
2SC2484	240p
2SC2491	200p
2SC2495	1900p
2SC2498	50p
2SC2500	80p
2SC2502	200p
2SC2509	800p
2SC2516	125p
2SC2519	60p
2SC2523	500p
2SC2527	300p
2SC2534	150p
2SC2535	300p
2SC2538	100p
2SC2539	1000p
2SC2540	1900p
2SC2542	300p
2SC2545	55p
2SC2546	75p
2SC2547	65p
2SC2550	70p
2SC2551	70p
2SC2552	150p
2SC2553	200p
2SC2555	150p
2SC2562	90p
2SC2563	200p
2SC2564	230p
2SC2565	260p
2SC2568	120p
2SC2570	60p
2SC2571	350p
2SC2577	125p
2SC2578	220p
2SC2579	130p
2SC2580	240p
2SC2581	290p
2SC2588	600p
2SC2590	75p
2SC2591	140p
2SC2592	200p
2SC2603	40p
2SC2608	800p
2SC2610	85p
2SC2611	40p
2SC2613	250p
2SC2615	400p
2SC2621	90p
2SC2625	380p
2SC2626	600p
2SC2630	1900p
2SC2631	65p
2SC2634	45p
2SC2635	450p
2SC2636	50p
2SC2637	120p
2SC2640	1800p
2SC2653	100p
2SC2654	180p
2SC2655	75p
2SC2656	550p
2SC2660	150p
2SC2665	200p
2SC2668	50p
2SC2671	120p
2SC2681	270p
2SC2682	120p
2SC2688	70p
2SC2690	120p
2SC2694	3200p
2SC2696	2600p
2SC2705	70p
2SC2710	50p
2SC2712	50p
2SC2716	50p
2SC2719	80p
2SC2721	120p
2SC2738	200p
2SC2740	450p
2SC2749	350p
2SC2750	300p
2SC2751	400p
2SC2752	140p
2SC2753	100p
2SC2767	300p
2SC2769	400p
2SC2773	700p
2SC2774	600p
2SC2785	60p
2SC2786	50p
2SC2787	50p
2SC2791	650p
2SC2792	550p
2SC2793	700p
2SC2808	40p
2SC2810	360p
2SC2812	40p
2SC2814	40p
2SC2824	75p
2SC2825	900p
2SC2826	200p
2SC2827	200p
2SC2832	300p
2SC2834	400p
2SC2837	360p
2SC2839	40p
2SC2853	70p
2SC2876	120p
2SC2877	120p
2SC2878	40p
2SC2879	3200p
2SC2883	60p
2SC2898	350p
2SC2899	120p
2SC2901	60p
2SC2909	60p
2SC2911	120p
2SC2912	120p
2SC2915	8200p
2SC2921	650p
2SC2922	610p
2SC2928	550p
2SC2929	280p

2SC2934	75p
2SC2937	250p
2SC2938	400p
2SC2939	400p
2SC2944	620p
2SC2958	75p
2SC2960	60p
2SC2962	800p
2SC2979	160p
2SC2987	325p
2SC2988	250p
2SC2995	60p
2SC2999	50p
2SC3001	1400p
2SC3012	300p
2SC3019	320p
2SC3021	1250p
2SC3025	50p
2SC3026	550p
2SC3030	750p
2SC3037	250p
2SC3038	125p
2SC3039	140p
2SC3040	260p
2SC3042	300p
2SC3057	150p
2SC3058	2500p
2SC3059	900p
2SC3060	1100p
2SC3061	1600p
2SC3068	60p
2SC3070	120p
2SC3074	200p
2SC3075	150p
2SC3077	120p
2SC3086	150p
2SC3089	150p
2SC3098	200p
2SC3099	100p
2SC3101	750p
2SC3102	2800p
2SC3104	1650p
2SC3105	3600p
2SC3112	35p
2SC3114	40p
2SC3116	75p
2SC3117	120p
2SC3122	50p
2SC3130	100p
2SC3133	600p
2SC3148	410p
2SC3149	180p
2SC3150	200p
2SC3151	230p
2SC3152	120p
2SC3153	250p
2SC3156	400p
2SC3157	200p
2SC3158	260p
2SC3159	200p
2SC3164	350p
2SC3169	200p
2SC3170	300p
2SC3173	180p
2SC3175	200p
2SC3178	340p
2SC3179	160p
2SC3181	140p
2SC3182	120p
2SC3199	50p
2SC3209	120p
2SC3210	550p
2SC3211	300p
2SC3212	350p
2SC3225	100p
2SC3244	80p
2SC3246	70p
2SC3257	275p
2SC3259	350p
2SC3260	320p
2SC3261	400p
2SC3262	280p
2SC3263	350p
2SC3264	510p
2SC3266	50p
2SC3268	110p
2SC3269	50p
2SC3270	50p
2SC3277	280p
2SC3280	250p
2SC3281	250p
2SC3284	600p
2SC3293	85p
2SC3296	125p
2SC3298	120p
2SC3299	120p
2SC3300	140p
2SC3303	120p
2SC3306	150p
2SC3307	600p
2SC3309	150p
2SC3316	280p
2SC3317	350p
2SC3318	400p
2SC3320	480p
2SC3327	60p
2SC3331	40p
2SC3333	120p
2SC3336	850p
2SC3345	170p
2SC3346	200p
2SC3352	200p
2SC3353	400p
2SC3355	90p
2SC3356	120p
2SC3358	80p
2SC3361	50p
2SC3376	300p
2SC3377	50p
2SC3378	120p
2SC3383	80p
2SC3387	550p
2SC3393	80p
2SC3399	50p
2SC3400	40p
2SC3401	50p
2SC3402	50p
2SC3409	400p
2SC3412	800p
2SC3416	80p
2SC3417	90p
2SC3419	120p
2SC3420	120p
2SC3422	110p
2SC3423	100p
2SC3446	150p
2SC3447	200p
2SC3450	350p
2SC3456	200p
2SC3457	200p
2SC3459	250p
2SC3460	250p
2SC3461	350p
2SC3466	300p
2SC3467	70p
2SC3468	70p
2SC3481	600p
2SC3482	400p
2SC3486	350p
2SC3502	120p
2SC3503	90p
2SC3504	120p
2SC3505	600p
2SC3506	600p
2SC3507	650p
2SC3509	750p
2SC3518	120p
2SC3519	550p
2SC3526	120p

2SC3531	225p
2SC3547	100p
2SC3549	200p
2SC3552	300p
2SC3568	200p
2SC3583	170p
2SC3584	200p
2SC3595	220p
2SC3596	280p
2SC3604	650p
2SC3605	60p
2SC3606	100p
2SC3607	150p
2SC3608	120p
2SC3631	130p
2SC3636	280p
2SC3651	600p
2SC3657	400p
2SC3659	600p
2SC3668	120p
2SC3675	160p
2SC3678	280p
2SC3679	200p
2SC3680	380p
2SC3685	450p
2SC3687	650p
2SC3688	750p
2SC3691	150p
2SC3692	150p
2SC3705	120p
2SC3715	480p
2SC3717	120p
2SC3719	150p
2SC3729	450p
2SC3743	270p
2SC3746	120p
2SC3747	120p
2SC3752	250p
2SC3769	700p
2SC3781	150p
2SC3783	600p
2SC3787	100p
2SC3789	75p
2SC3790	120p
2SC3796	200p
2SC3798	220p
2SC3807	120p
2SC3811	80p
2SC3832	200p
2SC3833	250p
2SC3853	220p
2SC3854	250p
2SC3855	280p
2SC3857	500p
2SC3858	550p
2SC3870	200p
2SC3883	280p
2SC3890	150p
2SC3895	400p
2SC3897	650p
2SC3907	420p
2SC3909	450p
2SC3927	550p
2SC3946	120p
2SC3950	120p
2SC3953	120p
2SC3954	150p
2SC3973	275p
2SC3975	275p
2SC3987	220p
2SC3996	1200p
2SC4006	100p
2SC4020	280p
2SC4023	325p
2SC4056	350p
2SC4106	200p
2SC4123	450p
2SC4124	250p
2SC4169	60p
2SC4236	550p
2SC4237	750p
2SC4242	200p
2SC4262	50p
2SC4301	550p
2SD198	140p
2SD199	280p
2SD200	210p
2SD201	260p
2SD257	195p
2SD313	40p
2SD315	75p
2SD325	30p
2SD330	110p
2SD348	460p
2SD357	40p
2SD358	40p
2SD371	240p
2SD380	650p
2SD381	80p
2SD388	170p
2SD389	90p
2SD400	14p
2SD401	50p
2SD402	120p
2SD415	120p
2SD424	400p
2SD426	150p
2SD427	350p
2SD438	45p
2SD467	15p
2SD468	25p
2SD471	75p
2SD525	50p
2SD526	70p
2SD545	60p
2SD549	120p
2SD551	400p
2SD556	500p
2SD560	150p
2SD571	80p
2SD575	530p
2SD600	30p
2SD601	40p
2SD602	60p
2SD612	50p
2SD613	70p
2SD636	10p
2SD637	40p
2SD638	60p
2SD639	60p
2SD640	350p
2SD642	50p
2SD655	60p
2SD661	60p
2SD666	70p
2SD667	70p
2SD668	120p
2SD669	40p
2SD673	350p
2SD676	250p
2SD716	80p
2SD717	180p
2SD718	100p
2SD722	240p
2SD725	270p
2SD734	60p
2SD-741	120p
2SD-743	130p
2SD-756	100p
2SD-757	120p
2SD-758	140p
2SD-762	140p
2SD-763	140p
2SD-768	180p
2SD-772	200p
2SD-773	40p
2SD-774	60p
2SD-777	400p
2SD-784	650p

2SD-786	100p
2SD-787	80p
2SD-788	100p
2SD-789	80p
2SD-792	400p
2SD-794	100p
2SD-795A	140p
2SD-811	450p
2SD-819	400p
2SD-820	450p
2SD-821	550p
2SD-822	400p
2SD-826	100p
2SD-836	60p
2SD-836A	60p
2SD-837	80p
2SD-838	400p
2SD-841	160p
2SD-844	200p
2SD-845	250p
2SD-850	260p
2SD-856	48p
2SD-858	250p
2SD-863	60p
2SD-864	200p
2SD-866	120p
2SD-866A	140p
2SD-868	450p
2SD-870	400p
2SD-871	450p
2SD-879	60p
2SD-880	40p
2SD-882	80p
2SD-892A	100p
2SD-894	120p
2SD-895	200p
2SD-896	200p
2SD-900	400p
2SD-905	450p
2SD-916	130p
2SD-917	300p
2SD-921	320p
2SD-923	360p
2SD-946	120p
2SD-947	100p
2SD-950	300p
2SD-951	350p
2SD-957A	520p
2SD-958	60p
2SD-965	100p
2SD-970	170p
2SD-973	60p
2SD-973A	70p
2SD-985	120p
2SD-986	120p
2SD-1012	60p
2SD-1020	40p
2SD-1021	120p
2SD-1022	400p
2SD-1024	130p
2SD-1030	75p
2SD-1031	130p
2SD-1037	750p
2SD-1046	200p
2SD-1047	225p
2SD-1051	130p
2SD-1060	130p
2SD-1062	150p
2SD-1063	200p
2SD-1064	250p
2SD-1065	200p
2SD-1069	150p
2SD-1071	450p
2SD-1073	350p
2SD-1088	150p
2SD-1094	520p
2SD-1110	225p
2SD-1111	60p
2SD-1113	225p
2SD-1128	200p
2SD-1133	100p
2SD-1135	150p
2SD-1138	80p
2SD-1140	40p
2SD-1142	350p
2SD-1148	175p
2SD-1151	50p
2SD-1159	90p
2SD-1160	150p
2SD-1163A	220p
2SD-1164	120p
2SD-1168	425p
2SD-1169	280p
2SD-1173	350p
2SD-1185	400p
2SD-1186	400p
2SD-1187	250p
2SD-1189	125p
2SD-1190	150p
2SD-1191	120p
2SD-1192	90p
2SD-1196	150p
2SD-1197	150p
2SD-1207	50p
2SD-1210	280p
2SD-1211	120p
2SD-1218	75p
2SD-1223	75p
2SD-1225	120p
2SD-1227	40p
2SD-1229	250p
2SD-1237	300p
2SD-1246	30p
2SD-1247	40p
2SD-1248	270p
2SD-1251	180p
2SD-1263	90p
2SD-1264	120p
2SD-1265	75p
2SD-1266	180p
2SD-1267	100p
2SD-1267A	125p
2SD-1271	40p
2SD-1271A	225p
2SD-1272	200p
2SD-1273	50p
2SD-1275	50p
2SD-1276	200p
2SD-1277	190p
2SD-1279	600p
2SD-1288	175p
2SD-1289	300p
2SD-1291	400p
2SD-1292	60p
2SD-1297	425p
2SD-1302	40p
2SD-1308	140p
2SD-1309	140p
2SD-1310	140p
2SD-1313	1000p
2SD-1326	200p
2SD-1328	60p
2SD-1347	70p
2SD-1348	85p
2SD-1350	150p
2SD-1376	125p
2SD-1379	100p
2SD-1380	100p
2SD-1383	100p
2SD-1384	50p
2SD-1389	200p
2SD-1390	350p
2SD-1391	450p
2SD-1392	150p
2SD-1395	150p
2SD-1396	240p
2SD-1397	175p
2SD-1398	130p
2SD-1399	300p

2SD-1400	280p
2SD-1402	280p
2SD-1404	125p
2SD-1406	80p
2SD-1407	160p
2SD-1408	125p
2SD-1409	170p
2SD-1412	100p
2SD-1413	175p
2SD-1414	700p
2SD-1415	190p
2SD-1417	125p
2SD-1425	360p
2SD-1426	160p
2SD-1427	380p
2SD-1428	360p
2SD-1429	410p
2SD-1430	280p
2SD-1431	400p
2SD-1432	400p
2SD-1433	750p
2SD-1438	140p
2SD-1439	270p
2SD-1441	280p
2SD-1445	200p
2SD-1448	140p
2SD-1450	60p
2SD-1451	260p
2SD-1452	350p
2SD-1453	140p
2SD-1455	250p
2SD-1467	220p
2SD-1459	120p
2SD-1468	60p
2SD-1479	200p
2SD-1487	225p
2SD-1491	100p
2SD-1494	300p
2SD-1496	450p
2SD-1497	350p
2SD-1505	120p
2SD-1507	60p
2SD-1509	100p
2SD-1511	100p
2SD-1519	250p
2SD-1521	70p
2SD-1541	350p
2SD-1548	450p
2SD-1554	500p
2SD-1565	350p
2SD-1556	700p
2SD-1564	100p
2SD-1565	75p
2SD-1571	200p
2SD-1572	100p
2SD-1576	450p
2SD-1577	480p
2SD-1579	120p
2SD-1589	100p
2SD-1590	100p
2SD-1591	310p
2SD-1593	125p
2SD-1595	160p
2SD-1604	200p
2SD-1608	210p
2SD-1609	70p
2SD-1630	50p
2SD-1632	500p
2SD-1633	125p
2SD-1637	50p
2SD-1647	50p
2SD-1649	260p
2SD-1650	300p
2SD-1651	270p
2SD-1663	450p
2SD-1664	40p
2SD-1666	120p
2SD-1667	120p
2SD-1668	120p
2SD-1677	300p
2SD-1730	350p
2SD-1732	400p
2SD-1739	350p
2SD-1740	125p
2SD-1748	90p
2SD-1760	80p
2SD-1762	70p
2SD-1773	160p
2SD-1783	100p
2SD-1796	180p
2SD-1815	100p
2SD-1825	120p
2SD-1843	100p
2SD-1846	350p
2SD-1849	325p
2SD-1850	325p
2SD-1858	40p
2SD-1877	250p
2SD-1878	300p
2SD-1879	275p
2SD-1884	300p
2SD-1886	450p
2SD-1887	450p
2SD-1896	300p
2SD-1910	280p
2SD-1911	400p
2SD-1913	50p
2SD-1929	60p
2SD-1939	75p
2SD-1941	500p
2SD-1959	280p
2SD-1961	50p
2SD-1978	50p
2SD-1984	150p
2SD 2012	50p
2SD-2046	50p
2SJ-48	425p
2SJ-49	425p
2SJ-50	425p
2SJ-56	700p
2SJ-74	60p
2SJ-75	280p
2SJ-76	220p
2SJ-77	350p
2SJ-79	225p
2SJ-103	75p
2SJ-106	40p
2SJ-108	60p
2SJ-115	525p
2SJ-116	1000p
2SJ-117	550p
2SJ-118	600p
2SJ-119	700p
2SJ-122	800p
2SJ-161	650p
2SJ-162	680p
2SK-19	45p
2SK-40	50p
2SK-49	50p
2SK-56	100p
2SK-68	100p
2SK-73	75p
2SK-106	40p
2SK-107	40p
2SK-109	120p
2SK-118	50p
2SK-125	100p
2SK-133	650p
2SK-134	415p
2SK-135	415p
2SK-147	160p
2SK-150	150p
2SK-162	115p
2SK-163	40p
2SK-168	40p
2SK-176	800p
2SK-192	45p
2SK-196	150p
2SK-197	140p

2SK-214	170p
2SK-216	200p
2SK-217	35p
2SK-218	400p
2SK-240	140p
2SK-270	50p
2SK-294	350p
2SK-310	200p
2SK-312	750p
2SK-315	70p
2SK-320	120p
2SK-322	140p
2SK-323	130p
2SK-358	300p
2SK-370	40p
2SK-371	40p
2SK-386	600p
2SK-388	850p
2SK-405	450p
2SK-413	500p
2SK-414	500p
2SK-415	500p
2SK-429	180p
2SK-511	450p
2SK-513	325p
2SK-517	200p
2SK-531	350p
2SK-534	700p
2SK-537	900p
2SK-538	450p
2SK-539	1100p
2SK-555	400p
2SK-556	500p
2SK-567	400p
2SK-566	475p
2SK-695	550p
2SK-719	300p
2SK-724	600p
2SK-725	600p
2SK-727	1200p
2SK-735	600p
2SK-758	300p
2SK-787	1100p
2SK-794	500p
2SK-872	950p
2SK-903	500p
2SK-1057	600p
2SK 1058	900p
2SK-45	100p
2SK-51	100p
2SK-59	100p
2SK-73	60p
2SK-74	50p
2SK-77	50p
2SK-81	50p
2SK-85	160p
2SK-87	45p
2SK-88	70p
2SK-121	150p
2SK-129	175p
2SK-165	225p
2SK-166	300p

COMPUTER IC's	
2114	150p
2532	200p
2716	100p
2732	200p
2732A	220p
2764	150p
27C64	200p
27128	150p
27256-25	150p
27512	300p
4116	40p
4164-15	80p
4164-12	90p
4164-10	100p
41256-15	80p
41256-12	100p
41256-10	110p
41464-12	150p
41464-10	200p
6116	80p
6264-15	160p
6264-12	200p
6264-10	210p
62256-12	300p
6502	300p
6502A	360p
65C02	930p
6522	280p
6551	380p
6800	210p
6802	220p
6803	500p
6808	500p
6809	500p
6810	150p
6818	380p
6840	290p
6845	200p
6850	90p
8080A	380p
8085A	300p
8086	500p
8088	480p
8156	300p
81LS96	130p
81LS97	130p
81LS98	130p
8224	240p
8226	240p
8243	250p
8250	750p
8251	200p
8253	160p
8255	160p
8256	700p
8257	220p
8271	3400p
8279	270p
8283	400p
8284	440p
8287	260p
8288	650p

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

SIMMS

256K × 9-80	1000p
256K × 9-70	1100p
1MB × 9-80	3000p
1MB × 9-70	3200p

SIPS

256K × 9-80	1100p
256K × 9-70	1200p
1MB × 9-80	3100p
1MB × 9-70	3200p

OPTO COUPLERS

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

BRIDGE RECTIFIERS

W005 1A/50V	16p
W01 1A/100V	18p
W02 1A/200V	19p
W04 1A/400V	21p
W06 1A/600V	23p
W08 1A/800V	28p
BR81D 2A/100V	33p
BR82D 2A/200V	33p
BR84D 2A/400V	37p
BR86D 2A/600V	43p
BR88D 2A/800V	43p
BR32 3A/200V	43p
BR34 3A/400V	43p
BR36 3A/600V	44p
BR62 6A/200V	80p
BR64 6A/400V	72p
BR251 25A/100V	150p
BR252 25A/200V	165p
BR254 25A/400V	185p
BR256 25A/600V	200p
BR258 25A/800V	240p
BR351 35A/100V	185p
BR352 35A/200V	200p
BR354 35A/400V	220p
BR356 35A/600V	230p
BR358 35A/800V	260p
EY164 1 5A/100V	40p
EY179 1 5A/800V	40p

TRIACS

TIC206D 4A/400V	60p
TIC225D 6A/400V	69p
TIC226D 8A/400V	68p
TIC236D 12A/400V	85p
TIC246D 16A/400V	105p
TIC253D 20A/400V	190p
TIC263D 25A/400V	205p
TI2800D 8A/400V	52p

THYRISTORS

2N5061 0.8A/60V	20p
C106D 4A/400V	28p
TIC116C 8A/300V	59p
TIC116D 8A/400V	70p
TIC116M 8A/600V	79p
TIC126D 12A/400V	75p
TIC 126M 12A/600V	90p
BR103	37p
BR303	85p
BT106	180p
BT116	80p
BT119	100p
TIC44	22p
T7088	200p
T7089	200p
T7127	200p
15/80H	230p
15/85R	230p
SG264	800p
SG613	800p

SERVICE AIDS

SERVISOL PRODUCTS

VIDEO HEAD CLEANER	140p
SWITCH CLEANER	150p
SILICONE GREASE	170p
FREEZE IT	170p
FOAM CLEANER	170p
ANTI-STATIC	170p
AEROKLEANE	140p
AERO DUSTER	170p
PLASTIC SEAL	160p
GLASS CLEANER	160p
COLDKLENE	160p

IF YOU PURCHASE MORE THAN ONE SERVISOL PRODUCT P&P WILL BE CHARGED AT 300p

GRANDATA LTD
K.P. HOUSE, UNIT 15,
POP IN COMMERCIAL CENTRE,
SOUTHWAY, WEMBLEY,
MIDDLESEX,
ENGLAND HA9 0HB
Tel: 081-900 2329 Fax: 081-903 6126
FOR EVEN MORE BARGAINS

SOLDERING IRONS

ANTEX
- 25 Watt 240V ac SOLDERING IRON (XS25W 240V) £8.00
- 15 Watt 240V ac SOLDERING IRON (X15W 240V) £8.00
- 25 Watt SPARE ELEMENT £4.50
- 15 Watt SPARE ELEMENT £4.50

SOLDERING IRON STAND

- SOLDERING STAND (Made by ANTEX) £3.50
- SPARE SPONGE £0.55

SOLDER

- 18 SWG 500 GRAMMES £5.00
- 20 SWG 500 GRAMMES £6.50
- 22 SWG 500 GRAMMES £7.00

DESOLDERING AIDS

- DESOLDER PUMP £3.20
- SPARE NOZZLE £0.60
- SOLDER MOP Standard Gauge 1.2mm £0.60

VIDEO HEADS

AIWA
- AV 66/AV 77 £14.00
- G700 £12.00
- G900 £22.00

AKAI
- VS-105/112/115/116/125/126/201/220/250/301/303/304/205/244/247/248/VSP £15.00
- VP7100/VP77/VS9300/VS9500/9800 £6.50
- VP88/VS1/2/4/5/10/VS9700/VSP1 £15.00
- VS35/37/38/53/55/56/66/765/767/768 £26.00
- VS512/515/516 £28.00
- VS465 £30.00
- VS11/12 £20.00
- VS6/8/9 £30.00
- VSX9 £32.00

ALBA
- VCR4000/5000/6000 £21.00

AMSTRAD
- VCR 4500/5200/9000/TVR1 £11.00
- VCR 7000 £11.00
- VCR 6000/6100 £13.00
- TVR2/TVR3/VCR4600/VCR4600 MKII/VCR4700 £11.50

AUTHENTIC
- N850 £8.00

AWA
- ATVI £8.00

BAIRD
- 8900/8901/8902/8903/8906/8922/8928 £6.50
- 8904/8923/8924/8925/8929/8935/8941/8943/8944 £6.50
- 8909/8912 £8.00
- 8930/8931/8933/8940 £8.00
- 8942 £23.00
- 8945 £20.00
- 8947/8948 £16.00

BAIRD
- 8950 £17.00

BOSCH BAUER
- VRP20 £10.00
- VRP25 £10.00
- VRP30 £33.50

CANON
- VR10 £10.00
- VR30A/30B/30E/40A £33.50

DAEWOO
- 912 £22.00
- VCP 11 RAF £22.00

DECCA
- 8300 £10.00
- 8400/8500 £6.50

FUNAI
- E11/VIP1000/VP1400/VCR4000/V1/2S/VCR4500/4800/VCR5200/5600/6400/6600/VIP3000/E1100 £12.00
- VCR4600/5400/5800 £12.00
- VCR5480/5843 £22.00
- VCR6800/6803 £18.00

FISHER
- FVHP510/520/530/615/622/710/715/720/721/722/910/FVHP620/711/905/906/908/911/915/916/5000/FVHP420/5005/5050/5075/5001/618/730/830/918 £12.25
- VBS3500/7500/7600/9900/VBS3500/7100/7600/9900/VBR330 £20.00
- VBS7000/VBS7100/VBS9000 £22.00
- FVH711/715/721/722/FVHD720 £12.00
- FVHP725/830 £25.00
- FVHP990 £27.00
- FVHP975 £24.00

FIDELITY
- HQS200/VCR600/6100 £16.00
- VCR100 £12.00
- VTR1000 £13.00

GOLDSTAR
- 8000 3HSSDB £19.00
- GVH51/GVH1221/VCP4000/VCP4100/VCP4200 £18.00
- GHV1232/1245/1246/8210/8215/GHVP1240/1241/GHVP1247/1248/VCP400 £16.50

G.E.C.
- 4000H/4001H/4002H £16.00
- V4001H/V4004 £16.00

GRANADA
- CS1/DS2 £21.50
- VHSAH1 £13.00
- VHSAH3 £31.00
- VHSAN3 £8.00
- VHSAY3 £14.00
- VHSBH1/CH1 £21.00
- VHSBP1 £8.50
- VHSBY3 £26.00
- VHSDS2 £16.00
- VHSEH2 £21.00
- VHSEY1/EY2 £14.00
- VHSFG2/FG4 £16.00
- VHSFS1/FS2 £13.00
- VHSTJ1/TJ2/TJ3/WJ3/VHSYJ2 £7.00
- VHSVH4/WH1/XH1/YH2 £16.00
- VHSWJ1/XJ3 £7.00

GRAETZ
- 4312/4605/4905/4912/4913/P4833/TR4605/4812/4905/4912/TR4913/4914/4943 £6.50
- 4935/4943/4963/4985/4993/TR4833/4935/4985/4993 £6.50
- 4920/4927/4930 £17.00
- 4946/TR4906/4916 £16.00
- TR4994 £23.00
- TR4995 £33.00

GRUNDIG
- VS410/440/450/460/500/505/510/520/521/530 £17.00
- BARCELONA/MVS400/440/500/600/SE5100/6100/TVR4500/VS400/440/500/505/510/518/600/610 £18.00
- MADRID/SE5140/VS540/VS5480 £35.00
- MVS550/620/630/640 £38.00
- VS120 £25.00

HINARI
- VXL2/VXL3/VXL4/VXL20/VXL25/VXL35 £11.50
- VXL5/V20H £13.00
- VXL6 £18.00
- VXL7 £22.00
- VXL8/VXL9/VXL10/VXL11/VTV100 £18.50

HITACHI
- VT11/VT14/16/30/33/34/330/340/503/640/5030 £12.00
- VT7/VT17/VT18/VT19 £23.50
- VT35/VT38/VT39 £24.00
- VT100/110/111/112/113/115/118/120/125/128/220/225/VT400/405/410/413/414/415/418/510/518/520/525/526/VTM625/626 £16.00
- VT3000 £10.00
- VT4000/4200/5000/5500 £12.00
- VT77/680/3000/6500/7000/8000/8030/8040/8100/8300/VT8500/8700/9000/9300/9500/9700/9900 £12.00
- VT8/VT9/VT56/VT57 £34.00
- VT65 £26.00
- VT130/VT135/VT138/VT145/VT250/VT255/VT258/VT420/425/426/428/430/435/438/535/536/VTL301/VTM630/635/636 £21.00
- VT52/61E/VT62E/VT63/VT64/VT640 £15.00
- VT150 (4 HEAD) £27.00
- VT530 £25.00

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

JVC 3HSS
- HR2200/HR3300/HR3320/HR3330/HR3350/HR3360/HR3660/HR3750/HR3860/HR4100 £6.50
- 3292/8903/8908/8901/8902/8903/8606/8922/8923/3VO1/3V06/3V22 £6.50
- HR3660/HR7600/HR7610/HR7650/HR7700/HRD110/HRD111/HRD120/HRD121/HRD220/HRD225/HRS100 £6.50

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

FERGUSON
- 8844/8943/3V42/3V44/3V45/3V46/3V47/3V52/3V54/3V55/3V56/3V57 £15.50
- 8950/8951/3V64/FB10/FV11/3V65/FV20/FV21/FV22/FV26 £17.00
- 3V48 £24.50
- 3V43/3V53 £31.50
- 8930/8940/3V29/3V30 £7.50
- 8945 £24.00
- 3V00 £10.00
- FV31 £22.00
- FV37 £38.00

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

JVC & FERGUSON
- 3V32/8942/HR7655 £23.00
- HRD180/230/3V59/FV12L/FV20B/FV22/26/30/32/33 £30.50
- HRD370/3V58/FV13H/HRD430/HRD470 £27.00
- HRD530/700/FV14T £33.50
- GRC1/GRC2/3V41 £30.00

LOGIK
- VR960 £16.00
- VR950 £16.00

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

LUXOR
- 9225 £21.50

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

MITSUBISHI
- HS303/HS304/HS320/HS700 £16.00
- HS306/HS318/HS710 £18.00
- HS307 £27.00
- HS319 £26.00
- HS330 £26.00
- HS400 £29.00
- HS349 £28.00
- HS411 £29.00
- HSE30 £24.00
- HS338 £24.00
- HSE11 £23.00
- HS300/HS301/HS302/HS310 £17.00
- HS200 £6.50
- HS337/HS347 £17.00

NATIONAL PANASONIC 4HSS-3HSSN
- NV3000/NV300/NV7200/NV333/NV7500/NV7800/NV7850/NV322/NV332/NV340/NV390/NV2000/NV2010/NV7000/NV8170/NV8200/NV8400/NV8600/NV8610/NV8620 £6.25

NATIONAL
- NV777/NV330 £17.00
- NV430/AG1000 £11.00
- NV280/NV460/470/480 £16.50
- NV730/NV770 (4 HEAD) £18.50
- NV336 £18.50
- NV180/NVD48 £23.00
- NV370/NV380/NV100/NV630 £8.50
- NV788 £36.00
- NV810/NV830 £27.00

NATIONAL Cont.
- NV850/NV950 £30.00
- NV870/NV890/NV970 £36.00
- NVG33/NVG46/NVL23/NVL25/NVL28 £24.00
- NVG30/NVG31/NVG40/NVG130
- NVJ30/NVL20 £18.00
- NVG10/NVG11/NVG12/NVG14/NVG16/NVG120/NV250/NV280/NV450/NV465 £16.50
- NVG18 £22.00
- NVG20/NVG21/NVG22/NVG25/NVG28/NVG200/NVD48 £22.00
- NVG50/NVG300 £30.00
- NVG45/NVG46 £30.00
- NVH70 £50.00
- NV688 £25.50
- NV600 £23.00
- AG-6800/6810 £39.00
- AG-6100/6200/6300 £32.00
- NVH65 £50.00
- NVG7/NVG9/NV230 £18.00
- NV780 £36.00
- NVG15/NVG400 £48.00
- NVM7/NVMC20/NVF70 £52.00

N.E.C.
- N9011/N9012/N9013E/N9014E/N9014G/N9015/N9016/N901A/N902A/N9033/N9034/N9054/N9063/N9065/N9066/N906A £20.00
- N911A/N915A/N916A/N917 £27.00
- PCV754/PV2300/PV2400/PV760/PV794/PV770/PV774/PVC763E £18.00
- N380/N381/N830/N831/N832/N833/N834/N835/N836 £7.00
- 8261/AH1 (for model DX3000) £45.00
- N895 £31.50

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

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

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

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

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

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

SAMSUNG
- SVX301/VB900/VB910/VVT510/VT320/VT5600/VX510/VX511/VX520/VX616/VX626/VX627/VX717/SV716/717/SVX303/305/VB510/520/610/616/617/619/620/626/627/629/710/971/V1520/616/621/626/900/710/VX617/619/629/710/712/VX720/730/970/971/972 £19.00
- VB770/V1730/770/VK8220/VX750/770/8225 £21.00

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

SHARP
- VC300/VC393/VC496 £3.00
- VC488 £48.00
- VC779 £20.00
- VC789/VC790 £32.00
- VC300/VC381/VC383/VC386/VC387/VC388/VC482/VC483/VC486/VC3300/VC8381/VC9100/VC9300/VC9500/VC9700/VC9400/VC9600/VC200/220/384/385/471/477/481 £13.00
- VC582/VC583/VC651/VC681/VC750/VC780/VC781/VC683/VC684/402/500/571/673/581/584/585/600/682/685/693/VC700/772/7810/782/7822/783/8481 £13.00
- VC6000/VC6200/VC6300/VC7300/VC7700/VC7750/VC8000/VC8300 £20.00
- VC793 £36.00
- VC473/785/786 £25.00
- VC699/VCA501/VCA602 £29.00

SONY
- DSR-19R (FOR SL-T 9ME) £39.00
- DSR-21R (FOR SLC 8-C9) £30.00
- DSR-35R (FOR C20/C30/C40/SLF1UB/SLF1E) 2 PIN SLC24PS/SLC33E/SLC44PS/SLF30PF/SLF60PS/SLK85/SLT20ME/SLT30ME £15.00
- DSR-43R (FOR SLC7 RANGE/SL5000/SL5100/SL3000) 1 PIN SLC6E/SL36ES/SL37E £13.00
- SL3000/8000/8080/SLC5E/SLT7ME £16.00
- SLV201/202 £29.50
- SLK95/SLT50ME £29.00

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

TRIUMPH
- VR9500/VR9501/VR9525 £13.00

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

VCR PINCHROLLERS

AKAI
- VS9300, VS9500, VS9700, VS9800 BP7100, VP77 £2.50
- VS1, VS2, VS3, VS4, VS5, VS6, VS9, VS10, VS8, VS15 £2.50
- VS105, VS112, VS115, VS116, VS126, VS244, VS245, VS247, VS248, VS515, VS516, VS205 £2.50
- VS201, VS301, VS303, VS304, VS603, VS606, VS607, VP58-P82 £2.50
- VS125, VS155, VS165, VS220, VS240, VS250, VS512, VSX9 £2.50

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

AIWA
- AV66, AV77 £2.50
- G700, G900 £2.50

ALBA
- VCR300X, VCR4000 £2.50
- VCR5000, VCR600 £2.50

AUTHENTIC
- N850 £2.50

BLAUPUNKT
- RVT100, 200, 202, 222, 224, 301, 306, 307, RTV309, 311, 312, 315, 316, 317, 319, 320, 328, RTV404, 414, 434, 444, 478, 707, RTX100 £2.50
- RTV211, 214, 321, 322, 348, RTX250, 260 £2.50
- RTV324, 325 £2.50
- RTV330, 454,520, 530, 535, 560, 660, 670, RTV720, 730, 740, 800, 810, 900, 910, 920 £2.50

DECCA
- VR8300 £2.50
- VRH8495DK (Pressure Roller Assembly) £4.50

FERGUSON
- 3V00, 3V16, 3V22, 3V23, 3V24, 3292, 8900, 8901, 8902, 8903, 8904, 8906, 8909, 8912, 8922, 8923, 8924, 8925, 8929 £2.50
- 3V29, 3V30, 3V31, 3V32, 8930, 8931, 8940, 8941, 8942 £2.50
- 3V35, 3V36, 3V38, 3V39, 3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 3V58, 3V59, 3V64, 3V65, FV10, FV11, FV12, FV14, 3V49, 8943, 8944, 8945, 8947, 8948, 8950, 8951, FV13H, FV20B, FV21R, FV22L, FV26D, FV30B, FV32L, FV33H, FC39S, VC141L £2.50

FISHER
- FVHP420, FVHP520, FVHP530 £2.50
- FVHP615, FVHP710, FVHP715, FVHP716, FVHP722, FVHP725, FVHP830, FVH618, FVH620, FCH622, FVH622, FVH771, FVH720, FVH721, FVH722, FVH725, FVH730, FVH840 £2.50
- FVHP905, FVHP970, FVHP980, FVHP990, FVHP5000, FVHP5005, FVHP5050, FVHP5075, FVHP5100, FVHP905, FVHP906, FVHP908, FVHP910, FVHP911, FVHP915, FVHP916, FVHP918, FVHP975 £2.50
- VBR330, VBS3500, VBS7000, VBS7500, VBS7600, VBS9000, VBS9900 £2.50

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

FUJITSU
- HS760, VX715, VX720D £2.50

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

GEC
- V4004 £2.50

GRANADA
- VHSAH1, VHSAH3, VHSVH4, VHSWH1, VHSXH1, VHSYH2 £2.50
- VHSAN3, VHSBP1 £2.50
- VHSAY3 £2.50
- VHSBH1, VHSCH1, VHSFS1, VHSFS2, VHSEH2, VHSEH3 £2.50
- VHSBY3, VHSCC1 £2.50
- VHSDS2 £2.50
- VHSDP1, VHSFP2 (Pressure Roller Assembly) £4.50
- VHSEY1 £2.50
- VHSFG2, VHSFG4 £2.50
- VHSFJ4, VHSYJ2 £2.50
- VHSF63 £2.50
- VHSTJ1, VHSTJ2, VHSTJ3 £2.50
- VHSWJ1, VHSWJ3, VHSXJ3 £2.50

GRUNDIG
- BARCELONA, MADRID, MVS500, MVS550, MVS600, MVS620, 660, SE5110, SE5140, SE6100, SE6160, TVR4500, VS500, VS505, VS510, VS520, VS521, VS530, VS540, VS550, VS600, VS610, VS620, VS630, VS640, VS660, VS680, VS5180, VS5480 £2.50
- MVS400, MVS440, VS400, VS410, VS440, VS460 £2.50
- VS120 £2.50
- VS510 £2.50

GOLDSTAR
- GHV1221, GHV1232, GVH1240, GHV1241, GHV1242, GHV1243, GHV1244, GHV1245, GHV1246, GHV51, GHV8210, GHV8215, GHVP1240, GHPV1241, GHVP1247, GHVP1248, GHVP1290, GHVP1291, GHVP1295, GHPV1296, VCP4100, GHV51, GHV8000, GHV8200, VCP4000, VCP4130, VCP4200, VCP4300, VCP4301, VCP4305, VCP4306, VCP4310, VCP4311, VCP4315, VCP4316, VCP4320, VCP4321, VCP4325, VCP4326 £2.50

HINARI
- V20H, VXL10, VXL11, VXL19, VXL5, VXL5, CXL7, VXL8, VXL9, VXL90 £2.50
- VXL2, VXL3 £2.50
- VXL4, VXL20, VXL35 £2.50

HITACHI
- VT11, VT14, VT16, VT17, VT19, VT33, VT330, VT34, VT35, VT38, VT39, VT52, VT6500, VT680, VT6800, VT7, VT7000, VT8000, VT8500, VT9700, VT9900 £2.50
- VT61, VT62, VT63, VT64, VT65, VT86, VT88, VT110, VT122, VT120, VT128, VT130, VT135, VT138, VT150, VT168, VT220, VM200, VM500, VM600, VT100, VT111, VT113, VT115, VT118, VT125, VT145, VT175, VT225, VT250, VT225, VT258, VT260, VT400, VT405, VT410, VT413, VT414, VT415, VT418, VT420, VT425, VT426, VT428, VT430, VT431, VT435, VT438, VT450, VT498, VT510, VT518, VT520, VT525, VT526, VT530, VT535, VT536, VT540, VT545, VT546, VT548, VT570, VT575, VT576, VT580, VT588, VT640, VT8, VT85, VT86, VT88, VTL30, VTM625, VTM626, VTM630, VTM636, VTM640, VTM645, VTM646, VTS80, VTS85 £2.50
- VT3000, VT5000, VT8000, VT9300, VT9500 £2.50

ITT
- VR3605, VR3905, VR3935, VR3985, VR3986, VR3993, VR3994, VP3826, VR3906, VR3916, VR3926, VR3946, VR3948, VR3976, VR3995, CR3997, VR6948 £2.50
- VR3913, VR3914, VR3943, VR3954, VR3963, VR3984 £2.50
- VR3907 £2.50
- VR3912 £2.50
- VR3917, VR3833 £2.50
- VR3929, VR3968 (PRESSURE ROLLER ASSEMBLY) £6.25

JVC
- HR2000, HR3300, HR3330, HR3360, HR3660, HR4100, HR7700, HR7200, HR7300, HR7350, HR7600, HR7610, HR7650, H7655 £2.50
- HRD110, HRD111, HRD120, HRD121, HRD140, HRD150, HRD160, HRD225, HRD455, HRD565, HRD725, HRD157, HRD158, HRD170, HRD180, HRD210, HRD230, HRD250, HRD257, HRD300, HRD320, HRD370, HRD400, HRD430, HRD470, HRD530, HRD566, HRD700, HRD750, HRD755, HRD950, HRP50, HRS5000, HRS5500 £2.50

MATSUI
- VX850 £2.50

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

NATIONAL
- NV100, NV180, NV300, NV333, NV340, NV366, NV600, NV688, NV777, NV788, AG6010, AG6015, AG6100, AG6200, AG6400, AG6810, NV3321 £2.50
- NV230, NV370, NV430, NV460, NV730, NV810, NV830, NV850, NV870, NV890, NV2000, NV2010, NV3000, NV7000, NV7200, NV7800, NV8600, NV8610, NV8620, NVG14, AG1000, AG1200, AG1500, AG2100, AG2100, AG2200, NV260, NV280, NV380, NV450, NV465, NV470, NV480, NV630, NV650, NV770, NV780, NV8050, NV8150, NV8200, NV8300, NV8400, NVG15, NVG30, NVG400, NVH70, NVG130 £2.50
- NVG7, NVG19, NVG12, NVG18, NVG9, NVG10, NVG11, NVG120, NVG16 £2.50
- NVG21, NVG25, NVH65, NVG33, NVG46, NVG50, NVG300, NVG65, NVF70, NVFS1, NVFS100, NVH75, NVJ30, NVL20, NVL23, NVL25, NVL28 £2.50
- NVD40, NVD80, NVG21, NVG45 £2.50

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

ORION
- VH1, VH2 £2.50
- VC150, VC180, VH1000, VH200, VH201, VH205, VH212, VH250, VH254, VH288, VH3, VH300, VH303, VH3030, VH312, VH33, VH3312, VH404, VH704, VH708, VH712, VH770, VH780, VR2948 £2.50
- VH300, VH3050, VH2308, VH2400, VH2600, VH2700, VH4300, VLX20, VXL25, VXL30 Etc £2.50

PHILIPS
- VR6460, VR6920 £2.50
- VR2020, VR2021, VR2022, VR2023, VR2024 £3.20
- VR6711 £2.50
- VR6540 £2.50
- DV8556, VR6485, VR6485, VR6589, VR6880, VR6948 £2.50
- VR445, VR6442, VR6542, VR6843, VR6943 £2.50
- DV464, VR2324, VR2300, VR2334, VR2340, VR2530, VR2414, VR2480, VR2486, VR2489, VR2490, VRS2498, VR6462, VR6463, VR6464, VR6560, VR6660, VR6860, VR6861, VR6862, VR6863 £2.50

Pressure Roller Assembly
- DV186, DV190, DV286, SV486, DV471, DV582, DV571, DV761, VR6180, VR6182, VR6185, VR6285, VR6290, VR6291, VR6293, VR6362, VR6367, VR6390, VR6391, VR6393, VR6467, VR6468, VR6470, VR6561, VR6570, VR6581, BR6670, VR6676, VR6760, VR6761, VR6762, VR6870, VR6970, VR6975, VR86B1, 62SB7, 68SB4, 71SB4, 72SB8, 92SB31 £4.50

SANYO
- VHR1100, VHR1300, VHR1500, VHR2300, VHR1150, VHR1200, VHR2100, VHR2500, VHR2700 £2.50
- VTC5000, VTC5150, VTC5500, VTC9300, VTCM10, VTCM20, VTC5150, VTC5350, VTC5400, VTC6000, VTC6500, VTC9100, VRP5800, VTCM11, VTCM21, VTCM31, VTCM50 £2.50
- VHR3100, VHR3300, VHR3310, VHR3700, VHRD500, VHRD700 £2.50
- VTC3000 £2.50

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

SEE PREVIOUS PAGES FOR MORE ← GRANDATA BARGAINS

SONY FLYBACK TRANSFORMERS

Part No.	Models	Price
1-439-216-00	KV-2002E, 2010E, 2200E, 2015, 1820E, 2010SE, KV-2012ME, 2016ME, 2015ME, 2010ME	£14.00
1-439-256-11	KV-2704EC, 2704UB, 2704ET, 2704E(A), 2704E	£35.00
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)	£27.00
1-439-311-00	KV-1440AEC, 1440AS MK2, CPS-14CD3, CPV-14CD2, KTX-1350NF, KTX-1430UB	£20.00
1-439-332-21	KV-2756, 2730EC, 2730FE, 2764EC, 2752UB, 2752F	£36.00
1-439-333-00	KV-1882EC, 1882UB, 1882F, 1882CH, 1882AEB, 1882AM, KV-1882ME3, 1882HK, 1882AS, 16TR1, 882EC(PS), 1770R	£20.00
1-439-363-21	KV-19HT1A, 19FX1MT, 18G2, 1602M7, 1602GE, ADM-16B, KV-2092UB, 2096UB	£22.00

FLYBACK TRANSFORMERS

FERGUSON		
00D-4208-001	TX9	£14.00
00D-4-208-002	TX9	£14.00
00D-4-235-002-01G	TX90	£14.00
00D-4-247-001	TX90	£14.00
00D-4-247-001 HT1	TX90	£14.00
06D-3-093-001	TX100	£14.00
(110) 06D-3-087-001	TX100	£14.00
(110) 06D-3-084-001	TX100	£14.00
06D-3-088-001	TX100	£14.00
GRUNDIG		
29201-019-05		£8.00
29201-024-11		£14.00
29201-024-04		£14.00
PHILIPS		
PS 140-17112	G11	£14.00
PS 140-10306	G90AE	£11.50
PS 140-10353	G90B	£15.50
PS 140-10151	K12	£15.00
PS 140-10283	K30 K30111	£15.00
PS 140-10246	K40	£13.00
PS 140-10247	KT4	£14.00
PS 140-10149	KT2	£9.00
PS 140-10161	KT3	£9.00
PS 140-17033	G8	£10.00
PS 140-17089	G9	£10.00
PS 140-10328	NC3	£14.00
ITT		
	CVC20	£11.50
	CVC25	£11.50
	CVC30	£11.50
HITACHI		
2432981	CPT 1444	£15.00
2434274	CPT 2174, CPT2176	£14.00
	CPT 2178	
OUTPUT TV MODULE	HM6251 (REF 2370551)	£5.50
	HM6232	£8.00

IDLERS & PULLEYS REPLACEMENT

AKAI			
VS1-2, VS4-5, VS15	FF-REW IDLER	M1327773	£4.50
VS3, 6, 12, 56, 58, 59			
VS1-2, VS4-5, VS15	T-UP IDLER	BV327815	£6.00
VS3, 6, 12, 59, 59			
V9700	IDLER	BV321979	£6.00
VS125, 126, 155,	IDLER ASSY	MZ366960J2	£11.00
VS165, 240, 244, 245, 247, 248, 250, 512, 515, 516			
VS22, 38, 105, 112, 115, 116, 205, 220			
VP7100, VS9300	T-UP IDLER	PU47752	£4.50
VS9500, VS9800			
VP7100, VS9300	UNLOADING IDLER	PU46381	£4.00
VS9500, VS9800			
VP7100, VS9300	REW IDLER	PU46380	£6.00
VS9500, VS9800			
VP77, VS10	REEL IDLER	BV327815	£3.00
VP88	IDLER	BV336067	£5.00
VS1, 3, 4, 9, 12	REEL TABLE	BR347731	£5.50
VS15, 58			
VS23, 35, 37, 53, 55	CLUTCH	ML373043	£13.00
VS66, 75, VSA77			
VS9700	FF IDLER	BV321761	£3.20
VS9700	REW IDLER	W321762	£4.25
AMSTRAD			
VCR7000	IDLER	150280	£1.50
TVR1, VCR4500	CLUTCH	150873	£3.75
VCR4600, VC5200, VCR9000			
TVR1, VCR4500	GEAR HOLDER	151284	£3.50
VCR4600, VCR5200, VCR9000			
TVR1, VCR4600	REF CLUTCH		£3.50
VCR5200			
VCR6000, VCR6100	CLUTCH	153202	£3.80
VCR4500, VCR9000	CLUTCH		£4.00
VCR4500, VCR4600	MOD KIT	(TAPE CREASING)	£4.50
VCR4700			
MOD KIT TAPE CREASING FOR AMSTRAD			
VCR4500, 4600, 4700			£3.00
FERGUSON			
3V00, 3V01, 3V16	T-UP IDLER	PU47752	£4.50
3V22, 3292, 8900, 8901, 8904, 9806			
3V16, 3V22	T-UP IDLER	PU49280	£5.50
8903, 8909, 8912, 8922			
3V23, 3V29 3V30,	REEL IDLER	PU48967	£2.50
3V31 3V32, 3V35, 8923, 8924, 8929, 8930, 8931, 8940, 8941, 8942			
3V23, 3V31	ROLLER ASSY	PU49042A	£4.00
3V29, 3V30, 3V31	T-UP IDLER	51402	£1.25
3V32, 3V35, 3V36, 3V38, 3V39, 3V49, 8930, 8931, 8940, 8941, 8942			
3V29, 3V30, 3V31	T-UP CLUTCH	PU51380	£2.25
3V32, 8930, 8931, 8940, 8941, 8942			
3V35, 3V36, 3V38	REEL IDLER	PU55374	£2.85
3V39, 3V49, 8943, 8944			
3V35, 3V36, 3V38	T-UP CLUTCH	PU55373	£2.00
3V39, 3V49, 8943, 8944			
3V58, 3V59, 3V64	IDLER ARM	PU58645	£2.25
3V65, FV10, FV11, FV12 FV13, FV14, FV20, FV21, FV22, FV26			
FV30, FV32, FV33, 8950, VC141L			
3V42, 3V43	CLUTCH ASSY	PU55822	£13.50
3V43, 3V44, 3V45	CLUTCH ASSY	PU57658	£11.50
3V48, 3V53, 3V54, 3V55, 3V57, 8947, 8948			
3V42, 3V43, 3V44	T-UP CLUTCH	PU56043 1-4	£2.80
3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 8947, 8948			
3V42, 3V43, 3V44	SUPPORT CLUTCH	PU56044-1-5	£2.80
3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 8947, 8948			
3V00, 3V01, 3V16	LOADING IDLER	PU43681	£4.00
3V22, 3292, 8900, 8901, 8902, 8903, 8904, 8906, 8909			
8912, 8922			
3V00, 3V01, 3V16	REW IDLER	PU43608	£6.00
3292, 8900, 8901, 8904, 8906			
3V16, 3V22, 8902	IDLER	PU49281	£1.70
8909, 8912, 8922			
3V16, 3V22, 8902	IDLER	PU49283	£1.00
8909, 8912, 8922			
FISHER			
FVHP420, 520, 530	FF-REW PULLEY	HI638531	£1.00
FVHP615, 618, 620	COMP. IDLER ASSY	FI1430420400300	£3.30
FVHP622, 710, 711, FVHP720, 721, 722, FVHP725, 730, 830			
FVHP840,905, 906, FVHP908, 910, 911, FVHP915, 916, 918			
FVHP615, 618, 620	GEAR IDLER ASSY	FI1430490400900	£4.50
FVHP622, 710, 711, FVHP720, 721, 722			
FVHP725, 730, 830, FVHP840			
FVHP615, 618, 620	REEL T-UP ASSY	FI1430410400900	£5.50
FVHP662, 710, 711, FVHP720, 721, 722			
FVHP725, 730, 830, FVHP840			
FVHP905, 906, 908,	GEAR IDLER ASSY	FI1430490402400	£4.00
FVHP910, 911, 915, FVHP916, 918			
FVHP975, 980, 990,	IDLER	FI1430420400700	£4.50
FVHP999, 5000, 5005			
FVHP5050, 5075, 5100			
FVHD40, 55, 140	REEL DRIVE ROLER		£6.00
FVHP1, 10, 20			
FVHP975, 980, 990	GEAR		£3.00
FVHP975, 980, 990	CLUTCH	F12430510404200	£9.50
FVHP420, 520, 530	IDLER		£2.80
FVHP420, 520, 530	TAKE UP IDLER		£3.60
FVHP990	LOADING GEAR		£2.00
VBS3500	REEL DRIVE PULLEY		£5.20
VBS3500	IDLER		£3.00
VBS7000	REW IDLER		£1.20
GOLDSTAR			
GHV1221, 1232, 1240	CLUTCH GEAR	435038A	£2.50
GHV1241, 1242, 1243, GHV1244, 1245, 1246, GHV1247, 1248, 8000,			
GHV8200, 8210, 8215, GHVP51, VCP4100, 4130			
GHV1221, 1232, 1240	IDLER		£1.70
GHV1241, 1242, 1243, GHV1244, 1245, 1246, GHV1247, 1248, 8000,			
GHV8200, 8210, 8215, GHVP51, VCP4100, 4130			
HINARI			
VXL3, VXL20	REEL IDLER	40000009	£1.50
VXL2	IDLER		£1.50
VXL4, VXL35	IDLER		£2.75
VXL4, VXL35	CLUTCH		£6.50
VXL4, VXL12, VXL25	LIMITER POST		£1.30
VXL30, VXL35, VTV300			
VXL5, VXL6	CLUTCH		£3.75
VXL5, VXL6	GEAR HOLDER		£3.50
VXL7, VXL8, VXL9	CLUTCH		£3.80
HITACHI			
VT11-33, VT63-64	CLUTCH ASSY	6879515	£7.50
VT14, 17, 19, 38, 57, 86, 88, 34, 35, 39, 52, 61			
62, 65, 85, 330, 640, VT16S			
VT120-220, 100, 110	CLUTCH ASSY	6886824	£7.50
111, 113, 115, 118, 200		6886972	
125, 128, 130, 135, 138, 145, 150, 175, 225, 250,			
255, 258, 260, VTL30			
VT8000-8300, 7000	FF-REW IDLER	6413663	£2.80
VT8500-8700			
VT8000-8300, 7000	PLAY IDLER	6414221	£3.60
VT8500-8700			
VT8000-8300, 7000	FF-REW PULLEY	6383531	£0.80
VT8500-8700			
VT9300-9500, 6500	FF-REW IDLER	8681471	£3.30
VT680, 6800, 9700, 9900			
VT9300 9500, 6500	PLAY IDLER	6861482	£3.20
VT680, 6800, 9700		6861481	
VT 9900			
VT9300 9500, 9700	IDLER	681505	£3.00
VT9900, 6500, 680, 6800	IDLER	687043	£3.80
VT11-33, VT63-64	FF-REW IDLER	6886971	£1.50
VT14, 16S, 17, 19, 34, VT35, 38, 39, 52, 61, 62			
VT65, 85, 86, 88, 330, 640			
VT1000, 110, 111, 113	FF-REW ARM	6886792	£2.75
VT115, 118, 119, 120, 125, 128, 130, 135, 138, 145, 150			
VT175, 220, 225, 250, 255, 258, 260, VTL30			
VT400, 405, 410, 413	FF-REW ARM	6897094	£1.30
VT414, 415, 418, 420, 425, 426, 428, 430, 431, 435			
VT438, 450, 498, 510, 518, 520, 525, 526, 530, 535			
VT536, 540, 545, 546, 548, 570, 575, 576, 580, 585			
VT588, VTM625, 626 630, 635, 636, 640, 645, 646, VTS80, 85			
VT400, 405, 410, 413	CLUTCH BASE	6896951	£3.25
VT414, 415, 418, 420, 425, 426, 428, 430, 431, 435			
VT438, 450, 498, 510, 518, 520, 525, 526, 530, 535			
VT536, 540, 545, 546, 548, 570, 575, 576, 580, 585			
VT588, VTM625, 626, 630, 635, 636, 640, 645, 646, VTS80, 85			
VT3000	T-UP IDLER (LARGE)		£4.50
VT3000	REW IDLER		£6.00
VT680, 6500, 6800	FS BRAKE	6861505	£3.00
VT9700, 9900			
HITACHI TV			
OUTPUT MUDULE HM 6251			£5.50
OUTPUT MODULE HM 6232			£8
JVC			
HR330, 3660, 4100	T-UP IDLER SML	PU49280	£5.50
HR7200, 7600, 7650	T-UP CLUTCH	PU53462A	£2.25
HR7655, 7300, 7350, 7610			
HR7200, 7300, 7350	REEL IDLER	PU48967	£2.50
HR7600, 7610, 7650, 7655, 7700			
HR7600, 7610, 7650	ROLLER ASSY	PU49042A	£4.00
HR7655, 7700			
HR3300, 3660, 4100	T-UP IDLER LRG	PU47752	£4.50
HR7200, 7600, 7650	T-UP IDLER	PU51402A	£1.25
HR7655, HRD110, HRD111, HR7300, 7350, 7610, HRD120-121, 225			
HRD110, HRD120-121,	T-UP CLUTCH	PU55373	£2.00
HRD225, HRD111,			
HRD110, HRD120-121,	IDLER ARM	PU55374-3-8	£2.85
HRD225, HRD111			
HRD170, 180, 210, 230	IDLER ARM	PU58465	£2.25
HRD320, 370, 400, 430, 470, 530, 700, 750, 950, 3000			
HRS5000, HRS5500			
HRD455, HRD725	CLUTCH MECH	PU558822	£13.50
HRD140, 150, 157, 158	CLUTCH MECH	PU57658	£11.50
HRD160, 250, 257, 565, 566, 755, HRP50			
HR3300, HR3330	REW IDLER	PU46380	£6.00
HR3660, HR4100			
HRD140, 150, 157, 158	TAKE UP CLUTCH	PU56043-1-4	£2.80
HRD160, 250, 257, 455, 565, 566, 725, 755, HRP50			
HRD140, 150, 157, 158	TAKE UP CLUTCH	PU56044 1-5	£2.80
HRD160, 250, 257, 455, 565, 566, 725, 755, HPR50			
MATSUI			
VX730, 735, 750, 755,	CLUTCH	850A00005	£6.50
VX810, 820, 850, 880, 990			
VX730, 735, 750, 755	LIMITED POST LEVER		£1.30
VX770, 800, 810, 880	ASSY		
VX990			
VX800A, VX900	IDLER REEL		£1.50
VX800A, VX820	REEL UNIT CLUTCH		£3.50
VX850, VX900	ASSY IDLER		£3.50
MITSUBISHI			
HS306, 307, 318, 319,	GEAR ASSY	522B00201	£6.25
HS400, 410, 710			
HS337, 338, 347, 349	IDLER	552B01701	£3.50
HS411, 412, 421, HSB10, HSB20, HSB30, HSE10, HSE20, HSE20, HSE30, HSE70			
HS306, 307, 318, 319	IDLER	641C34301	£2.00
HS400, 410, 710			
HS347, 349, 412	IDLER	522902002	£3.00
HSB10, HSB20, HSB30, HSE10, HSE20, HSE30, HSE70			
MITSUBISHI Cont.			
HS337, 338, 411, 421	IDLER	552B01801	£3.50
HS200	TAKE UP IDLER (LARGE)		£4.50
HS200	UNLOADING IDLER		£4.00
HS200	REWIND IDLER		£6.00
HS306, 307, 318, 319	SUPPLY REEL	522A00101	£3.20
HS400, 410, 710	DISK		
HS306, 307, 318, 319	TAKE UP REEL	522A00102	£3.20
HS400, 410, 710	DISK		
HS320	REEL DISK	522C06301	£3.00
HS337, 338, 411, 421	REEL DISK	522P00601	£5.00
HS300, 301, 302, 310	PULLEY	522C05201	£2.25
HS306, 307, 318, 319	GEAR WHEEL	641D71101	£1.50
HS400, 410, 710			
HS306, 307, 318, 319	GEAR WHEEL	641D71001	£1.50
HS400, 410, 710			
NEC			
N830, N831, N832, N833	TAKE UP CLUTCH		£2.25
N830, N831, N832, N833	TAKE UP IDLER		£1.45
N830, N831, N832, N833	REEL IDLER		£2.85
N895	TAKE UP IDLER SMALL		£6.00
N911, N915, N916, N917	REEL DRIVE PULLEY		£5.50
N9012, 9013, 9014, 9016, 9033, 9034, 9054, 9055, 9066, 9110			
N9510, 9520, 9530, 9610			
NATIONAL			
NV322, NV600, NV688,	IDLER UNIT	VXP0463	£2.75
NV777, NV788, NV332, AG6100, 6200, 6800, 6810			
NV300, NV333, NV340	IDLER ARM	VXL0997	£3.60
NV366			
NV300, NV330, NV333	IDLER UNIT	VXP0401	£0.75
NV340, NV366			
NV300, NV330, NV333	PLAY IDLER	VXP0433	£2.75
NV340, NV366, NV8620			
NV300, NV332, NV333	ACTION GEAR	VDG0016	£0.60
NV340, NV366, NV600, NV777, NV788, NV2000, NV2010, 3000, 7000			
AG6010, AG6015			
NV333, NV688, NV2000	LOADING GEAR	VXP0325	£2.00
NV3000, NV7800			
NV300, NV332, NV333	INTERMEDIATE GEAR	VXG0017	£0.65
NV340, NV366, NV600, NV777, NV788, NV2000, NV2010, 3000, 7000			
AG6010, AG6015			
NV330, NV333, NV340	CAM GEAR	VXG0158	£1.00
NV366, NV777, NV788			
NV230, NV250, NV260	IDLER ARM	VXP0521	£1.70
NV280, NV370, NV380, NV430, NV450, NV460, NV465, NV470, NV480			
NV630, NV650, NV730, NV780, NV810, NV830, NV850, NV870			
NVG7, NVG9, NVG10, NVG11, NVG12, NVG 14, NVG15, NVG16, VG18			
NVG30, NVG400, AG1000, AG1200, 1500, 1810, 2100,			
AG2200, NVH65, NVH70			
NV370, NV430, NV870,	CAM GEAR	VDG0200	£1.20
NV730, NV830, NV850, NVG10, NVG12, NVG18			
NV730, NV770	IDLER UNIT	VXP0581	£2.50
NV2000, 2010 3000	IDLER UNIT	VXP0331	£1.00
NV2000, 2010, 3000	IDLER UNIT	VXP0329	£1.00
NV2000, NV3000	CAM GEAR	VDG0069	£1.00
NV7000, 7200, 7800	IDLER UNIT	VXP0344	£1.00
NV7000, 7200, 7800	CLUTCH	VXP0343	£4.00
NV8150, 8200, 8300,	IDLER UNIT	VXP0245	£0.90
NV8400, 3600, 8610, 8620			
NV8200, 8400, 8600	PLAY IDLER	VXP0243	£0.90
NV8610, 8620			
NV8620	CLUTCH	VXP0343	£4.00
NV332, NV600, NV688	IDLER	VXPO488	£3.50
NVG20, NVG21, NGV25	PULLEY UNIT	VXP0767	£5.00
NVG40, NVG45			
NV230, NV250, NV280	WORM WHEEL	VXP0604	£2.00
NV430, NV450, NV460, NV465, NV650, NV730, NV770, NV810			
NV870, NV890, AG1000			
NV370, NV380, NV630	IDLER	VXP0523	£3.50
NV780, NV830			
NV370	CLUTCH GEAR	VXP0595	£1.00
NVG7, NVG11, NVG12	WORM WHEEL	VXP0631	£1.50
NVG14, NVG15, NVG18, NVG30, NVG120, NVG130, NVG400, NVH70			
NV2000, 2010, 3000	LOADING GEAR	VDG0035	£0.60
NV7000, 7200, 7800, 8050			
NV230, NV250, NV370	LOADING GEAR	VXP0520	£1.50
NV430, NV450, NV460, NV630, NV730, NV770, NV780, NV810			
NV830, NV890, NVG7, NVG10, NVG12, NVG15, NVG30, NVG120			
NGV130, NVG400, NVH70, AG1000			
NV230, NV250, NV260	CLUTCH GEAR		£2.50
NV280, NV430, NV450, NV730, NV770, NV810, NV870, NV890			
NVG7, NVG10, NVG11, NVG12, NVG14, NVG15, NVG18, NVG30			
NCG120, NVG130, NVG400, NVH70, AG1000			
NV230, NV250, NV260	LIMITER ROLLER		£1.50
NV280, NV300, NV333, NV340, NV366, NV370, NV430, NV450, NV460			
NV465, NV630, NV650, NV777, NV780, NV788, NV810, NV830, NV850,			
NV870, NV890, NV2000, NV2010, 7200, 7800, NVG7, NVG10, NVG12,			
NVG14, NVG15, NVG18, NVG30, NVG120, NVG130, NVG400, NVH70, AG1000			
ORION			
MULTIPLE MODELS	IDLER	850A200004	£3.50
MULTIPLE MODELS	IDLER	850A200005	£6.50
VH1, VH2A	IDLER		£1.20
VH1, VH2A	IDLER		£1.20
VH1, VH2A	DRIVING GEAR		£0.60
VH1, VH2A	INTERMEDIATE GEAR		£0.65
VC150, VC180, VH200	IDLER		£1.50
VH201, VH205, VH212, VH250, VH254, VH288, VH300, CH303, VH312			
VH404, VH555, VH700, VH704, VH708, VH712, VH780, VH844, VH900, VH3,			
VH33			
SAISHO			
VR605, VR800, VR900	CLUTCH	850A20000	£6.50
VR1100, 1200, 1600, 2500, 3200, 3300			
VR3500, 3600, 3800	LIMITER POST		£1.30
VR1100, 1200, 1600, 2500, 3200, 3300, 3500, 3600, 3700			
VR605, VR800, VR900	IDLER		£3.50
VR2500, 3200, 3300, 3500 3600, 3800			
VR705, VR805, VR905	IDLER		£1.50
SANYO			
VHR1110, 1150, 1200	IDLER	143-0-662T-14730	£5.00
VHR1300, 1500			
VTC5000, 5150, 6000	FF-REW IDLER	143-0-741T-20001	£3.00
VTC6500, VTCM10, M11, M20, M21, M30, M31, M50			
VTC9100, VTC9300	IDLER	143-0-551T-01400	£1.20
VTC9300	FF ROLLER ASSY	143-0-547T-00200	£2.20
VTCM10, M11, M20, M21	REEL DRIVE PULLEY	143-0-662T-10350	£5.00
VTCM30, M31, M50			
VHR2100, 2300, 2500	IDLER	6130374899	£5.00
VHR2700			
VTC5000, 5150, 6000	PULLEY	143-0-662T-01201	£5.20
VTC6500			
VTCM10, M11, M20, M21	PULLEY	143-0-662T-10350	£5.50
VTCM30, M31, M50			
VHR3100, 3300, 3310	REEL DRIVE	143-0-662T-15621	£4.25
VHR3400, 3700, 3800	ROLLER		
VHRD500, VHRD700			
VPR5800, VTC5300	LOADING ROLLER	143-0-661T-03800	£1.00
VTC5400			
VTC3000	FWD LIMITER		£3.50
VTC3000	IDLER		£5.00
SHARP			
	IDLER ASSY	NIDL0005GEZZ	£1.50
	IDLER	NIDL0006GEZZ	£1.50
VC600, 651, 681, 682	IDLER ASSY	NPLYV0107GEZZ	£6.15
VC684, 685, 693, 699, 700, 783, VC6FR, VC6V3			
VC7300, VC7700, 7750	PLAY IDLER KIT	NPLYV0041+ NDA1V1007	£5.00

PLEASE PHONE US FOR TYPE NOT LISTED HERE AS WE ARE HOLDING 5000 ITEMS AND QUOTATIONS ARE GIVEN FOR LARGE QUANTITIES.

Please send £1 P&P and VAT at 17½%. Govt, Colleges, etc. Orders accepted. Quotations given for large quantities. Please allow 7 days for delivery. All brand-new Components. All valves are new and boxed. Prices quoted are subject to stock availability and may be changed without notice. TV & video parts sold are replacement parts.

REMOTE CONTROLS

GRUNDIG	
TP160E	1050P
TP200, TP300	1000P
TP400	850P
TP590-600	1050P
TP390, TP610	1050P
TP621	1050P
TP630, TP650	1000P
TP660	1050P
TP661	1050P
HITACHI	
CLE800-CLE830	900P
A617402/655602	1000P
A512120/230	1000P
A514790	1000P
A5088470	1000P
A518612	1000P
SCL002	1000P
C2096	1000P
A511940	1000P
655602H	1000P
ITT	
IFB13, 14, 15	900P
FS4	850P
RG305	900P
RG306	900P
FS9/1-10/1	900P
VS5 RUK	900P
VS4-1	900P
MULTICONTROL (17C20)	1000P
KORTING	
18279, 18396, 18460, 18521 SE	1000P
40540 VTS	1000P
LOEWE	
DC11	1000P
MATSUI	
010270601	1000P
VX770	1000P
METZ	
JAVA COLOR (6890)	1000P
COLOR (7156)	1000P
JAVA (7180)	1000P
MITSUBISHI	
939P/03607, 939P/03609	900P
NOKIA	
SATELLITE	1000P
NORDMENDE	
TC2336	1050P
CMC1, TC3519	1050P
OCEANIC	
390C9500	1000P
ORION	
RC53	1000P
PANASONIC	
EUR51200	900P
TC2200	900P
VSQ0357/NV730	1050P
TNQ1621	1000P
PHILCO	
CARVEL, CONCORDE, MERCURY	1000P
TELESTAR	
TC10	1000P
PHILIPS	
RC5002, 5154	900P
KT3 NON TEXT	900P
69117032	1050P
69117194	1050P
RC5991 UNIV	850P
RC3B	900P
KT3 TEXT	900P
RC5352	900P
RC5375	900P
RC5 STANDARD	900P
RC5901	900P
RC5903	900P
SABA	
T6772	1000P
TC319-320	1050P
TC356	1050P
TC358	1050P
TC360	1000P
TC365	1000P
SALORA	
SERIES L	1000P
86173	1000P
SANYO	
RC218, RC222, RC228, RC238	900P
JXGE	1000P
JXDE	1000P
VHR2300	1000P
RC628	1000P
SHARP	
G0121CESA, 123CESA, 204, 251	900P
SIEMENS	
FC616	1000P
FC631	1000P
FC742	1000P
SONY	
RM604, RM605, RM606	900P
32 CHANNEL	900P
RM613	900P
RM632, RM636	900P
TATUNG	
FXA	1000P
RC70	900P
FX70 FASTTEXT	850P
TELEFUNKEN	
FB632	1000P
FB639	1000P
THORN/FERGUSON	
3V35-42	900P
3V31-32	900P
3V57-58	1050P
TX10 TEXT	850P
TX10 STEREO TEXT	850P
TX9-90-100	850P
3V55, FV11	1050P
TX100 FASTTEXT	900P
TX100 STEREO FASTTEXT	900P
PROFESSIONAL	850P
TOSHIBA	
CT937	1000P
CT9117	1000P
201R4B	1000P

UNIVERSAL PROGRAMMABLE REMOTE CONTROL
Controls up to 4 different devices which use infra red remote controls including TV, audio, VCR and satellite. (Need original remote control to program)
Order code: IR100R Price: 1950P

We stock Remote Controls for over 5000 different models. Ring for further details on 081-900-2329.

BACKUP BATTERIES

REPLACEMENT PHILIPS NI-CAD BACKUP BATTERIES
Replaces Philips Part No's:
138-10138, 138-10313. 1.2V – 90mAh 160P
Replaces Philips Part No's:
138-10229. 2.4V – 90mAh 260P

REPLACEMENT FERGUSON NI-CAD BACKUP BATTERIES
Replaces Ferguson Part No: 00E6-067-001. 1.2V
Used on: TX10 150P
Replaces Ferguson Part No's: 00E6-066-001. 2.4V
Used on: 3V35, 3V56, 3V58, 3V65 280P

LINE OUTPUT TRANSFORMERS

Description	Price	Order Code
HITACHI 2433752	1500P	LOT01
ORION 3714002	1500P	LOT02
FIDELITY ZX300	1500P	LOT03
FE TX100 90 DEG	1500P	LOT04
SABA 490007182	1500P	LOT05
FE TX90 WHITE	1650P	LOT06
ITT D307/37 EQ	1600P	LOT07
BLAUPUNKT 210	1600P	LOT08
GRUNDIG 2922010	1600P	LOT09
ITT CVC800/1/3	1500P	LOT10
ITTD218/37 EQ	1600P	LOT11
NORMENDE 5255	1600P	LOT12
SABA 81000 200	1600P	LOT13
SALORA T236 EQ	1650P	LOT14
SABA 811-50-24	1600P	LOT15
SABA 770223500	1600P	LOT16
TELEFUNKEN AT1	1450P	LOT17
TELEFUNKEN EQ	1400P	LOT18
SALORA FM0218B	1600P	LOT19
NORMENDE 5255	1600P	LOT20
ITT CVC 1150/1	1500P	LOT21
ITT COMPACT 80	1500P	LOT22
FE TX100 GREEN	1450P	LOT23
HINARI CT4/5 5113	1500P	LOT24
SELECO 6320410	1600P	LOT25
BLAUPUNKT 8667	1600P	LOT26
ITT COMPACT B1	1450P	LOT27
ITT CT3326 MUL	1500P	LOT28
ITT D066/37 EQ	1600P	LOT29
ITT 3546 EQ	1500P	LOT30
LUXOR 5810110	1600P	LOT31
SABA 849380920	1600P	LOT32
HITACHI 2434141 CP	1450P	LOT33
FE TX100 110 D	1700P	LOT34
HANTAREX 28021	1600P	LOT35
SHARP C3700 EQ	1600P	LOT36
HITACHI 2432981 CP	1500P	LOT37

We stock line output transformers for over 100 different models. Please ring 081-900 2329 for more information.

FAULT FINDING GUIDE BOOK

Video Recorders Edition 2
Lists more than 2200 faults for 43 different brands
Price: £9 45p Only. No VAT
Order Code: BOOK01

Television Edition 3
Lists more than 3500 faults for 50 different brands
Price: £9 45p Only. No VAT
Order Code: BOOK02

VIDEO HEAD CLEANING STICKS

Order Code: SP14
Price: 17p Each
15p Each Pack of 10pcs
13p Each Pack of 25 pcs

FUSES

Value	TIME LAG (20mm) Order Code	TIME LAG (20mm) Price	QUICK BLOW (20mm) Order Code	QUICK BLOW (20mm) Price
160mA	FUSE01	75P	FUSE17	60P
250mA	FUSE02	75P	FUSE18	60P
315mA	FUSE03	75P	FUSE19	60P
400mA	FUSE04	75P	FUSE20	60P
500mA	FUSE05	75P	FUSE21	60P
630mA	FUSE06	75P	FUSE22	60P
800mA	FUSE07	60P	FUSE23	60P
1A	FUSE08	60P	FUSE24	60P
1.25A	FUSE09	60P	FUSE25	60P
1.6A	FUSE10	60P	FUSE26	60P
2A	FUSE11	50P	FUSE27	60P
2.5A	FUSE12	50P	FUSE28	60P
3.15A	FUSE13	55P	FUSE29	50P
4A	FUSE14	55P	FUSE30	50P
5A	FUSE15	60P	FUSE31	50P
6.3A	FUSE16	60P	FUSE32	50P

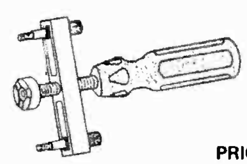
CERAMIC PLUG TOP

3A	FUSE33	100P
5A	FUSE34	100P
13A	FUSE35	100P

ALL THE ABOVE PRICES ARE FOR PACKS OF 10 FUSES

Solder Mop 1.2mm × 10 metres	300P
Tubed Silicon Grease 50 gram	200P
Tubed Heat Sink Compound 25 gram	150P

UNIVERSAL HEAD EXTRACTOR TOOL
Hand tool designed for extracting hard to remove heads without damage to either the head or the mounting assembly. Adjustable so as to suit various brand heads.



PRICE – £7

GRANDATA LTD
K.P. HOUSE, UNIT 15, POP IN COMMERCIAL CENTRE, SOUTHWAY, WEMBLEY, MIDDLESEX, ENGLAND HA9 0HB
Tel: 081-900 2329 Fax: 081-903 6126

TELEVISION

EDITOR
John A. Reddihough

PRODUCTION EDITOR
Tessa Winford

EDITORIAL OFFICE
081 652 8120
Fax 081 652 8956

Note that we are unable to answer technical queries over the telephone and cannot provide information on spares other than that given in our Spares Guide.

ADVERTISEMENT MANAGER
Carol Nobbs
081 652 8327

SALES EXECUTIVE
Pat Bunce
081 652 8339
Fax 081 652 8931

ADVERTISING PRODUCTION
Brian Chapman
081 652 8681
Fax 081 652 8917

PUBLISHING DIRECTOR
Susan Downey

SUBSCRIPTION ENQUIRIES
0444 445 566

SUBSCRIPTION HOTLINE
24-hour subscription ordering with credit card number phone 0622 721 666 and quote reference INJ.

COVER PHOTO
This month's cover photograph shows the Rediffusion Mk. 4 chassis. See servicing article on pages 180–183.

REED
BUSINESS
PUBLISHING

Broadcasting's Future

The government doesn't seem to be at all sure what to do about commercial TV. It has been under considerable pressure from major independent television companies to change the ownership rules, enabling them to merge or take each other over. The arguments for this have a certain plausibility. By international standards, even the largest of the UK companies are comparatively small. So they need to be larger if they are to become international concerns. If they don't, they may be taken over by larger companies with international broadcasting interests – the advent of the European Union brings with it the right of companies elsewhere in Europe to make hostile, cross-border bids. Conversely, some of the smaller companies have argued that things should be left as they are: that they are efficient and fulfil their franchise requirements. In the event, what the government is proposing is a sort of half-way house: ITV companies will be allowed to own two regional licences, though the London weekday and weekend licences must continue to be held by separate companies – and newspaper publishers will for the foreseeable future continue to be restricted to ownership of not more than twenty per cent of an ITV company. These proposals could result in a fall in the total number of ITV companies from fourteen to eight.

One gets the impression that the government feels it has to make some concession to the major franchise holders that are pressing for relaxation of the rules but is uncertain how much to concede. The government is right to be cautious. The question that it doesn't seem to have addressed is "what is broadcasting all about?" Till now it has been regarded, in the UK at any rate, as primarily a cultural – in the widest sense – phenomenon rather than a simple commercial business with the aim of generating a maximum return on the money invested. It can be argued that the current restrictions are becoming irrelevant as technical progress brings much greater possibilities: the regional ITV set-up was devised in the days when channels were few and needed to be allocated with care – the days before satellite broadcasting, wideband cable networks and digital transmission. But the fact remains that the existing franchises are valuable public assets whose use deserves careful consideration. Also that broadcasting is an aspect of our popular culture, and that this carries with it responsibilities. Are those who are pressing for complete deregulation suggesting that broadcasting companies should be there for buying and selling by anyone, with little regard for the purposes and possibilities of broadcasting? More sinisterly, that it no longer matters much who owns broadcasting companies and what they might choose to do with them? The recent antics of Silvio Berlusconi, owner of the major Italian networks, in using his channels to broadcast ninety-minute programmes propounding his own political views – at a politically sensitive time – serve as a warning to what can all too easily happen.

The unfortunate thing is that the European Union threatens to impose a purely commercial view of what broadcasting is all about. It needs to be emphasised that television broadcasting plays a major role in providing information and entertainment, and in so doing moulds people's view of the world. All right, you may say, but anyone can start or buy a newspaper, which is a similarly influential medium, so why not TV? The answer really is that the present set-up was originally devised with great care as a framework which would encourage free, independent, creative broadcasting that provides a variety of programming to cater for the diverse needs of different viewer groups. It is vital that this tradition is preserved. A choice of a hundred or a thousand channels will not of itself guarantee the continuation of quality broadcasting. These are the considerations that the government should weigh against the clamour for short-term advantages in the creation of media monsters.

Thanks

Our thanks to Terry Mahmood of Colourtrade who donated a TV receiver and a VCR as prizes for a Christmas charity raffle organised by Reed Business Publishing.

Modern TV Receiver Techniques

Part 13: Power Supply Circuits

Eugene Trundle

The various different sections of a TV receiver we've looked at in previous instalments all require operating power. This month we'll examine the power supply section of a TV set: basically it's used to convert the mains (or other) energy input to one or more closely stabilised and regulated d.c. supply lines.

Power Supply Requirements

Because of load and distribution factors the domestic mains supply, which is nominally 240V a.c., can vary by ±6 per cent. So an important function of the power supply is stabilisation, i.e. providing a constant output voltage despite mains voltage variations. Regulation is also required: this means holding the output voltage steady regardless of the load imposed on it by the various other sections of the set – within the normal operating limits. Variable loads are presented in particular by the beam current consumption, which can vary from zero to 25W over the possible picture content range in a large screen set, and the audio output stage whose current demand varies with sound volume, again from virtually zero to around 25W in a set with a high-power stereo sound system.

If the voltages supplied to the timebases are not stabilised and regulated there will be changes in picture size and proportion with image brightness and mains supply variations. Sound distortion will be the result if the voltage supply to the audio amplifier isn't held stable. To avoid tuning drift the varicap tuning voltage supply must be constant. And microcontroller and logic circuits can make wrong decisions and corrupt the data passing through them unless their operating voltages are held within a few per cent of the nominal figure. Hence the need for close stabilisation of virtually every supply line in a TV set.

Most TV receiver power supplies must also be able to adjust the stabilised output so that, for example, a chassis can be used to drive different types of tube. Another requirement is protection circuitry to ensure safe operation. The protection circuits incorporated must be able to cut off the power if a short-circuit or overload raises the set's consumption to a dangerous level or the voltages in the set rise by more than a few per cent above their nominal levels. Higher than normal

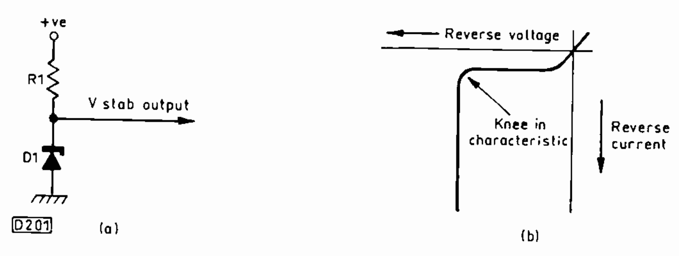


Fig. 1: Use of a zener diode as a shunt stabiliser (a), zener diode reverse voltage/current characteristic (b).

working voltages could lead to excessive dissipation and the emission from the tube of X-ray radiation in excess of the normal minimal level.

Ideally the power supply should draw current from the mains throughout both half cycles (positive- and negative-going). It should not pollute the mains supply by adding spikes and interference, while at the same time being immune to anything of the same sort present in the mains a.c. supply. It must not generate radiation in the form of strong magnetic or r.f. fields as these could be picked elsewhere in the set, causing sound interference and patterning on the picture. This is particularly important with non-synchronous power supply circuits and, in view of its wide dynamic range and high signal-to-noise ratio, where Nicam sound is incorporated in the set. The more efficient the power supply's conversion process the better, since this will conserve energy and contribute to good reliability through cool running.

We haven't completed the list of requirements yet! In most modern sets there's electrical isolation between the live mains input to the receiver and the outputs from the receiver's power supply. This makes it easier to link the set to other equipment. Finally the outputs from the set's power supply must be free from ripple, hum and hash, and have a low source impedance (or the effect of this) to ensure good decoupling between different sections of the receiver that use the same supply line.

From the practical design viewpoint many of these characteristics and features are interdependent: the same circuitry provides regulation and stabilisation; mains isolation, voltage conversion and energy storage use a single transformer; and so on. But unlike other circuit sections of a TV set, where the operating principles mean that the circuitry used is to some extent standardised, there is tremendous variation in the power supply designs used in different makes and models. We'll look at the principles and consider the most common types of power supply circuit in current use in TV sets. First however we must briefly examine the basic regulators and stabilisers on which more sophisticated designs are based.

The Zener Diode

The simplest form of voltage stabiliser is shown in Fig. 1(a). It consists of a series resistor R1 and a zener diode D1. The important feature of a zener diode is the sharp knee in its voltage/current characteristic when the device is operated with reverse bias, see Fig. 1(b). This means that the voltage across the diode remains constant over a wide range of current flow through it. The most common application for this simple arrangement in a TV set is in the provision of a stable tuning voltage for a varicap tuner. In this case the zener diode is usually in practice a two-terminal i.c. with built-in thermal compensation: unlike the simple zener diode, the two-terminal voltage regulator chip has virtually zero temperature coefficient.

All power supplies that provide regulation must have an internal voltage reference source of some form with which the output or a proportion of the output can be compared. It generally takes the form of a zener or similar diode, though it may be hidden away within a regulator/stabiliser chip of one sort or another.

Series and Shunt Regulators

An absorption circuit that compensates fully for supply and demand variations is easy to arrange. Fig. 2(a) shows the basic shunt regulator principle, with regulator transistor Tr1 connected across the load and both fed from an unstabilised

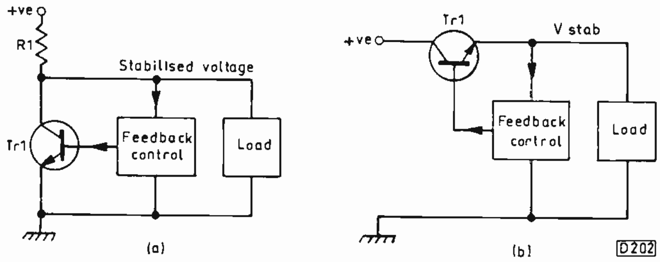


Fig. 2: Basic absorption regulator arrangements, (a) shunt type (compare with Fig. 1) and (b) series type. Both are closed-loop systems.

source via the ballast resistor R1. Feedback to the base of Tr1 varies its conduction to compensate for load variations, maintaining a constant voltage across its collector-emitter terminals. With this arrangement zero load corresponds with maximum dissipation in Tr1.

The series regulator idea, shown in Fig. 2(b), is less wasteful of energy. Here the regulating transistor is in series with the load. Feedback is used to alter its resistance as the current demand by the load varies, once again maintaining a constant output voltage. Series regulators are no longer used as the main stabiliser in large-screen TV receiver power supplies though many VCR power supplies, where the loading is lighter and more even than that of a TV receiver, continue to use them, often in heatsinked i.c. form. Series regulators are commonly used in both TV and video equipment for the auxiliary supplies, e.g. the provision of a 5V supply for logic circuitry. They are often packaged in the

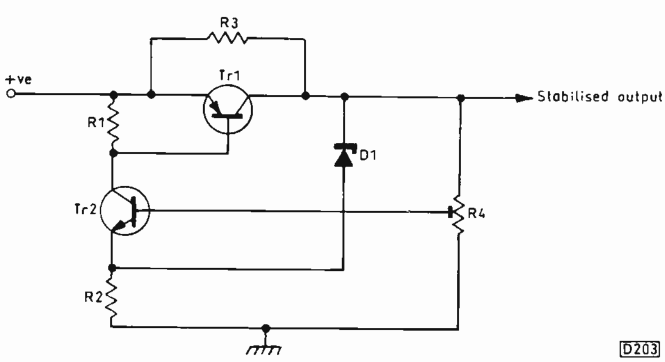


Fig. 3: A practical series voltage regulator circuit.

form of a three-legged i.c., for example the well-known 78 series.

The principle of a series regulator, using two transistors and a zener diode, is shown in Fig. 3. Tr1 is the series element, whose conduction/resistance is governed by comparator transistor Tr2's collector current. The emitter of Tr2 is held at exactly 7·5V below the regulator's output voltage by zener diode D1, which provides the voltage reference. A proportion of the output, set by R4, is applied to Tr2's base. If, because of increased current demand by the load, Tr1's collector voltage starts to fall, this voltage reduction appears across R2 in Tr2's emitter circuit and, in attenuated form, at its base. The effects of these voltage changes on Tr2's collector current are opposite but the change at Tr2's emitter, being larger, predominates. Thus in this example Tr2's emitter voltage falls and, being an npn device, its collector current increases, with a corresponding decrease in its collector voltage. Tr1's base-emitter current increases, in turn increasing its emitter-collector current. Thus Tr1's resistance is decreased, it supplies a greater current to the load and the output voltage is stabilised. R4 enables the output voltage to be set up. R3 serves two purposes. It provides a start-up feed for the output side of the circuit and shares the dissipation with Tr1.

This type of circuit provides a very low effective output impedance and, because of the very low dynamic resistance of the zener diode, excellent ripple suppression. The regulating action works up to quite high frequencies. Thus the circuit can be looked at as an active ripple filter, whether the ripple consists of mains-rate hum on the unstabilised supply at Tr1's emitter or is the result of short-term changes in current demand by the load.

The Switch-mode Concept

The regulator arrangements described so far have the advantage of simplicity but are wasteful of energy, which is dissipated as heat by the regulating device itself and any ballast resistor present, for example R1 in Fig. 1(a) and Fig. 2(a) and R3 in Fig. 3. Heat is not conducive to the reliability of either the device that generates it or the components that share its environment. Other disadvantages of the absorption type of regulator are that it cannot provide a voltage step-up while isolation between the input and output cannot be provided. A more efficient approach uses a control element that absorbs virtually no power itself as it acts as a switch. There is obviously no power dissipation when the switch is open-circuit: when the switch is closed it presents a very low impedance so that the dissipation is minimal.

In a switch-mode power supply (SMPS) the ratio of the on time to the off time of a driven switch (usually an npn transistor) that's used to chop the input is varied to suit the load demand. When little energy is required the switch remains in the on position for only a short time during each cycle of operation, briefly topping up an inductive or capacitive reservoir that supplies the load during the chopper's off period. When the load's energy demand is large a monitoring circuit automatically reduces the mark-space ratio of the chopper device so that it remains on for a longer period during each cycle, thus increasing the energy supplied to the reservoir. In this way the energy drawn from the primary power source almost exactly matches the energy required by the load with minimal wastage. The energy reservoir, whether in inductive or capacitive form, need not be large or bulky: if the chopping switch is operated at 20kHz or more small, light inductors and capacitors can be used.

Fig. 4 shows the principle of the switch-mode ('chopper') power supply. The incoming mains voltage is full-wave rectified by the bridge rectifier D1-4 to produce an unregulated supply of around 320V across its reservoir capacitor C1. This supply feeds the primary winding of transformer T1, the electronic switch S1 being in series with this winding. Each time

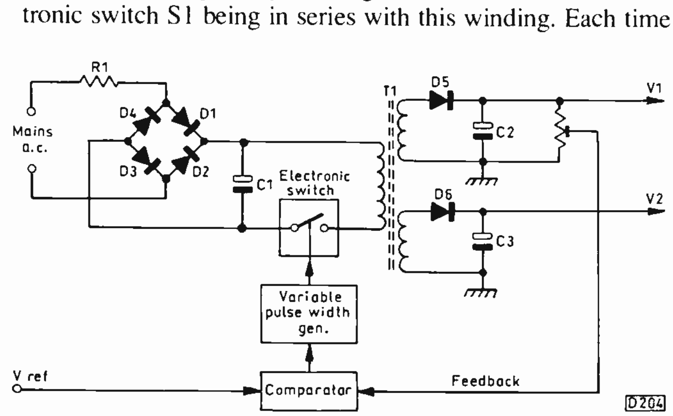


Fig. 4: Essentials of a switch-mode (chopper) power supply.

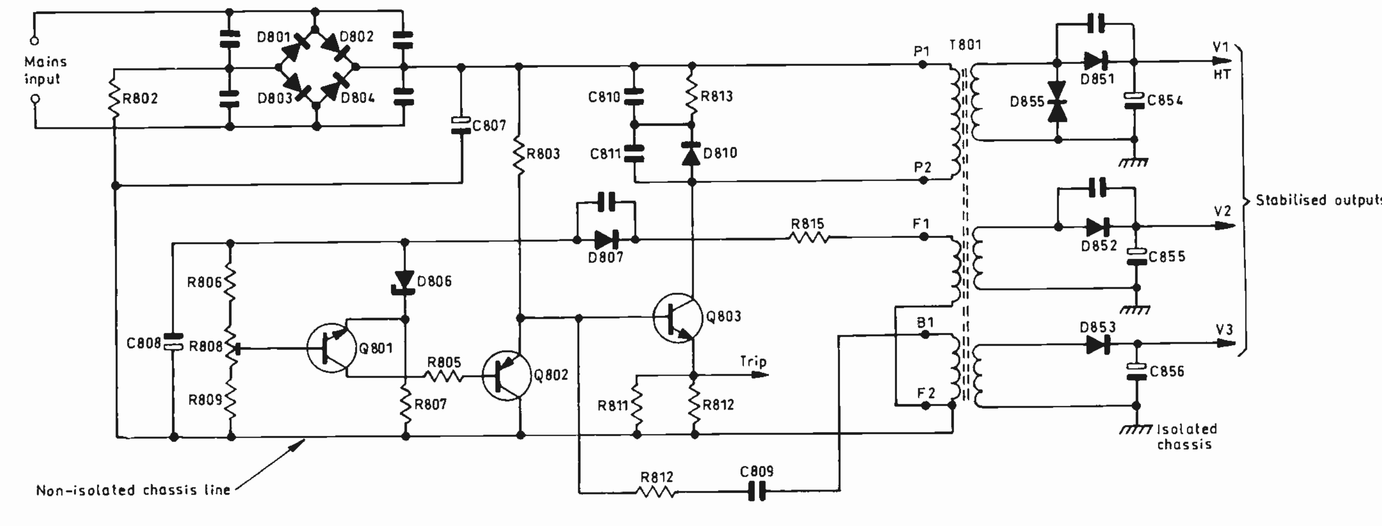


Fig. 5: Typical self-oscillating switch-mode power supply, often known as a ringing-choke converter. Note that T801 provides mains isolation, there being no electrical connection between the circuitry on its primary and secondary sides.

the switch is closed, a current ramp builds up in T1's primary winding and magnetic energy is stored in its core. When the switch is opened, say 50µsec later, the magnetic field collapses, transferring energy to the secondary side of the circuit – rectifier diodes D5 and D6 conduct, current flowing in the transformer's secondary windings to charge C2 and C3. The phasing of the windings is arranged so that there is no conduction on the secondary side of the circuit when S1 is closed. The loads are continuously supplied by the reservoir capacitors C2 and C3.

Since the total loading affects all the secondary-side supplies, because they are all activated when the transformer's magnetic field collapses, only one output need be monitored for control purposes – this is normally the one that supplies the major proportion of the total load. The output voltage here is monitored to provide feedback to the chopper control circuit. A comparator compares the feedback voltage with a reference voltage, producing an error voltage that's proportional to the load. This error voltage in turn controls a pulse-width modulator whose output pulses, of width proportional to the load, determine the on/off timing of the switch. Thus the switch's duty cycle is varied to suit the current demand.

In most modern circuits the frequency as well as the duty-cycle is varied to suit different load conditions. Many circuits are self-oscillating, with feedback from the transformer to the transistor to produce oscillation. Others use a purpose-designed i.c. as the control element to provide current drive to the base of a bipolar transistor, or voltage drive to the gate of a power field-effect transistor (FET), that contributes the switching action. The power transistor may be incorporated in the i.c., the result being a simple circuit with few peripheral components.

R1 is an important item in all rectifier circuits: it's included to limit the current surge when C1 charges at switch on, protecting the rectifier diodes.

Self-oscillating SMPSs

Discrete component SMPS circuits with the chopper transistor and transformer acting as an oscillator have been in and out of favour over the years and are still used in modern TV sets. Fig. 5 is representative of a large number of such designs – the same operating principle is used in most of the large, heatsinked i.c. packages that incorporate the power switch in the chip.

When power is first applied, the chopper transistor Q803 begins to conduct because of the forward base bias applied via R803. As a result, current flows in the primary winding of the chopper transformer T801. This induces a current flow in the feedback winding F2-B1. The signal generated here is coupled back to the base of Q803 via C809 and R812, and as a result Q803 is driven rapidly to saturation. In this condition the current in the primary winding of T801 soon stabilises and the positive feedback ceases (this is the classic blocking oscillator configuration). During this process C809 acquires a negative charge so that Q803 is cut off and held off – until the capacitor has discharged via R812 and R803. At this point Q803 begins to conduct again and the process repeats itself. Continuous oscillation occurs, and energy is fed to the loads across the secondary supplies produced by the transformer and the associated rectifier circuits.

In this arrangement regulation is achieved by monitoring the voltage developed by feedback winding F1-F2 and the associated rectifier circuit D807/C808. This voltage is proportional to those produced across the secondary supply lines. It's applied to the emitter of the comparator transistor Q801 and to the base of this transistor via the potential divider R806/8/9. Q801 acts in exactly the same way as Tr2 in Fig. 3 therefore, its conduction being governed by the negative voltage developed across C808. This transistor's operating point, and thus the circuit's output voltages, is set by R808 which forms the 'set h.t.' control.

Q801 in turn controls the conduction of Q802, which sets the d.c. level at the base of Q803 and thus the discharge time for C809: the effect is to control Q803's turn-on timing and hence the duty cycle of the oscillator. We thus have a complete control loop which regulates and stabilises the three output lines.

The voltage developed across resistors R811 and R812 is proportional to the current that flows in Q803 and T801. In the full design this voltage is fed to an overload trip circuit (not shown here) that shorts out the feedback drive to the base of Q803 in the event of an excess current overload. Over-voltage protection is provided by diac D855 whose breakover voltage is reached when the h.t. output rises to about 110 per cent of the normal figure. It then conducts and latches on, shorting out the windings on the secondary side of T801. This brings the excess-current trip into operation. The power supply then shuts down until the mains power is switched off and on again to reset the trip.

T801 also provides mains isolation, there being no electrical connection between the windings and circuitry on its primary and secondary sides. In this particular circuit the surge limiter resistor R802 is included at the chassis return

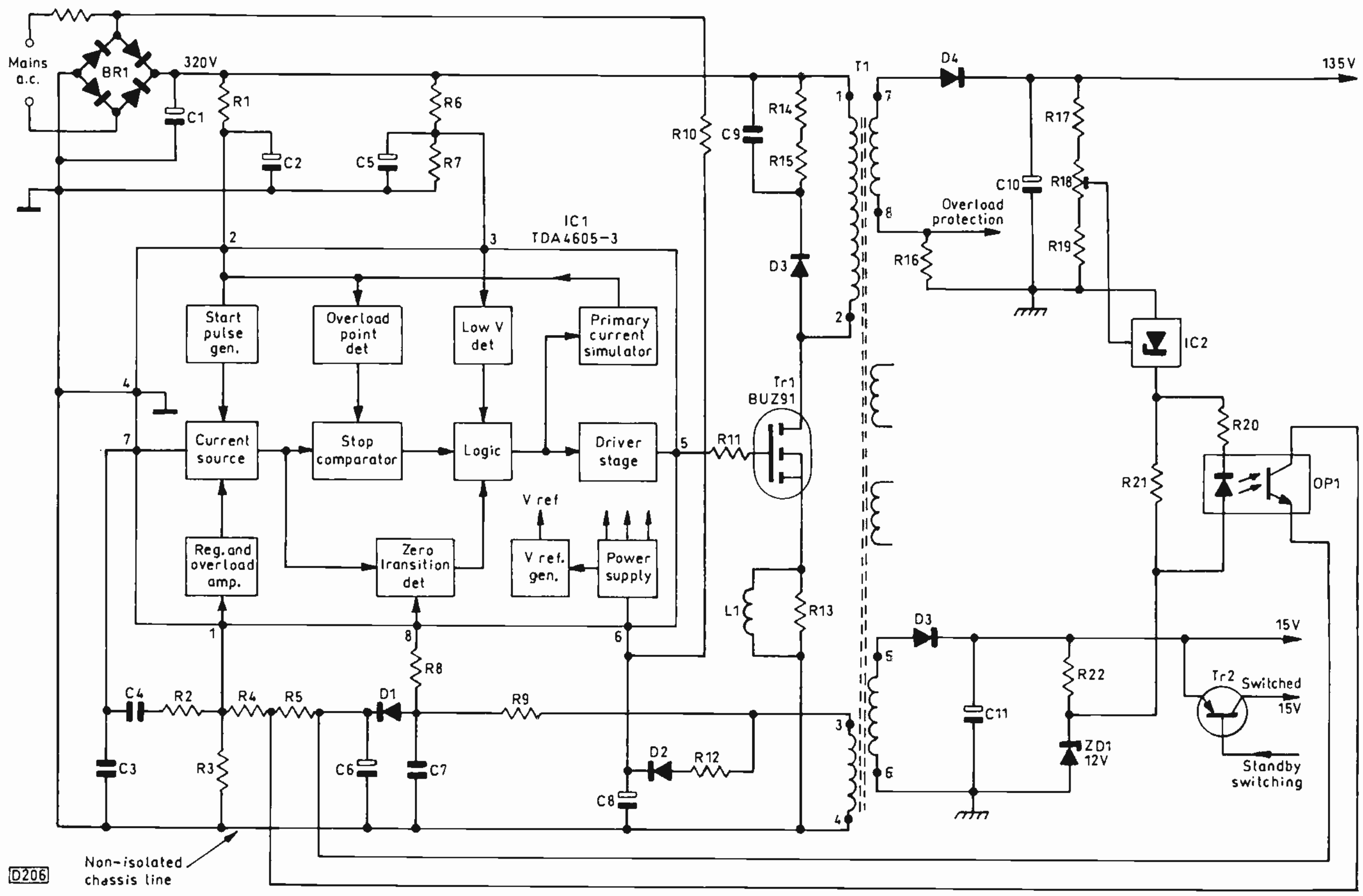


Fig. 6: A high-frequency, i.c.-controlled chopper power supply, using a MOSFET transistor and a dual-loop feedback system. Mains isolation is provided bt T1 and the optocoupler OP1.

side of the mains bridge rectifier instead of the live feed side.

IC-controlled SMPSs

Many different types of switch-mode power supply chips have been used in TV sets over the last decade. The early ones operated line synchronously, that is they were locked to the 15·625kHz line scan rate. There were two reasons for this: the avoidance of beat-pattern interference on the picture, and the supply of power when it's most needed – when the line output transistor switches on and current is drawn through the transformer. Later and current SMPS control chips run at a frequency that depends on the load. In the design shown in Fig. 6 the operation of the circuit varies between 32kHz at maximum load and 150kHz at minimum load, i.e. with the set in the standby condition.

The switching is done by the power FET Tr1, which earths and isolates pin 2 of the chopper transformer T1 alternately as it switches on and off. Circuit operation is basically as described above, though unlike the previous design (Fig. 5) the circuit doesn't oscillate. When Tr1 switches on, the 320V supply developed across C1 by the mains bridge rectifier BR1 is applied to T1's primary winding (pins 1-2). As a result there's a ramp current build up in the winding, and energy is stored in the transformer's ferrite core in the form of a magnetic field. The phasing of the secondary windings is such that rectifiers D3 and D4 don't conduct at this stage. After a few microseconds IC1 switches Tr1 off at its gate. The magnetic flux in T1 then reverses, producing current flows in the transformer's secondary windings via the now conductive rectifiers D3, D4 etc. (there are others, but these have been omitted in the interests of providing a simple circuit description). When T1's magnetic energy has been dissipated, Tr1 is switched on again and the cycle is repeated.

Thus T1 is being continuously charged and discharged with magnetic energy. When T1 is being charged, the reservoir capacitors on the secondary side of the circuit, C10, C11 etc., are being discharged by their loads. When T1 discharges, the charge stored by C10 etc. is replenished. It's important to appreciate that with this particular circuit the time scale is very short: there are typically six or seven 'pump' actions by the power supply during the period of a single line scan. This storage period of a few microseconds means that not much capacitance is required, so T1, C10 and C11 do not have to be large or heavy. But the circuit, especially T1, has to be well screened and decoupled to prevent radiation to other sections of the receiver.

The snubber network D3, C9, R14 and R15 across the primary winding of the transformer prevents excessive reverse voltage rise at the moment when Tr1 switches off, so that the dissipation in Tr1 during the brief transition from its on to its off state is reduced to a safe level. D810, R813, C810 and C811 serve the same purpose in Fig. 5.

The Control Chip

The heart of the circuit is the TDA4605-3 control chip IC1. At switch on it's powered from the mains supply via R10 and C8, which form an integrating network. Once the circuit is up and running its operating voltage is provided by winding 3-4 on the transformer in conjunction with rectifier diode D2 and the reservoir capacitor C8. The pulses generated at pin 3 of the transformer serve two other purposes: they are fed via R9 and R8 to pin 8 of the chip to indicate that the transformer's magnetic energy has been expended, so that a new switch cycle should be started, while rectifier circuit D1 and C6 generates a voltage that's proportional to the output voltages. This is applied via R5 and R4 to pin 1 for regulation

purposes. Thus the basic feedback loop is formed, with a sample voltage applied to pin 1 and a reference voltage generated within the chip.

When mains power is first applied the secondary reservoir capacitors C10, C11 etc. are all discharged. To limit stress on the power supply during the initial charging surge a soft-start system is provided within IC1. It brings up the duty cycle of the drive pulse output at pin 5 at a slow rate, governed by the charging time of capacitor C3 at pin 7. The driver stage behind pin 5 takes the form of a push-pull amplifier which switches the output between chassis and the chip's supply potential. Although the power MOSFET Tr1 is a voltage-operated device a drive current capability of ± 1A is required for rapid charge and discharge of its gate capacitance.

Most of the chip's other pins are concerned with circuit and component protection. Pin 3 samples the mains derived supply via potential divider R6/7: if the voltage developed across C1 becomes too low for normal operation of the circuit the power supply shuts down. Excessive mains voltage is sensed at pin 6, the circuit similarly shutting down.

The main overload protection centres on pin 2 however. When Tr1 is off, pin 2 is earthed (to pin 4) by a switch inside the chip – it's in the block labelled primary current simulator. During Tr1's on periods the switch is opened so that C2 can charge from the 320V line via R1. Thus C2 generates a sawtooth voltage whose peak amplitude is proportional to the chopper transistor's duty cycle. This waveform is monitored within the chip: if the peak voltage exceeds a certain threshold excessive energy demand is indicated and Tr1's duty cycle is limited to reduce the output from the power supply.

While this energy-limitation system provides good general protection, its position on the primary side of the power supply cannot guard against overloads in individual circuits supplied by the secondary side. For example a situation could arise where the line output stage draws excessive current without increasing the set's total power consumption beyond the preset limit. To guard against this the current in the 135V line is monitored by the low-value resistor R16 which is connected in series with winding 7-8 of the transformer. A negative voltage that's proportional to the current is developed at the junction of pin 8 and R16: if this voltage exceeds a certain level a switch is triggered, disabling the line oscillator so that the line output stage shuts down.

Apart from such extra arrangements the power supply is inherently short-circuit proof. If a secondary winding on the chopper transformer is shorted out for example the energy stored by the primary winding is very quickly transferred to the secondary side, leading to high-frequency operation with a minimal switching duty cycle and low energy dissipation.

We have already seen that feedback from the transformer via rectifier circuit D1/C6 and resistors R5 and R4 to pin 1 of the chip is used to provide stabilisation. There's an additional feedback loop that's also linked to pin 1 but monitors the 135V h.t. supply. A sample of the h.t. voltage is taken via the potential divider R17/18/19 to the input terminal of IC2, which acts as a variable zener diode. It's connected across the stabilised 12V supply produced by R22 and zener diode ZD1. Part of IC2's current flows through R20 and the optocoupler OP1: this current will vary with any increase or decease in the h.t. voltage. The light produced by the LED section of the optocoupler shines on and varies the conduction/resistance of the phototransistor in the package. This phototransistor is connected across R5, thus varying the voltage applied to pin 1 of IC1 to improve the stabilisation characteristic.

Isolation between the primary and secondary sides of the circuit is provided by T1 and OP1.

Power supplies like this continue to run in the standby mode, operating at high frequency. This represents minimum load, with a typical mains power consumption of about 6W. In the arrangement shown in Fig. 6 transistor Tr2 provides a switched 15V line. When the standby command is given the microcontroller chip in the set switches Tr2 off: removal of the switched 15V line shuts down the line output stage and other essential sections of the set while the control department remains operational to receive further commands.

Bipolar Transistor Circuits

The circuit we've been looking at is properly known as a free-running flyback converter. It's a development of the well-known configuration using a TDA4600/4601 series control chip. The latter has been very widely used by setmakers in conjunction with a bipolar switching transistor. The main difference with the arrangement shown in Fig. 6 is the much higher operating frequency, which is made possible by the fast-switching power MOSFET and the transformer's specially-developed ferrite core.

Degaussing

In dealing with picture tubes in Part 8 (August) we mentioned that the magnetic shield and shadowmask within the tube and the rimband are demagnetised by applying a decaying burst of mains a.c. to a coil that's wound round the bowl of the tube. The provision of this degaussing energy is another function of the receiver's power supply.

Fig. 7 shows the simple circuit generally used. At switch on mains current is passed through the two posistors (thermistors with a positive temperature coefficient) PTC1 and PTC2 and the degaussing coil/coils (depending on the tube type). The two posistors are mounted in intimate thermal contact in a small, three-legged package. Initially, when the dual posistor is cold, a relatively heavy current flows. PTC1 acts as a heating element while PTC2 contributes a switch-like action. The device warms up rapidly, its resistance rising substantially: PTC2 goes very high, virtually cutting off the current flow through the coil(s), while PTC1's resistance rises to a stable point so that it runs warm enough to keep PTC2 in its high-resistance state.

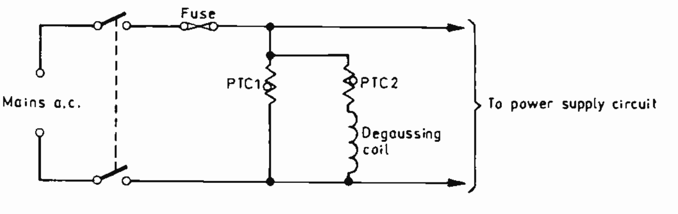


Fig. 7: Basic tube degaussing circuit. The current flowing through the degaussing coil falls from 400mA to less than 100µA within a few seconds of the application of the mains supply to the dual-posistor PTC1/2. In some designs the thermistor that acts as the heating element is connected in series with the supply to the rest of the receiver instead of being in parallel as shown here: it has to have a negative temperature coefficient therefore, and can contribute to switch-on surge limiting.

The usual practice has been to connect the degaussing circuit after the mains on/off switch so that the tube is degaussed each time the set is switched on. Where the set alternates between on and standby modes, with all or part of the power supply running continuously, a triac or relay triggered by the power-up or /standby line may be used to switch power to the degaussing circuit.

Next month: The digital bits

Teletopics

US HDTV PROGRESS

The Grand Alliance of firms developing the US HDTV system has reached broad agreement on three of the four main technical specifications. The MPEG-2 video compression system, with B Frames, will be used. There will be two scanning formats, 1,080 sequential lines with 1,920 square pixels per line at 24, 30 and 60 frames/sec; and 787·5 sequential lines variable to 1,050 interlaced at similar pixel and frame rates. For sound, Dolby AC-3 has been adopted. The main area of contention lies in the transmission system: several different techniques are to be tested in early 1994. The FCC has given approval for a prototype system for evaluation to be built. It's expected that a complete prototype system with all the final technical specifications agreed should be ready by the third quarter of 1994.

SERVICING NVQs

National Vocational Qualifications in consumer electrical/electronic product servicing should be available for award within a year. Standards of competence have been drawn up but not finalised: the Department of Employment is responsible for this and is to appoint a consultant to undertake the task. NVQs are intended as industry-led competence qualifications that are recognised as national standards. The City and Guilds of London Institute and the Electronics Examination Board will be the joint awarding bodies. Employers will be responsible for putting forward staff. There will be three levels.

CABLE TV

Channel One, a new cable channel for the London area carrying light entertainment and features, sports programmes and news, is to be launched in April. The London Interconnect Group, a consortium of the capital's six largest cable TV operators, has awarded a ten-year licence to Channel One, which will be run by Associated Newspapers and SelecTV. Initially there will be about twelve hours a day of programmes. Associated Newspapers has an 80 per cent stake while SelecTV will be mainly responsible for the provision of entertainment programming. An investment of £30m is to be undertaken over the next few years and the group will be building a television studio.

The ITC has issued the first invitation for four years to apply for a new UK cable TV licence: the franchise will cover Sevenoaks, Tonbridge and Tunbridge Wells in west Kent and will be the first to be advertised under the 1990 Broadcasting Act.

The latest cable figures show that for the first time the number of UK subscribers to modern, broadband cable services has exceeded half a million.

INTERACTIVE TV

Swedish public broadcaster Sveriges Television (SVT) is the first in Europe to plan an interactive TV system, with digital transmission capable of terrestrial, cable or satellite operation at standard or HDTV line rates. The system, being developed in conjunction with the Swedish Institute of Computer Science, is called Idun. It will provide teletext type displays though the quality will be much higher than standard teletext, and output to a laser printer is envisaged: both still and moving pictures can be presented. Receivers will need to be able to store about 100Mbytes of information. The system works like a Windows program, controlled by the TV handset. A feedback channel is incorporated for viewer interactive use and/or pay TV operation. Philips' Postscript decoder development could be used.

BUSINESS NEWS

Amstrad chairman Alan Sugar sees no evidence of a pre-Christmas spending boom. At the company's annual general meeting he commented that "trading conditions are not very good: people just aren't spending money". October produced worse results than anticipated, particularly in the UK where volumes and margins have been under pressure. The company expected November and December to reflect "relatively weak demand". Amstrad is losing money on its remaining high street personal computer sales, and has seen satellite television margins plunge.

Satellite TV equipment distributor Longreach Marketing Ltd. of Bath has agreed to buy Supervision from the administrative receivers. A new company, Longreach Supervision, has been set up.

Daewoo has set up the headquarters for its UK electronics sales company at Winnersh Triangle near Reading. Full address is Daewoo Electronic Sales UK Ltd., Daewoo Building, Wharfdale Road, Winnersh Triangle, Wokingham, Berks RG11 5TP, telephone 0734 272 272, fax 0734 699 922. An alteration to our spares guide entry is required – the spares/service fax no. is now 0734 699 900. The company is building a plant for the production of colour TV sets and tubes at Fameck, France.

Grundig has shut its TV receiver assembly plant at Creutzwald, France.

PUBLICATIONS

U-View, 4 South Parade, Bawtry, Doncaster, Yorkshire DN10 6JH (0302 719 997, fax 0302 719 995) has now published *Video Servicing 1991-2* at £195. This massive three-volume set provides circuit diagrams and other essential servicing data for 322 models from 44 manufacturers.

GDN Publications, Longmeadow, Miles Lane, Cobham, Surrey KT11 2EA (0932 862 592) has published *Hacker Radio*. There is a special price to *Television* readers of £3·20 inclusive of post and packing from the above address. This well-illustrated, 28-page book by Geoffrey Dixon-Nutall and Gordon Bussey is a fascinating account of the Hacker brothers' involvement in the UK radio industry, first with the Dynatron company and later Hacker Radio.

NEWS ROUND-UP

The colour television licence fee is to rise from £83 to £84·50 from April 1st 1994, an increase of 1·8 per cent.

Kodak is now offering higher-capacity, writable CDs that store up to 17 per cent more information in digital form. The new discs can hold up to 680Mbytes of data or 74 minutes of digital audio and cost £18·50 each (the original discs hold 580Mbytes/63 minutes of audio).

Dixons has issued a recall for the 20in. Matsui Models 209R and 209T for a safety modification because of possible overheating. About 50,000 sets have been sold. Owners can contact Mastercare's Customer Relations Department on freephone 0500 234 558.

Matsushita and Sony have both entered the video games market.

VCR Clinic

Reports from Philip Blundell, AMIEIE, Eugene Trundle, Richard J. Avis, Adrian Farnborough, John Edwards, Alfred Damp, Mike Leach, John Coombes, Chris Avis, Steve Cannon, Chris Watton and Simon Bodgett

Philips VR6761

In the E-E and playback modes there was sound but just a blank raster. Checks on the record/playback switching voltages showed that there was only 2V instead of 12V at D6403 on signals board P306 in the E-E and playback modes. This voltage comes from mother board P606, where the BC328/40 transistor Tr7607 was found to be open-circuit base-to-emitter. **P.B.**

Ferguson 3V35/JVC HRD120

Check for h.f. ripple on the 12V supply, at pin 1 of connector CN4, if the playback picture suffers from herringbone patterning. A ripple voltage of 0·5V here should lead to a check on C16 (47μF) which you will probably find is open-circuit. **P.B.**

Samsung SI/SX7220/Goodmans VCR2500

If one of these machines fails to eject the tape or dies as it completes the tape loading process it's likely that the loading motor is weak. On a couple of occasions recently however we've found that poor regulation by the STK5333 chip on the power regulator PCB was the cause. **E.T.**

Tatung TVR6111/Amstrad VCR9410/etc

There are doubtless other Amstrad VCRs and more makes and models that use this mechanism. A very common fault with it now is intermittent failure to rewind or wind fast forwards. The motor whirrs but the reel-drive gears don't move into engagement. The cause of the problem is failure of the trigger lever (item 260 in the exploded view of the deck) to flip back into position in the stop mode. Cure it by filing a fraction of a millimetre off the end of its skirt, as shown in Fig. 1. **E.T.**

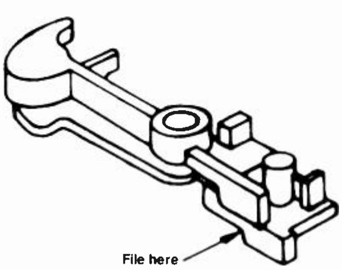


Fig. 1: Where to file the trigger lever – see Tatung TVR6111/Amstrad VCR9410/etc.

JVC HRD520

This machine had been to several service departments, always with the complaint of intermittent tape looping. After a great deal of time we traced the cause of the fault to the mode switch, which is available from CPC under part no. TNPU60622-1-1. **R.J.A.**

Ferguson 3V32/JVC HR7655

The 3V32 is not a common visitor to our workshop. In view of this and its complex circuitry we tend to be apprehensive when one comes along. The fault with this one was complete absence of the fluorescent display. Not surprisingly we found that the filament supply voltage was missing. It comes from a 37kHz oscillator which is mounted on a small subpanel behind the main display, the main items here being T201 and Q205. There should be 3V p-p at the centre-tapped secondary winding but a scope check showed that the oscillator had stopped. It turned out that the oscillator transistor's 22kΩ base bias resistor R281 was open-circuit. **A.F.**

Akai VS22

The tape loaded correctly but there was no drum or capstan rotation in either direction because the BU2735AS chip IC503 was faulty. We've had failure of this chip on a number of occasions. **J.E.**

Ferguson 3V23/JVC HR7700

A tape was stuck in this machine: the eject button had no effect because there was no voltage across the carriage loading motor. We found that fuse F5 had blown because C36 was short-circuit. Replacing these items put matters right. **J.E.**

Panasonic NV370/830/850

If you get one of these machines that's dead with no displays and no functions check the 0·39Ω resistor R1001 in the small power area on the main board. It will probably be open-circuit with no contributory cause – it feeds the 5V regulator. A new resistor should provide a cure. **J.E.**

Hitachi VT8000

All functions worked in this old machine, but only for about five seconds. It would then shut down. The cause was a stretched take-up spool carrier to counter belt – so the counter and the take-up spool rotation pulses stopped. A new belt solved the problem. **J.E.**

Philips VR6362

In rewind or fast forward this machine would stop and eject the tape after a few seconds. In the play mode it would lace up then unlace and eject the tape. All this was because the drum didn't rotate as the 3·3Ω resistor R3142, which is in the 13V feed to the drum drive circuit, had failed. **J.E.**

Philips DMP2 Deck

Shortly after we'd fitted a service kit to one of these machines the customer returned it with the complaint that although it now worked it would occasionally refuse to load a tape. The machine worked all right for several days before the fault showed up. When we called up the fault status from the machine's software we got an indication that tape loading was too long, heavy loading, etc., in other words a service kit was required. In an attempt to see what was happening we examined the machine from all angles. Nothing was obvious until I peered into the loading motor and pulley housing:

while a tape was being loaded the pulley moved from side to side. When the top deck was dismantled we found that the shaft on which the differential gear sits was loose in its chassis mount. We got over the problem by fitting a chassis from a scrap machine – otherwise the machine would have been beyond economic repair. **A.D.**

NEC DX1000K

This machine was brought in for a new idler and service. When we obtained and fitted the necessary parts we found that the E-E video was overloaded – there was a gradual improvement as the machine warmed up. This machine has a digital still TV picture mode. When this was selected we got a good still E-E picture. The cause of the fault was traced to pin 3 of IC207, where the voltage didn't go low enough for E-E video. There was leakage here, due to the glue that had been applied to the PCB to secure cables. **A.D.**

Panasonic NVG21

There was no audio playback. We found that the audio mute line was high, the cause of this being absence of the CTL pulses. We checked back to the servo pack where C240 in the 'AGC CTL' circuit was defective. **A.D.**

Saisho VR1000/Matsui VX800

The complaint was that the 2·5AT fuse F502 would blow intermittently. While the machine sat on the bench it behaved normally, but as soon as it was moved the fuse blew. We found that the bottom PCB had warped beneath the power supply. As a result the fuse blew every time the PCB came into contact with the metal bottom case. **A.D.**

Crown VRS200/Alba VCR7000/8000

The capstan speed would slow and the machine would switch from the SP to the LP mode. Scope checks showed that the control pulses were curved and that there were 1V negative-going pulses on the 6V line. The bridge rectifier was the cause of the fault. **A.D.**

Samsung SI1260

There was a blank raster and no playback. After removing the top cover we saw that there was neither drum nor capstan rotation: the blank raster gave the impression that the machine was stuck in the AV mode, though it wasn't. Voltage checks showed that the switched 5V supply was missing at D109 (1N4001) which had gone open-circuit. A replacement restored normal operation. **M.L.**

Ferguson 3V54

The clock worked but there was no other operation. None of the front controls had any effect. As the circuit protectors in the main body of the power supply were all in order we turned our attention to the main PCB where we found that the switched 5V supply was missing. The cause of the fault was C605 on the top panel – it was leaky, a replacement restoring normal operation. **M.L.**

Akai VSC200

If there's no playback check that the video lock is not in the on position. To unlock, press the remote control unit's play button and hold it down for ten seconds then do the same with the stop button. If this fails to restore playback check that the cassette is accepted correctly. If not, check or replace the cassette loading block. **J.C.**

Mitsubishi HS337

For no rewind or fast forward operation and failure to record check the record inhibit switch. It may be misaligned, broken or damaged as the result of use of a C format cassette. **J.C.**

JVC HRD540

There was no E-E sound. The cause was failure of the 4·7Ω safety resistor R47 in the l.t. feed to the audio circuit. **J.C.**

JVC HRD520

For muted sound with lines on the picture check the f.m. waveform. This will show that the guide poles are misaligned. Under these conditions the VCR may record and play back its own tapes all right but it won't play back prerecorded tapes. **J.C.**

Toshiba V110

If the tuning is off, check the 2·7V zener diode DT53 in the video 5V supply regulator circuit. It tends to become leaky. Other possible symptoms when this diode is leaky are no playback colour or distorted playback and E-E pictures. **J.C.**

Amstrad TVR2

It's difficult to decide whether to list this fault in the TV or VCR section. The symptom was severe 100Hz hum on the TV picture and sound, though tape playback was o.k. Its cause was in the video power supply however, where the 2,200μF, 25V capacitor C606 was almost open-circuit. It smooths the 20V supply to the 12V regulator chip IC601. **C.A.**

Hitachi VT410

An obscure fault caused this machine to lace up, play briefly, then unlace. The counter was working, and the waveforms around the syscon chip IC901 were all o.k. except for the 25Hz signal at pin 23 which was found to be of low amplitude when a comparison check was carried out with a working machine. The signal comes from the servo chip IC601, where a comparative resistance reading to chassis revealed that the faulty machine had a 400Ω leak. The cause of this was C23, a surface-mounted capacitor on the video head preamplifier PCB! **C.A.**

JVC HRD540

The problem was intermittent E-E and playback sound. Application of freezer anywhere around Q5 and Q6 on the tuner/i.f. PCB instigated the fault, as did any attempt to measure the voltages around Q6 (FMS2) which proved to be the culprit. This tiny, five-legged surface-mounted device is not listed by any of our usual suppliers, but a replacement was obtained from JVC without difficulty. **C.A.**

Philips VR422

There was intermittent mistracking and generally very poor playback. As there were no obvious mechanical faults and the deck had been realigned a few times we suspected an electronic fault. A scope check on the drum PG/FG pulses at the head amplifier showed, when a comparison was made with the oscillogram, that there was no synchronising pulse. The oscillogram shows this as a gap in the drum pulse waveform. After replacing the TDA5140 drum motor driver chip IC7301 and carrying out slight realignment of the deck we obtained an excellent picture. **S.C.**

Bush VCR185

There were no E-E signals. Checks showed that the u.h.f. tuner received a 0-30V ramp voltage while search tuning but, as voltage UB was missing, no signals were selected. R132 (10kΩ) in the band-switching system was open-circuit. **C.W.**

Logik VR950/Samsung VI611

This machine wouldn't play. We found that the drum didn't rotate and the operate LED didn't light up. Although some of the power controlled circuits were working, the PC12 line was low. The cause of the trouble was D4 (1N4002) on the power supply PCB. **C.W.**

Akai VSF33

When any operation was selected, via either the machine's own controls or the remote control unit, the power went off leaving just the clock. When the machine was switched on again it would stay on until a tape was inserted or the channel was changed. It would then power down again. The cause of the fault lay in the 23·5V regulator circuit, where R221 (120Ω) had gone high in value. **C.W.**

Hitachi VTM740

The customer complained that there were lines on the picture and that the tracking light flashed, mostly at the start of a tape. When we ran a test tape the symptoms were as described: the tape speed varied, being mostly slow. Checks on the pinch roller, the back tension and the tape path led us to the capstan motor, whose upper bush was bone dry. Dismantling the motor, lubricating the bush then reassembling the unit provided a complete cure. **C.W.**

Pye 65VR20/Philips VR6520

This machine sometimes stopped after only a few minutes, but only in the record mode. It turned out to be a nice easy job for a change: the recording tab switch was as black as your hat! A new switch restored normal operation. **C.W.**

Amstrad VCR8600

There was no drum rotation. The cause was traced to tiny cracks on the signal panel, where the YC subpanel is joined. This is a very flimsy area, and the print is quite tricky to repair. I applied a few blobs of glue to help support the subpanel. **C.W.**

Panasonic NVG21

The lift was jammed half way in and the machine was dead – no clock display or power-on LED indication. A check in the power supply showed that the 1Ω safety resistor R15 was open-circuit. This was the cause of the dead machine, and I assume that the jammed lift was responsible for its failure. Once the lift had been extracted I found that various plastic tabs had broken off, so a new side plate (part no. VXA2677) was obtained from SEME. If you have to fit one of these I recommend that you read Nick Beer's article (May 1991) on servicing this model: without his advice I'm sure that I would still be trying to align the gears. **C.W.**

Hitachi VT430

This machine was stuck in pause. When a cassette was inserted the pause indicator lit up. Other functions could be selected, e.g. play, but this produced only a still picture. A check at pin 56 of IC901 produced a reading of 3·2V instead of 0V. This led us to I1581, a 100µH choke that's in series with the camera pause socket. **C.W.**

JVC HRD880

A tape was stuck in the cassette housing and there were no functions. We found that a key scan port associated with IC1 was stuck high. Everything worked correctly when the chip had been replaced. **S.B.**

S-VHS Instability

The complaint with a JVC HRD4700 was that it wouldn't record via the S-VHS sockets while the S-VHS output signals were inherently unstable. We found that it recorded and played back very well in the S-VHS mode. The playback instability occurred with titles that had been added by the amateur film maker who owned the VCR. We told him that the black-level clamping in his titling machine wasn't up to much – if indeed it had such a thing. **S.B.**

JVC HRD560

One of these machines wouldn't tune. We replaced the tuner, the tuning memory chip, then the tuner/timer chip for key scan control, all to no avail. Finally we replaced the system control chip. That did it!

Another of these machines came in dead. We replaced circuit protector CP1 in the power supply then, on final test, noticed that the capstan motor was inclined to act erratically – in fact at one time it went into reverse. A new motor had to be fitted. **S.B.**

Panasonic WJMX12 Mixer

This mixer caused us a lot of trouble. The alleged fault was loss of channel 2 colour after some time – a tape was supplied as proof. We were unable to confirm the fault and got a second opinion from Panasonic who ran the machine on test for a week then concluded that it wasn't faulty. The report said that the VXOs and VCOs were all set up correctly and that full genlock was consistently obtained. We eventually discovered that the fault did exist when the mixer got hot. The cause of the fault was a crystal in the channel 2 input colour decoder. It went off frequency when hot, i.e. very hot. **S.B.**

Grundig 2 x 4 Super

I rarely see one of these machines. This one came in with a power supply fault. After removing the 25A car fuse and replacing the intermittent on/off switch I eventually found the real cause of the fault – the coupling capacitor between the TDA4600 chopper control chip and the chopper transistor. **S.B.**

Faults that Aren't There

D.A. Chaplin

Because of the complexity of many modern consumer electronic products the service engineer must, when fault-finding, take great care to check on the basics before plunging in at the deep end. A careful check on control settings, both mechanical and electronic, can save a lot of time that might otherwise be spent on searching for the cause of a fault that isn't actually there. Here are some examples where a fault was initially thought to be present but it wasn't necessary to use any tools to put matters right. Most of them are based on my personal experience, and I admit that with hindsight some of them look like blunders. But it's easy to assume that a fault is present when some of these conditions are met for the first time, and I doubt whether I'm alone in this respect.

A Handset Problem

There were two symptoms with an ITT Trimline receiver that came in. The main one was intermittent loss of the signals. This was quickly diagnosed as being caused by dry-joints in the tuner/i.f. module: a quick rework of all the connections here restored reliable operation. I was also told that the remote control system hadn't worked for months. As the batteries were flat I cleaned and retensioned the contacts and fitted new ones. But there was still no action when the unit was tried.

A couple of fruitless hours were then spent stripping the unit more than once, replacing the remote-control receiver assembly in the set and the associated i.c.s. Finally in desperation I pointed the handset at the receiver and pushed each button in turn. Suddenly everything began to work normally. The next few minutes were spent working out what had happened. Then the penny dropped. It was one of those TV sets that come with a teletext handset even though there's no text panel. Someone had pushed the text button, after which the normal functions weren't available until the picture button had been pressed. To make matters worse the markings on the buttons had worn off, so it was not obvious that the handset was a teletext one. I tried removing the batteries with the text mode selected: when they were replaced several minutes later the unit was still in the text mode.

Standby Problems

My first brush with the Ferguson ICC5 chassis occurred when a friend gave me a set that bore the Model number 51L5BQ – incidentally in every list of ICC5 sets I've come across this model is omitted, does anyone know why? Anyway the set was in a really bad way, hence the gift.

After repairing much damage and many faults the set finally sprang to life. But the second time I switched it on the set went into the standby mode before a picture appeared. Several more attempts produced the same result. I eventually found, to my great relief, that the set could be brought back to life by holding in the channel-up button. I subsequently learnt that when the set is switched off in the standby mode this fact is stored in the memory, the result being that it returns to the standby mode when next switched on. The set can of course also be brought out of standby by using the handset in the normal way.

I've heard that some sets behave in a similar fashion when switched off manually while programmed in the timer-off mode. The next time the set is used it switches off after the period for which the timer was set on the previous occasion. Those unaware of this could waste much time looking for a non-existent fault.

Play Problem

An Amstrad TVR3 televideo unit I had in for repair had a badly cracked control PCB in the video section. When I tested the machine after carrying out the repair I found that it went into play as soon as a tape was inserted and the stop button was ineffective. I stripped the unit down twice more and rechecked the panel but no further faults were found. Luckily the last time I inserted the video section into the cabinet I noticed a switch, marked 'repeat play', at the rear of this section. Normal operation was obtained when this switch was flicked to 'off'.

Store Lock/Hotel Mode

I carry out TV/VCR repairs for local hospitals. A recent addition to my list of customers is the private wing at the District General Hospital. Eighteen Philips GR1-AX portables had been installed here. The first one to cause problems produced only very limited volume. Fortunately I hadn't wasted much time on fault-finding before something began to stir at the back of my mind. I searched through my copies of Philips' *Service Link* and eventually found details of the store lock/hotel mode that's a feature of this chassis.

This facility is used to prevent alteration to stored TV and VCR programme tunings, to prevent alteration to sound and picture personal-preference values, and to limit the available volume range to a preset maximum. Store lock is made operative by selecting programme 38. Adjust the volume to the maximum desired level, then press the store and programme-up buttons simultaneously. To unlock, you select programme 38 then press the store and control-up buttons simultaneously. The set worked normally when this unlocking procedure had been followed.

The Philips GR2.1 chassis also has a hotel mode and channel 38 again has to be selected when locking and unlocking. But with this chassis you press programme '–' or volume '+' to lock or unlock respectively.

Child Lock

A Toshiba V411B VCR wouldn't respond to any key commands. The cure was simple but not obvious. Someone had accidentally activated the child-lock function. When the machine is in this mode the only clue is the stop indication in the VCR display. Normal operation is restored by pressing the handset's tuner button until the stop indication goes out. To set the child-lock function, press the standby button for more than eight seconds – until the stop indicator lights up.

In Conclusion

In conclusion I hope that these examples will be helpful in saving some of you time and would welcome information from other readers on similar potential time-wasters.

Letters

COWBOYS ETC

Much has been written in recent issues on the subject of what makes a cowboy. It's not the qualifications they do or don't have but their attitude and approach to the work they handle. My business deals with brown and white goods and in both these fields we have to compete with various self-employed engineers who have worked for national TV rental companies or domestic appliance manufacturers' service depots. You wouldn't expect men from such backgrounds to be cowboys, but in my experience they certainly are. Here are some examples.

One TV man is notorious for quoting around £90 to repair simple little faults. He was well known by his colleagues at his previous employer for being lazy. He probably quotes high because he doesn't want many of those who approach him to go ahead with a repair. If say three people a week accept a £90 quote he has £270 in his hand. Working from home, the only overhead he has is his ad. in the paper. Another TV man seems to be capable of repairing only Ferguson products. We've seen numerous items that he has botched up then told the customer that parts aren't available. He told the owner of a set fitted with the Philips KT3 chassis that it had a duff tube when the cause of the trouble was faulty RGB output stage operation because of a small print crack in the line output stage.

Two guys from the same previous employer compete with us in the domestic appliance field. They both appear to have gone into business to make the maximum amount of money for the least effort. They charge for parts they've not fitted at prices that would be too high if they had fitted them, and in some cases have invented names for things they claim to have fitted. They never turn up when they get a call-back, and both have been known to return items they either couldn't fix or for which they had an estimate refused with bits missing.

A man you would call a skip scavenger has brought me numerous items that had been dumped though they had only minor faults. I can't help wondering whether they were dumped because their owners had been misled by these real cowboys.

Name and address supplied.

I'm appalled by the increasing number of manufacturers that refuse to give advice to non-account holders. Often the only response I get is "buy a £30-£35 manual" to help with the repair. I always mention such lack of support to my customers and hope that the message gets through.

I've been in the business of servicing TV sets, VCRs etc. for over twenty five years and have worked for a manufacturer. I always gave advice, technical or not, as I felt that you should look after your products, not just sell them. We're not all cowboys.

J.R. Luniss,
Swindon, Wilts.

NICAM ON A SHOESTRING POSTSCRIPT

I'd like to add the following postscript to Keith Wevill's article in the February 1993 issue. Like Mr. Wevill I bought a Nicam unit from Sendz Components, though there was no Nicam service in this area at the time. Once Nicam became available I got the article out and studied it. The suggested interface was more complex than necessary for my purposes: all I required was for my set to switch to stereo automatically when this was present and back to mono otherwise. The following modifications – additional to the filter, crystal etc. modifications in the previous article – make this possible.

(1) Fit a link between pins 16 and 20 of input plug BS15. This makes IS12 (4053) switch between Nicam (pins 2 and 12) and second scart (pins 1 and 13) inputs in accordance with the status of the N line.

(2) Lift the IS04 side of R524 and connect the freed end to pins 1 and 3 of the second scart socket. This supplies the mono signal.

(3) Lift the IS04 side of J031 and J008. These provide the right- and left-channel outputs respectively. Because of the values of C557 and C556 a fairly high-impedance load is needed: I fitted emitter-followers here.

Not having any way of applying I2C control I decided to use IS06, IS16 and IS07 on their own. The modifications required to do this are as follows.

(1) Lift CW28 and CW25 on the IS05 side. These are the inputs to IS06 and IS16 respectively. Note the polarity of these capacitors to ensure that this is compatible with your interfacing arrangements.

(2) To use IS07, lift the IS05 sides of J033 (right) and J020 (left). These feeds require a bias of about 6V.

I won't provide details of the gain-controlled interface I use between IS12 and IS06/16 as it employs an obscure Japanese chip that happened to be in my junk box. The output from IS12 does need a small amount of amplification to drive IS06/16, but none is necessary for IS07.

Philip Lane,
Aberaeron, Dyfed.

CAR RADIO-CASSETTE PLAYERS

As I spend my time repairing car radio-cassette players I found Alan Bouskill's article in the October issue and B.D. Andrews' letter in the November issue interesting.

My experience with the Philips P1 and P6 decks is that the belts do need to be replaced – I do it as a matter of course. In these mechanisms the belt provides drive during play and wind/rewind and also moves the head and pinch roller(s) into the cassette when one is inserted. If the belt is at all slack the head/pinch roller assembly will stall before this movement is complete and it will then be impossible to eject the cassette. Should this happen while the owner is using it and he employs strong-arm methods to force out the cassette a plastic lug will as often as not break off, rendering the deck fit only for the bin! In addition the corners of the square-section belt used in the P6 deck become rounded after a time: the result can be intermittent rotation of the belt along its length, which in turn causes unpleasant speed variations.

I agree that it's now uneconomic to replace the on/off switch in the Ford RST21P unit, which was made in Brazil by Blaupunkt. When it was a current model however I replaced over a hundred. The job takes about one and a half hours. Everything has to come out of the case, including the push-button/tuner unit! What finally finished this a.m. only model for me was the demise of Radio 2 on the medium wave (so customers lost interest) and the increasingly expensive deck spares (available from Motorola stockists).

It's possible to wire across the legs of the switch. Remove the left-hand spring clip (one of the pair that secures the unit in the car), the left-hand upper PCB (the one over the volume control) and the cassette deck. Getting a soldering iron in isn't easy – but is possible! Alternatively the switch can be bypassed by shorting out two points on the rear socket-panel PCB, or by connecting the 12V+ and electrical aerial terminals together and feeding power to their junction via a 3A fuse. Despite some loss of supply filtering, these bypass methods don't seem to create interference problems. But I don't personally wire across or bypass switches any more, because what happens when a unit develops a fault and starts to emit smoke while the owner is driving in the outside lane of a motorway and the only method of switching the unit off is to use the ignition key?!
Geoff Davies,
Rugby, Warwickshire.

SCOPE REPAIRS

Roger Burchett's letter (November) on the high cost of scope repairs reminded me of a problem we had with the popular Philips PM3055. A few years ago the company I work for bought ten of these scopes. Earlier this year they all started to fail. The symptom was always the same: the scope would be running all right at the end of one day, but wouldn't start at the beginning of the next. The screen remained blank, the cursor illumination didn't work and the power supply made a singing noise.

The cause of the fault proved to be very elusive. We sent a scope to a local calibration and maintenance company, but they couldn't fix it. Meanwhile, other scopes were failing in the same way. Some could be persuaded to work after a few off-on switchings, and the situation became so acute that if a scope was working all right we left it on for 24 hours a day. We spoke to Philips, who told us that it was a power supply fault which they fixed by simply replacing the power supply. Their standard charge for doing this for us would be about £800 a time!

As this was more than the value of the ageing scopes I decided to have a go and, to cut a long story short, discovered that most of the electrolytic capacitors in the power supply had gone low in value. The main culprits were C6011, which caused the control loop to hunt, and C6103, which resulted in the –6·4V supply dropping to about –5·8V: this was sufficient for the protection circuit to become trigger happy and fire the crowbar thyristor. Also the ripple voltages were inconsistent. So we replaced all the reservoir capacitors, using high-frequency, high-ripple types. Ten scopes were fixed in this way. We didn't have to spend £8,000, just fit a hundred capacitors. Materials and labour came to about £400, a 95 per cent cost saving!

The capacitors required for this repair are listed below. Note that the high-frequency, high-ripple current types marked * have radial, not axial, leads. They can be easily fitted however but the leads must be sleeved to prevent shorting to adjacent tracks.

C6011	22µF, 63V	RS107-094
C6103/6/8	470µF, 16V*	RS105-925
C6111	220µF, 25V*	RS105-975
C6113	100µF, 25V*	RS105-969
C6116	100µF, 63V*	RS106-114
C6119	22µF, 63V*	RS106-091
C6132	100µF, 25V	RS107-022

C6011 was 33µF originally. We also added an 0·1µF capacitor (RS124-178) across the emitter and base of V6137 in the protection circuit to prevent spurious transients triggering the crowbar thyristor. This capacitor is small enough to fit on the back of the PSU board.
Keith Cummins,
Holbury, Hants.

Because of a leak in the roof a drop of water had fallen into our Hameg HM203-6 scope. This caused a lot of grief, as the scope is an old friend and I'm lost without it. So I removed the top cover, inspected and dried the panel, replaced the 50mA fuse 701 and switched on. Almost instantly there was a spark between various components in the high-voltage circuit. I then cleaned the panel and made sure that no further tracking could occur. The unit then operated after a fashion, with only a single spot on the screen. The spot moved, the timebase started to run then stopped again. I switched off, started to check the silicon in this area and noticed that R525 was burnt. After fitting a new 1kΩ resistor I thought that the scope might work, but that would have been too easy.

On checking more components in this area I found that transistors T506/7/8 were all faulty. When these had been replaced I had a display, with two very bright dots on the left of the trace and a narrow X scan. I connected the probes (both channels) to the squarewave test pin at the front of the unit: though the display now worked it looked as though it was in a chopped mode. After more testing T504/5 were found to be faulty and were replaced. This removed the chopped effect but there was still lack of width. Closer inspection of the display showed that the Y and X amplitudes were both reduced. This led me to the conclusion that the e.h.t. was too high. Transistors T506/7/8 which had previously been replaced are part of an e.h.t. regulating system, along with the 741 operational amplifier chip IC502. Replacing this chip cured the last fault. The scope was now back to full health and after using some equipment that was close by to test it I put it back together, gave it a loving kiss and wrapped it in cotton wool!
Chris Watton,
Boston, Lincs.

A PRINTER REPAIR

Here's another story about manufacturers' high repair charges. When I upgraded my old computer system to an IBM compatible for my wordprocessing I was given a Canon PW-1080A dot-matrix printer to go with it. Unfortunately the printer wouldn't print anything: it just fed out blank sheets until it was switched off. It would print out a test pattern in its test mode however. I decided to phone Canon and ask for advice. After chatting to the technical department for a few minutes about correct connections etc. I was told that repair would cost £120 labour plus parts. I told them I'd think about it and rang off.

I managed to get a service manual from a colleague, and after looking at the circuit and going through the circuit description narrowed the cause of the fault to four chips. One of these was a Canon special but the other three were standard items (and gates, nor gates and a RAM) that are available from RS Components for £5·50 the lot. I decided that this small sum was worth a gamble and replaced all three chips, leaving the Canon special alone. The printer has worked perfectly ever since. I thus saved £120: total time for the repair was a few hours one evening, not counting the one-day wait for the chips to arrive. So repairing your own equipment is well worth it if you possibly can. Maybe I should extend my business to the repair of printers!
Richard Newman,
Croydon, Surrey.

Servicing the Rediffusion Mk 4 Chassis

Chris Watton

On a recent visit to an ex-rental TV receiver outlet I was amazed to see so many Doric/Rediffusion Mk 4 sets. As they were originally used mainly as rental models many engineers may be unfamiliar with them. So here's a short survey of some of the areas that cause problems and how to deal with them.

One thing that's unusual is the fact that many of these sets have a three-core mains lead. This earths the chassis instead of leaving it floating, as is usually the case. Any set with an isolated power supply could have its chassis earthed of course, but the fact that this one sometimes has a solid earth connection to the mains plug should be borne in mind when doing any servicing without a mains isolating transformer, the point being that live mains will be present along with an earthed metal frame.

The power supply is on the right-hand side of the chassis. It's a chopper circuit with a TDA1060 control chip, a two-transistor (4TR1/2) driver stage and a start-up circuit with a thyristor (4THY1) and a wirewound, spring-off resistor (4R2). The circuit is shown in Fig. 1. Chopper transformer 4T1 provides mains isolation. The timebase panel is mounted at the bottom. It provides field and line drive, e.h.t. from a tripler and scan correction. Note that there are two versions, one for use with 90° the other for 110° tubes. There are also two different types of field timebase (the chip type was changed in later production). Moving over to the left-hand side the next panel, which is hidden behind the aerial socket, is the audio/video interface board. The colour decoder/RGB output panel is mounted above this, facing a text interface board in sets that have teletext. To the left of this there's the tuner/i.f./audio output panel: there are several types, some with separate v.h.f. and u.h.f. tuners and some with a prescaler can for use with frequency-synthesis tuning, in which case a large panel at the extreme left-hand side of the chassis provides tuner control and remote control operation. The teletext decoder panel, where this is fitted, is fixed to the side of the cabinet.

Faults

There are quite a few common faults, but fortunately they are in the main easy to remedy. Provided the tube is in good condition the set should display a good picture and provide reliable operation. The following notes provide guidelines on fault tracing: a fault summary with the usual cures is provided at the end of the article.

The Power Supply

A dead set usually means that there's a power supply fault. You will probably find that either 4R2 is open-circuit or the fuse has blown because the BU326A chopper transistor 4TR3 is short-circuit. If the fuse is o.k. and 4R2 is intact but hot check 4C6 which may have dried up. If 4TR3 has failed check whether 4C16 in the snubber circuit is dry-jointed, the transformer for dry-joints and 4TR2 in the driver stage for leakage. If 4R2 is open-circuit check whether 4D6 is short-circuit then move over to the line output stage and check the BU208A output transistor.

It's quite common to find that 4R2 is open-circuit. As a result the set won't start up. The cause may be an overload in another circuit, usually the line output stage – more on this later. 4R2 fails when there's no l.t. supply from the chopper transformer. Any fault that reduces the voltage developed across winding G-A on the transformer will have this effect: the power supply then tries to run on the start-up voltage and after a short while 4R2's spring opens as the solder melts.

If the fuse is open-circuit, usually blackened, and the chopper transistor 4TR3 is short-circuit the cause is almost certainly on the power supply panel, dry-joints being the usual culprit. These may be obvious – disastrous-looking scorch marks, though these can usually be cleaned off and a successful repair carried out. If 4C16 in the snubber network is badly jointed a trail of destruction may be left behind – check 4TR1/2/3, 4IC1 and resistors 4R30, 4R23, 4R22 and 4R26. When these components have all been replaced the power supply should run. It's advisable to check the connections to 4C16 whenever one of these sets is serviced. Another common source of dry-joints is the transformer: it may look as though it's connected perfectly, but faults start to occur when the set has been on for a while. Also tiny cracks can appear close to the transformer, blowing 4TR3. A leaky BD433 transistor (4TR2) in the chopper driver stage can cause a trail of component failures.

If the set is dead, 4TR3 and 4R2 are o.k. but the fault is in the power supply, check that 4IC1 is receiving its 14V supply at pin 1. If this is o.k., check that the chip is producing output pulses at pin 15. On a few occasions I've found that the chopper transistor is open-circuit. All voltage checks on this side of the circuit should be made with respect to the power supply earth line (the negative side of 4C5/6/7 etc.), not the main chassis earth line (the negative side of 4C20/21 etc.). The rectifiers on the secondary side of the circuit (4D20/21 etc.) and their associated reservoir capacitors (4C20/21 etc.) can be responsible for the dead set symptom, but in this case 4R2 will normally be open-circuit.

Note that there are two power supply panels, one for 90° and the other for 110° sets. The former provides a 125V h.t. output while the latter provides 150V. Different transformers are used, and the connection plug is arranged so that a 110° panel can't be connected to a 90° set and vice versa.

In most sets the power supply unit can be removed from the chassis and disconnected from its load: provided there's no major fault and a suitable dummy load is provided (a 60W or 100W bulb connected between 4L5 and the chassis on the secondary side) the supply will run when connected to the mains. There's an earth connection point with a push-on plug which is normally connected to the chassis frame. This serves as as earth test point for checking the output voltages when the panel has been removed.

The Timebase Panel

There are different timebase panels for 90° and 110° sets. In addition in later production a TDA1670 field timebase chip is used instead of a TDA1470. Earlier version panels can be interchanged with later ones and vice versa, but the

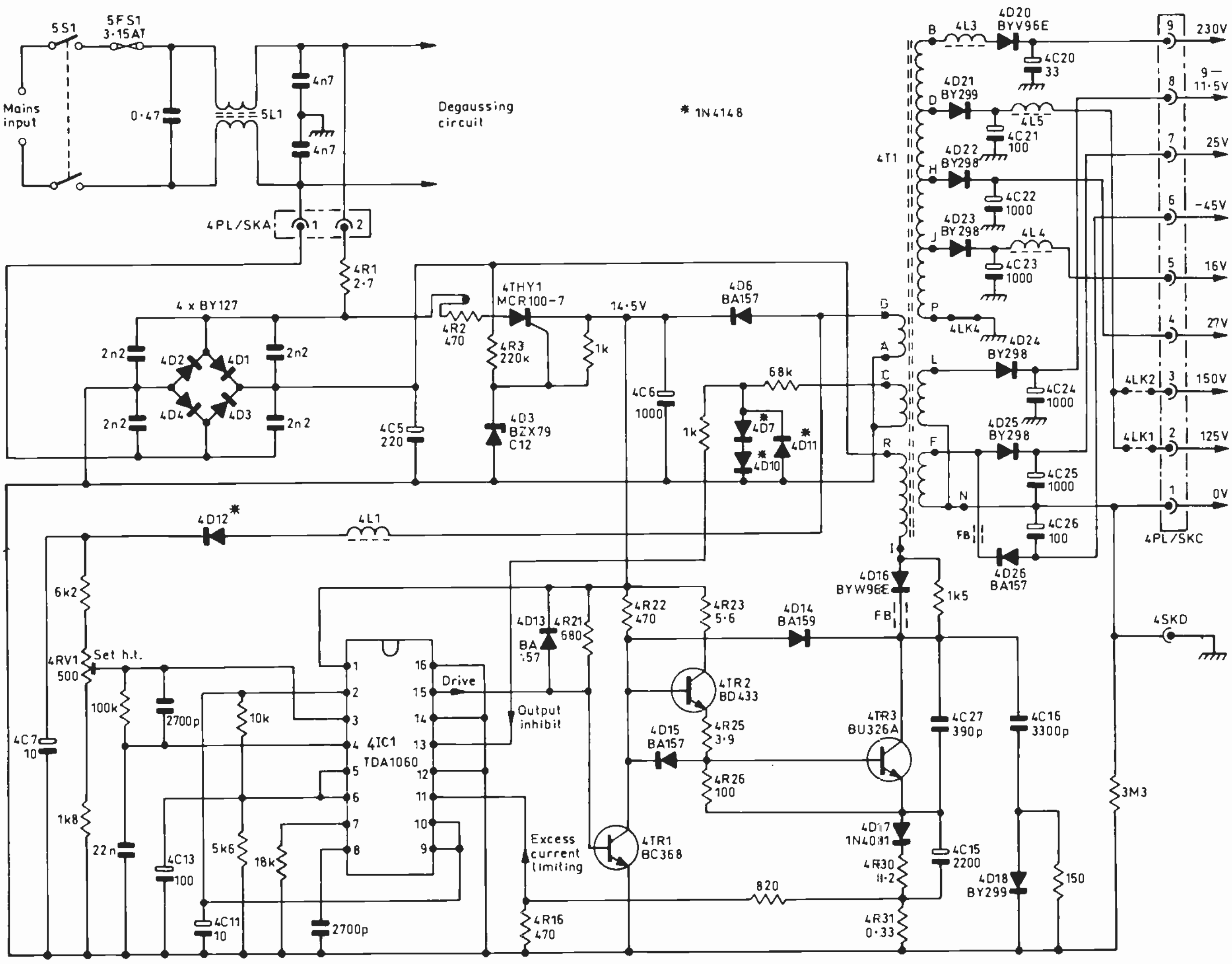


Fig. 1: The power supply circuitry.

correct type must be used to drive either 90° or 110° tubes. The 110° type can be recognised by the extra components fitted for EW correction. Fault finding in this part of the set can be tricky. The panel is difficult to work on when in the chassis, and the short leads mean that the set can't be operated with the panel removed. Only small areas of the print are accessible from the bottom.

The tripler, which has a built-in focus control, often fails. It either goes short-circuit internally or a crack or hole appears in the case. With the latter fault you get sparks and bangs as the e.h.t. jumps to the fixing screws. Care is required when removing the tripler as the solder tag on the transformer isn't the strongest thing in the world and the lead to the tripler is wrapped through the hole.

The BU208A line output transistor will fail in 110° sets if there are any dry-joints around the EW modulator transformer 3T3 or diodes 3D4 (BYW96D) and 3D3 (BY228). These components should be resoldered whenever a set is repaired. In all sets a dry-jointed chopper transformer can kill the line output transistor. The screws that hold this transistor can be extremely tight, a stout screwdriver being needed to remove them. Be sure to support the panel when doing this as it can crack.

EW faults are usually caused by failure of the BDW23C output transistor 3TR6. Failure of 3C24 (3·3nF, 2kV) can cause lack of width with overheating.

The beam current trip on this panel operates when the beam current exceeds about 3mA. It uses thyristor 3THY1 as a crowbar across the 12V supply. When it fires there's no supply to the line oscillator and the set shuts down. The trip is reset by switching the mains supply off. False tripping can be caused by the tripler. The beam current limiter circuit is also connected to the colour decoder panel for normal limiting via the contrast control.

The line drive comes from pin 2 of the TDA1950 chip 3IC1. Between this point and the base of the line output transistor there's a conventional line driver stage with a BF819 transistor (3TR1) and transformer (3T1). 3IC1 contains the line and field sync circuits, the video input being at pin 11 and the field sync output at pin 9. There's also a sandcastle pulse output at pin 4. This goes to the decoder panel and, in sets with remote control, the frequency-synthesis tuning circuit. Pin 5 of the chip is used for VCR sync adjustment: it's linked to either the tuner pushbutton unit or the remote-control panel. The chip is quite reliable, but can be responsible for a ragged picture or no line sync. Before changing it check capacitors 3C4 (0·1μF) and 3C5 (0·01μF). The line hold control 3RV2 (10kΩ) can also be faulty. To set the line hold short together the two pins next to the i.c. and adjust 3RV2 for a stationary picture.

The most common fault in the field timebase is loss of scan because of a dry-jointed deflection coil plug. The fault may be intermittent of course. Poor joints can also be present around the chip itself, whichever type is used, though the TDA1670 version seems to be more prone to this. Field collapse can also be caused by failure of 4D22 (BY298) on the power supply panel, since this provides the field timebase chip's 27V supply. Failure of the safety resistor 3R53 (4·7Ω) is another cause of field collapse, though this usually goes open-circuit only when the chip is faulty with an internal short. If you find that the field timebase chip has failed, check for dry-joints around the chopper transformer and the scan coil plug.

The Colour Decoder Panel

The decoder panel is almost certainly the most reliable part of the set. The main items here are the TDA3300B chip, which provides auto grey-scale tracking as well as colour decoding, and the RGB output stages. Each of these has three transistors. You get occasional trouble here, such as one colour missing or a predominance of one colour. We've found it best to replace all three transistors and any burnt resistors in the faulty channel – changing single transistors usually leads to further breakdowns. No colour can be caused by the 4·43MHz crystal 2XL1, but the chip is more often responsible for this symptom. Another fault that can be blamed on the chip is when the colour level increases as the set warms up, until the colour is at maximum with the control at minimum.

The Signal Panel

As previously mentioned there are various versions of this panel. The most common problem is drift and/or loss of signals caused by cracked earthing in the u.h.f. tuner, where its internal PCB meets the metal frame. Resoldering will often provide a cure but a new tuner is sometimes required. If you suspect a low-gain tuner, it's worth checking the TDA2540 i.f. chip 0IC3 and the SL1430 SAWF driver chip 0IC2 first: they can both be responsible for a snowy picture that gives the impression of a low-gain tuner.

Tuning drift can be caused by the ZTK33B 33V regulator 0IC1, but in most cases the tuner or, in manual control models, the pushbutton unit is responsible.

The TDA1035T chip 0IC4 and the 33μF, 16V capacitor 0C33 are the usual causes of no sound.

Control Units

The basic set has an eight-button tuning selector that has given more than its fair share of trouble. It can be responsible for drifting or sudden loss of signals. In most cases a successful repair is possible as the cause of the problem is the spring contacts, which become tarnished. Clean them and the unit will be all right. It's a waste of time using miracle spray or even (joke) WD40 as the cause of the fault will still be there.

Care is required when separating the pushbutton unit as the plastic snap-fit parts can easily be broken. At first sight getting the unit apart may look difficult. Remove a couple of wires from the a.f.c. switch, gently ease the plastic catches outwards, then pull the potentiometer pack from the latch section. You will now have a piece with spring contacts that stick out: they must be as bright as new pins before reassembly. If you feel that the contact area is too worn it's possible to remove the springs and turn them over. I clean them with a soft fibre stick, but a cotton bud and meths will do. The latch assembly also has a contact plate in it. This can be removed but is difficult to replace. If a cotton bud is used the contact area can be cleaned without any need for removal. Reassemble the unit when every part is clean: take care to position the a.f.c. switch and its button (which is easily lost) correctly otherwise it will work the wrong way round, i.e. when the door is open.

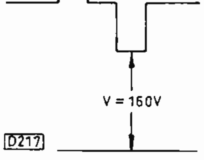


Fig. 2: Waveform at the collectors of the RGB output transistors when using a scope to set 6RV1. Check which transistor has the highest amplitude trace, then use this to set V to 160V.

Remote Control Versions

The remote control and frequency-synthesis tuning circuitry is on a large panel at the left-hand side. The chips used are of the same type as in many ITT sets produced at that time. This panel also drives the release solenoid for the on-off switch.

Knowing the functions of the chips can be helpful when looking for the causes of faults in this area. 8IC1 (SAA1174) provides frequency-synthesis control, 8IC2 (SAA1075) is a non-volatile memory, 8IC3 (SAA1276) provides the on-screen display while 8IC4 (SAA1251) decodes the remote-control signals. There's also a TEA1009 chip in the remote-control receiver can – circuit reference 9IC1.

The supplies in this section are as follows: 18V, which is derived from the 25V rail via 8R81 (12Ω) and the three-pin 7818 regulator 8IC5, and 5V which is used by the prescaler module and comes via 8R1 (56Ω), with zener diode 8D1 (1N5338) providing regulation.

Remote control handsets are available quite cheaply from most major component suppliers. Many ITT remote control units will work with these sets as similar chips are used.

Setting Up

Power supply: There's only one adjustment, for the h.t. voltage. Set 4RV1 for 125V (90° sets) or 150V (110° sets) at the top of coil 4L5 on the power supply panel.

Tube drive: 2RV3/4/5 on the colour decoder panel are the drive controls for the RGB output stages. They should be set for maximum drive then if necessary one or two of them can be adjusted to correct the picture highlights. The first anode preset 6RV1 is on the tube base panel. It's important that this is correctly adjusted, which is best done using a scope. Turn down the colour, brightness and contrast controls, then check the waveforms at the collectors of the RGB output transistors 2TR1/2/3 to find which one has the greatest amplitude. The traces will be as shown in Fig. 2. Set voltage V to 160V. The voltage can be set using a meter, but this is not as accurate. The method is as follows. Switch to the video mode, turn the brightness to minimum then check at the collectors of the three RGB output transistors 2TR1/2/3 to find out which one gives the highest reading. Adjust 6RV1 to bring this reading to 185V.

All other controls in the set are straightforward.

Use with a VCR

On receivers with manual control the VCR line sync time-constant is set by a small switch at the back of the pushbutton unit (at position 8). With remote-control receivers four programmes can be used, 7, 8, 15 and 16. Alternatively direct audio and video can be fed in via sockets at the back, with selection by a switch at the front of the set – it's behind a small flap at the bottom of the speaker grill. A red LED comes on when this mode is selected.

Fault Summary

No signals: The U341 tuner unit, the pushbutton unit, the TDA2540 chip or the SL1430 chip may be responsible. If the pushbutton unit is replaced it may be necessary to fit link 2 (u.h.f.) on the signal panel. With remote-control sets the SAA1174 chip may be responsible for loss of the tuning voltage.

Tuner drift: The ZTK33B stabiliser 0IC1, the U341 tuner unit or the pushbutton unit may be responsible

AFC pulls off when the door is closed: The switch on the tuner unit may be incorrectly fitted or 0L7 might need slight adjustment.

No colour: Check the TDA3300B chip and crystal 2XL1.

Can't turn the colour down: The colour control may be open-circuit or the TDA3300B chip faulty.

No sound: Check the TDA1035T chip and capacitor 0C33 (33μF).

Distorted sound: Check 0C33 (33μF).

No picture, raster o.k.: The TDA1950 chip may not be providing a sandcastle pulse output or the TDA3300B chip may be faulty.

No raster: Tripler faulty.

No sync: Replace the TDA1950 chip.

Field collapse: Check for dry-joints at the scan coil plug and around the field timebase chip 3IC2. 4D22 or 3R53 could be open-circuit. If 3R53 is open-circuit 3IC2 is probably shorted internally.

Lack of width: Check the 3·3nF, 2kV capacitor 3C24 (110° sets).

Concave picture: Check 3TR6 (BDW23C) and 3D4 (BYW96D). Cause could be dry-joints, which could also have been responsible for failure of the semiconductor devices (110° sets).

Line shimmer: Check 3C4 (0·1μF), 3C5 (0·01μF) and 3IC1 (TDA1950).

Dead set with 4R2 open-circuit: Check the tripler, the BU208A line output transistor, 4D6, 4C6, 4IC1 and the chopper transformer for dry-joints.

Dead set with fuse open-circuit: Check the bridge rectifier diodes 4D1-4 and the associated reservoir capacitor 4C5. Then check the BU326A chopper transistor. If it's short-circuit check for dry-joints or cracks around the chopper transformer, for dry-joints at the connections to 4C16, and 4TR2 for leakage. If 4C16 is dry-jointed or 4TR2 is leaky check 4TR1, 4IC1, 4R22, 4R23 and 4R26.

Dead set with fuse and 4R2 o.k.: Check 4TR2 (BD433), 4THY1 (MCR100–7), 4C6 and for a cracked connection at the feed to the chopper transformer (pin R).

Line output transistor keeps blowing: Look for dry-joints on the EW modulator drive transformer 3T3: they may look o.k. but open when hot. Also check the EW modulator diodes 3D3/4. These items are in 110° sets only. Poor joints around the chopper transformer can also lead to the destruction of 3TR2. Again, they may look o.k.

Long-distance Television

Roger Bunney

Pressure over the UK during much of October was high and stable, producing overcast skies here in the south. Fortunately tropospheric conditions improved during the final week of the month, particularly in the north. I spent a week's holiday at Croyde Bay near Barnstaple in late October: despite the sloping site to the west across the sea there was no sign of RTE (Ireland), which I suspect was screened by the rocky headland nearby. Apart from the local vertically-polarised relay signals the TV bands were largely empty – an ideal spot for Band I TV DXing! Given time and patience Sporadic E reception was possible on most days, as the following collated log testifies:

5/10/93	TVE (Spain) ch. E2.
6/10/93	TVE E2, 3.
9/10/93	TVE E2.
10/10/93	DR (Denmark) E3; TVE E3; ARD (Germany) E2, 4; RAI (Italy) IA.
12/10/93	TVE E2, 3, 4.
13/10/93	TVE E2, 3, 4.
14/10/93	NRK (Norway) E2, 3; RUV (Iceland) E4.
15/10/93	RTP (Portugal) E2, 3; TVE-1 E2, 3, 4; TVE-2 E2; RAI IA.
16/10/93	DR E3; TVE E2, 3, 4.
17/10/93	RAI IA, B; TVE E2, 3, 4.
18/10/93	TVE E2, 3, 4; DR E3; +PTT (Switzerland) E3.
19/10/93	TVP (Poland) R1, 2, 3; CST (Czech Republic) R1, 2; ARD E2, 3; TVE E2, 3, 4.
22/10/93	+PTT E3; TVE E2, 3.
24/10/93	+PTT E3; TVE E2, 3, 4.
25/10/93	TVE E2; TVP R1, 2.
30/10/93	DR E3; +PTT E2.

There was a good tropospheric opening on the 19th, with Band III/u.h.f. signals from Germany, Scandinavia and the Benelux countries – Simon Hamer sent in an impressive log of Swedish and Norwegian reception at his location in mid-Wales. From the 25th the prolonged high-pressure system produced reception from the same countries/areas across much of England and into Scotland – David Glenday reported very strong signals, his highlight being an RTL (Luxembourg) test pattern with the identifications CH24 and RTL – TV1 on November 1st. Oddly, conditions in Scotland were much better than in the south.

My thanks to Peter Schubert (Rainham), David Glenday (Arbroath), Simon Hamer (Powys), Iain Menzies (Aberdeen), Roger Fussell (Torpoint) and Brian Williams (Penarth) for sending in logs and reports.

News Items

Portugal: A new ch. E2 transmitter, location not known, is in operation. The first RTP service is now called Canal 1, a small 'C1' being inserted at the top left of the screen during programmes; the second service is called TV2, again with logo at top left. Our thanks to the Benelux DX Club for this information. Outside programme times RTP transmits either a FubK test pattern, with or without clock, or a black/white pattern. The third service, SIC, is a commercial one that comes on in the early afternoon. A fourth service is run by Catholic Radio Renascenaca, which also runs an f.m. radio service.

Canal Plus: The French broadcaster has applied to run a national service in Poland, also local services in ten major towns. It has also entered into a partnership with an organisation called EKO to provide services to the five largest cities in Turkey – the Syster scrambling system will be used.

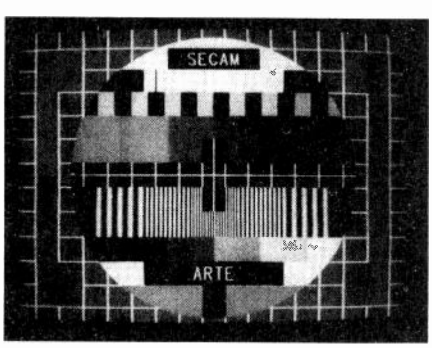
Sri Lanka: The ETV-2 service is now transmitting 'Prime Sports' on ch. E35 while ETV-1 is transmitting BBC WSTV, both taking their feeds from Star TV Hong Kong via AsiaSat-1. ETV-2 is Colombo's sixth TV channel. For FM DXers, TNL-FM is at 90MHz and 101·7MHz stereo while the TNL-TV audio channel is transmitted in stereo at 89MHz. Our thanks to Bandula Gunasekera for this information.

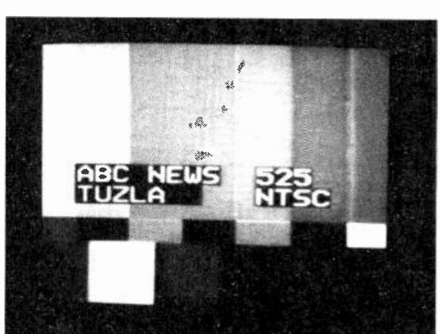
Israel: Palestinian radio and TV broadcasting has started from Ramallah on the West Bank. The Israeli Broadcasting Authority proposes to start a third channel operating in Hebrew, Arabic and Russian: it would probably be distributed via satellite.

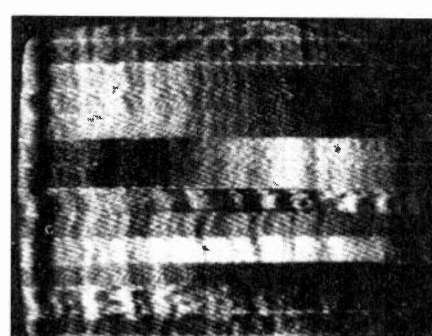
Estonia: There are now five terrestrial channels the most recent, a commercial one, being Kanal Kaks (Channel Two).

The Netherlands: Nozema plans to start scrambled Pay-TV services via NED1 and NED2 during the night (0200-0700). DX catch ZH-TV continues with test transmissions on ch. E49.

Czech Republic: The country's first commercial service,







Left: The French ARTE test pattern, received by Tim Anderson (St. Leonards, East Sussex). Centre: An NTSC news feed received by D.J. Hunt (Brighton) from Eutelsat II F1 at 13°E, using a 60cm dish and a Pace 9210 IRD. Right: F2 layer reception of the IRIB (Iran) ch. E2 test pattern by Tim Anderson.

the Prague-based Nova, plans to open in February using the present F1 channels.
Russia: There's a new channel, NTV, in Moscow.
China: The commercial City Network Corporation is to provide an evening service to areas with a population of some 55m. These include Guangdonng, Chengdu, Ningbo, Hangzhou, Nanjing and Harbin City. China hopes to start an HDTV service by 1999, with test transmissions from 1996 onwards.

TV-DXing for Beginners – 2

This time we'll consider the equipment required for DX-TV reception. First the receiver itself. There are three options here: (1) a multistandard set, (2) a standard u.h.f.-only UK set with a v.h.f.-u.h.f. converter, (3) use of an outboard tuning system that provides a u.h.f. output for feeding to a standard UK set.

The first option is the simplest. Though more expensive it will cater for the different vision and sound standards and, if it includes system L, the unusual French standard (with positive-going vision modulation and a.m. sound). You should be able to get a small-screen monochrome system B/G/I/L receiver for under £100, though a colour set will cost around £250. Multistandard sets have v.h.f. and u.h.f. coverage and can handle several different sound carrier spacings. Such sets are available from specialist dealers. Asda often has v.h.f./u.h.f. sets on sale, while Nikkai markets a relatively inexpensive multistandard colour receiver. A set that also caters for the US NTSC standard is likely to be on the expensive side.

The second option is a much cheaper way of getting v.h.f./u.h.f. coverage. It works best with a u.h.f. receiver that has a single rotary tuning knob or one with lots of memory channels. The converter is a small box that converts 40-250MHz to a similar chunk of the u.h.f. spectrum. Connect a v.h.f. aerial to its input and feed its output to the main receiver's aerial socket. Then, by tuning the receiver between about chs 30-60, using either a rotary knob or memories, you have v.h.f. coverage. The converter changes only the frequency, not the standard, so a UK set will display foreign pictures, in colour if they are PAL ones, but will not provide sound reproduction (unless the signal is a system I one). You will not be able to resolve French transmissions. A new upconverter costs around £50. Labgear produces converters for use with cable systems: some have an r.f. amplifier, others may not – you want one with an r.f. amplifier.

The third option operates in a similar manner to the second but the separate v.h.f./u.h.f. tuner provides an output on a single u.h.f. channel. Thus all the tuning is done by the outboard unit. Several systems have been described in past issues. One advantage is that the tuner unit can incorporate variable i.f. selectivity – much better results are obtained with weak signal reception when the i.f. bandwidth is reduced. Surplus tuners etc. are available from suppliers such as Sendz Components. A commercial tuning system, Model D100, is available from HS Publications, 7 Epping Close, Mackworth Estate, Derby DE3 4FR at around £100. For further details send an s.a.e. to HS Publications.

While multiband aerial arrays are available they are expensive. For Band I reception it's not difficult to make a suitable aerial. We need something that will pick up all the Band I channels. Fig. 1 shows two designs. The wideband dipole (a) works well but doesn't provide any gain. It should be mounted horizontally (though SpE signals have no respect for polarisation) and will need to be rotated by hand or motor. The addition of a reflector, see (b), adds gain and directivity. It will also need to be rotated. If you don't want to rotate the aerial, make or buy two wideband dipoles and mount them at right-angles to each other. Connect them either via separate feeders to an indoor selector switch or via similar lengths of coaxial feeder to a wideband combiner, e.g. a triax, Fringe or Antiference ferrite combiner, taking the output from this to the receiver. If you can weatherproof it, the cheap Taiwan-type Y splitter/combiner can be used. Make sure that the unit is ferrite cored, not the resistive version. The two female sockets are for the aerial inputs, the male plug providing the output.

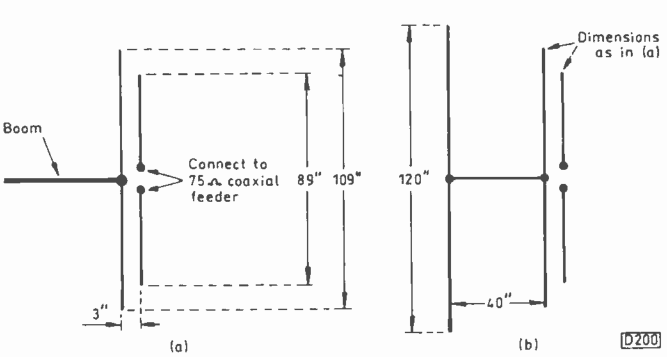


Fig. 1: DX aerial designs for Band I reception. (a) Wideband (48-68MHz) dipole. (b) Dipole plus reflector. Use 1in. outside diameter aluminium tubing for the boom, 0·5in. aluminium tubing for the aerial elements.

Satellite TV

Starting this summer the London-based Middle Eastern Broadcasting Centre (MBC) is to provide a five-channel package for the Arabic states. Other services due to start this year include Orbit Satellite Television Network, a Pay-TV service for North Africa and the Middle East, and a German Channel devoted to travel, Reise-TV, which will use a Eutelsat transponder.

Intelsat has brought its first series 7 satellite into operation at 174°E to provide a trans-Pacific communications link for telephone and TV services.

Berry Habekotte (Holland) recently tried using a Triax offset feedhorn and magnetic polariser with a 65cm Maspro dish. Sadly the results were disappointing. When a Triax dish was used however the performance was impressive. He suggests that it's important to use a feed assembly recommended by the manufacturer of the dish being used. The Triax feedhorn is manufactured by Fuba.

Test Case 373

Dylan wearily walked up the path of number 16, Rother View. It was getting near the end of the day, was dark and the call promised no joy at all – jumbled teletext it said on the card. Once in the living room he was confronted with a large TV set that produced a very corrupted text display. Some of the pages were half readable, and at each transmitted update the form of the corruption changed. It was the same on all channels. There was no way in which he was going to tackle this one on the spot! Into the van with it then, and away to the workshop.

As it happened there were few calls next day, so Dylan was given the set to repair himself. It had a CCT (computer-controlled teletext) decoder, using the well-known SAA5230/SAA5240-41 chip combination in conjunction with an MAB-series microcontroller. This arrangement was very common in sets produced a few years ago.

The fact that the fault was the same in the workshop eliminated Dylan's first suspect, the aerial system. Although reception and aerial faults can upset text reception, they seldom affect all four channels equally – and here the fault was present with the set run from the workshop distribution system, alongside others with clear text displays.

The symptom, randomly incorrect or missing characters that changed with each update, suggested to Dylan that the cause was data corruption. So he started by hooking an oscilloscope to the decoder's video input – pin 27 of the VIP chip – to check the waveform. It looked perfectly all right, but how could he be sure? He switched off the a.f.c. and adjusted the tuning so that it was spot-on. He then made slight experimental adjustments to the vision demodulator coil. This produced no improvement in either the waveform displayed on the scope or the jumbled teletext display – indeed the clock readout at the top right of the page started to change from numbers to letters when the coil's core was moved more than a quarter of a turn. Dylan next had the bright idea of carrying out an eyeheight test on the video signal. But when he checked up on the procedure in a servicing book he hastily concluded that neither he nor his modestly-specified oscilloscope was up to it! He decided that the decoder's input signal was not the cause of the problem.

Into the decoder itself then. His first check here was on the supply lines. The needle of the AVO meter swung over to show that they were within ten per cent of the correct 5V and 12V for the logic and analogue sections respectively. Were the chips getting a reset, Dylan wondered? He couldn't find any reset pins around the SAA-series chips, but there was one at the MAB microcontroller chip: this was being reset all right. Maybe the frequency of the text clock was incorrect? A new 13·875MHz crystal was found and fitted at pin 11 of the VIP chip, but this made not the slightest improvement to the decoding process. Dylan didn't check the dot clock because he knew that this is concerned with synchronisation of the text display rather than the data-decoding process.

There seemed nothing for it but to replace the VIP chip, so in went another SAA5230. The results were little different from before, and while his soldering iron was still smoking Dylan had another CCT/decoder chip in there. The display was still garbled in exactly the same way as it had been on initial inspection at the house in Rother View. Enquiries around the workshop produced the suggestion that the decoder's chassis line was not properly earthed to the rest of the set, but it was.

Where had Dylan been too hasty with his checks? See page 208 for the answer.

Camcorner

Reports from Simon Bodgett and Davic C. Woodnott

Ferguson FC31

The complaint with one of these camcorders was of intermittent no functions with a drip showing in the viewfinder: a dodgy dew sensor was the cause of the problem.

Another FC31 suffered from random operation, a permanent dew indication and a warped cassette housing, the latter probably because of forced cassette extraction. As first steps we fitted a new dew sensor and cassette housing. The cause of the random operation was a noisy record safety switch. **S.B.**

Sony CCDF380

There was a cassette stuck in this camcorder. At least the customer hadn't used too much force in trying to get it out: the damage was restricted to a poor eject damper, while the cause of the trouble was failure of a circuit fuse buried deep inside, on the main deck PCB. **S.B.**

Ferguson FC06

This machine had suffered at the hands of an incompetent. As a result of previous 'repairs' all the circuit protectors had blown and there was some print damage. After replacing the circuit protectors and tidying things up a bit we found that the loading motor drive chip was the cause of the original fault. **S.B.**

JVC GRS70

The cause of very intermittent luminance was traced to R339 in the camera encoder section. A second machine came in with the complaint that the picture went green, red then black-and-white. This was not as serious as it sounds: all that was required was to set up the camera phase-locked loop. **S.B.**

Panasonic NVMS2

We had two of these camcorders in recently from the same customer. Both had the same fault symptom: no functions. The cause was also the same – reversed battery supply connections. You know what happens: this one doesn't work so we'll try the other one! Naturally the cure was the same in both cases, replacement of the fusible link (VSF0059) and the M54543L loading motor control chip. This restored normal operation though further checks were carried out to ensure that no other damage had been sustained. **D.C.W.**

Sanyo VMD6P

There was no viewfinder picture because the viewfinder focus control was open-circuit. Its lower end feeds the brightness circuits. **D.C.W.**

Panasonic NVMC6

The complaint was of a loud 'shrieking' noise from the mechanism, with picture wobble and warbling sound. When we inspected the capstan motor's rotor we found that the plating material which covers the magnetic disc had almost completely lifted. The remaining material scraped against the motor's windings, causing the noise and damage to the varnish. Motor drive signals in the windings were being conducted to chassis via the plating material. A new motor restored normal operation. **D.C.W.**

Sanyo VMD3P

There were no viewfinder pictures. The cause was yet another electrolytic capacitor, this time C9911. Maybe it's best to replace all the electrolytics in these camcorders. Nearly every day seems to bring a 'new one'. **D.C.W.**

Sharp VLC690

The cause of intermittent operation, cutting out and various other symptoms was traced to broken connections at the junction of the main PCB and the operation PCB. If there's a shock at the rear end because one of these cameras has been dropped, as this one had, the connectors at this point are easily detached from their respective print points. **D.C.W.**

Panasonic NVM7

This camcorder would intermittently go into the pause mode, with 'tape' showing in the viewfinder, when recording. The cause was a corroded contact on the 'rec. prevent tab switch'. **D.C.W.**

Sony CCDTR55

There was a cassette stuck in the mechanism and the 'caution' warning was being displayed. No functions were available. The cause of the trouble was a short-circuit loading motor (the short was to chassis). There was also an open-circuit circuit protector (type PS602-N25). **D.C.W.**

Panasonic NVMS2

The customer's complaint was that batteries lasted for only a very short time. We checked the charger and batteries and found that they were o.k. On test a fully-charged battery gave a recording time of about two hours. Nothing wrong then – except that the viewfinder display said that the battery was low after only a very short period of operation! We checked and set up the supply rails and R6002 (battery low detect). This provided a complete cure. **D.C.W.**

Sony CCDTR50

Playback was o.k. but there was no camera picture. We found that Q501 on the main camera PCB was open-circuit all ways. **D.C.W.**

Panasonic NVMC6

The complaint was that this camcorder cut out after a few seconds in both the record and playback modes. Checks on the sensor inputs to the syscon microcontroller chip showed that the supply-reel pulses were intermittent. This was because R6075 had gone open-circuit. **D.C.W.**

Panasonic's Cardiff Chassis

Ray Meadows

In recent issues we've taken a look at Panasonic's new Euro 1 digital TV chassis. Readers may find it helpful if we provide a short survey of its predecessors, particularly some of the older types that sometimes cause confusion. We'll go back in time to the first models produced by National Panasonic, as it was then known, at the Cardiff plant.

The very first sets were assembled from kits prepared in Japan, using almost all Japanese components. The first models to use the S1 chassis were the TC2201, a 22in. set fitted with the Philips A56-120X tube, and the TC262G which was fitted with a 20in. Japanese tube. Very shortly afterwards a new chassis specifically for the European market was introduced. This used a large proportion of locally-sourced parts and was known as the U1 chassis.

The U1 Chassis

The U referred to the approximate shape of the chassis: it has a main base board with a vertical panel at the left-hand side for the signals, colour decoder and RGB output stages and a vertical right-hand frame that supports the line output transformer and power supply protection circuit panel, see Fig. 1. Introduced in 1979, it used mainly Philips chips for signal processing and a Philips line output transformer. Most models, for example the TC2203 and the remote

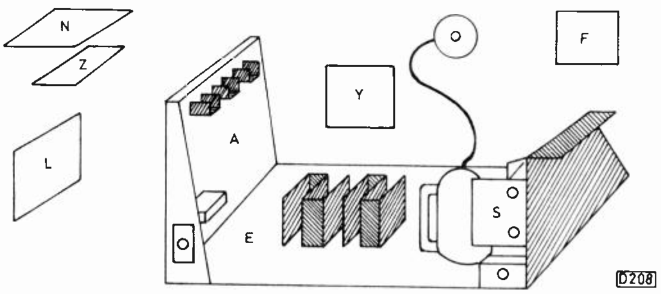


Fig. 1: The U1 chassis. Panels are as follows: E power supply, timebases, audio, EW correction and mains filter; A tuner, i.f., colour decoder and RGB output stages; F NS correction and line linearity; N local controls and the remote-control receiver; Y tube base; S protection; Z mains switch. Models include the TC9200, TC2203, TC2204 and TC2206.

control versions TC2206 and TC2002, were fitted with Philips 510X type tubes, but the TC2204 had a Matsushita tube. This was a Quintrix tube, an early black-matrix type. All models bore the Quintrix logo however, regardless of the tube type fitted. There were 20 and 22in. models. One popular low-cost model, the TC9200, had simple mechanical pushbuttons for channel selection, a throwback to the S1 chassis.

Memorable features include a mains lead that's soldered to two hollow pins at the rear of the chassis, just at the point where most people grab the metalwork to pull it out. The live chassis design has a discrete-component power supply with a 2SC1875 chopper transistor. Over-voltage protection of the 160V h.t. line is provided by two diodes (diacs actually) that tend to protect the set rather too often. As a result, service engineers sometimes simply removed them. Another thing to watch out for is the two large copper heatsinks near the centre of the main panel: they carry h.t.! All models have a 'magic-line' tuning system: the a.f.c. system drives a green, on-screen vertical bar that narrows as the optimum tuning point is reached.

A separate control block screwed to the inside of the front panel carries the mains switch, local controls and, where fitted, remote-control receiver. One model (TC2292UR) which was designed for the Italian market had two panels back-to-back, joined by not quite flexible wires that easily break when the panels are hinged apart. This set was the first and for quite some time only one to be equipped with search tuning, with two AA batteries for memory back-up. A problem could occur when a set was manually degaussed, as a strong magnetic field applied close to the side of the cabinet would stop the dynamic memory's oscillator circuit with loss of the tuning information. Nevertheless the performance of all these models was excellent.

The U2 Chassis

The U2 chassis, see Fig. 2, was introduced around 1980-1. From the servicing point of view the most useful features were the adoption of an isolated chassis and the fact that the main cord is directly attached to the switch itself, on the control block. The base model, TC2205, has remote control but still used manual thumbwheel tuning, the controls being hidden in a long push-open drawer. Standby power is provided by a transformer that's screwed to the inside of the cabinet. As before, all models have the magic-line feature to assist with manual tuning. Model TC2207 is the non-remote control, touch-sensor version.

The design was again based largely on European components, though a Japanese line output transformer is used. The discrete-component power supply has a BU326A chopper transistor and two crowbar thyristors to provide over-voltage and excess-current protection.

A weak point in this chassis is the Thomson TDA1104SP

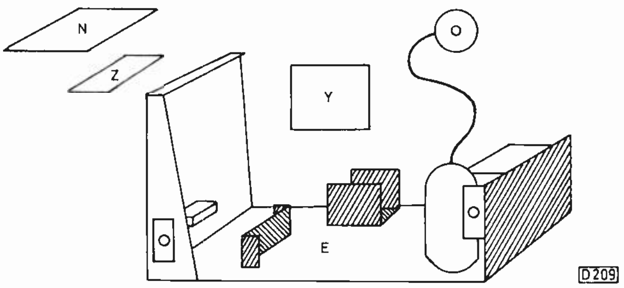


Fig. 2: The U2 chassis. Panels are as follows: E power supply, timebases, EW correction, audio; A tuner, i.f., colour decoder and RGB output stages; N user controls and remote-control receiver; Y tube base; Z mains switch and filter. Models include the TC2205 and TC2207.

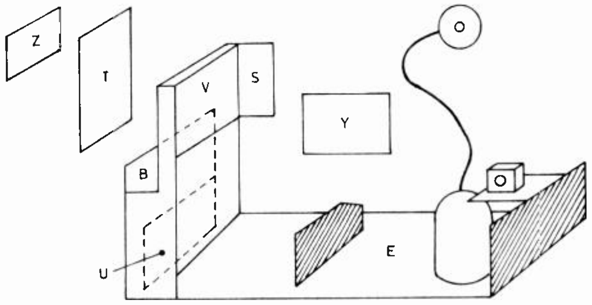


Fig. 3: The U3 chassis. Panels are as follows: E power supply, timebases, tuner and i.f.; B colour decoder; T remote-control receiver and tuning; Y tube base with RGB output stages; Z mains switch and filter. Text models incorporate the V text module, U buffers and S interface panel. Models include the TX2284.

field output chip. Failure of this device results in field collapse, with or sometimes without beam limiting. It was also quite easy to short the chip's output pins when connecting probes to them, thereby destroying the chip, so silicon bond was used on the foil side of the PCB to cover the chip's sensitive pins.

There were 20 and 22in. models, also some 26in. ones later mostly for export markets. As with the U1 chassis, Philips tubes (540X series) were used in most models.

The U3 Chassis

Perhaps because of reliability problems with some of the European sourced components used in the U2 chassis the U3, see Fig. 3, uses Japanese semiconductor devices for almost every function. This isolated chassis has a complex power supply with an AN5900 control chip, a 2SD792 chopper transistor and five signal transistors. It was the first Panasonic chassis to use a SAW filter in the i.f. strip, eliminating the block filter with its many alignment cores. A discrete-component field output stage was used for improved reliability. There are two versions of the chassis, the U3 for models fitted with 90° tubes (20in. and Japanese 22in.) and the U3W for models with 110° tubes. The latter incorporate EW correction.

One model, the TX2284, was equipped with a teletext decoder. It was added to the basic U3W chassis by using a Philips VM6101 module and three small interfacing panels. By this time remote control and voltage-synthesis search tuning were standard on all models. So the magic line was dropped, as auto and manual search tuning were available. Auto was of little use in practice however, as it tuned and hence stored all the channels in frequency order: this is not how most people like them. Rather infuriatingly it immediately cleared all existing memory positions, so a moment of carelessness could wipe out all the stored channel settings.

On reflection this chassis was probably more reliable than its predecessors had been, though it didn't seem to offer quite the same picture quality.

The U4 Chassis

The U4 chassis (Fig. 4), introduced in 1983, saw a move back to the use of European components, being designed around a mixture of Philips and Matsushita devices. At last the teletext decoder was fully integrated as a single panel which was mounted adjacent to the i.f. panel. There was a simpler, discrete-component isolated power supply with a 2SD1391 chopper transistor and three signal transistors. Field output was provided by an AN5521 chip. This device has remained in use, being employed in some Alpha 2 chassis sets. All U4 sets have a Matsushita line output transformer with integral focus and first anode (screen) presets.

As the chassis is quite small the first model was a portable, the TC1631, which later became available with text as the TX1632. Prior to this all portables had been imported, being based on the Japanese M series chassis. One major addition appeared on the U4 chassis: AV inputs.

An early problem that was troublesome, particularly with small sets, was memory loss. This could usually be attributed to electrostatic damage to the CITAC tuning processor chip. As the control panel on which this item is mounted is very close to the tube an antistatic plastic barrier was fitted.

While most 22 and 26in. models continued to be fitted with Philips 540X series tubes a new low-cost model with a 90°, 22in. Japanese tube was introduced. This was the TX2200, which as the number indicates was text equipped: many of these sets are still in service.

The U4 sets were the first to drop the National badge from the model designation, the company at this time shortening its name to just Panasonic in Europe, though the National bit was retained for white goods. Shortly after this two Saisho

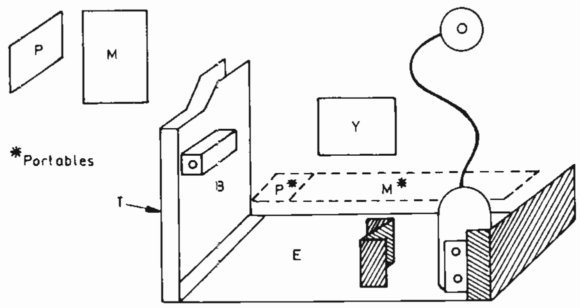


Fig. 4: The U4 chassis (the U5 is similar). Panels are as follows: E power supply, timebases and (U4W) EW correction; B tuner, i.f., audio and colour decoder; T text; M user controls and remote-control receiver; Y tube base and RGB output stages; P mains switch and filter. Models include the TX2200 and TX1632 (U4) and the TXC22 and TX5500 (U5).

(Japanese for first) models were produced exclusively for Dixons, using older cabinet designs and colours. These were the CT20S and CT22S, the former being fitted with the U4 chassis and the latter the U4W (with added EW circuit).

The U5 Chassis

The next chassis in the series, the U5, again used a discrete-component, isolated power supply, of very similar design to that in the U4 chassis. There were no major changes apart from those required to drive the new FS type of tube. As a result of the new glass shape, cabinet design was changed from the older push-through tube presentation to the mask type with which we are familiar today. Some small-screen models began to be fitted into monitor-style cabinets, with a symmetrical layout and beneath the screen controls.

There were two main versions of the chassis, the U5 for use with 17in. 90° tubes and the U5N for 21, 24 and 28in. 110° tubes.

The Alpha 1 Chassis

What was to have been called the U6 chassis was eventually produced as the Alpha 1 chassis (see Fig. 5). This

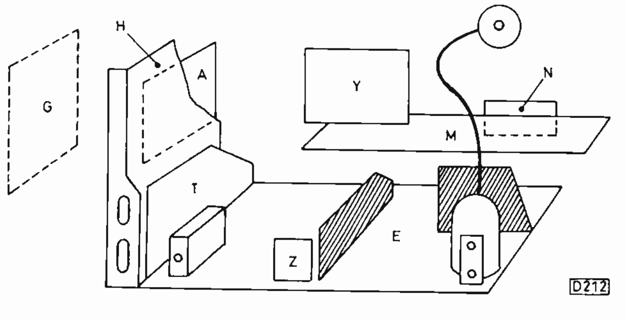


Fig. 5: The Alpha 1 and Alpha 1W chassis. Panels are as follows: E power supply, timebases/EW correction, audio, AV1, tuner, i.f., colour decoder; H AV2, sound i.f., Nicams; T text; M local controls, remote-control receiver, mains switch and filter; N LED display; Z int/ext speakers (stereo models); Y tube base with RGB output stages; A Nicam adaptor option; G graphic equaliser option. Models include the TXC78, TX2 and TX3.

change of name was probably a good idea as the Alpha 1 was quite different from its predecessors.

The power supply employs a Sanken STR54041 chopper chip with relatively few other components. Philips chips are used extensively for signal processing and CITAC tuner control. A Philips MAB84XX series microcomputer chip is used for remote and on-board control, a second one being used for text control. On-screen displays are generated by the text system, though a few models such as the 28in. TXC78 have an extra graphic equaliser panel with an OSD chip. There's extensive AV switching with provision for two external inputs and two outputs. The internal and external AV signals take a rather laborious route around the set: as a result there was an increase in the quantity of interconnecting wires, something that Panasonic has been trying to reduce ever since.

Some models incorporate Nicam reception circuitry while an add-on kit was available for others. For Nicam reception a different H panel, with a new sound i.f. circuit and Nicam demodulator, is required. Also required are an X panel with a PCM decoder and DA converters, and an A panel to interface the lot. It was not an elegant solution, but worked fine. As Nicam was then in its infancy, it was often necessary to realign the H panel to cater for local conditions. This problem was not unique to Panasonic.

Black monitor styling was used for many models, some with stereo sound from front- and side-facing speakers. With these sets the model numbering scheme changed, though older-style sets such as the TX2488 continued to use the previous scheme. A low-cost, 21in. mono-sound monitor-style model, the TX2, proved popular, as did its successor the TX3. These used the basic Alpha 1 chassis while models with 110° tubes used the Alpha 1W variant.

The Alpha 2 Chassis

The Alpha 2 chassis (Fig. 6) was introduced in about 1988. At the time of writing some of these models are still in production, this being the longest-lived chassis of them all. Internally the chassis is of similar design to the Alpha 1, but the Nicam arrangement is much simpler and next-generation colour decoder and video control chips (the TDA4510 and TDA3505 respectively) are used. There were originally two chassis variants, the Alpha 2 and Alpha 2N.

Monitor-style sets continued with models such as the 28in. TXC88 and 24in. TXC84, some with Nicam built in while others were adaptable. Two new mono-sound sets had all-plastic cabinets. These were the TX21T1 and TX24T1 and their non-text equivalents the TC21R1 and TC24R1. The most interesting models however were the W1 and A1 series. These stereo-sound sets have invar-shadowmask tubes, two or three AV inputs and high-quality sound. The TX24W1 and TX28W1 (W for wide) feature full-size, two-way speakers for each channel and a removable glass face-plate while the TX24A1 and TX28A1 have slimline coaxial speakers sealed in enclosures that are wrapped around the rear of the tube. Panasonic promoted the A1s under the name 'dome sound'. A 33in. model, the TX33A1G, which is made in Japan and has a Mitsubishi tube, completes this range. A locally-designed 21in., 90° stereo model, the TX21V1, with 'mini-dome' speakers and a Toshiba tube, was later introduced. It's the company's smallest stereo set to date.

Although the Alpha 3 was subsequently introduced as a replacement for the Alpha 2, some Alpha 2 variants continue to be produced as they offer excellent cost-performance ratios. One example is the TX24T1, which was fitted

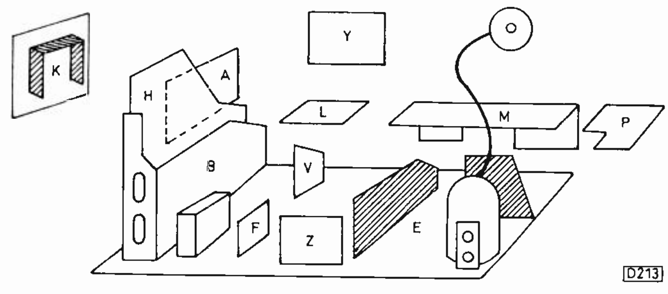


Fig. 6: The Alpha 2/2M/2N chassis. Panels are as follows: E power supply, timebases, tuner, audio, AV1, colour decoder; B vision and sound i.f./Nicam; H AV2, S-VHS, text; V video buffer; F beam limiter; Y tube base with RGB output stages; M user controls, remote-control receiver; Z int/ext speakers (stereo models); P mains switch; A Nicam option; L front AV (where fitted); K audio (prism model only). Models include the TX25T1, TX21V1, TX25A1 and TXC88.

with a Toshiba tube and later became the TX25T2. Later still the tube was changed to a Philips black-matrix type, the model number becoming TX25BM1.

In 1991 a modified A2N chassis called the A2M appeared. The main changes were the use of a Philips IVT text decoder and a Toshiba Nicam decoder. This chassis was used in two low-cost stereo models, the TX25G1 and TX28G1, and in some cost-reduced variants of A1 models (renamed J1) which are fitted with iron-mask tubes.

The Alpha 3 Chassis

The Alpha 3 chassis (Fig. 7) represented another big design change, being significantly more complex than the Alpha 2. The first models appeared in early 1990. This time the main chassis was split in two, with separate signals and power/deflection base panels. The vision i.f./Nicam and text/AV panels plug into the left-hand signals panel. Improved mains filtering was achieved by splitting the line filters between the P and the Z panels. Scan velocity modulation was added, with the tube-neck hung S panel.

Models fitted with this chassis include the TX25W2, TX28W2, TX25A2, TX28A2 and TX33A2, the latter having a more powerful deflection circuit. Other variants appeared during the life of the chassis, to take advantage of changing tube technology and other advances. Because of the large physical size of this chassis and its cost, there were

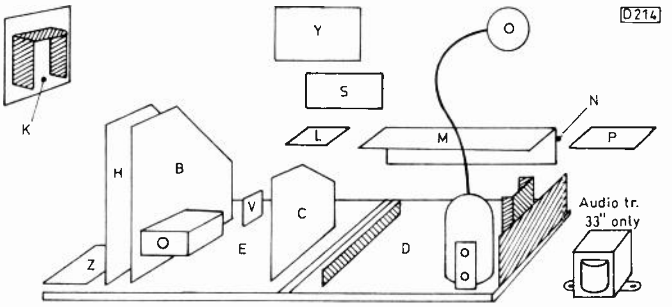


Fig. 7: The Alpha 3 chassis. Panels are as follows: D power supply, timebases, EW correction; E AV1, colour decoder and RGB switching, microcontroller chip; B tuner, i.f.s and Nicam; H AV2, text, S-VHS; K audio amplifiers; M user controls, remote-control receiver; P mains switch and filter; Z mains filter; C int/ext speakers, ambience; EV video buffer; L AV3, headphone; Y tube base with RGB output stages; S scan-velocity modulation. Models include the TX25A2, TX28A2 and TX33A2.

no small- or medium-screen models. An Astra tuner was included in the very first model, the TX25W2A, and is also a standard feature of the Japanese-made TX37A2G.

More information on the Alpha 3 chassis will follow in later articles.

The Alpha 4 Chassis

The Alpha 4 chassis, see Fig. 8, is the current mid-/large-screen analogue chassis. There are two variants, the Alpha 4 for 90° tubes and Alpha 4H for 110° tubes. The base panel returns to being a single item, though the plug-in board system and the actual circuitry are similar to the Alpha 3. New developments such as a single Nicam chip and integration of the audio amplifiers back on to the main panel help to simplify things and reduce costs.

The current Model TX21V2 is fitted with the Alpha 4 chassis while the TX25X1 and TX28X1 have the Alpha 4H chassis.

Euro 1

The Euro 1 digital chassis was introduced at the end of 1992, taking over from the Alpha 3 for top-of-the-range sets. Current models include the TX25W3, TX28W3, TX25A3 and TX28A3. The W3s are fitted with the Philips Black-Line Super tube and are 'conventional' in appearance, the A3s continuing the 'dome-sound' tradition with, in addition, the new Philips Superflat tubes.

The Z3 Chassis

As mentioned above the first UK-produced portable set, Model TC1631, was fitted with the U4 chassis. This was an expensive solution, as a large-screen chassis was being used in a small cabinet. The Z3 single-panel chassis was developed as a better solution, being introduced with Model TC1480. Because it was a live chassis, a simple composite AV input could be added only by using opto-isolators. When the requirement for a small-screen model with teletext and RGB inputs arose, the Z3T chassis was introduced. This is similar to the Z3 but has an isolated power supply and a full-scart AV specification. Models include the TX1786 and TX2195.

There have been many 14, 17 and 21in. models, including some monitor-only versions, and as with the Alpha 2 chassis the introduction of a new chassis failed to kill off the earlier one as it offered excellent cost-performance ratios. Thus models with the Z3 and Z4 chassis have been produced side by side.

The Z4 Chassis

The Z4 is really a mini Alpha 3, being aimed at the high-quality, multi-feature portable TV market. Models include the TX15M1T and TX21M1T, which have 'top-dome' speakers and curious on-screen displays including calculator, calendar and 'mood-light' modes. The subsequent M2 models are basically the same except that the 'soft' paint finish has been changed to a harder wearing and less costly one while the 15in. tube has been changed from an invar- to a cheaper iron-mask type.

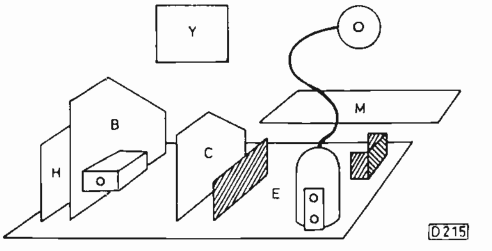


Fig. 8: The Alpha 4/4H chassis. Panels are as follows: E power supply, timebases, AV1, microcontroller chip, audio and EW correction (Alpha 4H); B tuner, i.f.s, Nicam; H text, AV2, S-VHS; C colour decoder, video switching; M user controls, remote-control receiver, AV3, mains switch and filter; Y tube base and RGB output stages. Models include the TX21V2 and TX25X1.

Current Line-up

The present Panasonic line-up includes Alpha 2N, 2M, Z3, Z4 and Euro 1 based models. Possibly the best performer however, and certainly the most complex, was the Alpha 3. We shall be returning to it in later articles.

Chassis Identification

Figs. 1-8 will enable the various chassis to be identified. In all cases small subpanels that carry LEDs, a headphone socket etc. have been omitted in the interests of clarity. Shaded areas are heatsinks.

HELP WANTED

Wanted: Help in enabling the stereo switching with a Loewe Model T26 (C9000 chassis), also a circuit to emulate the 54·7kHz pilot tone – the receiver is being converted to the *Television* Nicam stereo sound project. P. Hill, 3 Mayfair Avenue, Halifax HX4 9JH. 0422 370 338.

Wanted: Circuit diagram and any other information on ADE alarm panels Logic 4, Optima Mk. 2, Optima Plus, also any information on the chips used, and can anyone provide details of and suggest a supplier of the TDA1070P chip used in a Hoover washing machine motor PCB? D. Lee, 16 Devonshire Place, Claughton, Birkenhead, Merseyside L43 1TU16.

Wanted: Fidelity M20 ZX3000/M Mk. 2 chassis or chopper transformer, also a circuit. M.J. Levy, 19 Totternhoe Close, Kenton, Harrow, Middx HA3 0HS. 081 907 3620.

ECONOMIC DEVICES 32 TEMPLE STREET, WOLVERHAMPTON, WV2 4AN

15/80H	3.83	2SC1398	0.80	2SD468C	0.00	BB105B	0.24	BD190	0.31	BF959	0.18
15/85R	3.84	2SC1413A	1.30	2SD476	0.97	BC107B	0.20	BD201	0.40	BF960	0.27
17052	3.85	2SC1509	0.51	2SD525	1.27	BC108	0.15	BD203	0.46	BF966	0.61
17053	2.38	2SC1520	0.54	2SD551	5.81	BC109A	0.16	BD232	0.28	BF970	0.30
17088	2.38	2SC1573	0.36	2SD613	0.63	BC109B	0.15	BD234	0.25	BFR39	0.35
17089	3.39	2SC1573Q	0.26	2SD636	0.14	BC117	0.14	BD237	0.30	BFR41	0.44
17127	1.77	2SC1675	0.09	2SD637	0.12	BC139	0.33	BD238	0.11	BFR90	0.61
1N4001	0.04	2SC1685	0.17	2SD667	0.26	BC140	0.21	BD239	0.29	BFR90A	0.77
1N4002	0.07	2SC1740	0.12	2SD669	0.63	BC141	0.34	BD241	0.41	BFR91	0.43
1N4003	0.05	2SC1741	0.17	2SD669A	0.63	BC147A	0.06	BD243	0.39	BFR96	0.53
1N4004	0.07	2SC1815	0.14	2SD716	1.46	BC148	0.12	BD243A	0.43	BFW92A	0.48
1N4005	0.06	2SC1826	0.72	2SD718	1.45	BC148A	0.06	BD243C	0.44	BFX85	0.55
1N4006	0.06	2SC1827	1.00	2SD734	0.24	BC148B	0.04	BD244A	0.34	BFY50	0.34
1N4007	0.06	2SC1845	0.20	2SD762	1.51	BC149	0.04	BD244C	0.42	BFY51	0.34
1N4148	0.04	2SC1846	0.51	2SD774	0.43	BC149C	0.04	BD245C	0.72	BR100	0.17
1N4448	0.06	2SC1923	0.14	2SD787E	0.36	BC157	0.13	BD246C	0.71	BR101	0.98
1N5061	0.38	2SC1942	3.33	2SD837	0.90	BC159	0.06	BD278A	0.56	BR103	0.53
1N5402	0.12	2SC1959	0.11	2SD841	1.34	BC161	0.27	BD317	0.87	BR303	1.22
1N5404	0.13	2SC1969	2.46	2SD856	0.94	BC167	0.42	BD318	1.10	BRX44	1.02
1N5406	0.12	2SC1983	1.78	2SD869	3.28	BC171B	0.14	BD380	0.34	BRY56	0.43
1N5408	0.12	2SC2001	0.14	2SD870	3.81	BC177	0.14	BD433	0.29	BSS38	0.23
1N914	0.04	2SC2073	0.51	2SD871	5.08	BC178	0.11	BD434	0.34	BT120	1.28
1S1555	0.22	2SC2078	0.77	2SD880	0.48	BC182L	0.06	BD435	0.38	BT129	3.26
1S2076	0.29	2SC2141	1.48	2SD882	0.43	BC182LB	0.06	BD436	0.32	BT139600	1.14
2N2219A	0.27	2SC2166	1.27	2SD898B	4.23	BC184	0.09	BD437	0.32	BT151/500R	1.10
2N2222	0.22	2SC2168	0.85	2SD904	5.95	BC184L	0.04	BD438	0.31	BT151800	1.15
2N2905	0.21	2SC2236	0.25	2SD973	0.38	BC184LC	0.10	BD441	0.34	BU205	1.07
2N2926G	0.37	2SC2271	0.22	74LS00	0.21	BC204	0.14	BD442	0.29	BU208A	1.16
2N3053	0.36	2SC2274	0.22	7805	0.28	BC207B	0.23	BD510	1.34	BU208D	1.53
2N3054	0.98	2SC2274K	0.22	7808	0.30	BC212B	0.06	BD529	0.97	BU326A	1.36
2N3055	0.77	2SC2314	0.33	7812	0.30	BC212L	0.06	BD530	1.10	BU406	0.68
2N3442	1.00	2SC2335	1.43	7815	0.30	BC213	0.11	BD535	0.43	BU406D	1.02
2N3702	0.11	2SC2458	0.12	7818	0.41	BC214L	0.09	BD536	0.48	BU407	0.53
2N3704	0.14	2SC2482	0.34	7905	0.34	BC237	0.10	BD675	0.30	BU407D	0.97
2N3773	1.27	2SC2547E	0.24	7912	0.43	BC237B	0.05	BD677	0.32	BU426A	0.96
2N3819	0.34	2SC2565	8.46	AA119	0.36	BC238	0.11	BD707	0.51	BU426E	2.13
2N3904	0.11	2SC2570A	0.29	AA143	0.13	BC238B	0.05	BD839	0.51	BU500	1.32
2N4444	3.22	2SC2577	1.46	AC127	0.11	BC239	0.04	BD901	0.51	BU508A	0.95
2N6292	0.62	2SC2581	3.05	AC141K	0.46	BC252B	0.07	BD902	0.51	BU508AF	1.27
2SA1015	0.10	2SC2632	0.43	AC176K	0.30	BC300	0.48	BD911	0.65	BU508D	1.27
2SA1016	0.17	2SC2655	0.25	AC187	0.16	BC301	0.28	BD912	0.63	BU508DF	1.87
2SA1020	0.43	2SC2671	0.68	AC187K	0.33	BC3D2	0.36	BDV65B	1.16	BU508V	1.43
2SA1020Y	0.43	2SC2688	0.30	AC188	0.36	BC303	0.22	BDW84C	1.28	BU526	1.41
2SA1095	7.44	2SC2785	0.12	AC188K	0.82	BC307	0.06	BDW93C	0.59	BU536	1.60
2SA1102	2.54	2SC2791	5.44	AD149	0.52	BC307A	0.06	BDW94C	0.46	BU608	1.44
2SA1143	0.17	2SC3150	1.44	AD161	1.02	BC307B	0.06	BDX32	1.70	BU705	1.61

BYW56	0.46	M192B1	1.86	SG613	18.79	TA7176P	1.30	TDA1190Z	4.08	TEA1009	1.61
BYX55600	0.20	M21C	1.65	SGSIF344	6.62	TA7193AP	3.36	TDA1200	0.91	TEA1014	1.87
CA1310E	0.78	M293	14.63	SKE4F104	0.97	TA7193P	7.09	TDA1270	1.79	TEA1039	2.15
CA3094	3.06	M490	15.30	SKE4F210	0.87	TA7205AP	1.51	TDA1412	0.77	TEA2018A	1.49
CD4001	0.14	M491	7.94	SKE5F310	1.68	TA7207P	1.68	TDA1506	4.59	TEA2164	2.68
CD4011	0.21	M50115AP	3.24	SL1430	1.41	TA7210P	1.50	TDA1510	2.54	TEA2165	6.26
CD4013	0.34	M51102L	1.77	SL1431	1.70	TA7214P	3.74	TDA1512	3.17	TIC106D	0.55
CD4016	0.14	M51231P	2.03	SL1432	2.10	TA7217AP	1.27	TDA1515A	2.54	TIC106M	0.75
CD4021	0.43	M51393AP	4.64	SL471	1.70	TA7222	1.24	TDA1516Q	3.56	TIC45	0.59
CD4052	0.29	M51515L	2.01	SL490	2.31	TA7222AP	1.27	TDA1518Q	3.32	TIL100	0.52
CD4053	0.20	M51521L	0.54	SN29764AN	1.99	TA7227P	2.29	TDA1670A	2.81	TIP110	0.36
CD4066	0.30	M5218L	0.48	SN7474N	0.38	TA7230P	1.60	TDA1701	4.86	TIP112	0.00
CD4069	0.17	M5231L	0.55	SN76013ND	7.99	TA7233P	1.95	TDA1870	3.37	TIP112H	0.58
CD4070	0.21	M53216P	1.48	SN76227N	1.07	TA7240P	2.46	TDA1904	1.21	TIP120	0.57
CNX62A	2.95	M54543L	1.61	SN76666N	1.26	TA7241	2.30	TDA1905	0.94	TIP121	0.42
CR3CM	2.62	M54544L	1.87	SN76705AN	1.70	TA7250	4.03	TDA1908A	1.14	TIP126	0.48
CRO2AM	2.17	M54548L	3.29	STA341M	2.54	TA7267P	2.02	TDA1940	2.77	TIP132	0.46
CV12E	2.70	M54644BL	3.30	STA401	2.46	TA7270	1.68	TDA1950	1.86	TIP137	0.48
CX109	7.05	M54648L	6.62	STA441C	2.80	TA7270P	1.73	TDA2002	0.85	TIP2955	0.83
DTA124EF	0.13	M54898AP	20.45	STK0029	5.88	TA7271P	1.76	TDA2004	1.27	TIP29C	0.30
DTA144EF	0.17	M58485P	5.95	STK0039	7.11	TA7273	3.21	TDA2005	1.36	TIP29E	0.46
ER1400	2.15	MB3730	2.38	STK0040	7.40	TA7274P	2.72	TDA2006	1.06	TIP3055	0.77
HA11235	1.95	MB3731	2.20	STK0059	9.75	TA7280	2.11	TDA2009	2.29	TIP30C	0.17
HA11244	3.83	MB3732	2.88	STK025	9.61	TA7299	2.34	TDA2020	3.72	TIP31A	0.32
HA1124A	1.21	MC13002P	5.74	STK3042	6.90	TA7313AP	0.62	TDA2030H	0.61	TIP31B	0.30
HA11423	2.02	MC1310P	0.85	STK3062	8.88	TA7317P	0.93	TDA2030V	1.05	TIP31C	0.44
HA11440	2.92	MC1327AP	1.62	STK4131	7.79	TA7325P	0.45	TDA2170	2.55	TIP32A	0.39
HA1166X	3.43	MC1330AIP	1.26	STK4141	9.31	TA7343AP	0.72	TDA2270	1.68	TIP32C	0.38
HA11713	1.24	MC1350P	1.82	STK4142	8.21	TA7358P	0.78	TDA2530	3.76	TIP33A	0.92
HA11741	6.77	MC1352P	1.45	STK4162M	9.51	TA75358P	0.68	TDA2540	0.88	TIP33C	0.80
HA11745	5.10	MC1358P	1.59	STK4171	10.50	TA7607AP	2.62	TDA2541	0.72	TIP34	0.00
HA13001	1.72	MC14528BCP	1.70	STK4181	12.85	TA7609P	1.95	TDA2560	4.46	TIP34C	0.89
HA13108	3.56	MDA2062	2.21	STK4181A	12.46	TA7630P	1.87	TDA2576A	5.95	TIP41A	0.38
HA13118	1.87	MJ2955	0.97	STK4332	5.54	TA7640AP	0.98	TDA2577A	4.25	TIP41C	0.37
HA13119	2.03	MJ802	2.37	STK4352	1.70	TA7676P	4.25	TDA2578A	2.55	TIP42A	0.39
HA13403	4.66	MJE13005	0.85	STK437	8.30	TA7680AP	3.81	TDA2581	5.75	TIP42C	0.37
HA1377	2.42	MJE2955	0.68	STK4392	5.92	TA7698AP	5.93	TDA2581Q	10.15	TIP47	0.51
HA1388	2.63	MJE3055	0.51	STK441	11.81	TA7705P	1.68	TDA2582	1.95	TIPL791A	1.24
HA1389	2.52	MJE340	0.50	STK459	11.17	TA7769P	1.43	TDA2591	1.15	TIS43	0.66
HA1392	1.61	ML923	14.26	STK461	10.49	TA8205	3.89	TDA2593	0.75	TL011CP	1.36
HA1397	2.63	MN1405VKF	11.08	STK4843	11.10	TA8210H	4.74	TDA2594	2.21	TL071CP	0.38
HA1398	2.33	MN1435VX	14.35	STK5211	15.78	TA8215	4.57	TDA2595	2.41	TL494	1.61
HA1452	4.86	MN1435VXB	10.66	STK5322	6.35	TA8691N	6.67	TDA2600	3.08	TMP47C432AP	11.24
HM6232	10.36	MN650	2.50	STK5325	5.92	TAG626	1.05	TDA2611A	0.64	TMP47C434N-3555	17.87
HM6251	9.52	MPSA42	0.23	STK5326	6.20	TBA120	0.53	TDA2611AQ	2.03	UC3844	1.78
HM7103	14.07	MPSA56	0.12	STK5331	3.02	TBA120AS	0.90	TDA2640	4.13	UPA81C	0.94

SPECIAL OFFERS – ENDS 31/01/94 OR WHILE STOCKS LAST

BU208A x 5	3.99	'F' CONNECTOR (SCREW TYPE) x 25	3.00
BU 426A x 5	3.50	TDA 2600 x 2	3.95
BU 508A x 5	3.60	TDA 2579A x 2	5.00
BU 508AF x 5	5.00	TDA 3562A x 2	3.99
BUT 11AF x 5	3.25	TDA 3654 x 2	2.20
TV FAULT FINDING GUIDE	9.99	TDA 4501H x 2	2.49
VIDEO FAULT FINDING GUIDE	9.99	TDA 4601 x 2	2.50
SATELLITE FAULT FINDING GUIDE	14.95	TDA 4601D x 2	2.95
CO AXIAL AERIAL PLUG x 25	3.75	STR 54041 x 2	7.50

2SA1175	0.25	2SC3153	2.37	AD162	0.96	BC308	0.06	BDY20	2.13	BU806	0.82
2SA1186	3.73	2SC3156	4.22	AF124	0.77	BC308A	0.09	BF115	0.41	BU806A	0.80
2SA1208	0.34	2SC3182	3.25	AF127	0.59	BC308C	0.06	BF179	0.31	BU807	0.51
2SA1265	1.95	2SC3225	0.50	AF139	0.29	BC327	0.10	BF184	0.41	BU826A	1.59
2SA1286	0.39	2SC3795	1.95	AF239	0.43	BC327B	0.17	BF185	0.29	BU908	1.17
2SA473	0.71	2SC380	0.12	AF279	0.34	BC328	0.07	BF194	0.22	BUK444	2.38
2SA562	0.17	2SC388A	0.59	AL102	5.08	BC337	0.09	BF196	0.15	BUT11	0.77
2SA634	0.54	2SC458	0.10	AN3821K	7.23	BC337L	0.22	BF197	0.34	BUT11A	0.85
2SA639S	0.83	2SC536	0.09	AN5265	1.75	BC338	0.06	BF198	0.17	BUT11AF	0.85
2SA673	0.09	2SC710	0.12	AN5435	1.45	BC368	0.25	BF199	0.04	BUT12A	0.85
2SA684	0.43	2SC867A	5.25	AN5512	2.14	BC369	0.17	BF200	0.39	BUT56A	1.19
2SA733	0.17	2SC945	0.12	AN5515	2.33	BC372	0.47	BF240	0.11	BUW11	0.99
2SA769	1.27	2SD1051	0.48	AN5521	2.14	BC546A	0.06	BF244	0.30	BUW11A	0.90
2SA798	0.41	2SD1128	1.02	AN5612	2.97	BC547	0.11	BF245A	0.19	BUW41B	1.02
2SA872	0.14	2SD1138	0.94	AN5900	1.27	BC547A	0.04	BF245B	0.41	BUW81A	2.29
2SA872A	0.20	2SD1207	0.35	AN6310	4.69	BC547B	0.11	BF255	0.11	BUW84	1.11
2SA940	0.82	2SD1265	0.77	AN6326	3.61	BC548A	0.29	BF256	0.24	BUX84	0.44
2SA952	0.17	2SD1273	0.82	AN6341	2.29	BC548B	0.18	BF256LC	1.40	BUX85	0.60
2SA958	1.44	2SD1275	0.88	AN6610	0.93	BC548C	0.12	BF257	0.36	BUZ71	0.52
2SA966Y	0.41	2SD1276	0.85	AN6671K	5.35	BC549	0.06	BF258	0.04	BY127	0.15
2SA970	0.19	2SD1279	7.62	AN7158	2.73	BC556B	0.06	BF259	0.31	BY133	0.08
2SA984	0.27	2SD1292	0.41	AN7161	3.56	BC557	0.07	BF324	0.12	BY164	0.67
2SB1010	0.34	2SD1308	0.77	AN7171K	4.37	BC557B	0.06	BF337	0.34	BY179	0.80
2SB546	0.53	2SD1397	1.89	BA145	0.11	BC557C	0.11	BF338	0.43	BY184	0.39
2SB633	0.93	2SD1398	2.13	BA156	0.06	BC558B	0.06	BF355	0.48	BY206	0.13
2SB643S	0.20	2SD1426	2.54	BA157	0.07	BC559	0.11	BF392	0.23	BY207	0.18
2SB644	0.34	2SD1427	2.89	BA158	0.07	BC560C	0.21	BF393	0.17	BY210400	0.19
2SB688	1.28	2SD1432	4.88	BA159	0.25	BC635	0.19	BF422	0.19	BY224600	5.10
2SB772	0.43	2SD1439	3.05	BA317	0.19	BC637	0.15	BF423	0.14	BY226	0.16
2SB772Q	0.43	2SD1453	1.87	BA318	0.04	BC639	0.14	BF435	1.97	BY227	0.14
2SB793	0.31	2SD1497-02	7.05	BA5102A	1.46	BC640	0.06	BF450	0.19	BY228	0.38
2SB819	0.48	2SD1497-06	7.06	BA536	1.14	BC879	0.39	BF458	0.30	BY229	1.64
2SB861	0.97	2SD1541	4.66	BA5406	2.12	BC880	0.38	BF459	0.29	BY229600	0.84
2SB891	0.43	2SD1555	2.80	BA6109	1.85	BCY70	0.07	BF469	0.34	BY229800	1.02
2SC1008	0.17	2SD1577	4.33	BA6209	1.31	BD131	0.28	BF470	0.33	BY238	0.31
2SC1061	0.83	2SD1649	2.03	BA6219	1.45	BD132	0.21	BF480	0.67	BY255	0.14
2SC1096	0.50	2SD1650	2.47	BA6222	1.61	BD135	0.33	BF493S	0.34	BY298	0.15
2SC1114	1.16	2SD1876	4.88	BA656N	0.84	BD136	0.20	BF597	0.16	BY299	0.12
2SC1162	0.31	2SD1877	2.12	BA718	0.77	BD137	0.45	BF757	0.43	BY476A	0.68
2SC1213	0.14	2SD1911	5.06	BAS11	0.32	BD139	0.29	BF758	0.32	BYD14J	0.31
2SC124	0.44	2SD234	0.89	BAV18	0.07	BD140	0.24	BF759	0.36	BYD33G	0.68
2SC1306	1.16	2SD313	0.56	BAV20	0.26	BD168	0.76	BF760	0.24	BYD33J	0.27
2SC1318	0.10	2SD350A	1.23	BAV21	0.19	BD175	0.29	BF762	0.29	BYV10-40	2.20
2SC1364	0.29	2SD401	3.46	BAW62	0.17	BD179	0.34	BF869	0.25	BYV95C	0.44
2SC1384	0.34	2SD438	0.34	BAX14	0.28	BD189	0.41	BF870	0.23	BYV96D	0.27

ICH28I	0.26	MPSA93	0.09	STK5332	2.74	TBA120S	0.89	TDA2652	14.32	UPC1181H	6.80
KA2101	0.83	MR854	0.14	STK5333	4.28	TBA120T	0.51	TDA2653A	3.26	UPC1182H	5.95
KBL08	0.47	MSM5840H	15.36	STK5372	3.40	TBA120U	0.39	TDA2680	5.10	UPC1185H	10.20
KSR1004	0.09	MVS240	0.53	STK5421	2.60	TBA2800	1.62	TDA3190	1.27	UPC1188	3.83
L200CV	1.13	NE545B	3.20	STK5422	6.38	TBA395	0.68	TDA3190P	1.36	UPC1212C	0.83
LA1201	0.56	NE555	0.21	STK5451	5.27	TBA520	0.85	TDA3300B	20.88	UPC1228HA	0.56
LA1230	1.95	NE555N	0.37	STK5466	4.71	TBA540	1.97	TDA3330	10.78	UPC1230	2.21
LA1385	1.65	NE592	1.85	STK5471	4.51	TBA540Q	0.77	TDA3541	0.95	UPC1230H	2.80
LA3161	0.40	NE646N	2.63	STK5476	5.00	TBA560C	2.02	TDA3560	3.65	UPC1278H	2.66
LA4140	0.37	NP1106	11.86	STK5481	6.12	TBA570A	1.77	TDA3561A	3.31	UPC1318	2.96
LA4182	1.75	OA47	0.25	STK5482	4.06	TBA651	1.01	TDA3562A	4.21	UPC1335V	3.91
LA4192	1.14	OA90	0.59	STK6962	2.59	TBA750Q	5.10	TDA3565	2.29	UPC1351C	1.70
LA4220	1.29	OA91	0.15	STK7216	5.53	TBA800	0.51	TDA3566	3.40	UPC1353	1.34
LA4261	2.29	R2540	2.98	STK7226	8.14	TBA810P	1.66	TDA3571B	3.08	UPC1363C	1.06
LA4270	2.73	R2540X	1.92	STK7308	4.99	TBA810S	0.66	TDA3576	11.90	UPC1363CA	2.13
LA4282	2.37	R2M	0.77	STK7348	4.67	TBA820	0.85	TDA3640	4.75	UPC1365C	1.70
LA4422	1.27	R3297	4.27	STK7356	5.57	TBA820L	0.55	TDA3650	9.83	UPC1378H	1.19
LA4440	1.68	R4050	2.38	STK7358	5.46	TBA820M	0.34	TDA3653AQ	1.92	UPC1391H	0.52
LA4445	1.29	R4051	2.95	STR1096	4.67	TBA920	0.51	TDA3653B	1.86	UPC1394	1.23
LA4460	1.48	RB156	2.07	STR40090	6.80	TBA950	1.68	TDA3654	1.66	UPC1420CA	6.60
LA4461	1.48	RGP15	0.41	STR4090	16.36	TBA970	4.08	TDA3810	2.55	UPC1488H	1.28
LA4475	2.29	RGP15J	0.35	STR4211	4.72	TCA270S	1.03	TDA4420	1.27	UPC2002	2.08
LA4476	2.29	RGP30M	0.30	STR440	6.38	TCA440	1.95	TDA4427	1.89	UPC324C	1.74
LA4500	2.17	RM11C	0.68	STR441	6.27	TCA660B	0.43	TDA4442	3.49	UPC4558C	0.51
LA4505	1.79	S2000AF	1.19	STR451	14.69	TCA800Q	1.65	TDA4500	3.79	UPC574	1.07
LA4508	2.29	S2055AF	1.81	STR50020	9.02	TCA910	1.21	TDA4501	5.08	UPC580C	2.55
LA4520	1.11	S2530A	1.98	STR50103	5.92	TCA940	3.40	TDA4503	3.38	UPD1937C	3.15
LA4700	3.81	SAA1004	1.14	STR54041	6.75	TD3F900H	6.57	TDA4505E	4.64	X0065CE	2.20
LA5112	5.89	SAA1121	11.22	STR5412	8.27	TDA1004A	3.40	TDA4600	1.70	X2402	4.62
LA5512	0.61	SAA1174	5.10	STR58041	6.35	TDA1011	1.27	TDA4600/2	2.14	ZPY120	9.17
LA7223	2.54	SAA1250	2.92	STR6020	10.15	TDA1011A	1.47	TDA46002D	3.54	ZTX650	0.51
LA7520	2.75	SAA1251	5.74	STR6020KIT	11.23	TDA1013A	1.45	TDA4600F	1.70	ZTX753	1.01
LA7800	1.44	SAA1351	8.23	T6064V	2.63	TDA1015	0.99	TDA4601	1.56		
LA7801	1.27	SAA3027P	7.62	T6076V	3.34	TDA1020	1.27	TDA4601D	2.42		
LA7820	2.03	SAA501D	4.60	T9013V	5.23	TDA1035SB	4.15	TDA4605	3.64		
LA7830	1.27	SAA5012	3.31	T9034V	1.45	TDA1035T	1.87	TDA4950	1.09		
LM1303N	0.88	SAA5030	6.42	T9035V	1.50	TDA1037	8.50	TDA7240A	2.36		
LM1877	1.45	SAA5050	4.68	T9038V	6.09	TDA1044	1.43	TDA7270S	8.17		
LM317T	0.52	SAB3013	5.81	T9053V	0.92	TDA1060	1.58	TDA8140	2.38		
LM324N	0.35	SAB3021	6.15	T9054V	1.65	TDA1082	4.25	TDA8153	5.10		
LM339N	0.15	SAB3035	6.35	T9064	1.20	TDA1083	1.19	TDA8170	2.58		
LM358	0.23	SAF1032P	5.50	T9065V	4.66	TDA1151	0.51	TDA8180	5.35		
LM358N	0.42	SAF1039	2.44	TA7063P	1.14	TDA1170	1.59	TDA8190	3.30		
LM380N	0.82	SDA2112	11.00	TA7122BP	0.63	TDA1170N	1.38	TDA9503	2.13		
LM393N	0.27	SG264A	10.62	TA7146P	7.70	TDA1170S	1.16	TEA1002	4.98		

OVER 10,000 DIFFERENT DEVICES IN STOCK

IF YOU DON'T SEE IT LISTED ASK FOR QUOTE. GIVE MAKE, MODEL, LOCATION. REMEMBER TO ADD £1.00 POST & HANDLING U.K. MAINLAND ONLY. HANDLING CHARGE TO ALL EXPORT ORDERS AT COST. ADD 17½% VAT TO TOTAL

Ottawa HDTV '93

Geoff Lewis, B.A., M.Sc.

The great advantage of this Canadian event lies in the compact venue. It's always easy to have individual discussions with the authors of the technical papers and the other delegates, making it much easier to gain a clear appreciation of the current situation. There have been many conflicting statements recently on the situation in North America, and I hoped that HDTV '93 would provide some definitive answers. After much discussion however it appears that there are still many problems to be resolved before a digital high-definition (HDTV) service can be brought into operation.

The three-day programme included sessions on both the broadcasting and the non-broadcasting applications of HDTV and the implications for satellite, terrestrial and multi-channel use. To further complicate the issue there were a significant number of papers on ultra-definition TV (UDTV), which is defined as systems with resolutions in excess of 2,000 lines, and three-dimensional TV (3DTV). These, together with papers on new bit-rate reduction and coding techniques for broadcast, cable and recording systems, confirm that a considerable amount of research is going on.

US HDTV System

The Advisory Committee on Adanced Television Systems (ACATS) and the Federal Communications Commission (FCC) recently said that to enable a decision on the US HDTV system to be made before the end of 1994 they expected final hardware to be laboratory and field tested before next June. It was therefore expected that the Grand Alliance (GA) formed by those who have developed the various proposals would be able to present a definitive system for consideration by the assembled experts. This was not to be however.

A number of problems have arisen because of the sometimes conflicting interests of the broadcast, cable, satellite and computer industries involved. As a sop to the latter, square pixels have been included in the specification, even though the analogue nature of the display device will round the corners. Then there is the fear that each member of the GA will expect elements of their original proposals to be included in the final specification in order to safeguard their patent and intellectual property rights. Such in-fighting could lead to a less than best final choice.

The proposed US digital TV system has now been defined in terms of a four-layer model, with some layers more precisely defined than others.

Layer one, the picture or image, provides a future-proof, flexible strategy that includes 24, 30 and 60 frames per second (f/s) with progressive scanning. The original 1,050-line resolution has been uprated to 1,080 lines, with 1,920 digital samples per line. Because 60f/s is not currently practicable, the initial specification is based on 24 and 30f/s progressive. To cater for live video feeds and provide backwards compatibility, the specification includes 787·5 lines progressive and 1,050 lines with interlaced scanning. With this degree of flexibility there's a need to define a common image format (CIF).

Layer two, the compression system, is based on the MPEG-2 standard, as far as the video signal is concerned at least. After testing the European Musicam system the ACATS decided that Dolby AC-3 running at 384kbits/sec, as used by many current cinema feature films, suits North America better. Further tests are being carried out by the MPEG committee in Seoul, Korea however, so it's just possible that the final specification will include both as alternative sound systems.

Layer three, the transport layer of the MPEG-2 standard, specifies the arrangement of the data stream, the data packets, priorities and universal headers.

Layer four, which relates to transmission, specifies the use of either quadrature amplitude modulation (QAM) or vestigial sideband (VSB) after rejection of the European coded orthogonal frequency-division multiplex (COFDM) system. Further tests will lead to a decision on whether to adopt 32QAM, which provides five bits per transmitted symbol, or 4 or 6VSB. With the latter the carrier signal is amplitude modulated to one of four or six discrete levels, the carrier being positioned half way down the lower band edge of the 6MHz channel.

The Wider Scene

A report that the MPEG-4 committee is close to producing a draft report dealing with the future needs of audio-visual processing suggests that ideas about compression and coding techniques are not yet ready to be cast in concrete. This body is considering the applications and operational conditions with bit rates as low as a few tens of kHz. With all the variations that have now been put forward, a future world digital HDTV standard will almost certainly have to be based on an open and smart receiver. Fortunately this problem can be easily resolved with digital systems: by including special code patterns in the transmitted bit stream the receiver can automatically switch to the correct system.

With a view to the possible introduction of wide-screen NTSC as an interim measure the Communications Research Centre (CRC) of Canada reported on the results of a survey it had carried out on the scan-and-pan and the letter-boxing techniques used in Europe. This involved a relatively small sample – a hundred professional and non-professional viewers. Whilst a majority of both groups preferred to view a full-screen image and disliked the black banding with letterbox displays, the latter were found to become more acceptable after a period of viewing. In all cases however pan-and-scan was preferred to letter-boxing. Although the report didn't mention the display screen size, one wonders whether the same results would hold for PAL-Plus in the UK and mainland Europe.

Miscellaneous Problems

Several concerns became apparent during private discussions with authors and delegates.

Many of the 1,600 or so US TV transmitter stations operate in the v.h.f. band. With ageing masts, there were doubts as to whether many would meet current construction standards. The point about this is that because HDTV is to be introduced using simulcasting the extra v.h.f. aerials could overload the structures. As an alternative a new service using smaller, u.h.f. aerials could be introduced. But this would reduce service areas and the incomes of the broadcasters. However this is resolved, it amounts to more bucks per bit! Could a similar situation arise in those parts of Europe that still use the v.h.f. bands for TV broadcasting?

Concern was also expressed about the multi-channel possibilities with digital TV: how could profitability be achieved with perhaps 150 or more channels of video-on-demand becoming available, and what effect would this have on the introduction of the new HDTV services?

The wide use of personal and home computers and video games has created serious r.f. interference problems for low-power mobile and amateur communications. Will this problem get out of hand when every TV receiver becomes a digital processor?

Pirates have demonstrated that it's possible to use a computer monitor's electromagnetic radiation to copy its display. If this could be done with an encrypted TV signal, it would be possible for pirates to bypass the need for an authorised decoder. This introduces a further problem that might need to be considered in the design of an HDTV receiver.

After three days of intensive discussions it was clear that even if a worldwide digital HDTV standard came to be adopted TV engineering would continue to be a field full of interest.

HELP WANTED

Wanted: A line output transformer for the Sanyo CTP3131 and for the CTP5101. Keith Docwra, DTV Service, 38 Kent Road, Margate, Kent CT9 3SN. 0843 231 408/220 773.

Wanted: LOPT for the ITT CVC40 chassis and any information on converting a Sony SL-HF100 PAL/Secam (Beta) B/G machine to PAL I. Bill Harris, 13 Bridle Drive, Clapham, Beford MK41 6BB. 0234 363 813.

Wanted: Handbook/circuit for the Tektronix 561A scope and 3A1, 3B3 plug-in units. Phil Lacey, 12 Chaworth Road, Ottershaw, Surrey KT16 0PE. 0932 872 730.

Wanted: KEF 8in. B200 bass-mid driver (SP1039). P. Brown, 14 The Moat, Weston Coyney, Stoke-on-Trent ST3 6NB. 0782 32 234.

Wanted: Circuit diagram (or copy) for the Finlandia Model C22TZ5. A. Tomkinson, 10 Lodge Court, Station Grove, Wembley, Middx HA0 4AP. 081 903 5574.

Wanted: Handset for the B and O 30AX chassis (Beovision 5100 etc.). T. Jarman, Acme TV Repairs, 7 Cadet Way, Church Crookham, Fleet, Hants GU13 0UG. 0252 616 938.

Wanted: LOPT for the Network Model 1410 and a chrominance panel for the Osaki Model P50G. B. Potter, 10 Holmbury Close, Southgate West, Crawley RH11 8TG. 0293 513 787 (evenings).

Wanted: Service manual for the Philips Model 3570. I have for disposal copies of *Television* for the years 1949 to 1990 except 1960. I.R. Holmes, 33 Avenue Road, Winslow, Buckingham MK18 3DH. 0296 722 462.

Wanted: Circuit diagram and layout or service manual (photocopy will do) for the Rollie P3800 dual-slide projector. Fred Hay, 27 Crayke Road, Stockton-on-Tees, Cleveland TS18 4EY. 0642 674 560.

Wanted: Data sheet or any information on the General Instrument 72522-1 on-screen display chip. S. Duddridge, 53 Burgoyne Road, Thornhill, Southampton, Hants SO2 6PA.

Wanted: Service manual/sheet for the Matsui VX800 (Currys). I have the VX850 sheet but this model differs. George Pond, 57 Summerwood Lane, Clifton, Nottingham NG11 9FU.

TV Fault Finding

Reports from Philip Blundell, AMIEIE, Nick Beer, Eugene Trundle, Richard Newman, Steve Cannon, Mike Leach and Edward Joyce

Philips Anubis A AC Chassis

There was a blank raster and no sound with this new set, though the on-screen display worked. An external video signal fed in at the front sockets proved that the set was in the external mode with the u.h.f. program positions. A check on the status voltage at pin 18 of IC7015 produced a reading of 3V instead of 0V. This voltage comes from transistor 7877, where we found that the earth line was floating because the jumper by the scart socket had never been soldered. **P.B.**

Panasonic Alpha 2W Chassis

This set was almost dead: there was no sound or vision, but the power supply was making a ticking noise. Checks showed that the 155V supply's protection diode D854 was short-circuit, indicating an over-voltage problem, while R567, the fusible resistor that's in series with the supply to the line output stage, was open-circuit. I replaced the protection diode, removed R567, connected a dummy load and powered the set via a variac. A check on the voltage at TPE1 as the input was increased showed that there was no regulation – the voltage would have passed 160V if I'd let it. A new STR54041 chip restored regulation, and the h.t. voltage could now be stabilised at 155V. So a replacement was fitted in the R567 position, the dummy load was removed and the set was tried with the full mains input. R567 went open-circuit and the line output transistor Q551 went short-circuit. A new line output transformer, transistor and R567 completed the repair. **P.B.**

Philips 24CE7570/05S (3A Chassis)

For no sound when cold, or the picture and sound flashing on and off every second or so, check by substitution the electrolytic capacitors in the FE644 tuner/i.f. module. **P.B.**

Toshiba 201T4B

If the set is slow to go into the standby mode, check whether R819 or R820 is open-circuit. These resistors both have a value of 110kΩ. **P.B.**

Philips GR1-AX Chassis

If you get the dead set symptom because the line oscillator isn't working, check whether the 12V zener diode D6030 is open-circuit.

For no sound or vision, just a blank screen, check whether C2044 (4µF) is short-circuit. **P.B.**

Grundig Cinema 9050

This projection set produced a washed out picture. We decided to carry out checks on the RGB board. The supplies and the beam-limiter signals were o.k. but the data switching signal at pin 7 was suspect, the voltage here being 0·6V. This point is connected to pin 31 of the abstimm (tuning) module. When this pin was disconnected the picture was restored. The 0·6V was coming from the TMS3743 chip on the tuning board, a replacement solving the problem. **P.B.**

Philips CP110 Chassis

This set had no sound or vision, with F1 showing in the channel display. We found that the line oscillator had stopped as there was no supply at pin 12 of the sync/i.f. module. The cause of the trouble was a crack in the print beside the line output transformer. **P.B.**

Panasonic TX28W3 (Euro 1 Chassis)

This is the fearsome digital chassis that has been featured in recent issues of *Television*. This one intermittently lost signals, on any preset channel, as you watched it. It was not a memory problem – the data for each preset remained correct. Calling up the self-test display during the few seconds when the fault was present showed that there were no errors, so no help here. Despite the fact that the tuner address was o.k. the fault was in the tuner, though obviously nothing to do with the bus. A new tuner restored correct operation. **N.B.**

Samsung CI5013T (P58 Chassis)

This set would drift off tune about five seconds after selecting a channel stored in the memory. If sweep tuning was tried the set wouldn't stop when a channel was found. There's precious little by way of voltages or waveforms in the manual, but I decided to check the voltage at pin 9, the a.f.c. input, of the microcontroller chip RIC01. There was nothing much by way of d.c. here. The input comes from pin 18 of IC101 via a potential divider that consists of two 120kΩ resistors, RR26 and R116. The latter was open-circuit. **N.B.**

Ferguson 51J7 (TX99 Chassis)

The picture would intermittently go pink or bright green. The cause was dry-joints on the green output transistor. **N.B.**

Salora 22K37 (K Chassis)

This set operated in standby but was otherwise dead. A check on the S2000A line output transistor showed that it was very leaky. The set worked when a replacement had been fitted but after soak testing for a few hours the fault returned. This time the line output transistor was o.k., but the tuning capacitor CB507 was low in value at only 55pF instead of 15·5nF (1·5kV). **N.B.**

Philips GR90AE Chassis

This set is used as a computer monitor in a local school. The complaint was of no red in the display with an RGB input. I found that the cause was the BAS32 surface-mounted diode

D6854 which is connected between the R input and chassis – it was short-circuit. **N.B.**

Sony KV21XRTU

When teletext was selected we obtained only TV chroma. When mix was selected there was TV vision but no text. When TV was selected all was well. The cause of the problem was a high-impedance connection at pin 5 of connector D3, the blanking output from the text decoder. Cleaning cured the fault. **N.B.**

Salora 24K7H (K Chassis)

Every few hours this set would quitely revert to standby. There would be no clues – no effect on the picture or sound prior to the event. The usual dry-joints had been attended to and it wasn't the mains switch, as is often the case. I eventually traced the cause of the fault to a hairline crack around one leg of CB613. **N.B.**

Samsung CI5012Z (P58 Chassis)

This set wouldn't produce any signals: the tuning voltage showed that it swept, but no station was ever found. A check at the tuner showed that the tuning voltage was missing. There was 33V at the cathode of DZ824 but nothing at the collector of the integrating transistor RQ04. Its tiny 0·25W feed resistor RR05 (10kΩ) was open-circuit. **N.B.**

B and O 39XX Chassis

Spitting from the left-hand speaker at switch on has twice been traced to a poor connection between the earthing braid, its spring, the c.r.t.'s Aquadag coating and the rimband. A rusty deposit forms under the spring on the right-hand side as viewed from the back of the set, i.e. behind the left-hand speaker as viewed from the front. Also clean dust from behind the speaker frets. **N.B.**

Fidelity C14M06/C14R06

Intermittent field collapse was the problem with one of these sets. We found that D25 (1N4002) which is connected to pin 6 of the TDA3653 field output chip IC10 was going open-circuit. **N.B.**

Saisho CT142RX/Matsui 1440A

This set suffered from very severe tuning drift. The cause of this was the the BT amplifier transistor Q501 which had a varying collector-emitter leak. **N.B.**

Panasonic TX21M1T (Z4 Chassis)

There was a strange fault with this set: if you stored a channel in a tuning memory position that already stored information the same information would be stored in all other locations in use. The cause of the fault lay on the text PCB, which had been subjected to previous damage. Link J10 was broken. In other circumstances it would be worth looking for a dry-joint in this area. **N.B.**

Boots CTV1417

This set wouldn't go into the standby mode properly: the light didn't come on and although there was no sound or vision a raster was still present and the audio output stage continued to operate. Standby switching is applied to the base of transistor Q607 in the power supply. This transistor was switching correctly. When it switches on Q605 should turn on and Q606, which is in series with the 108V h.t. supply, should switch off. The cause of the trouble was that Q606 was short-circuit: a new 2SC2335 transistor put that right.

We ran the set on soak test and two days later the fault returned. The new transistor had bitten the dust and the h.t. was now very high and couldn't be set. In fact the h.t. was at over 200V in standby, which is why Q606 had again failed. When the set warmed up however the h.t. fell and could be set. A spot of freezer on C607 (47μF, 25V) which couples the drive to the base of the chopper transistor made the h.t. go high again, with loss of control. A new electrolytic finally put an end to these pranks.

What usually happens with capacitors in this position is that they dry up then reform at a higher capacitance value when warm. Often the chopper transistor will fail as a result, being left on for too long. Electrolytic capacitors in higher temperature and frequency circuits are prime suspects when a fault is present. If I find that a capacitance-coupled chopper transistor has gone short-circuit I always replace the capacitor as well, believing that this saves a lot of potential recalls. **N.B.**

NEI 2031TX

This set wouldn't come on from standby via the remote control unit. It would start if precise action was applied to the mains switch, but this didn't seem to be quite right. The cause of the trouble was the start circuit in the SAA1293A remote control decoder chip, a replacement restoring normal operation. **N.B.**

Tatung 170/180 Series Chassis

The symptom with one of these sets was described as "yellow faces – sometimes". We put it on soak test and after a few hours the colour bars looked strange indeed: the red bar turned to an orange hue and the blue bar was brighter than it should have been. The cause was traced to intermittent leakage in C531 (1μF, 50V), which is in the colour decoder's a.p.c. loop. **E.T.**

Philips G110 Chassis

On test this set behaved exactly as the fault report said – "intermittent start and no standby". The on-off switch sometimes had to be operated half a dozen times before the set would come on. Everything then worked normally until the set was put into the standby mode, when it shut down without even the standby LED being alight.

In the fault condition the h.t. voltage fell to almost zero and a slight whistle came from the chopper transformer. This suggested that the power supply was in the protection state, which was confirmed by measuring the voltage at the base-collector connection between transistors T7656/7655. The voltage here should be zero or slightly negative but was 0·7V, enough to turn on the transistors and thus the optocoupler, shutting down the power supply. Disconnecting the line output stage made no difference to the fault condition, so I checked the 20V zener diode D6657 which monitors the 16V supply. It read perfectly when checked with the diode test facility of a digital meter but produced a 1MΩ reverse leakage reading when checked with the good old Avo. A new diode cured both problems with the set.

I've had this diode fail before, but on previous occasions the set shut down completely. All this confirms my belief that digital meters are no substitute for a good analogue meter when it comes to testing diodes and transistors. **R.N.**

Akai CT2125/Samsung P58SC Chassis

The complaint was of an intermittent blank raster with flyback lines. We found that the fault cleared when connector TD203 on the teletext board was removed. Scope checks then showed that the 27MHz crystal TZ01 wasn't oscillating properly. A replacement cured the problem. **R.N.**

JVC AV25F1EK

The customer complained about various intermittent faults. He said that the remote control sometimes locked up and didn't appear to work, the signals would disappear briefly and then come back again, and other things. I removed the back cover and tapped around the tuner section. This instigated the fault condition, which was caused by dry-joints at the 7805 regulator chip IC522. A good solder-up here cured all the intermittencies, including the apparent remote-control problem. **M.L.**

Alba CTV743

The channel numbers on the front control panel lit up but there was no h.t. supply. As we didn't have a circuit diagram we poked around a bit and stumbled across the cause of the fault: D806 in the power supply was short-circuit. We fitted a new BYD33M in place of the original 1N4936 and our problem was solved. **M.L.**

GEC C2201 (Tatung 146 Chassis)

The initial problem was field collapse. We found that R434 was open-circuit, which seems to be a common fault these days. With the full field scan restored the set produced only a blank raster. The TDA3561 colour decoder chip was getting warm but a replacement made no difference. Checks around this chip showed that the voltage at pin 7 was very low. This brought us to the BZX79C5V6 zener diode D502 which was short-circuit. A replacement restored the picture. **M.L.**

Panasonic TX25W2A (Alpha 3 Chassis)

This set was stuck in standby, a fault we've had on several occasions in sets fitted with this chassis. This time however the fault was related to the microcontroller chip. Transistor Q825, which drives the optocoupler in the power supply, was hard on. By removing R843, which links the base of this transistor to the microcontroller chip's power on/off pin, the set was able to start up. Full h.t., e.h.t. etc. were obtained but there was no sound, picture or on-screen display – total failure of the microcontroller section. We checked the supplies to the microcontroller chip and found that they were o.k. When we checked the reset line however we found that it was stuck at 2V instead of being at 5V. What notorious component is connected to this line? A 10nF capacitor, C1251. It read about 2kΩ in and out of circuit. A replacement cured the fault. **S.C.**

Philips FL1.1AA Chassis

This fault took us a while to pin down. The set would go into the protection mode, i.e. with the standby, mute and stereo LEDS flashing but the set otherwise dead. Unfortunately the fault was extremely intermittent – it might happen only once a week! We suspected a fault in the protection circuitry, but as the protection provided in this chassis is comprehensive it took us a while to find the culprit. This turned out to be the 18V zener diode D6376 that monitors the chopper transformer derived 17V supply (it feeds the 13V regulator). Sanity was restored when a new surface-mounted zener diode had been fitted. **S.C.**

Hitachi CPT2188 (Salora Ipsalo 3/K Chassis)

There was line tearing and the screen would intermittently go bright blue. Was it a single fault or two separate ones? At first I suspected faulty decoupling. The 12V line goes to the sync/timebase generator and the colour decoder chips, but it was rock steady with an insignificant line-frequency content. What else could be common to the two symptoms? The sync/timebase generator's validate pin was the answer. It's pin 13 of the TDA2579 chip ICB500. With a 50Hz signal there should be 11V here, falling to 7·5V with a 60Hz signal and 0V with no signal at all. A check showed that the voltage was stuck at zero even though the set was tuned in, with sound and a picture present. This line also goes to the auto grey-scale correction circuit in the colour decoder chip ICB200, hence the video fault. A new TDA2579 chip cured the trouble. **S.C.**

Sony KVX2162U

The problem with this almost new set was intermittent sound, which cut out when the volume control was turned up. Its cause was a dry-jointed crystal, X1101, on the Nicam sub-PCB. **E.J.**

Philips CP110 Chassis

This set had a very misleading fault: there was no picture for a few minutes then when it did appear it looked as though the tube's emission was low. I had the feeling that the tube was probably o.k. however, and so it was. The cause of the fault turned out to be the 22μF, 250V h.t. reservoir capacitor C2670. For good measure we replaced the associated 22μF smoothing capacitor C2621 as well. **E.J.**

Osaki P10R

The fault with this nice little set was field collapse. We found that C428 (0·022μF) was leaky. **E.J.**

Philips 2A Chassis

There were black lines on the picture – it looked as though every other line of picture content was missing. After a long time had been spent carrying out scope checks etc. we finally found that C2050 (47μF, 50V) was open-circuit. It's off the 12V rail, in the i.f. can. **E.J.**

Panasonic TX24A1 (Alpha 2W Chassis)

I was asked to look at this set as a colleague had run out of ideas with the fault he now had. The set had originally been dead. After replacing R815 (5·6Ω fusible), Q801, Q802 and the STR54041 chopper chip it would start up and then immediately turn off again. This was because the wire attached to plug V2 had been fitted to socket H16 (factory preset) instead of socket M2 on the front PCB – a case of more haste, less speed! **E.J.**

Test Report: The Emerson Model 20 UPS

Donald Bullock

Almost every aspect of our lives nowadays depends on electronics. The importance of the reliability of electronic systems is thus evident. But this depends in turn on the reliability of the mains supply. A sudden power cut or even a voltage reduction can cause havoc with a mains-driven computer system. Since most of the power used in the UK is dsiributed via landlines, none of us is immune.

As a writer, the advent of the wordprocessor has been a great boon. But it wasn't long before I learnt, the hard way, that it has one major disadvantage compared with the typewriter. Anything you've typed is yours. Anything you've written into a wordprocessor is yours only once you've printed or saved it. A sudden power blip can rob you of at least some work that may be hard if not impossible to recreate.

Having one day lost half a chapter of carefully prepared prose because of a sudden, momentary power cut, I decided to equip myself with an uninterruptible power supply (UPS). The one I chose is made by Emerson, which produces an extremely wide range of UPS units to cater for almost every possible requirement. The AccuPower Model 20, rated at 300VA, should be suitable for most individual users and small offices.

I've used my Model 20 daily for well over a year, including trips to rural Spain where voltage fluctuations are common and it's not unusual to suffer at least one power cut a day. If it weren't for the musical warning chirps that the 20 emits when the mains power is interrupted or falls to an unacceptable level, I would not even notice these hiccups.

Description

The 20 requires no installation. It operates with a 220V or 240V, 50Hz single-phase a.c. mains supply, its output being the same with a power rating of 300VA. Dimensions are 93 x 140 x 380mm (width, height and depth respectively), weight being 6·8kg. The finish is a pleasant fine matt light grey. At the back there's a pair of recessed sockets, that can't be confused, for the input and output. The unit comes with a heavy input lead that has a moulded 13A plug and an output lead that's terminated with a 13A, four-socket terminal strip.

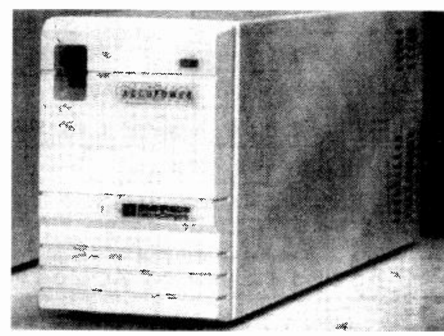
The simple front panel has a recessed lift-for-on mains switch and an 'on' beacon that lights up green unless the mains input is reversed (easy on the Continent, where non-polarised two-pin mains plugs are used) when it lights up amber. Emerson advise against using an incorrectly polarised mains input.

Use

You simply plug the unit in series with the mains connection to, in my case, the wordprocessor. When settling down to use this I simply lift the UPS switch as well as switching on my machine. If a power cut occurs the unit bleeps softly for as long as it lasts and my wordprocessor continues unabashed, giving me time to save everything I've written and in fact to work on. The specified time for operation without the mains supply being present is eight to ten minutes, with continuous use, but I've worked on through power cuts lasting well over twice as long. The unit has never failed me and since buying it I've not lost a word.

Electronics

After rectification the input from the mains supply is filtered to reduce spikes, transients and general noise. It's then stabilised and processed for application to an electronic 'fast-transfer' switch. When the unit detects a significant fall in the input voltage it immediately switches on the inverter section of its a.c./d.c./a.c. converter system. This



The Emerson Accupower Model 20 uninterruptible power supply.

draws power from the built-in, maintenance-free battery, converting it to a.c. which is passed via the transfer switch to continue feeding the load. When the power cut ends, the UPS switches off the inverter. Under normal running conditions the internal battery is kept charged by a d.c. supply.

The Emerson Model 20 is the last word in careful design and manufacture. A glance at the circuit shows the lengths that have been taken to provide tight voltage stabilisation at every stage. I've never seen so many voltage stabilisers before in any piece of equipment!

In Conclusion

I have complete confidence in the unit. Time and time again it has done its job, bleeping away and giving me ample time to complete and save work in hand. I wouldn't, in fact couldn't, be without it.

Finally I am indebted to Darren Jell of Emerson Computer Power who supplied me with circuits and advice on my requirements, also to Javier Nogales Moran, commercial director of Emerson's Spanish distributors Itisa Investigacion Tecnica Industrial, S.A.

Enquiries in the UK should be sent to Emerson Computer Power, Elgin Drive, Swindon, Wilts SN2 6DX, telephone 0793 553 355, fax 0793 553 401. The current list price of the AccuPower Model 20 is £271.00 plus VAT.

FUZZY PLAYBACK?

EURAS SYSTEM WILL BRING IT INTO FOCUS

Video technology is changing fast. New models get introduced with alarming regularity, each with the latest enhancement. So it's not surprising to find models and faults you've not encountered before.

The problem is you can spend costly, unchargeable time searching for elusive faults, which is where Euras System can help.

The Euras System is Europe's largest repair tips database for Video, Television and CD.

With over 120,000 repair tips for 14,000 models from 270 manufacturers you are sure to find the solution quickly. And because it is frequently updated, it always covers the latest models.

FREE DEMO DISKETTE

For a FREE demonstration diskette to run on your PC or details of Euras System in manual form, clip the coupon or phone **0272 860900.**

EURAS INTERNATIONAL LTD
EURAS HOUSE, 51 BRISTOL ROAD, KEYNSHAM, BRISTOL, BS18 2BA

TV 1/94 C

EURAS

Solutions at your fingertips

PLEASE SEND ME A FREE DEMONSTRATION DISKETTE ☐
PLEASE SEND ME DETAILS OF EURAS SYSTEM IN MANUAL FORM ☐

NAME ____________________

TITLE ____________________

COMPANY ____________________

ADDRESS ____________________

____

____________________ POSTCODE ____________

OUT NOW!!

HENRY'S NEW 1994 COLOUR CATALOGUE

TRADE • EDUCATION
RETAIL • MAIL ORDER
EXPORT

Open 6 days a week - CALLERS WELCOME

RETAIL - MAIL ORDER VERSION
With price lists, special offers and purchase vouchers. Send PO/Cheque £4.00 (UK) £6.00 (EC) £10.00 (Non EC) Callers £2.00.

Education, trade, quantity purchasers
Post or fax letterhead for ***FREE*** copy with trade/quantity price list (UK). Overseas prices as above.

HENRY'S

404 Edgware Road, London W2 1ED

Components
Telephone: 071-723 1008

Security - Communications
Telephone: 071-724 0323

Audio and Test Instruments
Telephone: 071-724 3564

Trade/Quantity
Telephone: 071-258 1831
Fax: 071 724 0322

COMPONENTS
For TV ★ Video
Audio ★ Computer

IC SELECTION

AN5753	£3.68	TA7280P	£4.99
BA6109	£1.95	TA7281P	£5.21
AY38912/P	£7.74	TA7288P	£3.59
BA4236L	£3.92	TA7324P	£2.69
BA5408	£2.90	TA7668BP	£1.89
BA6259N	£2.57	TA8400P	£4.95
CA741CE	£0.29	TA8410K	£4.97
CDP6818AE	£7.24	TBA530	£1.74
CNX62A	£3.55	TA7343AP	£3.49
DS1488N	£0.85	TBA810P	£1.16
DS75150N	£1 85	TBA810S	£1.62
DS75154N	£1.85	TCA940	£3.33
H11L3	£2.88	TDA1001B	£2.86
HA1137W	£3.61	TDA1020	£2.64
HA12006	£6.09	TDA1035T	£2 59
HA12413	£4.75	TDA1170D	£4.98
HA13007	£5.12	TDA1180P	£3.49
HD6845SP	£15.18	TDA1516Q	£4.63
KIA7217AP	£2.47	TDA1906A	£2.06
LA3160	£2.28	TDA2003	£2.44
LA3361	£1.79	TDA2541	£2.49
LA4480	£3.86	TDA2593	£3.45
LA7016	£2.99	TDA3653	£3.93
LA7910	£2 62	TDA4420	£2.71
LM1203N	£10.79	TDA4510	£3.75
LM733CN	£2.43	TDA4600-2	£2 95
LM833	£1 79	TDA4601	£2.49
M54544L	£3.38	TDA4950	£2.15
M54548L	£5.29		
MAB8461P	P.O.A.	MANY MORE	
MAB8049H	£5 17	FROM STOCK	
MB81416-12	£4.99		
MK4564N	£2.45		
MP4504	£6.94	TDA8140	£3.49
MSM6242B	£11.77	TDA8170	£3.47
MC1377P	£7.32	TEA2000	£4.33
MC14502BCP	£0.78	TL431	£1.85
MEA2901	£2.69	UM6522	£6.99
NE555CDP	£0.29	UM8272A	£14.09
P8255A	£2.86	UPC1277	£4.23
PC713V	£2.99	UPC1378H	£2.45
SAA1124	£3.88	UPC1397C	£3.94
SED9420CAC	£15.68	UPD8039LC	£12.39
STK4332	£5.71	ZX8400APS	£4.63
STK5451	£6.29	14DN476G	£19.25
STK5482	£6.99	27C256-200	£2.98
TA7226P	£3.76	4116-2N	£1.89

IC PROTECTORS (F or N Ranges) each £0.79

SPECTRUM & QL CHIPS
★ SPECIAL OFFER ★

			(1+)	(5+)
TMS4532NL4	DRAM	(Spec)	£0.99	£0.89
ZX8302	ULA	(QL)	£6.49	£4.99
ZX8401	ULA	(Spec)	£5.44	£4.89
40054	ROM	(+2)	£11.69	£9.99
74LS00	TTL	(QL)	£0.15	£0.10
74LS157	TTL	(Spec)	£0.30	£0.25
74LS245	TTL	(QL)	£0.39	£0.35

THIS IS JUST A SMALL SAMPLE OF STOCK
We can supply spares for many makes of equipment. WRITE (Encl. s.a.e. please) or PHONE FOR A 'PRICE & AVAILABILITY' on your requirements.

0452 526883

COMPUTER SPARES

AMSTRAD

Cer. Capacitor 2200pf/4Kv	£1.85
Printer Armature (PCW 9512)	£4.20
User Manual (CPC464)	£10.95
Serv Manual (PCW9512)	£14.99
Serv. Manual (PC1640)	£19.32

PHILIPS

Serv. Manual BM7513	£3.49
Serv. Manual CM8833	£7.82
Serv. Suppl. CM88xx	£3.00
Serv. Manual CM11342	£8.51
Power Switch CM9073	£8.63

COMMODORE

IC 6569 VIC (Sp. Offer)	£17.49
IC 8372B (A3000)	£44 19
IC 8565 VIC	£23.96
IC 906114-01 PLA	£9.24
Modulator 251916-02	£18.76
Serv. Manual (C64/C64C)	£14.99
User Manual (C64)	£4.99
XTAL 17 73447MHz	£4.99

Most Amstrad, CBM, Philips parts available – plus selected Acorn, Atari, Sinclair & others

MONITOR LEAD – Amiga to Scart I/P £8.29

TRANSISTORS

2SA1706	£1.85	2SK301	£1 85
2SA2331	£1.59	BUV48A	£4.99

TV/MONITOR LINE OUTPUT TRANSFORMERS

AMSTRAD, IBM, DIGITAL, etc.	P O A
COMMODORE 1084-P/SP etc.	P O.A
PHILIPS CM8533/CM8833 etc.	£24.94
PHILIPS CM11342/62 (CM8833 MK II)	£28 51
Ferguson TX90 14" 90°	£23.99
Ferguson TX100 20" 90°	£22 25
Ferguson TX100 22"/26" 110°	£20.91
Ferguson TX100 51cm FST	£23.95
GEC C2089H/90H/C2288 to 2291H/C2294H	£23 99
Hitachi CPT1463/CPT1623/24/26/44/46	£22.99
Hitachi CPT2036/46/76/78/CPT2234/36/CPT2246/78	£23 99
Matsui 1480A/1481/1481B	£22 25
Saisho CT141X etc. (Supply No. on L.O.T.)	P O A

Many other Line O/P Transformers available

AUDIO SPARES

AMSTRAD MX200/CDX400 (FUNAI) CASSETTE DOOR	£3.64
B T. FREEWAY TELEPHONE – REPLACEMENT AERIAL	£3.65
PHILIPS CST427 SERVICE MANUAL	£4.50
PHILIPS D8458 SERVICE MANUAL	£3.49
SHARP RGF278, 281, 284 MAIN BELT	£1 40
TOSHIBA STU2/L MAINS TRANSFORMER	£9 99

TV SPARES

AMSTRAD TVR2 SERVICE MANUAL	£17.39
GEC/HITACHI FRAME MODULE HM6251	£9.29
PHILIPS 96009 Deg. POSISTOR (White)	£1 34
GOLDSTAR CIS4361/4441/CIT2162X/2172X 0/0 SWITCH	£6 49
SAMSUNG CI537V/CX558WT On/Off SWITCH	£6.05

Many other Switches, Manuals, Posistors, etc from stock.

VIDEO SPARES

SHARP VC381/385/VC9300 CAPSTAN MOTOR £34.99

Large range of Video Heads, Idlers, Belt Kits, Pinch Rollers from stock – plus much, much more. Please contact us.

We also stock REMOTE CONTROLS + Many General Components.

We are pleased to serve both the Trade and End User.

DO NOT ADD VAT TO THE PRICES SHOWN – BUT PLEASE ADD £1.25 P&P

All items subject to availability – Prices can change without notice.

ORDER BY POST OR PHONE

We accept payment by VISA, Access, DELTA, SWITCH, Cheque or P.O.

VISA

MAIL ORDER ONLY to:
MARAPET (TVA)
1 HORNBEAM MEWS
GLOUCESTER GL2 0UE

18 BROOKWOOD ROAD, SOUTHFIELDS, LONDON SW18 5BP

TEL: 081-877 3492/877 3518 FAX: 081-877 3518

BELT KITS

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

VIDEO MOTORS

A range of **Reel Motors** made by Ferguson, Hitachi, Sanyo, Sharp & Panasonic are available, please state model and make.

We stock **capston motors**, makes include Ferguson/JVC, Hitachi and Sharp.

Also available are Ferguson **Mode Control Motors**, please state make, model.

Mode Motor Assembly 3V35-49 at £12.50

Sharp Reel Motor Pulley only £1.20

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

REMOTE CONTROLS

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

MANY HITACHI TV REMOTE CONTROLS NOW IN STOCK.

STATE MODEL FOR PRICE.

One for all Mk 3, 4, 6, ... From £18.50

Toptel Universal R/C £28.00

Fox £22.50

TRIPLERS

Universal Tripler £6.20

Universal Tripler with focus unit £9.50

Decca 120/130 series tripler £8.50

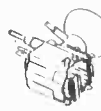
Thorn TX10 Focus Unit Kit .... **This month only**

SPECIAL OFFER £5.00

Grundig Trips .... POA

MAINTENANCE KITS

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



LINE OUTPUT TRANSFORMERS

LOPT Hitachi 2174,76,78	£17.50
LOPT Hitachi CPT1476	£18.00
LOPT Hitachi CPT2276 etc	£19.00
LOPT Matsui 1440	£18.00
LOPT Matsui 1450	£22.00
Decca 100	£9.50
ITT CVC25/30/32	£9.50
ITT Compact 80 Series 110	£16.75
ITT Compact 80 Series 90	£19.75
ITT CVC1204	£11.50
ITT CVC800/1/3	£21.50
ITT CVC1100	£16.50
ITT CVC1150/1175	£20.00

Other ITT transformers available

Fidelity all models up to 20" ZX3000	£15.50
Fidelity Panel for ZX2000	£1.00
Fidelity 22" ZX3000	£18.50
Hinari CT4/5 & TVA1	£17.50
Philips KT3	£12.95
Thorn TX100 Green Spot 110	£14.50
Ferguson TX90 LOPT specify size screen	£17.75

Sony – Please state model for price

VIDEO HEADS

AMSTRAD, FERGUSON, HITACHI, PANASONIC, SANYO, SHARP, FISHER, HINARI, ALBA, MITSUBISHI, ORION, SAISHO, SAMSUNG, TOSHIBA. State Model No. Price from £7.50

PINCH ROLLERS

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

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

BACK-UP BATTERIES

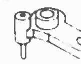
Philips 1.2V Back up Battery	£1.75
Philips 2.4V Back up Battery	£2.80
Ferguson TX10	£2.00
Ferguson TX10 1.2	£2.10
Ferguson TX10 2.4	£3.58
5.5V Back Up Cap	£1.85

TV ON/OFF SWITCHES

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

SONY PUSH SWITCH 80p

Limiter Post Assembly £1.75



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

OTHER SPARES

Universal Video Copying Kit	£4.25
Universal Copying Kit (Scart)	£5.20
Universal Camcorder Kit	£8.00
Video Cassette Lamps from	£0.50
CRT Anode Caps	£0.60
Video Tape Splicing Kit	£6.95
Hitachi TV Frame Module HM6251	£8.00
Hitachi TV Frame Module HM6232	£10.50
Cassette Loading Roller Assembly 3V23,3V31,3V32	£4.50
Degaussing Positor Blue	£4.00
Degaussing Positor White	£1.30
Degaussing Positor Hitachi	£3.40
Degaussing Positor Philips	£3.00
End Sensor for Hitachi VT63,64,65 (Pair)	£2.75
Cassette LED Sensor for Panasonic etc	£1.60
I.C. Circuit Protectors	£0.60
Clear Service Cassette	£5.90
Video Idlers Spring Kit	£7.50
Video Washer & E Clip Kit	£6.00

Universal Video head Puller	From £7.90
Akai VS22 Series Power Board	£26.00
Soldering Iron 25W	£9.50
Multimeter	From £11.50

CASSETTE HOUSING

Cass. Carriage 3V35	£22.50
Cass. Carriage 3V42	£22.50
Cass. Carriage 3V58, 59, FV11	£21.00
Cass. Carriage HRD 500, 30, 700, FV10, 12	£22.50
Cass. Carriage HIT. VT 11	£15.00
Cass. Carriage HIT. VT 64	£19.50
Cass. Carriage Philips VR6462	£16.85
Cass. Carriage Philips VR6362	£11.00
Akai Carr. Kit	£10.25

MANY OTHER VIDEO AND TV SPARES IN STOCK

Back Tension Bands in Stock for Akai, Fisher, Hitachi, Ferguson, JVC, Mitsubishi, Panasonic, Sanyo and Sharp.

IDLER ASSEMBLY

FERGUSON, FISHER, HITACHI PHILIPS, PANASONIC, SANYO, SHARP, AKAI, SAMSUNG, MITSUBISHI, NEC, In Stock.

Price on Application **Wide Range Available**

L18205 . . . SCART SWITCHING UNIT. At the push of a button it is now possible to link your AV & audio systems together via the commonly used Scart sockets. No more unplugging, just a simple push-button operation allowing recording & playback of up to five different appliances £14.50

SATTELITE SPARES

SATT DISHES, LNBs, CABLES, SATT FINDER KITS, INSTALLATION KITS, etc NOW IN STOCK

0.9 DB	at £39.50
Special Offer 1.2 DB	£29.00
Dual LNB both outputs H/V	£52.00
63cm Dish	£19.75
80cm Dish	£39.50
100cm Dish	£69.00
Other items in stock	P.O.A.
35cm Sat. Dish comp with wall mount brkt	£19.95

Prices subject to change without notice. Please add £1.25 per order for p&p and then add 17.5% VAT.

POSTAGE VARIES ON HEAVY ITEMS. SEND A4 SAE FOR LIST

INTEGRATED CIRCUITS

AN103	£1.00
AN214Q	£2.50
AN240P	£1.30
AN253P	£1.00
AN3821K	£7.00
AN3822	£7.50
AN5015	£3.30
AN5033	£5.00
AN5132	£3.95
AN5265	£1.35
AN5510	£4.50
AN5512	£2.00
AN5521	£3.50
AN5730	£3.20
AN5750	£2.50
AN5760	£2.00
AN5900	£1.50
AN6326	£4.00
AN6332	£4.40
AN6341	£2.75
AN6344	£6.50
AN6346	£4.50
AN6346	£4.50
AN6359	£5.50
AN6360	£3.75
AN6362	£4.25
AN6387	£5.50
AN6612	£2.20
AN6651	£0.60
AN6671K	£5.50
AN6677	£5.70
AN6884	£2.75
AN6912	£2.00
AN7111	£1.50
AN7112	£3.00
AN7116	£1.20
AN7143	£2.20
AN7148	£1.70
AN7158	£4.00
CNX62A	£1.50
AN7160	£8.00
AN7169	£3.50
AN7171K	£4.50
AN7205	£1.95
AN7213	£1.10
AN7218	£1.20
AN7220	£1.60
AN7222	£2.10
AN7223	£7.60
AN7224	£1.40
AN7225	£1.90
AN7273	£2.00
AN7310	£1.10
AN7311	£1.75
AN7315	£1.75
AN7324	£4.50
AN7410	£2.10
AN7415	£1.40
AN7420	£3.20
AN7818F	£1.60
B1403	£1.00
BA1320	£1.50
BA1332	£1.00
BA301B	£1.50
BA318	£2.50
BA328	£1.10
BA3308	£2.10
BA333	£1.40
BA3416L	£2.75
BA343	£1.30
BA3505F	£2.75
BA3704	£2.75
BA4210	£2.50
BA4220	£2.00

BA4236	£1.50
BA4402	£1.00
BA4403	£2.75
BA5102	£2.45
BA5204	£2.75
BA524	£3.00
BA5402	£2.40
BA5406	£2.50
BA6104	£2.50
BA6109	£1.80
BA6124	£2.75
BA6154	£2.50
BA6208	£2.75
BA6209	£3.20
BA6219	£1.95
BA6222	£3.10
BA6229	£1.85
BA6238A	£1.85
BA6239	£3.75
BA6259	£3.00
BA6301	£2.00
BA6302A	£2.10
BA6304	£1.70
BA6305	£1.75
BA681	£0.80
BA7001	£1.90
BA718	£1.80
BA728	£1.10
BA7767S	£5.00
BTT6018	£3.50
CNX62A	£3.50
HA11215A	£3.50
HA11223	£3.75
HA11225	£2.10
HA11226	£3.75
HA11235	£3.10
HA1124A	£1.75
HA11414	£2.50
HA11701	£3.10
HA11713	£8.00
HA11714	£3.50
HA11715	£3.20
HA11747A	£12.75
HA11749	£7.00
HA11750	£3.50
HA12005	£3.00
HA12017	£2.00
HA12026	£2.00
HA2413	£1.20
HA13001	£1.80
HA13402	£6.20
HA13403	£4.00
HA1350	£8.00
HA1368R	£2.55
HA1374	£8.00
HA1377	£2.00
HA1388	£4.00
HA1392	£3.00
HA1394	£4.00
HA1397	£5.40
HA1398	£3.50
HA1406	£2.00
HA1457	£2.10
HA4219	£2.70
HD14081	£0.25
HD4539	£0.70
KA2210	£2.30
L7805	£0.60
L7806	£0.80
L7808	£0.80
L7812	£1.00
L7815	£0.80
L7818	£0.80
L7824	£0.95
L7905	£0.80
L7912	£0.80

L7915	£0.80
L7918	£0.80
L7924	£0.80
LA1180	£2.60
LA1185	£2.80
LA1201	£0.95
LA1235	£2.50
LA1260	£1.75
LA1403	£3.75
LA3160	£1.90
LA3210	£1.80
LA3220	£1.80
LA3350	£1.50
LA3361	£1.50
LA3600	£1.50
LA3700	£2.50
LA4100	£1.80
LA4102	£1.20
LA4125	£5.50
LA4140	£0.70
LA4160	£1.25
LA4182	£2.10
LA4183	£2.75
LA4192	£1.70
LA4422	£1.30
LA4440	£2.70
LA4445	£2.50
LA4460	£1.70
LA4461	£1.80
LA4500	£2.70
LA4570	£2.20
LA5522	£2.20
LA5527	£1.95
LA6358	£1.00
LA7016	£2.50
LA7096	£4.00
LA7210	£3.10
LA7305	£8.90
LA7309	£3.75
LA7507	£4.00
LA7520	£3.25
LA7800	£1.50
LA7801	£1.50
LA7820	£1.90
LA7830	£2.50
LA7913	£1.30
LM1011N	£3.00
LM1017/M19281	£2.30
LM1035	£5.75
LM1036N	£3.70
LM1112CN	£3.30
LM13600	£5.00
LM1868N	£1.50
LM1894N	£5.75
LM317T	£1.00
LM324	£0.80
LM339	£0.80
LM339N	£0.75
LM384	£3.60
LM386N	£0.80
LM556CN8	£2.50
LM6402G-2003	£10.00
LM641	£1.80
LM748CN 8 PIN	£1.25
LM748N	£2.00
M104	£7.00
M293B1	£15.00
M490BB1	£14.50
M4918/BB1	£11.50
M50127AP	£6.00
M50453-012P	£8.20
M50560-01P	£2.70
M51014L	£1.85

M51164	£1.40
M51356P	£5.00
M51381P	£1.50
M51393	£4.25
M51513	£10.00
M51515L	£3.10
M51516	£4.00
M51903L	£3.50
M5213L	£3.10
M52184	£1.00
M52314	£1.10
M54519P	£1.00
M54543	£1.75
M54544L	£3.50
M54548L	£4.50
M58478P	£4.75
M58655P	£8.50
M58839	£8.00
M708	£5.50
M709	£4.75
MA150-E	£2.20
MB3106	£1.00
MB3730	£2.75
MB3731	£3.25
MC13002P	£5.00
MC1310	£1.25
MC1330P	£2.95
MC14001BCP	£1.10
MC14093B	£1.50
MC14426P	£2.50
MC14429P	£2.20
MC14497P	£5.50
MC14516BCP	£2.00
MC1458/UPC1458	£1.95
MC3359	£1.10
MCU2632	£1.90
MEA2050	£4.60
MEA2901	£3.00
MH27316	£3.00
ML232B	£4.50
ML237 (BTT6018)	£3.50
ML238B	£7.50
ML923	£5.50
ML923DP	£4.50
ML926	£4.20
MM314APL	£1.75
MM53108N	£1.25
MM5387	£2.00
MM5402	£1.50
MM5405N	£3.50
MM5456	£2.25
MM5457N	£2.50
MM5458N	£2.50
MM55108	£2.65
MM7317	£3.75
MM74C901	£1.10
MPD4011C	£2.00
MPD4069C	£1.10
MPD4081	£1.10
MPD4514BC	£5.00
MPD5521066	£11.00
MSL9378RS	£3.50
SAA1006	£2.50
SAA1025	£5.80
SAA1124	£3.85
SAA1174	£8.50
SAA1250	£4.00
SAA1251	£8.50
SAA1276	£4.50
SAA1290-02	£10.70
SAA1293-02	£6.00
SAA1293-03	£5.70
SAA3027	£5.00
SAA5000	£7.50

SAA5010	£5.00
SAA5012	£5.00
SAA5020	£5.00
SAA5030	£8.00
SAA5040A	£3.50
SAA5040B	£3.50
SAA5041	£8.50
SAA5050	£7.00
SAA5231	£8.00
SAB3013	£5.77
SAB3037	£11.00
SAF1032P	£8.00
SAF1039P	£2.00
SAS560	£3.50
SAS570	£3.00
SAS580	£3.50
SAS590	£3.50
SL1430	£2.60
SL1431	£1.60
SL1432	£2.00
SL471DP	£2.20
SL480	£3.30
SL490	£3.00
SL901B	£3.00
SL917B	£4.00
SN76670N	£1.25
SSA1075	£5.90
SSA1250	£3.50
ST082	£12.00
ST1195	£5.50
STA401A	£3.75
STA441C	£3.00
STK0029	£4.30
STK043	£15.00
STK082	£12.00
STK2029	£8.50
STK2125	£10.00
STK2250	£8.20
STK3041	£5.70
STK40090	£8.00
STK4121 II	£8.75
STK4141 II	£7.90
STK4142 II	£10.00
STK4151	£11.50
STK4171 II	£12.00
STK430	£8.00
STK4311	£10.20
STK433	£7.50
STK435	£8.00
STK4352	£5.80
STK437	£12.00
STK4392	£7.00
STK441	£10.50
STK459	£11.00
STK461	£10.50
STK463	£12.00
STK465	£12.00
STK5315	£7.50
STK5322	£8.50
STK5325	£5.50
STK5331	£3.75
STK5332	£3.50
STK5333	£6.00
STK5338	£8.00
STK5339	£4.00
STK5361	£6.25
STK5421	£8.50
STK5422	£6.00
STK5434	£6.50
STK5451	£5.50
STK5471	£5.25
STK5476	£6.00
STK5481	£5.00
STK5482	£5.20
STK5720	£7.00
STK5730	£5.25

STK6962	£3.20
STK6972	£8.00
STK7216	£8.10
STK7308	£5.75
STK7309	£5.30
STK7348	£5.00
STK7356	£6.50
STK7358	£6.50
STK772B	£5.30
STR1096	£4.00
STR3125	£5.50
STR4090	£10.00
STR40090	£8.00
STR4211	£5.95
STR440	£8.50
STR441	£6.50
STR451	£15.00
STR454	£4.85
STR50020	£7.90
STR50103A	£5.50
STR5412	£5.85
STR58041	£8.75
STR6020	£6.50
TA4180	£3.00
TA4193	£5.00
TA4194	£5.50
TA4301	£4.50
TA4345	£3.40
TA4350	£0.00
TA7120	£1.25
TA7137	£1.25
TA7176	£2.50
TA7176AP	£2.40
TA7193AP	£8.00
TA7193P	£8.00
TA7205	£1.75
TA7205AP	£2.50
TA7222	£2.25
TA7223	£2.50
TA7227P	£2.30
TA7230P	£1.65
TA7232P	£1.50
TA7233P	£2.10
TA7240	£3.00
TA7241	£2.50
TA7241AP	£3.00
TA7243	£3.30
TA7245	£4.50
TA7267P	£2.80
TA7270P	£2.50
TA7271P	£3.25
TA7274	£2.80
TA7280P	£3.00
TA7281P	£3.00
TA7299P	£3.00
TA7302	£1.30
TA7303	£1.10
TA7310	£1.75
TA7312	£1.75
TA7313	£8.00
TA7313AP	£1.40
TA7314	£2.00
TA7323	£3.25
TA7325	£2.00
TA7325P	£1.50
TA7328	£2.00
TA7335	£1.50
TA7335P	£4.20
TA7342	£2.10
TA7343	£1.75
TA7350	£2.10
TA7358	£1.50
TA7607	£2.50
TA7607AP	£2.40
TA7609P	£2.70
TA7614	£2.50

TA7628P	£2.40
TA7629	£4.00
TA7629P	£2.75
TA7630P	£2.00
TA7640	£2.00
TA7658	£2.00
TA7668	£2.00
TA7680	£4.00
TA7681AP	£5.75
TA7687	£2.00
TA7698A	£8.95
TA7698AP	£7.50
TA7705P	£1.50
TA7709	£2.50
TA7738	£2.50
TA78L010P	£1.75
TA8101N	£4.25
TA8102P	£4.25
TA8644	£5.50
TAA310A	£2.00
TAA550	£2.10
TBA120S	£0.50
TBA530	£1.50
TBA560	£1.60
TBA750Q	£4.20
TBA800	£0.95
TBA820M	£0.45
TBA920S	£1.50
TCA640	£3.75
TCA650	£3.95
TCA660B	£3.50
TDA1005	£2.70
TDA1010A	£1.30
TDA1011	£1.20
TDA1013	£2.00
TDA1013A	£1.00
TDA1015	£1.20
TDA1020	£2.50
TDA1022P	£4.50
TDA1035	£1.80
TDA1035T	£1.00
TDA1037	£7.00
TDA1044	£2.50
TDA1044U	£1.50
TDA1057	£2.00
TDA1082	£3.50
TDA1083	£1.70
TDA1151	£1.50
TDA1154	£2.70
TDA1170S	£1.50
TDA1180	£1.80
TDA1180P	£3.00
TDA1190	£1.90
TDA1270M	£4.10
TDA1365	£4.00
TDA1412	£1.00
TDA1470	£5.00
TDA1501A	£3.20
TDA1506	£0.50
TDA1510	£3.20
TDA1510A	£3.20
TDA1512	£3.75
TDA1515A	£2.50
TDA1520	£3.95
TDA1522	£1.50
TDA1670A	£3.00
TDA1701	£4.00
TDA1770A	£3.00
TDA1870A	£2.00
TDA1905	£1.40
TDA1908A	£2.25
TDA1940	£2.00
TDA1950	£2.50
TDA2002	£1.40
TDA2003	£1.30
TDA2004	£1.70

TDA2005	£1.70
TDA2005S	£2.95
TDA2006V	£1.85
TDA2020	£2.00
TDA2030	£1.10
TDA2030H	£2.00
TDA2030V	£1.75
TDA2040	£2.00
TDA2151	£5.50
TDA2161	£3.50
TDA2170	£3.25
TDA2270	£2.20
TDA2320	£0.90
TDA2510	£5.00
TDA2521/3	£0.75
TDA2522Q	£10.75
TDA2530Q	£8.00
TDA2532	£3.00
TDA2532Q	£3.00
TDA2540	£2.75
TDA2541	£2.00
TDA2543	£5.25
TDA2560	£3.75
TDA2600	£8.00
TDA2576A	£8.00
TDA2578	£3.00
TDA2578A	£3.00
TDA2579	£3.50
TDA2581Q	£8.00
TDA2582	£2.55
TDA2590	£2.25
TDA2591	£2.70
TDA2593	£1.50
TDA2594	£3.00
TDA2611A	£2.00
TDA2640Q	£4.50
TDA2653A	£3.50
TDA2822	£2.00
TDA3190	£0.95
TDA3303	£7.50
TDA3330	£0.50
TDA3540	£4.00
TDA3541	£2.25
TDA3560	£5.00
TDA3561A	£5.00
TDA3562A	£5.00
TDA3565	£3.00
TDA3571BQ	£9.52
TDA3590	£6.00
TDA3651	£3.00
TDA3651AQ	£6.50
TDA3653	£3.00
TDA3654	£2.00
TDA3810	£2.00
TDA3950	£3.00
TDA440	£2.00
TDA4420	£7.45
TDA4422	£3.95
TDA4500	£3.80
TDA4501	£5.80
TDA4503	£4.50
TDA4505	£6.75
TDA4510	£4.40
TDA4600	£2.60
TDA4600-2	£2.00
TDA4601	£2.10
TDA4610	£4.50
TDA5101	£2.00
TDA7250	£8.00
TDA7606AP	£2.40
TDA8180	£6.00
TDA8190	£3.00
TDA8341	£6.50
TDA9503	£3.00
TDA9513	£2.95
TEA1009	£2.00

TEA1014	£2.00
TEA1039	£2.00
TEA2018	£2.10
TEA2018A	£2.10
TEA5101	£8.00
TL011CP	£2.00
TL072CP	£2.00
TMM 2114AP	£5.75
TMS1944AN2L	£2.00
TMS1952	£2.50
TMS1956	£2.30
TMS1965NL	£2.00
TMS3450	£4.50
TMS3615	£1.75
U410B	£1.60
U416B	£1.60
UA767PC	£1.20
UA78/10	£2.00
UA78M15	£2.00
UAA1008DP	£2.00
UC38445	£5.00
UPC1185H2	£5.00
UPC1225H	£3.75
UPC1230	£3.00
UPC1238V	£2.10
UPC1263	£3.00
UPC1288V	£5.00
UPC1361C	£3.00
UPC1362C	£4.50
UPC1363	£1.00
UPC1365	£4.50
UPC1377C	£3.50
UPC1378H	£2.00
UPC1379	£2.20
UPC1382	£1.50
UPC1394	£1.70
UPC1420A	£7.00
UPC1458	£1.95
UPC1513HA	£2.00
UPC1520CA	£2.40
UPC339C	£0.70
UPD4011	£1.75
UPD4066	£1.85

TRANSISTORS

2N3773	£1.80
2SA1095	£5.50
2SA1102	£1.00
2SA1112	£0.95
2SA1124	£0.35
2SA1220	£1.10
2SA1386	£4.70
2SA564	£0.40
2SA673	£0.20
2SA942	£0.35
2SA985	£0.85
2SB1016	£1.50
2SB772	£0.40
2SB775	£1.60
2SB819	£0.55
2SB965	£2.30
2SC1413A	£2.50
2SC1826	£1.60
2SC1942	£5.50
2SC1983	£1.30
2SC2003	£0.25
2SC2027	£4.50
2SC2230	£0.50
2SC2238	£0.75
2SC2331	£1.00
2SC2335	£1.50
2SC2531	£0.20

2SC2564	£0.84
2SC2570	£0.55
2SC2577	£1.50
2SC2592	£0.85
2SC2621	£1.25
2SC2631	£0.30
2SC2632	£0.30
2SC2655	£0.80
2SC2958	£2.50
2SC2979	£3.00
2SC3153	£3.40
2SC3402	£0.40
2SC3519	£4.60
2SC3678	£2.70
2SC3715	£4.00
2SC458	£0.20
2SC789	£2.50
2SD1047	£2.75
2SD1051	£0.85
2SD1128	£1.50
2SD1138	£0.85
2SD1159	£0.75
2SD1207	£0.75
2SD1273	£1.00
2SD1275	£1.30
2SD1288	£1.70
2SD138	£0.85
2SD1391	£4.20
SMC1397	£3.75
2SD1398	£2.25
2SD1426	£4.50
2SD1432	£5.00
2SD1453	£1.60
2SD1455/2SD1730	£3.10
2SD1496	£4.00
2SD1497	£2.00
2SD1497-02	£5.05
2SD1497-06	£5.95
2SD1650	£3.50
2SD1877	£2.30
2SD639	£0.35
2SD667	£1.00
2SD725	£3.70
2SD787E	£0.30
2SD811	£2.95
2SD836	£1.10
2SD837	£0.80
2SD845	£2.70
2SD868	£3.50
2SD869	£3.00
2SD870	£3.50
2SD871	£4.50
2SD895	£2.00
2SD898	£2.75
2SD898B	£2.75
2SD900B	£4.00
BC107B	£0.10
BC108	£0.10
BC108B	£0.10
BC115	£0.10
BC118	£0.12
BC147A	£0.07
BC159	£0.09
BC171	£0.08
BC172	£0.08
BC172C	£0.07
BC182L	£0.08
BC183	£0.08
TDA8180 ORIGINAL	£0.50
BC184	£0.08
BC212	£0.09
BC213	£0.09
BC214A	£0.07
BC214B	£0.07

BC214L	£0.09
BC237	£0.07
BC238	£0.07
BC307	£0.12
BC308B	£0.07
BC327-25	£0.07
BC328-40	£0.05
BC337	£0.07
BC372	£0.85
BC392	£1.50
BC441	£0.25
BC461	£0.25
BC547	£0.07
BC548	£0.07
BC549	£0.07
BC557	£0.30
BC559B	£0.07
BC639	£0.10
BC640	£0.30
BD131	£0.50
BD132	£0.40
BD137	£0.35
BD237	£0.22
BD238	£0.22
BD243B	£0.30
BD243C	£0.40
BD244	£0.30
BD244C	£0.30
BD278A	£0.80
BD434	£0.80
BD508	£0.80
BF195	£0.07
BF196	£0.15
BF197	£0.15
BF198	£0.07
BF199	£0.14
BF244	£0.40
BF259	£0.22
BF422	£0.15
BF458	£0.22
BF459	£0.22
BF469/BF471	£0.25
BF471	£0.25
BF472	£0.25
BF870/BF472	£0.25
BU108	£0.75
BU126	£1.40
BU208	£1.00
BU208A	£1.25
BU208D	£1.15
BU208T	£1.00
BU326A	£1.00
BU406	£0.90
BU406D	£1.50
BU407	£0.50
BU426A	£1.00
BU500	£1.00
BU508A	£1.00
BU508AF	£1.70
BU508D	£1.00
BU806	£0.75
BU807	£0.75
BUT11	£0.95
BUT11AF	£1.05
BUW84	£1.05
BUX84	£0.80
SD12659	£0.75
T9064V	£2.20
TIP110	£0.45
TIP112	£0.45
TIP29	£0.30
TIP30	£0.45
TIP31	£0.30
TIP32	£0.30
TIP41	£0.27
TIP42C	£0.40

TIP47	£0.90
TIPL791A	£1.20
ZTR604	£0.55
ZTX650	£0.70

DIODES AND THYRISTORS

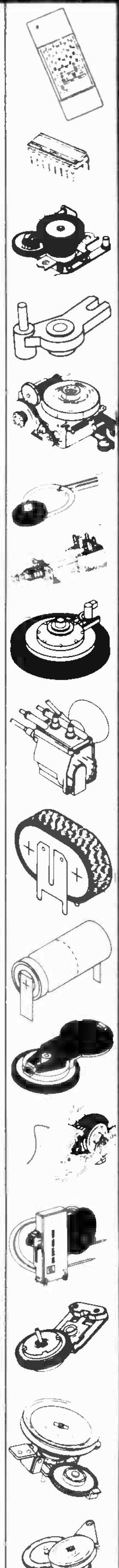
BA157	£0.07
BR100	£0.20
BR101	£1.40
BR103	£0.75
BR303	£1.50
BRY56	£0.75
BT116	£2.50
BT128P	£4.50
BT129P	£4.50
BT151/800R	£1.75
BY126	£0.20
BY127	£0.00
BY133	£0.20
BY164	£0.80
BY164/SKB2/02	£0.80
BY179	£1.10
BY179/SK2/08	£1.10
BY184	£0.85
BY189	£2.00
BY190	£2.00
BY223	£2.00
BY206 (BYB96R)	£0.55
BY210/800/BYV96	£0.55
BY227	£0.20
BY228	£0.50
BY229	£1.15
BY299	£0.50
BY96D	£0.30
BYV96D	£0.55
BYW56	£0.50
BYW96E	£0.50
BYX10	£0.50
BYX55/600	£0.55
FB2506	£1.50
IN4001	£0.06
IN4002	£0.06
IN4004	£0.10
IN4005	£0.10
IN4006	£0.08
IN4007	£0.08
IN4148	£0.10
IN5408	£0.25
KBL08	£1.05
OA91	£0.20
OT112	£2.20
RGP15G	£0.45
RGP15J	£0.55
RGP15K	£0.35
RGP30K	£0.70
RHI	£1.30
RM11C	£0.45
SG264	£0.50
SG613	£12.00
SKB/02	£0.80
SKB/08	£1.20
SKB2/02	£0.80
SKB2/08	£1.10
SKE1/02	£0.80
SKE1M15	£0.85
SKE2G2/02	£0.75
SKE2G3/04	£1.30
SKE4F1/04	£0.45
SKE4F1/06	£0.45
SKE5F3/10	£2.20
SR2M	£0.75
T9053V	£1.40
T9064V	£1.50

ASK FOR SEMICONDUCTORS NOT LISTED. PRICES SUBJECT TO CHANGE

SEND FOR PRICE LIST ☆ ☆ ☆ Trade Counter now open Monday-Friday 9.00-5.30. Saturday 9.00-1.00. Closed between 1.30pm-3.00pm every Friday. Nearest Underground Station – Southfields District Line.

VISA

A Z ELECTRICS



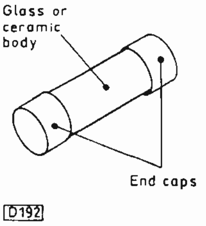
All About Fuses

Ray Porter, M.Sc., C.Eng., M.I.E.E.

The first patent on fusing was filed by Edison in 1880. Ever since fuses have been used as current interrupters in electrical and electronic systems, being low-cost devices that always go open-circuit when subjected to the overload level at which they are designed to trip. It gives you a feeling of safety when a piece of equipment is fitted with a fuse, which is the first item an engineer checks when confronted with a completely dead circuit. There are several different types of fuse: this article explains the forms of protection they provide.

Miniature Wire Fuses

The fuse most commonly seen by the electronics technician is the miniature wire type. They are made to meet the varying national standards that exist throughout the world. Should an excessive current flow the wire overheats, melts and finally evaporates. An arc occurs at the melting point:



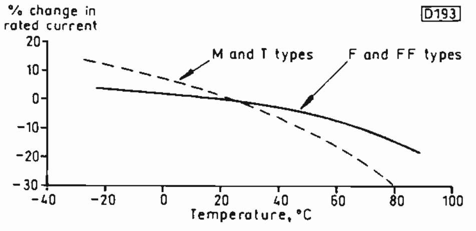


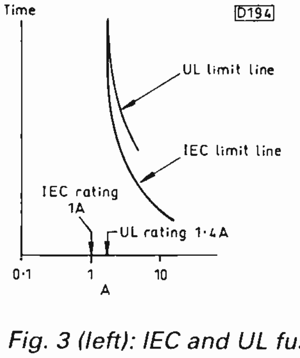
Fig. 1 (left): The conventional cartridge fuse.

Fig. 2 (right): How the current rating changes with change in the ambient temperature.

as a result the temperature rises to several thousand degrees and molten metal particles shoot away from the arc region. With a cartridge fuse, see Fig. 1, the pre-arcing heat and metal spray are contained by a glass or ceramic tube. PCB-mounted Wickman fuses are very similar to the tubular cartridge type in their ratings and characteristics.

Current Rating

The current rating marked on a fuse is the current it will carry continuously, at an ambient temperature of 23°C or



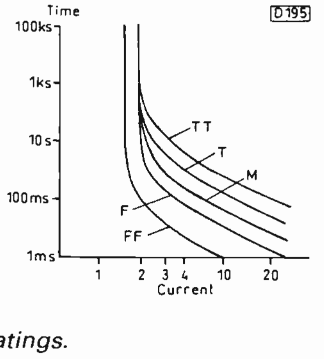


Fig. 3 (left): IEC and UL fuse ratings.

Fig. 4 (right): Time-current fuse characteristics.

whatever the relevant approval standard specifies, without blowing. As Fig. 2 shows, the rating changes when the fuse is operated at a different ambient temperature. It's important to note that the relationship between the current which will blow a fuse and the current which the fuse is rated to carry continuously differs with the standards organisation that gives it approval. European fuses are rated in accordance with IEC standards while American equipment uses UL (Underwriters' Laboratories) approved fuses. Fig. 3 shows that a 1A IEC fuse would be rated at 1·4A by UL.

Time-current Characteristics

Fuses don't blow instantly: it takes time for the wire to heat to its melting point. Delayed-action fuses are made by adding more cooling to the wire. Fig. 4 shows curves for TT (very slow), T (slow), M (medium or normal), F (fast) and FF (very fast) fuses. T fuses are often used in domestic electronic equipment to avoid fuse blowing when there's a current surge at switch on – as the power supply capacitors charge initially and when degaussing posistors are cold.

The energy a fuse allows through into a circuit depends on its I^2t value. I^2Rt is the energy a fuse dissipates during a time period t, where R is the fuse's resistance. Thus a fuse with a small I^2t value imposes less stress on the circuit being protected. Circuit designers also take this into account.

Voltage Drop

Voltage drop is the voltage developed across a fuse when it is carrying its rated current. The voltage drop across a 1A, 20mm fuse is a few hundred mV. Up to half a watt may be dissipated by a high-current 20mm fuse. In most electronic equipment this causes an insignificant local temperature rise.

Current Breaking Capacity

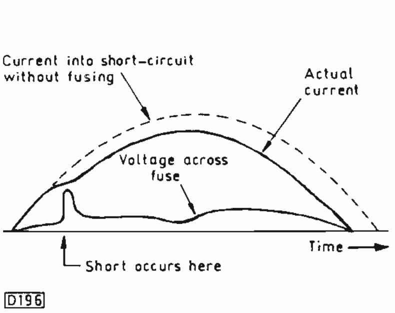
When maximum fault current is present the wire heats so rapidly that there's a risk of fuse explosion and fire within the fuse holder. To ensure a safe shut-off, circuit designers specify a fuse that has a breaking capacity greater than the maximum prospective short-circuit fault current. To increase their breaking capacity fuses can be filled with heat-resistant material and enclosed in a ceramic tube. So that it doesn't flash over a fuse's voltage rating has to be taken into account – don't use a 125V fuse in a 240V circuit.

Cut-off Characteristic

To minimise arcing a fuse must shut off the fault current rapidly, before the voltage maximum of the sinusoidal a.c. mains supply is reached. A poorly designed fuse could arc for a complete half cycle, i.e. 10msec with a 50Hz supply, allowing considerable energy to enter the faulty circuit. Fig. 5 shows how a poorly-designed fuse will fail to cut off the fault current. A similar situation arises when a fuse is used at a voltage above its rating.

Deterioration with Age

The passage of current pulses through a time-delay fuse will wear it out. Thus the number of pulses such a fuse can survive is limited. The rate of deterioration depends on the I^2t value of the current pulses, see Fig. 6. Note that a fuse could fail after 3,000 pulses of ten times the normal overload surge. This explains why fuses can fail when there is



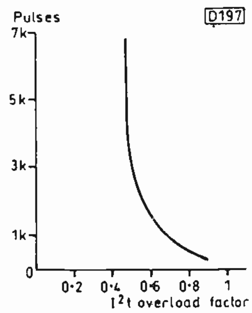


Fig. 5 (left): Fuse arcing to the end of an a.c. half cycle.

Fig. 6 (right): Ageing of time-delay fuses.

no overload fault. For example if a mains switch is operated 3,000 times in three years and the switch-on surges haven't been taken into account a fuse could fail, much to the user's annoyance.

Colour Coding

International standard IEC 127A specifies fuse ratings and an optional colour code that's similar to the three-band resistor colour code. The first two bands are in mA, the third band being the multiplier. Thus a fuse marked like a 1kΩ resistor has a 1A rating. A fourth band, twice the width of the other three, signifies the speed of the fuse: brown is FF, red is F, yellow is M and blue is T.

Integrated Circuit Protectors

ICPs are miniature fuses packaged for easy assembly on PCBs that carry low-voltage circuitry. The N type looks like a two-legged signal transistor while the F type looks like a two-legged single in-line chip. Their voltage rating is 50V, the voltage drop being less than 100mV at the rated current. To determine the current rating, multiply the last two digits of the type number by 40: for example, an ICP-F10 has a 400mA rating and blows in 100msec when a three-times overload occurs. Thus the characteristics are similar to those of an F type cartridge fuse. The N and F versions are similar electrically, the only difference being in the packaging. Never use an ICP where there's more than 50V.

Thermal Fuses

The thermal fuse doesn't offer protection against an excess-current condition until the fault produces heat that warms the outside of the fuse's body. Construction and application are similar to those of a thermostat, an internal switch opening when a preset temperature is reached. A thermal pellet inside melts at a calibrated temperature, allowing a spring to open contacts that remain open when the temperature falls back. Typical current ratings are 1-15A, usually at 250V. Temperature settings can be in the range 60-240°C: 100°C to 150°C units are commonly used to provide insulation protection, in a transformer for example.

Don't try to substitute a conventional wire fuse for this type of component, as the protection the two types provide is different. And don't try to solder to them – the temperature of the iron can melt the pellet inside, catastrophically.

Fusible Resistors

The fusible type of resistor is similar in appearance to a conventional carbon resistor, but the construction is such that the device goes open-circuit readily when severely overloaded, with no fire hazard. Fusible resistors are used in power supplies as surge limiters, providing safe fusing when the associated reservoir/smoothing capacitor goes short-circuit. The fusible resistor fails open without a long high-temperature period. Philips' fusible resistors are the size of a conventional 0·33W resistor: they are coloured grey and go open-circuit in thirty seconds when 4W is applied or ten seconds when 6W is applied.

Fault-finding is simple: there's an open-circuit to trace, though there won't be any charred board to home in on.

Polymer Fuses

The polymer fuse is a relatively new device. It consists of a mixture of carbon black and plastic and operates like a PTC thermistor, i.e. it heats up when excess current is present, its resistance increasing dramatically but slowly, then resets automatically when left to cool. Polymer fuses have more closely defined resistance characteristics than a normal thermistor, and a very low cold resistance, e.g. 10mΩ for an 8A device. The voltage rating is usually 60V or less, but some low-current 250V types are now available. The current rating is included in the marking on the body: an MF090 type for example is rated at 900mA continuous current.

Safety

Fuses are included in circuits to protect the user and his equipment in the event of a malfunction. If you fit a device with different current cut-off features to the original one designed into the circuit there is an increased risk of injury, to yourself and others. So the correct type as specified by the equipment manufacturer must always be used. Remember that the manufacturer will have carried out extensive product testing, with faults intentionally introduced, and chosen fusing critically to ensure that the user is protected. If you alter a fusing system, will you have considered all the effects that an increased current flow could cause?

Adding a Bubblejet Printer to the Amstrad PCW

Keith Wevill, B.Sc.

There are probably many *Television* readers who use one of the Amstrad PCW series of word processors. Originally introduced in 1985, they consist of a keyboard, monitor and printer, with Locoscript word-processing software. The original PCW8256 had a single 3in. 180Kbyte capacity disc drive, 256Kbytes of RAM and a dot-matrix printer. Later additions were the PCW8512 which had two 3in. disc drives with 180K and 720K capacity and 512K of RAM, and the PCW9512 with one 3in. 720K capacity disc drive, 512K of RAM and a daisy-wheel printer instead of a dot-matrix type. The original Locoscript 1 and later Locoscript 2 were described in the December 1986, March 1989 and May 1989 issues. The latest version of Locoscript 2 is v2.32.

The 3in. discs, with a capacity of 180K in the single-sided, single-density format or 720K in the double-sided, double-density format, never really caught on with the computer industry, which adopted the 3·5in. disc as its standard. It's possible to add a 3·5in. disc drive to a PCW8256 – many companies supply suitable drives. An article in the December 1992 issue dealt with this. 3·5in. discs are cheaper and more readily available than the 3in. type. The more recent Amstrad pcw series word processors have a 3·5in. disc drive as standard. The pcw9256 has 256K of RAM and a dot-matrix printer, the pcw9512 512K of RAM and either a daisy-wheel or a bubblejet printer.

Types of Printer

The types of printer supplied with the various versions of the PCW differ in their print quality and versatility. This is because of the method used to produce the characters. With a dot-matrix printer the characters are formed, as the name suggests, from a series of dots. A daisy-wheel printer has solid characters on the 'petals' of the wheel. Bubblejet printers shoot small dots of ink on to the paper.

The PCW dot-matrix printer uses nine pins in one of two modes. In the draft mode the dots are visible and the printing speed is around 90 characters per second (c.p.s.). For the Near Letter Quality (NLQ) mode the paper is shifted up by half the vertical inter-dot gap after each line is printed and the characters are then reprinted. This fills in the gaps, improving the appearance of the text but slowing the print rate to about 20 c.p.s. Other dot-matrix printers that use 24 pins are available, giving finer text in a single printing.

The daisy-wheel printer produces solid characters on the paper like a typewriter, but the wheel has to be changed should a different font, e.g. italics, be required. It cannot handle graphics and tends to be noisy.

The bubblejet printer forms small ink droplets by heating the ink in a nozzle, ejecting the droplets on to the paper. Characters are formed in a similar manner to the dot-matrix printer, but there are many more nozzles than pins. The bubblejet printer supplied with the PCW9512 has 64 nozzles and is capable of very high-quality printing at high speed. It's also much quieter than a dot-matrix or daisywheel printer.

There is another type of printer, the laser type, that's now the standard for many offices and businesses. It works in a similar way to a photocopier and is capable of extremely high-quality printing. But it is much more expensive. So for the time being the bubblejet is fast becoming the standard low-cost, high-quality printer.

The Canon BJ10ex Printer

The bubblejet printer supplied with the PCW9512 is a Canon BJ10, which is available separately for under £200 plus VAT. It can, with the appropriate interface and software, be used with any PCW series word processor. Once installed it can print all the characters and fonts available with Locoscript 2.

In order to match many laptop type computers the BJ10ex is physically small (310 x 216·5 x 47·5mm), weighing 1·8kg. It's powered by an a.c. adaptor but has space for an optional NiCd battery pack for portable use. There is a parallel Centronics interface, and the print speed in either the high-quality or economy mode is 83 c.p.s. – the economy mode puts less ink on the paper, making the text lighter.

Front-panel controls select high quality/economy, pitch, line/form feed, forward and reverse paper feed adjustment. Other functions are available by using these controls – details are contained in the user's manual.

The BJ10ex can emulate several different types of printer in one of three modes that are set by eleven DIL switches and has various built-in fonts. By using a program such as Microdesign 2 or 3 in the PCW graphics and drawings can be printed. A slot at the back enables envelopes to be printed and an optional sheet feeder to be fitted.

The ink is supplied in a cartridge that also contains the print nozzles. So you get a new printhead whenever the cartridge is replaced. This makes the cartridges more expensive than the ribbons for a dot-matrix or daisywheel printer, but the print quality is consistent over the life of a cartridge – which is more than can be said of a ribbon. Cartridge life is quoted as approximately 700,000 characters, but it's possible to refill a cartridge and many firms can supply a refill kit at about half the price of a new cartridge.

Note that the BJ10e is similar but has only two modes and one less DIL switch. It is otherwise compatible with the following installation instructions.

Installing the Printer

To use a BJ10ex with a PCW the software required to drive the printer has to be installed and the appropriate hardware interface connected. The PCW has neither a parallel Centronics nor a serial RS232 port but does have an expansion port, in the form of an edge connector, to enable different interfaces to be fitted. Many different interfaces are available from various manufacturers. The most popular types are the RS232/Centronics and extra memory interfaces. Each just plugs into the exposed edge connector at the back of the PCW. Many have a through-port facility so that more than one interface can be added. The memory interfaces enable up to 1·5Mbytes of extra memory to be added, and some have a built-in Centronics port. The extra memory is useful when copying B-drive discs as the disc can be copied in one go instead of having to keep on changing over the source and destination discs. The graphics and desk-top publishing (DTP) programs also benefit from the extra memory. The PCW can use a maximum 2Mbytes of memory.

Those with a PCW8256 or PCW9256 can easily fit an extra 256K of memory internally by installing eight extra RAM chips in the eight empty sockets on the PCB and switching over two internal DIL switches. Many firms can supply a kit with full instructions for under £20.

Once a parallel Centronics port has been installed an external printer can be used by converting the document to a page-image ASCII file. Run CP/M, use the command DEVICE LST = CEN to set the list device (the printer) to the Centronics port, then transfer the ASCII file to the printer by using the command PIP LST:= *drive:filename* where *drive* is the disc drive, A or B, that the file is on and *filename* is the name of the ASCII file. This is a long-winded method and is not recommended to any but the most desperate or computer-literate CP/M enthusiast. It will print out the text but won't allow such things as underlining or italics. The font and pitch have to be set on the printer, and it may take more than one attempt to get it right.

To get the full character set, styles and layouts available with Locoscript 2 the Start Of Day disc must contain suitable printer drive files. This calls for the Locomotive Software Printer Support Pack, which contains all the files needed to drive a number of types of printer including the dot-matrix (both 9- and 24-pin), bubblejet and laser types. Full installation instructions are supplied with the support pack – it's advisable to read through the booklet before attempting to install the files.

The following procedure however is the one I used when installing a BJ10ex with my PCW. My first attempt took over two hours but, once the problems had been sorted out, subsequent installations took 10-15 minutes.

There are two posible modes of operation for the printer, download and built-in character set. The latter uses the printer's own character set when printing and cannot print all the characters available with Locoscript. In the download mode the computer sends details of the character set to the printer before printing starts, so it can print any of the available characters including the Greek and Cyrillic alphabets. This is the mode for which the following procedure is intended.

My PCW system consists of a PCW8256 expanded to 512K of memory, an external 3·5in. B drive, a Centronics and RS232 interface, a BJ10ex bubblejet printer, the standard dot-matrix printer and a Keymouse for use with MicroDesign 2 and 3.

Installation Procedure

You will need your Locoscript 2 Master disc, the Printer Support Pack discs and at least one blank A drive disc that doesn't need to be formatted. If Locospell, Locomail or Locofile are to be installed, either the MATRIX.#SS or MATRIX.#ST file will have to be deleted to make room on the disc. These are font files for use with the internal dot-matrix printer. There's an easy way of overcoming this if a B disc drive is available – more on this later. The procedure will have to be followed for each different Start Of Day disc made. The installation program is fairly easy to follow, and will prompt you to insert your master disc(s) and the blank disc(s) when required.

(1) Switch on the computer and insert the Installation Program for Locoscript 2 – at the time of writing the latest version for the PCW is v2·32. A message will appear on the screen, with the amount of memory found. If this is correct, press ENTER.

(2) Select OPTION 6 – Multiple Products. Insert your Locoscript 2 Master disc and press ENTER. The screen menu will then prompt you to select the additional programs required – Locospell, Locomail or Locofile. Select the required programs and press ENTER. When prompted, install these programs from the appropriate master discs.

(3) When the printer menu comes up select 'Built in matrix' and 'External printers using downloaded characters'. Press ENTER.

(4) Insert a blank disc in the A drive and press ENTER. Press ENTER again to format the disc and copy the files to it. This is now your Start Of Day disc.

(5) Once the files have been written on to the disc press ENTER to return to the initial options menu. Select OPTION 9 – Quit Installer. Then press any key to restart the computer, using the new disc just created? Check that the file LQ24.DRV (the 24-pin printer drive file) is in group 0 of drive A.

Now the printer files have to be installed.

(6) Insert the Printer Support Disc 1, Side 1, and copy file 24BJ10E1.PRI to the M drive group 0. This is the BJ10 driver file.

(7) Insert the Printer Support Disc 2, Side 1, and copy one of the 24PIN fonts to the M drive group 0. There are four font files on the disc in group 7 (24FONTS) – 24PIN.#LS, 24PIN.#LT, 24PIN.#SS and 24PIN.#ST. #LT and #ST are the standard fonts, #LS and #SS the sans-serif ones (the type used, in italic form, for captions in *Television*). #LS and #LT are lighter versions. Select one of the fonts and copy it to the M drive group 0.

(8) Insert the new Start Of Day disc just created and copy file 24BJ10E1.PRI to group 0 of drive A. Copy a font file 24PIN.#XX to group 0 of drive A and rename it to 24BJ10E1.#XX where XX is either LS, LT, SS or ST.

The font and .PRI files must have the same file name up to the dot. The instructions recommend renaming the .PRI file, but I chose to rename the font file as this enables me to see which printer I've chosen.

(9) Press SHIFT + EXTRA + EXIT simultaneously to restart the computer. Check that group 0 of the M drive now contains files LQ24.DRV, 24BJ10E1.PRI and 24BJ10E1.#XX where XX is the font selected in (7).

The settings now have to be updated. Note that to select or deselect most of the options in this section you use the + or – selection keys at either side of the space key followed by the ENTER key.

(10) Select the 'settings' option by pressing f6.

(11) Select 'For printer' then option 24BJ10E1.

(12) Select 'Standard printer' then option 24BJ10E1.

(13) Select 'Printer defaults', then 'Printer options' then 'Sheet feeder'. This simplifies the printing procedure when changing paper, as the PCW cannot tell when a new sheet of paper has been inserted in the BJ10 and needs to be told by pressing the PTR key followed by the + selection key and the ONLINE button on the printer when the new sheet of paper has been loaded. By selecting the sheet feeder option all that's needed is to load a new sheet of paper then press the printer's ONLINE button.

(14) Select 'EXIT' then 'Write SETTINGS.STD'. Press ENTER to write the SETTINGS.STD file on the Start Of Day disc.

Your Start Of Day disc is now set up with its standard printer as the BJ10ex with the selected font. Set the write protect hole on the disc to prevent accidental erasure. If you print any existing documents you'll get a warning message that the current and intended printers don't match and will have the option to use the current (BJ10ex) or the intended (matrix) printer. To avoid this, the document set-up for the document must be changed as follows:

(15) Select the document and edit it with E.

(16) Select 'f1 Actions'.

(17) Select the 'Document set up' option.

(18) Select 'f6 Printing'.

(19) Select 'Printer' then 24BJ10E1.

(20) Check that the character set is the one chosen in step (7). If the character sets are different a warning message will be displayed when the document is to be printed. This is not serious, as the character sets available are compatible and either one can be used. Other character sets, available as a LocoFont disc, may not be compatible and could cause problems when printing. So it's advisable to ensure that the character set is the same as that chosen in step (7).

(21) Select 'Exit', then 'Exit' and return to the document.

The document and computer are now set up for the bubblejet printer with a single Start Of Day disc. All that remains is to set the DIL switches in the printer. These tell it, when it has been switched on, how to respond to the data sent to it. The factory settings are with all eleven switches at off. For use with the PCW and Locoscript, set switch 8 to on. This sets the download memory to 34K and the receive buffer to 3K, enabling the character set to be downloaded from the PCW. All the other switches should be off.

If you intend to use the printer with other programs it may be worth setting switch 4 to on. This sets the page length to 12 rather than 11in. For use with MicroDesign 2 the Alternate Graphics Switch 7 must be set to on. For MicroDesign 3 this switch must be off.

The user manual contains more information on the functions of all the switches.

Two Disc Drive Systems

If you have two disc drives it's possible to use the printer in more than one mode and to have more than one font available. Follow the instructions given above but, instead of copying the .PRI and .#XX files to the A drive, copy them to group 0 of the B drive. In this way you can load both the standard and sans-serif fonts and their lighter versions if necessary.

You can use the printer's own built-in character set as well by selecting the 'External printer using built in characters' option when initially setting up the Start Of Day disc. Then copy file BJ130E.PRI to group 0 of the B drive. When you examine the printer options you will find that there are now three printers available.

Using the B drive like this has advantages and disadvantages. One disadvantage is that you need the disc in the B drive when you start up the system, but this is no real problem if you put the files on all your B discs. Another disadvantage is that the files take up space on the discs, but this is typically less than ten per cent of the space available. I've yet to succeed in filling a B disc – yet! The advantage is that you can set up each B disc for a different printer and font that suits the documents on the disc.

Back-up Copies

It's a good idea to make a note of the procedure you used, and which files you used, on each Start Of Day disc – in case the disc gets damaged and a new copy has to be made, or changes are made to the disc such as adding Locospell, Locofile, Locomail or a new printer. I've included a copy on one of my B drive discs, with a print out stored in a separate file, along with other useful notes on the computer. Keep your master discs in a safe place, and make back-up copies of the Start Of Day discs.

Installing Other Printers

To install a printer other than the BJ10ex the procedure is the same except that the .PRI files appropriate to that printer have to be used. There is a list of printers and their .PRI files in the PCW External Printers Guide that's supplied with the Printer Support Pack.

Switching on/off Procedure

There's a recommended procedure for applying the mains supply to the printer and the computer. Switch on the mains supply to the printer first, then switch it on using its own on/off switch. Finally switch on the computer. The switch off procedure is the reverse. If the printer is switched on when the computer has been powered the printer can affect it. At worst the result will be a complete lock-up, with possible loss of files being edited.

To allow it to clean the print head, switch the printer off with its own on/off switch before you switch off at the mains.

Postcript

Since this article was written the BJ10sx printer has replaced the BJ10ex and Locoscript 2 has been superseded by Locoscript 3. The BJ10sx has a higher print speed than the BJ10ex: the same installation procedure can be used. Locoscript 2 and the Locoscript 2 Printer Support Pack are no longer generally available, but you may still be able to obtain a copy. Otherwise you could upgrade to Locoscript 3 with its own Printer Support Pack.

What a Life!

Donald Bullock

A dead Hitachi colour portable came in the other day – it was fitted with the NP84CQ chassis. When I opened it up I found the most crowded little chassis I've seen for some while. As I didn't have a circuit diagram I started to make checks in the power supply and immediately found that Q902, a BU806 Darlington power transistor, was short-circuit. I replaced it then checked the 2SD1453 line output transistor Q703 which was also short-circuit. So I replaced this too then switched on. The set grunted, but that was all. At this point a circuit was really needed and an idea came to me. I took down Mike Lyon's ECS model-chassis guide and found that the chassis is also used in the GEC Model C1405H, for which we do have a manual.

The BU806 is part of a sort of pre-regulator, or initial regulator, circuit. It's followed by an LM317 variable voltage regulator chip, IC901, that lives at the other end of the giant heatsink. A check showed that it had also failed. I replaced it and switched on again. Once more the set grunted, and that was all.

Then I stopped and thought. I'd been silly, hadn't I? I hadn't checked the replacement BU806 after replacing the LM317. They'd both be useless now. I checked them and they were.

As I'd just one more BU806 and LM317 I carefully checked the resistance between the h.t. line and chassis. The reading was respectable, so the remaining BU806 and LM317 were fitted. Then I checked the line output transistor again. The new one was all right.

I took down my variac arrangement – I've added a voltmeter, an ammeter and a 2A mechanical cutout (from a Thorn 3500 chassis) to the variac itself – and used this to supply power to the Hitachi portable. All went well as I wound up the voltage. The ammeter's hand shuddered a bit at switch-on, then settled back happily against its stop. I wound on cautiously, darting my eyes about like a weights and measures pest. Then the hand suddenly flew over to the other stop as the set grunted again and died.

Mrs Tubby

It was at this point that Mrs. Tubby rolled in from the Dean Forrest. She talks in riddles and a visit from her was the last thing I wanted.

"I've parked my car in the road. It's faulty" she said.

I looked up wearily. "I can't mend cars Mrs. Tubby" I said.

"The telly's faulty" she said, leaning towards me as though I was an idiot, "the one you mended the other day. It's never been right since you did it. But we thought we'd give it a chance. It didn't settle down though. You'll have to get it out of the car."

I followed her out from the drive, wishing I'd been an optician or a rich and aloof car mechanic. She walked on. Her car was a hundred yards away. I pulled out the weighty Sony KV2217UB and started the treck back to the workshop. When I got there I was tottering.

"I want you to do me a favour Mr. Bullock" she then said. "My son Walpole leaves school soon. He seems to have some electrical questions to answer. Perhaps I could pop him in tomorrow. This workshop could do with a clean up. He'll do it while you answer his little questions." And off she went.

Back to the Hitachi

I took another look at the Hitachi/GEC circuit and noticed that there's a bit of the power supply that's right over at the other side of the chassis, as far away from the rest as could be. It's an over-voltage trip that removes the 12V supply to the line driver transistor and various other parts of the set. Maybe something here was causing the grunting. There's a crowbar thyristor and a 36V zener diode (ZD903), which turned out to be short-circuit. I'd have to order one. So I phoned JJ Components and placed an order for this and various other items.

They arrived next morning. After fitting the zener diode in the Hitachi set I started it up again. This time it came on perfectly. The faulty line output transistor must have killed ZD903 as well as causing the damage in the power supply. Anyway the birds were now singing and the sun was shining. Then a cloud appeared. It was Mrs. Tubby and her son Walpole.

Walpole's Questions

Sure enough Walpole had the workshop tidy in no time. He then made some tea and we sat down for his questions.

"What's electricity, voltage and current?" he asked, with his pencil poised.

"Steady" I said, "first things first. Electricity is the movement of electrons. Got that?" He looked blank.

"Everything – pear-drops, elephants, copper wires – consists of lots of atoms which in turn consist of a nucleus with some little electrons bumbling around it. The atoms are each like a tiny solar system."

"Can't see it" Walpole said blankly.

"Look" I said, "imagine a long tunnel full of footballs. Each one has a dozen tennis balls jostling around it. You're at one end with an enormous basket of tennis balls and I'm at the other with an empty basket. And I just love tennis balls. You lob a tennis ball into your end of the tunnel. This attaches itself to the nearest football which now has say thirteen tennis balls surrounding it, an unlucky number. So it jettisons a tennis ball farther into the tunnel. This in turn enters the orbit of another football which in turn kicks one out. The chain reaction carries on all along the tunnel and I wind up with a tennis ball in my basket – though not the one you tossed in. Then you lob the rest of your tennis balls in, as fast as you can, and I get an equal number out at my end. Call the tennis balls electrons. You've created a flow of electricity."

"But what's current and voltage?"

"Current is the number of electrons – er, tennis balls – you're lobbing in" I said, "and voltage is the force with which you're lobbing them in."

He made some notes, then looked at me thoughtfully.

"Where do all these electrons come from?"

"There's an enormous reservoir of them" I replied, "and your standing on it – the earth. They are cruelly dragged out of it at the power station and can't wait to get back. We send them all over the place before they get there, to wherever we want work done, and make them flow through our gadgets as they fight their way back home."

Walpole looked even more thoughtful. "What's resistance, capacitance and inductance then?"

"Walpole" I said, "I've got sets to fix, and your ma's just entered the drive. Bring the rest of your questions along next time."

I humped the Sony set (YE2 chassis) on to the bench, hoping that I could mend it. I'd fitted a new mains switch six months earlier. When I switched it on the power supply sang like a kettle for a few seconds then fell silent. There were no voltages at its outputs.

I headed for the usual culprits, R607 and R618, but they were all right. C12 also proved to be o.k. when checked on my capacitance bridge. So I disconnected plug F6 and connected a 100W bulb across pins 1 and 2 – the 135V output and chassis – then switched on again. The bulb lit up. Checks showed that the other output voltages were also present and correct. So the cause of the fault had to be an overload on the 135V line, which supplies the line output stage.

I turned to the line output panel and checked the resistance between the h.t. input and chassis. It was down at 5Ω. So I rushed to the line output transistor which was all right. I traced the short to pin 1 of the line output transformer. The circuit shows that it's connected only to pins 10 and 11, so I isolated these by nicking the print. But the short remained. There was nothing for it. Out came the transformer, and I then found that pins 1, 10 and 11 read continuously with nearly every other winding. A new line output transformer restored normal operation.

Mr Flighty's Mitsubishi CT1447BM

Just as Greeneyes brought in my tea Mr. Flighty danced in with a Mitsubishi CT1447BM TV set. He ignored me, put the set down with part of it on my hand, and grinned at Greeneyes, asking how she was and had she been on holiday yet. He went on and Greeneyes chortled. I waited. When he'd run down I pointed to my trapped hand with my good one and he moved the set off it.

"Sorry old chap" he said, "it's stuck in standby."

"I know the feeling" I replied.

He then danced out, waving at Greeneyes. Muttering something about ferrets I applied myself to the set. I checked the STR44115 chopper chip IC901 and found that its pins were all shorted together. So I fitted a replacement. The set again failed to start up and I noticed that the chip's heatsink was getting hot. In this chassis (Euro 3) D906, a 132V zener diode, acts as a crowbar in the event of excessive h.t. voltage. It was short-circuit. I fitted a replacement and started the set up with the variac. It drew current but that was all: there was still an h.t. short-circuit. So I disconnected the 115V supply at pin 2 of the line output transformer. This cleared the short. I checked and cleared the 2SD1426 line output transistor Q551, then the two rectifier diodes D552 and D553 which were also o.k. I then took out the line output transformer to check its windings with the circuit. The primary winding (pins 1-2) was shorted to the two secondary windings. A replacement cured the trouble.

Another Visit from Mr Pearshape

Mr. Pearshape's Jaguar sang into the drive. He tumbled out in a cloud of cigar smoke. A shy but well-built little lady hung in the background. She might have been his cleaner, but wasn't. . .

"Set in the boot. Bad back you know" he rasped. I carried it in and he propelled the young lady in with his finger.

"Blue picture wasn't it m'dear?" he croaked. She nodded at the ground. He handed me his card and added "mend it quick and ring me, right?" Then they departed.

The set was a 14in. Sony Model KVM14TU. Its picture had scarcely any blue content and the red was smeary. In addition the chroma seemed to be far too intense. When I changed channels the blue content improved. I decided that the actual fault was a dark picture with a varying chroma balance but I had no means of adjusting it – the remote control unit hadn't been brought along.

A check showed that the tube's first anode voltage was low at 150V. I traced its source back to the line output transformer where R852 was powdered and white while D852 was sooty. When these items had been replaced I had full brightness and correct colour balance. A relatively simple cause of symptoms that had threatened to baffle me.

A phone call to Pearshape brought a hoarse chuckle. "I like to keep her happy you know" he rasped.

Answer to Test Case 373

– see page 186 –

Teletext problems are not usually too difficult to sort out: the circuitry runs at low energy levels, and apart from the control and RAM chips there are, in the type of decoder used in this example, only two processing chips to worry about. What do you do when you've replaced them both and the fault is still present? With this particular fault you don't consider replacing either the control or the memory chip because they cannot really cause this type of random data corruption or decoding error. A sensible course of action would be to replace the entire decoder if it's separate from the rest of the set and a substitute is available. But this was not the case here! In fact the fault would have remained the same had the entire decoder been replaced.

Sage was called in. He examined the decoder's video input signal and agreed that it was free of defects. He next transferred the scope's probe to the supply lines. The 12V supply was fine, but the 5V line carried a mass of hash and noise whose peak-to-peak amplitude, riding on a mean voltage level of about 4·8V, averaged about 1V! This supply comes from a 5V stabiliser that consists of a three-legged, heatsinked chip on the main panel. The 9V input to this chip was correct, and the fault was cured when a new regulator had been fitted. The previous one must have been grumbling mightily inside! Dylan would have found the culprit himself of course if he hadn't made such a cursory check on the 5V supply.

Published on the third Wednesday of each month by Reed Business Publishing Ltd, Quadrant House, The Quadrant , Sutton, Surrey SM2 5AS. Filmsetting by Marlin Graphics, 2-4 Powerscroft Road, Sidcup, Kent DA14 5DT. Printed in England by BPCC Magazines Division, Carlisle Web Offset, Cumbria. Distributed by IPC Marketforce, Kings Reach Tower, Stamford Street, London SE1 9LS (071 261 5000). Sole Agents for Australia and New Zealand, Gordon and Gotch (Asia) Ltd.; South Africa, Central News Agency Ltd. "Television " is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to currency exchange fluctuations and VAT, and that it shall not be lent, resold, hired or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever.

Design your own satellite system!

NEW!

You can with the help of this brilliant new program by DJ Stephenson

SATMASTER Version 4 *Only £35* (plus post)

- Allows you to design a system and test its performance *before* you install it!
- Provides essential dish setup angles: polar and apex elevation for motorised systems, elevation, azimuth, polarisation offset, from ***any*** location in the World for ***any*** geo-satellite - now and in the future!
- Includes magnetic map and footprints for all popular satellites across Europe
- Easy-to-use pop-up menu interface makes tedious tasks simple for everyone!
- Complete with User Instruction Manual!
- Contains 20,000 word on-screen technical context-sensitive helpline, with fault-finding, cable specs and site survey guide.
- Calculates full link budget including dish size optimisation to ensure the best quality picture!

requires IBM PC compatible with MS DOS 3.0 or higher, and 1 MB hard disk.

- Plots beamwidths and lobe patterns so you can judge potential interference from neighbouring satellites!
- Results and graphs can be output to file, screen or printer!

SATMASTER PRO *Only £69* (plus post)

- Contains additional country/town files!
- Supports laser printers!
- Displays CCIR rain-climatic zone map!
- Takes account of circular or linear polarisation in link budget analysis!
- Lists polar and apex angles per town!
- Calculates rain fade margin automatically!

Avoid guesswork ... order SATMASTER V4 or SATMASTER PRO today!

Swift Television Publications

17 Pittsfield, Cricklade, Swindon SN6 6AN Tel: 0793 750620 Fax: 0793 752399

Please send me program (3.5" disk):
SATMASTER V4 @ £35 ☐ tick choice (✓)
SATMASTER PRO @ £69 ☐
Postage £1 in UK, Europe add £2, Other add £4

I enclose cheque/PO for £ _______ made payable to Swift Television Publications, or please debit my Access/Visa credit card.

No. ____________

Expires: __________ Access VISA

Name ____________

Address: ____________

Postcode: ____________

W.M.T.V.

THE LARGEST INDEPENDENT WHOLESALERS IN WALSALL – SUPPLIERS OF HIGH QUALITY EX-RENTAL TVs AND VIDEOS TO THE TRADE AT COMPETITIVE PRICES

ALSO AVAILABLE: NEW B-GRADE PRODUCTS – TVs, VIDEOS, AUDIO & MICROWAVES – ALL TESTED & BOXED

½ Mile of Junction 10 M6. *Easy Parking Facilities*

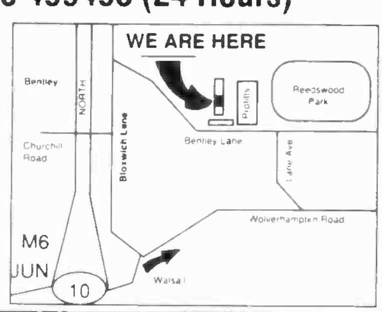
UNIT 3, BENTLEY LANE BUSINESS PARK

BENTLEY LANE, WALSALL WS2 8TL

Tel: 0922 724542. Fax: 0922 722208

Mobile: 0860 499495 (24 Hours)

OPEN:
MON-FRI, 9-6pm
SAT 9-2pm
SUNDAY BY APPOINTMENT
DELIVERY SERVICE THROUGHOUT THE COUNTRY



TUBES TUBES TUBES

A Merry Christmas and a Prosperous New Year to all our Friends and Customers

Possibly the largest range of television tubes, at the right price, in the UK.

Ring Irene or Jane for a quote

Callers Welcome

Carriage and VAT extra

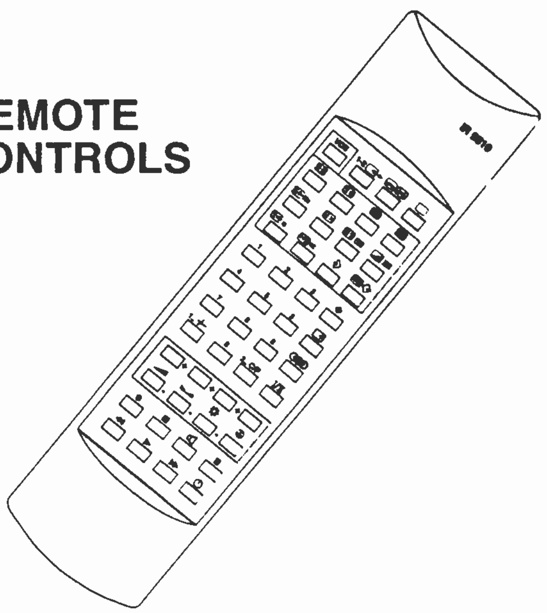
Access VISA

EXPRESS TV

The Mill, Mill Lane, RUGELEY, Staffs WS15 2JW

Tel: 0889-577600

Fax: 0889-575600



ADVERTISERS' INDEX

EUROVISION

25 Bradford Street, Walsall WS1 1PN
Tel: 0922 22279 Fax: 0922 22279

TV VIDEO AUDIO MICROWAVE WHOLESALERS

LOWEST PRICES

SMALL OR LARGE ORDERS WELCOME

HIGHEST QUALITY

TOP QUALITY EX-RENTALS ALWAYS IN STOCK

DELIVERIES THROUGHOUT THE UK

CALL NOW AND START SAVING WITH EUROVISION

0922 22279 MULTI LINE

24 HOUR ORDERING SERVICE

EXPORT ENQUIRIES WELCOME

B-grade Stock All Boxed, working
If you require one item please read on:

10″ R/C Portable	£95
14″ Basic Portable	£85
14″ R/C Portable	£95
20″ R/C	£119
20″ Text	£139
21″ FST R/C	£145
21″ Fastext FST	£165
21″ Nicam	£219
25″ Nicam	£259
L/P Videos	£99
Stereo Midi System	£110
Microwave Oven	£50
TV & Video Stands	£3

DISCOUNT ON QUANTITY

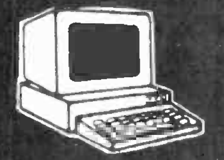
CD Midi Systems working (RRP £279) all boxed £129
CD radio cassette, working £49
Free Standing Gas Cookers £155
Gas Hobs £39 Calor Gas Hobs £35
All items unused & working

Customer returns in block.
Example. Untested 3x21″ FST 3x25″ FST
6xF/L Videos £40 each. Total £480+VAT
This price does not include handsets.
Some in need of repair. Some working.

Ex-rental TV & Videos, all untouched.
Basic £10 & £15 R/C £20 & £25 Text £25 & £30
Videos T/L £20 F/L £25. All untouched.

W TREE WAREHOUSE
UNIT 1, SUNSHINE MILLS, WORTLEY RD, LEEDS 12
TEL: 0532 638804 FAX: 0532 310275

CENTRAL TV



EX-RENTAL

- SUPERB RANGE OF TV'S & VCR'S
- THORN & GRANADA

DIRECT LOADS AVAILABLE FROM SOURCE

EXPORT ENQUIRIES WELCOME

'B' GRADE

SWITCH ON TO TOP QUALITY BRANDS OF

PHONE TODAY FOR BEST RESULTS

ALL SIZES OF SCREEN TV AVAILABLE, BOTH IN FAST TEXT & DIGITAL NICAM STEREO

VIDEOS: CURRENT MODEL
Single, Twin Speed, Nicam S-VHS

CAMCORDER
C FORMAT, FULL SIZE, 8mm

MICROWAVES ● PORTABLE ● HIFI ●
SATELLITE ● VIDEOCRYPT ●

PORTABLE £100
FULL REMOTE, BOXED

CTV LONDON
Eley Estate, Nobel Road
Edmonton N18
TEL: 081-807 4090
FAX: 081-884 1314

CENTRAL TV WHOLESALE DISTRIBUTION LTD
369 Stratford Road, Sparkhill
Birmingham B11
TEL: 021-772 1591
FAX: 021-766 6383

Access VISA

ANGLIAN TV WHOLESALE

EX-RENTAL TVs & VCRs

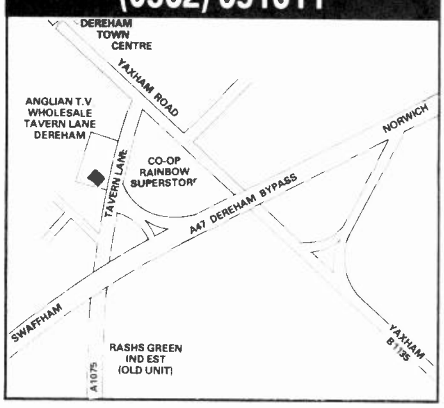
THORN AND GRANADA STOCK

NEW 'B' GRADE
T.V., VIDEO
AUDIO, MICROWAVE

**BEST POSSIBLE PRICES
EXPORT ENQUIRIES
WELCOME
& DELIVERY AVAILABLE**

RING FOR DETAILS

ANGLIAN TV
WHOLESALE,
NOW AT
UNIT 4, BRECKLANDS
BUSINESS CENTRE
TAVERN LANE,
EAST DEREHAM,
NORFOLK
(0362) 691611



TELECENTRE

NOW OPEN
7 DAYS A WEEK
FOR TOP QUALITY
EX-RENTAL AND
'B' GRADE TV'S
AND VIDEOS.

WEEKDAYS OPEN
TILL 9PM. WEEKENDS
& EVENINGS BY
APPOINTMENT.

15 MINS FROM
JUNCTION 16 M6

**79A COLERIDGE WAY,
CREWE.**

TEL: 0270 589392

ACCESS AND
VISA WELCOME

SILVERSCREEN VIDEOS

**EX-RENTAL TV
& VIDEOS
THORN & GRANADA**

Great deals on working and non-working videos and TV's

Direct loads of
white goods available

UK DELIVERY AVAILABLE

**– EXPORT ENQUIRIES –
– WELCOME –**

**24 GOLD STREET
TIVERTON
DEVON EX16 6PY**

**TELEPHONE:
0884 256257**

AERIALS

FOR TV & FM RADIO, PLUS 1000's OF MASTS, BRACKETS, LASHING KITS, CLAMPS, PLUGS, CABLES, OUTLETS, DIPLEXERS ETC.

AMPLIFIERS

FOR DISTRIBUTION SYSTEMS AND DOMESTIC, MAST HEAD OR SET BACK. WE HAVE ONE OF THE LARGEST RANGES, AVAILABLE FROM STOCK

MAIN DISTRIBUTORS

FOR ANTIFERENCE, LABGEAR, WOLSEY FRINGE, TRIAX, TELEVES, VOLEX-RAYDEX, KUBLER + MANY MORE

COASTAL AERIAL SUPPLIES

UNIT X2 Rudford Industrial Estate
Ford, Arundel

0903 723726

NO MINIMUM ORDER VALUE
NEXT DAY DELIVERY ACROSS UK
CARRIAGE FREE ON ORDERS £250+

Access — BARCLAYCARD VISA

CAMPION WHOLESALE LTD.

QUALITY USED T.V. & VIDEO

**COMPLETE RANGE OF
T.V.'s AND VIDEOS
MOST MAKES AND
MODELS AVAILABLE**

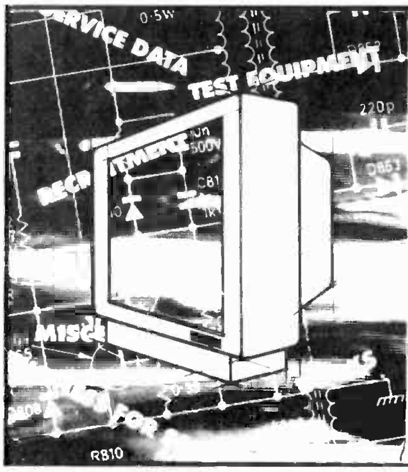
**STOCK ARRIVING DAILY
T.V.'s from £3.00
Videos from £30.00**
Prices Ex-VAT

**Free Delivery Service
to most areas of the U.K.**

UNIT 75, BARRACKS ROAD,
SANDY LANE INDUSTRIAL ESTATE,
STOURPORT-ON-SEVER,
WORCESTERSHIRE DY13 9QB
Just 10 Mins from
M5 Junct. 6 Worc's North

For your export
requirements contact us.

**0299-879642 or 879643
FAX: 0299 827984**



TELEVISION CLASSIFIED

No other consumer magazine in the country can reach so effectively those readers who are wholly engaged in the television and affiliated electronic industries. They have a need to know of your products and services.

The prepaid rate for semi display setting is £12.00 per single column centimetre (minimum 3 cm). Classified advertisements £8.40 per line, box number £22.00 extra. All prices plus 17½% VAT. All cheques, postal orders etc., to be made payable to Reed Business Publishing. Advertisements, together with remittance, should be sent to The Television Classified, 11th Floor, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

PHONE 081-652 8339 FAX 081-652 8931

SERVICE DATA

STREECARDS CAN SAVE YOU £100's, EVEN £1000's, EVERY YEAR

Each STREECARD entitles you to unlimited exchanges (1 at a time) for 1 year in either Library of your choice

The 1st card in any Library costs £59.95
Each card thereafter costs £49.95

DATA LIBRARY TERMS

You can now exchange manuals from the largest known collection of service/repair data in the world! Giant manual supplied FREE updated yearly, lists all the 1000's of available manuals.

Single exchanges (1 card) cost £3.95
Extra cards exchanges at the same time £2.95

PC Games Library terms

Your 1st choice can be anything on the market up to £60 inc. CD-ROM, thereafter from big regularly updated lists with well over 100 of the latest games, FREE hints/tips/Guides.

Each single exchange (1 Streecard held) only £4.95
Further exchanges at the same time £3.95 each

Join now using Access, Visa, etc. by phone or write for full details to:

STREE (Est 1968)

76 Church St, Larkhall, Lanarks ML9 1HE
Tel: 0698 883334/888343Fax: 0698 884825

INFOTECH SYSTEMS
Special UK Offers this Month

TV Repairs to 1989

10- 12"x17" binders (£299 set) containing circuits for every major CTV chassis PLUS 17 Big TV Repair Manuals (£150 set) PLUS Practical TV Repairs, Servicing TV & The PAL System — *for £399*

TV Repair & Service

The above system PLUS your choice of £300 worth of CTV Service Manuals — *for £445*

VCR Repair & Service to 1989

35 Fault Guides (£79.95 set) PLUS 7 Giant binders of VCR Diagrams (£225 set) PLUS Thorn's VCR Technical Manuals (£59.50) PLUS your choice of £200 worth of VCR Service Manuals + Beeching VCR Servicing — *for only £359*

The TVAR System

3 Huge binders packed with circuits & layouts + 3 big Manuals cover servicing & repair data for hundreds of models; Audio systems, CD, Computers, CTV, HiFi, Satellite, Radio, VCR for late 1890's to 1993. (Vols 1&2 by return, Vol.3 in December 1993 after updating!) — *only £149*

For full details & FREE Catalogue, write phone or fax to
76 Church St., Larkhall, Lanarks ML9 1HE,
Tel:0698 883334/888343 Fax:0698 884825

SERVICE MANUALS

We have what is probably the largest range of Service Information available anywhere.

From the Earliest Valve Wireless to the Latest Video Recorders. Colour Televisions, Test Gear, Audio, Computers, Amateur Radio, in fact practically anything.

Originals or Photostats as available.

Also available. Our FREE catalogue detailing Hundreds of Technical Books and Repair Guides available.

Send 2 x 1st class stamps for your copy TODAY.

Mauritron Technical Services (TV),
47A High Street,
Chinnor,
Oxfordshire,
OX9 4DJ

Tel: 0844 351694 Fax: 0844 352554.

GERMAN SERVICE SHEET SPECIALISTS

Our connections are world-wide. We furnish any kind of German, European and Japanese service sheet or manual. Thousands of different sheets and manuals in stock. For any enquiries

DÖNBERG ELECTRONICS
Schoolmasters House, Rannafast,
Co. Donegal, Republic of Ireland.
Phone: 075 48275

PLEASE ADDRESS ALL BOX NUMBER ENQUIRIES TO:

BOX NO: .... TELEVISION
11TH FLOOR QUADRANT
HOUSE THE QUADRANT
SUTTON, SURREY SM2 5AD

TRAINING

If you require a home study course in the fundamentals of electronics, either to begin a career, pursue a hobby, or refresh your knowledge, a BASIC ELECTRONICS course, from the Direct Personal Learning scheme, could be just what you're looking for. Contact:
K. Sparrow etc . . . 11 Claydon Green Whitchurch BRISTOL Avon BS14 0NG
Telephone: (0275) 835669

TRANSFORMERS

TV LINE OUTPUT TRANSFORMERS

PHONE 081-948 3702 FAX: 081-332 0583

ALBA . AMSTRAD . BUSH . DECCA . DORIC . BLAUPUNKT . FERGUSON . FIDELITY . GEC . GRUNDIG . GRANADA . HITACHI . HINARI . INDESIT . ITT . KIMARA . NIKKAI . MATSUI . MURPHY . OSAKI . NORDMENDE . LOEWE-OPTA . PANASONIC . PYE . PHILIPS . SANYO . SAISHO . SHARP . SONY . SOLOVOX . SUSUMU . TANDBERG . TELEFUNKEN . THORN . TRIUMPH . THOMSON . GOLDSTAR . BINATONE.

FULL RANGE OF KONIG: VIDEO HEADS, BELT KITS, IDLERS, PINCH ROLLERS, TENSION BANDS.
LARGE RANGE OF REMOTE CONTROLS IN STOCK

TIDMAN MAIL ORDER LTD . 236 SANDYCOMBE ROAD . RICHMOND . SURREY . TW9 2EQ.
Approx. 1 mile from Kew Bridge.

Mon-Fri 9 am to 12.30 pm & 1.30-4.30 pm
Sat 10 am to 11.45 am

CLASSIFIED CLASSIFIED CLASSIFIED CLASSIFIED CLASSIFIED

RECRUITMENT

University of Brighton

Department of Learning Resources

Video Engineering Posts

Two key engineering staff are required to work in the department which provides central media production facilities and associated engineering support to the University. Both jobs are of a highly practical nature and are primarily concerned with the maintenance and continuing development of the department's extensive range of video, audio and other AV equipment and facilities.

Chief Engineer

up to £21,207 per annum — Ref: LR 529

To organise the technical workshop and maintain the broadcast standard video and audio production studios and editing suites. You will also play a key role in the future engineering development of the facilities. A background in broadcast engineering or comparable environment, with a sound knowledge of the maintenance of video and audio equipment to component level are essential.

Senior Engineer

up to £18,495 per annum — Ref: LR 531

To ensure the maintenance of the extensive video replay network, based mainly on the Video-8 and VHS formats, and to contribute to general operational, maintenance and development work. Substantial experience in the maintenance of consumer video equipment to component level, preferably with knowledge of the Video-8 format and the desire to develop your expertise more broadly are essential.

For further details and an application form please contact the Personnel Department, University of Brighton, Mithras House, Lewes Road, Brighton BN2 4AT, or 24 hour answerphone: (0273) 642849 quoting the appropriate reference number.
If you need further information, please telephone (0273) 642837

For an informal discussion about the post, please telephone Ian Spalding, Technical Facilities Manager, on (0273) 642776.

Closing date: 7 January

Working for equality of opportunity

TUBES

REBUILT CRTs

VDU – MONITOR – TV

Image Burn-In Removed From Screen Phosphors

B.S.I. Certification

N.G.T. ELECTRONICS LTD

120, Selhurst Road, London SE25 6LL

PHONE: 081-771 3535

Britain's Oldest Established Tube Rebuilder

SOFTWARE

RELAY
OMAGH LTD — COMPUTER SOFTWARE

DO YOU RENT TELEVISIONS?
DO YOU STILL USE A CARD SYSTEM?
DO YOU FIND IT DIFFICULT TO KNOW YOUR ARREARS TOTAL AT ANY GIVEN TIME?

If you do then we recommend our computer TV and Video Rental package. This package includes

* automatic updating of each customer's record
* alphabetical print-out of each customer's arrears and payments missed
* total arrears immediately available
* easy to use and operate.

NEW HIRE PURCHASE PROGRAMME NOW AVAILABLE AS WELL.

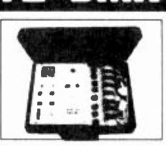
These programmes operate on all IBM compatibles running under MS-DOS. Free demonstration discs available.

CONTACT
WILLIAM J THOMPSON
Donaghanie Post Office
Beragh Co. Tyrone
Telephone Beragh 58214 (0662 7)

TEST EQUIPMENT

MÜTER · AT2 · BMR95 · BMR700

AT 2, Audi-Multi-Tester, 16 test-circuits for loudspeakers, tuners, amplifiers, headphones, tape recorders, mikes, boosters,



BMR 95

BMR 700

car radios, CD-players; measurment of millivolt, drift, watt, performance; with generator, radio, signal tracer/injector, 13 volt supply etc.

Regenerating Computers & Measurers for CRT's with cathode protection, gas clean-up aid, short repair; exhausted CRT's becomes bright and sharp again even if all other machines do not succeed.

United Kingdom: P & E Services, Llandudno, Tel. (0492) 549246, Fax 547880.
Ireland: Dönberg Electronics, Ranafast, Co. Donegal. Tel: 353 75 48275 and 48532. Fax: 353 75 71031.
New Zealand: TDON Ltd., Onehunga, Auckland. Tel. 6 68-9 07, Fax 668-4 99.
Germany: Ulrich Müter, Oer-Erkenschwick, Fax (0 23 68) 5 70 17.

SPARES & COMPONENTS

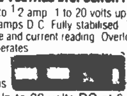
SURPLUS/REDUNDANT ELECTRONIC COMPONENTS WANTED

I/Cs – Tuners – Transistors – Valves – Diodes etc. any quantity considered – immediate payment.

ADM Electronic Supplies
Tel. 0827 873311. Fax 0827 874835

RCS VARIABLE VOLTAGE D.C. BENCH POWER SUPPLY

1 to 24 volts up to 1/2 amp 1 to 20 volts up to 1 amp 1 to 16 volts up to 1 1/2 amps D C Fully stabilised Twin panel meters for instant voltage and current reading Overload protection Fully variable Operates from 240V A C Compact Unit size 9 × 5 1/2 × 3ins



£45 inc VAT Post & Ins £4

NEW MODEL. Up to 38 volts DC at 6 amp 10 amps peak Fully variable Twin panel meters Size 14 1/2" × 11" × 4 1/2" **£96** inc VAT Carr £6

RADIO COMPONENT SPECIALISTS
337 WHITEHORSE ROAD, CROYDON
SURREY, U.K. Tel: 081 684 1665
List, Large SAE. Delivery 7 days. Callers Welcome Closed Wed

BUY DIRECT

From manufacturer C.E.D. 7A CRT Tester reactivator £195 inc base sockets or triple meter type £320 inc base sockets, satellite Signal strength meters professional selective tuning type £180 or Digital type £275. UHF Signal Strength meters £140 or Digital type £195 all signal strength meters are rechargeable and come complete with ni-cad batteries.
All brand new 12 months guarantee, p&p FREE, Callers welcome by appointment

CAPENER ELECTRONICS 0296 682030
Used Satellite Receivers from £30.

FOR SALE

FULLY REFURBISHED GAMA UK
Mint condition slim line front loader Videos for disposal to the trade, for further details ring 021 458 4093 or Fax 021 486 2980

MISCELLANEOUS

LINEAGE

AVO MULTIMETER Model 8, £45.00. 500 volt megers, £30.00. Prices plus VAT and p&p. Send SAE for lists of surplus instruments and scopes etc. A.C. Electronics, 17 Appleton Grove, Leeds LS9 9EN. Tel: 0532 496048.

OCHRE MILL Technical Services. Grundig TV spares for most models to 1985. Fast, friendly, helpful, sensible prices. Gt Lype Farm, Charlton, N. Malmesbury, Wilts. SN16 9DR. Tel: 0666 823228.

PRIVATE RETAILER has excellent part exchange colour televisions and videos to clear. Tel: 0494 814317.

VIDEOCRYPT DECODER Service sheet with smartcard contact details, Eurocrypt card interface, £12.00. E.M.O., Ramsbottom, Lancs. BL0 9AG. Tel: 0706 823036.

WANTED. VALVES TRANSISTORS especially manufactured EL34, KT66, KT77, KT88, PX4, PX25. Please post list of what you have, cash waiting. We also supply CRT for radars, scopes, monitors (not domestic TV) plus camera tubes, vidicon, magnetrons, image intensifiers and valves for audio, transmitting and television. Billington Export Ltd., 1E Gilmans Industrial Estate, Billingshurst, Sussex RH14 9EZ. Callers strictly by appointment only telephone 0403 784961. Fax 0403 783519.

CRT FOR MONITOR, SCOPES, RADAR ETC (not domestic TV)

2J 3D P1	£12 00	1424A G1	£43 50
CV3946	£12 00	D14-270GH/50	£79 50
F21-12LC	£125 00	M31-190GR	£61 50
3JP1	£18 00	95447GM	£79 50
CV8897	£69 00	D15-100GH/97	£79 50
F31-12LD	£132 00	M31-191GW	£61 50
3RP1A	P O A	CME1431W	£21 00
D10-210GH	£53 00	D16-100GH/67	£79 50
LD708	£61 60	M31-271W	£61 50
3WP1	£18 00	CME1523W	£27 00
D13-611GH	£53 00	DG7-5	£53 00
LD729	£61 50	M31-325BH	£29 00
5AP7	P O A	CME2024W	£21 00
D13-611GM	£79 50	DG7-6	£61 50
M7-120W	£15 75	M36-141W	£61 50
7ABP33A	£18 00	CME3132GH	£31 50
D13-630GM	£53 00	DG7-32	£28 80
M14-100GH	£18 00	M40-120W	£61 50
12CSP4	£27 00	CRE1400	£27 00
D14-150GH	£79 50	DG7-36	£12 00
M14-100LC	£23 50	M44-120LC	£61 50
89L	£27 00	CV1587	£29 00
D14-173GM	£79 50	E4412-B-9	£29 00
M17-151GVR	£112 0	MV6-5	£47 00
190CB4	£43 50	CV1976	£47 00
D14-173GR	£79 50	F16-101GM	£61 50
M23-112GV	£61 50	SE5FP31	£41 00
1074H	£43 50	CV2302	£79 50
D14-181GM	£79 50	F21-130GR	£41 00
M31-182V	£41 00	SE5JP31	£41 00
1396P	£43 50	CV2472	£61 50
D14-200GM	£79 50	F28-130LDS	£41 00
M31-184W	£41 00	SE32BP31	£41 00

Please add £5 p&p. in UK and 17.5% VAT. For overseas p&p please enquire. 10,000 pieces in stock, 400 types. Please enquire for any type not listed above. We also have in stock camera tubes, image intensifiers, magnetrones, vididons and audio valves. We wish to purchase valves type KT66, KT77, KT88, PX4, PX25, DA100. Minimum order £50 UK, £100 Export. Callers strictly by appointment only.

BILLINGTON EXPORT LIMITED Unit 1E, Gillmans Industrial Estate, Billingshurst, W Sussex, RH14 9EZ, UK.
Tel: 0403 784961
Fax: 0403 783519

TELEVISION CLASSIFIED LINEAGE

advertisements can be submitted on this coupon with a cheque made payable to Reed Business Publishing, Television Classified Room 11th Floor, Quadrant House The Quadrant Sutton, Surrey SM2 5AS. The charge is £8.40 per line plus 17½% (minimum £33.60 + VAT)

TV/01/94

For Issue Dated ....or next available. Total insertions ....Total of Cheque £..

Name ....Address...

....Post Code ....Tel Num ....Signature ....

Debit my Access/ Visa Card (delete)

Expiry Date

VAT Reg No 238 8937 10

MARCONI COMPACT L.N.B.
1.2DB £30
10.7 TO 11.7GHZ

60cm BACK MESH DISH £20, £5 post

Switched Mode Trans 3112. 338. 32642 Ferguson £1

VIDEO AMSTRAD HANDSETS (EXPORT) £2.50
WILL WORK IN HOME MARKET
6.000 and 4.600 4.700 £5

SEND FOR DATA D2 MAC SATELLITE RECEIVER, LNB AND DISH.
£50
(£10 Post)

SATELLITE RECEIVERS — New Ferguson BSB
Chassis with Tuner, Modulator etc £10
Hand Set £1.50 £4 Post

60cm SATELLITE DISH £35 Postage £5

SATELLITE FINDER KIT AND LNB TESTER WITH METER BOX £25

PB500 Panic and Button Transmitter 180MHz £1.00
G11 CAP 250V, 470M £1.35

New Eprom for converting Ferguson BSB Receivers to D2 MAC and PAL – 99 channel is tunable and each one can be put into memory – also has menu.
£20
PAL panel (to convert to PAL)
£20
SEND FOR DATA

TELEPHONE BATTERY SANYO 3.6V 250/MA – £3

SMALL SATELLITE TUNERS (950 to 1750 MHz), L.F. frequency 4000MH	£9.00 each
VHF/UHF S.BAND TUNER	£3.00
NEW PLASTIC CASE 32 C.H. SAT-RECEIVER (no hand set)	£35 (Post £5)
NEW METAL CASE SAT-RECEIVER, 32 C.H. WITH DOLBY & CHANNEL C (no hand set)	£35 (Post £5)
DAM MAINS CHASSIS AMSTRAD MONITOR C	£10
UNIVERSAL TRIPLER. NEW TYPE	£4.00
VIDEO LEADS	80p
AMSTRAD Line O.P. Transistors with Diode 2SD/453	£1.00
BU208A	£1.00
VIDEO LAMPS. Long Lead	24p
HITACHI & GEC FRAME, Thick Film	£6.00
FIDELITY SPLIT DIODE ... FCC2215AE....£20 FCC2015BE....£10	FCC2215BE....£10
K30 FRONT PANEL TEL-TEX TYPE	£5.00
NEW G11 LINE OP PANEL	£8.00
PHILIPS YEARS AHEAD	
THE CREDIT CARD CALCULATOR Solar Powered	£3.75
NEW PHILPS SBC 1833 Solar & Battery Powered Calculator	£8.00
THORN PANEL TX9 REC & REMOTE PANELS with Mains Trans	£5.00
TX10 REC & REMOTE PANELS with Mains Trans	£5.00
TX100 FRONT PANEL	£5.00
TX10 TUBE BASE ON PANEL	£3.00
TX91F	£2.00
THORN PANEL No.515-353, 548.02, 565-01, 509/102, 515/173, 508/161	£5.00
THORN TX STEREO SOUND O.P. PANEL (I.C. TA7227P)	£1.00
THORN VIDEO AERIAL AMP 01 M4-597-001	£6.00
ULTRASONIC TRANSDUCER	15p

CAMCORDER SANYO NP22
6v 1300mah Rechargeable Battery Pack
£6.00

Scart to Scart all pin connected £2.50

Miniature Xmas tree with flashing LED's (12) £7.50

VARTA 3.5V 280 M/A £3.00

PHILIPS C.D. MECH. 691-30212 £14.00

SATELLITE UNIT
Video Out/Audio Out, L and R Polariser ± 35M/A and Decoder Socket
£10

Gas Soldering Irons — New Type £10.00
Variety Nickel Cadmium Batteries from Telephone Type to Sub-C.50p per cell. Mainly in packs of 6 to 8.

HITACHI UHF-VHF SMALL TUNER
ET598A £5.00
ET595A £5.00

GREY OR BLACK £1.50 5AMP MAINS LEAD WITH PLUG SOCKET FOR TEST EQUIPMENT ETC.

06D4-025-001 Mains input choke for TX9 £4

THORN M494B1 on Remote Panel £5

THORN FRAME IC TX100 etc IC TDA 3652 IS OBSOLETE REPLACEMENT TDA 3654 £1 EACH

TX100 REMOTE PANEL
No.56413IC M293B/and
SAA5012 £10 etc

144MHz Changed Over Relay Aerial 50p

6251 FRAME O/P THICK FILM HITACHI GEC £9.00
THICK FILM HITACHI HM9205A £4.00

PHILIPS UNIVERSAL BATTERY TESTER SBC 1695 £5.00

BATTERY CONVERTER FOR TA185 FERGUSON TX85 £8.00

ONE I.C. K35 Decoder £10.00 — PHILIPS Deck Calculator £7.00

REGULATED PWR. SUP. 500M A 1 5V-12V DC switched + & – £5.00

TX100 SWITCH MODE TRANS 5157/48 £5 AND 00D4252001 06D3082001

STEREO SOLAR RADIO VHF AND MW £10.00

1000V AC 1000V DC ETC. PHILIPS METER ANALOG £11

NICAM UNIT — Ferguson made for ICC5 Chassis — home market and export — has circuit diagram and can be converted to most sets — £15.
TOSHIBA Nicam panel & IF export only has the Toshiba chip set £8.50

TX 85 FERGUSON BATTERY MAINS CONVERTOR £5 each

TX9-TX100 FRONT PANEL £5 WITH REMOTE £10
NON REMOTE 8 push button £10

MADE BY PLESSEY – MADE IN ENGLAND
New public telephone exchange original price cost £299.00
Network exchange line (at home or in a small business) has two telephones and cables and NS5107 control unit
SPECIAL PRICE
£54
Send for data

G11 470 MFD 250v £1.35

420M/400 £1
220M 3850 £1

12 Volt Relays 35p with D/P changeover

LARGE Foacs Pots. Fits Pye, GEC, ITT, Decca 75p

BSB SAT/REC HALF COMPLETED. CHASSIS, TUNER AND MOD £5 + Post £3

PHILIPS NEW TYPE U/V HANDSET £10

GLASS BEADS Diodes 200v/1.2A 50 for £1.00

G11 LOPT Panel	£4.00
G11 Tip Switch	£20.00
G11 IF Panel	£3.00
G11 Decoder Panel	£2.00
G8 Push Button Unit	£2.00
G8 Con/Panel New Back Type	£4.00

MIXED TOSHIBA HAND SETS FIVE FOR £12

PHONO TO LEADS 3 Metre 30p

Have you got Acid Rain in your garden? PH METER £5.00
Video Power Supply for Amstrad. Last year mods. £1.50
Mains Transformer for Amstrad Video 25p (£1 post)

DECODER C-CAM
PHILIPS MADE for K40 CHASSIS
IC No. TDA 3590
£5.00

LEAD SCART TO D PLUG 50p

LATEST VIDEO
For Latest Philips, GEC, Pye and Hitachi, Front panel with memory chip and bush button and pots and LED's £6.00 NEW

BRIDGES RECTIFIER Mixed BR-31 to 34
2 Amp to 5 Amp 8 for £1.00

FERGUSON CHASSIS
IKC-2000 £20 TX86 Chassis £14
TX90 Chassis 14" £15
8 PUSH BUTTON £15
Post each, £5

TX100 FRONT PANEL £5
8 Button

56420A 20A/600V THYRISTOR £1.75

LCD VIDEO AMSTRAD HANDSET for models 1900 £8 each

G11 8 WAY TIP SWITCH WITH DARW ASS £10

1 METRE SCART LEAD £1.00

GEC, HITACHI DECODER PANEL TBA810AS, TBA120, HA1/215A, UPC1365 £10

SCART TO SCART LEADS
TX90 REMOTE PANEL IC TMS1000 AND M293 £12

SALORA SAT RECEIVER CONVERSION KIT
For models 24M60, 25M90, 28M90, SB1206E, SB1365
£15

ITT BG2032-642A TRIPLER £5.00

ITT/NOKIA RF IF MODULE £20

VIDEO SCART TO SCART ALL PIN, LONG LEAD £2.50 ALL PINS

5 Mixed AMSTRAD VIDEO MOTORS £5.00

COAX PLUG TO PHONO LEADS £1

TX90 TX925 TX100 Mains Switch with Stand-by and Lead 50p each

SATELLITE TUNER UNIT 2427611 with Base Band, Video Out £6.00

TV GAMES AERIAL VIDEO COMBINER SWITCH £1.50

TX10 8 way button unit	£8.00
24v O 24v 3Amp MAINS TRANSFORMER	£3.00
10 MIXED FERGUSON CIRCUIT DIAGRAMS	£5.00
MSH1FCF09	£?.??

TX90 TO TX100 8 BUTTON UNIT £4.00

MIXED 20 BRIDGE RECTIFIERS (1 Amp to 5 Amp) £1.50

BURGLAR ALARM USE INFRA RED DETECTOR WIDE AND SHORT ANGLE WALL MOUNT £8 WITH RELAY

2433752 £20
2432984
2432871
2432301
2435016
2433952
2434393
2432211
T9048A
DST85B243
TFB3069D
K4 L.O P.T.
K35 L.O.P T.
K40
2433452
2432904
2434451 £14
£15 EACH

SPLIT-DIODE
2433752 £15
TX100 Green Spot £15.00
TX100 Yellow Spot L O.P.T. £10.00
TX90 White Spot L.O.P.T. £15.00
Split Diode 110° £12.50
Orion 65-3M
GEC 85-9793-6
TX9 Thorn 2432101-2 £5
2434141, 2434492, 2435066, 2434493 EACH £10

DST 81N243
TFB4023AD £10.00
MSH1FPT131 £12.00
MSH1FBW27 £12.00
DST186N243 £10.00
3220029 £10.00

TOSHIBA
DST 186N243 £10
TFB-4023AD £10
CP90 Philips Split Diode £10.00
2435141 £15
2432491 £10
2435065 £15

36761
36881
2692120/10
37051
CTK Lopt
36212
33651
36072
36362
36482
36761
36831
36832
36833
36921/79
36922/79

TX85
2435701
2434393
2435016
2435014
£10

2436797
£15

TRANSFORMERS

24357/01	£10
2435012	£10
FERGUSON	
47003481	£10
AMSTRAD	TVR3
LPTS	£10
TFB3069D EQU	
TFB4009AN	

AT2036/00	AT2076/55
AT2048/11	AT2076/71T
AT2055	AT2080/15
AT2076/35	RCO ST CT3325
AT2076/38	OT2041
AT2076/51	FB165KA Orion
CVC 820	2076/51
CVC 800	2432461 2433451

BRIDGE RECTIFIERS 10 FOR £1.00
4 Amp for Video Power Supply

SHARP MSHIFCF09
£10 EACH
0004-235 002-01
FIT MOST SETS
New Thorn Hand Set Type u/v (£10)

VIDEO MOTOR for VT568 type VC62DD8 £8.00
AMP TUNER IF for VT568 Hitachi & GEC £9.00

SATELLITE TUNER 950MHz-1750MHz £5.00

TTT PANEL
CMC 301 CMC 113 CMC 302
CMC 115 CMC 303 CMC 96/4 £5.00

BURGLAR ALARM £2.00 with siren 9 VOLT

PHILIPS HAND SET G11 TEXT ULTRASONIC £10

G11 TEXT IN RED HAND SET £15.00

G11 HAND SET ULTRASONIC £10

PHILIPS RC5 EASY CONTROL £10

U/V 6, DIODE TRIPLERS £2.00

4600 TO 8600 AMSTRAD VIDEO HAND SET WITH LCD £10

VIDEO LEADS 4 for £1

TRV3 Amstrad Cassette Mechanisms. New with 2 motors and sound head. £15
£5. Amstrad Television Tuner UHF. Small, Fits most Amstrads. £6.

NICAM MkII KIT MODULE £20.00 with data

SEL ITT IFB254F/2 Front Panel £15.00

25 Way Plug and Socket with Case £1.50

SENDZ
SEE BACK PAGE

FERGUSON SAT HAND SET
SR D1
SR D2
SR D3
SR D4
£3

FERGUSON ICC5 STEREO O.P. PANEL ICs TDA8405 TDA8421 TBA1204 £10

Burglar Alarm Has time delay to set £2
Mains Transformer 240v in 110V to 120v out 1 amp post £3 £4.00

DECCA — GEC — ITT 6 push button £5.00

SENDZ COMPONENTS

63 BISHOPSTEIGNTON, SHOEBURYNESS, ESSEX SS3 8AF
NORMALLY SAME DAY SERVICE • SUBJECT TO AVAILABILITY
No accounts • Technical information by telephone only • No credit cards
Unless specified add £1.70 P P to small orders • Additional charges for heavier items • Specific P P charges are PER ITEM • For UK addresses please add P P TO ORDER THEN 17½% VAT TO TOTAL • This applies for the EC unless VAT No. is given • EXPORTS – P P at cost •
Postal Order Cheque with order.
Callers to shop – 212 London Road, Southend • Open 9.30-1, 2.45-5.
Tel: 0702 332992 • Fax: 0702 338805 •
GVMT School orders on official headings

DIODES

Bridge KBF-08	40p
BY 126	10p
BY 127	10p
BY 133	10p
BY 134	10p
BY 176	25p
BY 179	40p
BY 184	25p
BY 187	10p
BY 190	40p
BY 196	30p
BY 198	10p
BY 204/4	8p
BY 206 – BY 407 Eqv.	8p
BY 208/800	8p
BY 210/400	5p
BY 210/800	10p
BY 223	60p
BY 226	15p
BY 227	15p
BY 228 1500v	20p
Flat BY229 black	15p
BY 229 Red	20p
BY 229/400	30p
BY 229/800	30p
BY 237	5p
BY 254	10p
BY 255	30p
BY 298	10p
BY 299	10p
BY 406	8p
BY 527	20p
BY 407a	10p
BY 448	10p
BY 500/200 – 5 amp	8p
BY 527	10p
BY 602	10p
BYV 26C	10p
F247	10p
GP20G	5p
GRP80G (TX10)	30p
XK 3102	50p
BYV 28/200	20p
Bridge 1X10 800/3 amps	30p
KBPC35-02 Bridge	£1.50
Bridge Rec D35B10	40p
BYT71/800	12p

Hitachi sets etc.

STR454	£2.00
STR6020	£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	£1.50
BU 208D	90p
BU 222	£1.00
BU 326	£1.00
BU 407	60p
BU 508A	90p
BU 508AF	£1.00
BU 508D	80p
BU 705	£1.00
BU 806A	£1.00
BU 807	£1.00
BU 808DFI	£1.00
BUK 454/600	£1.00
BU 824	50p
BUT 11	50p
BUT 11AF	£1
BUT 13 600V-28A	£1.00
BUT 18	£1
BUW 84	60p
BYW 20-08-9	£1.00
BYW 95	10p
BUX 39 25A-150V	£1.00
BUX 84	50p
BUY 19	50p
BUK 444/800	£2.00
BUK 445/600	£2.00
BUK 454/600	£2.00
TIC 106a	30p
TIC 116m	30p
TIC 116n/Y 1003	30p
TIC 126N	30p
TIC 226m	30p
TIC 236m	30p
TAG 226/600	30p
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	70p
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
TIP 41D	70p
TIP 42	10p
TIP 42/BRC6109	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

Voltage Regulators

+5V/UA78PO5SC	30p
–8V/79M08c	30p
+6V/78M06c	30p
LM 3171	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

Ferguson ICs

Ferg-TX982	£3.00
TMP47C 634N 2685	£3.00
ST6391 B1/B2 ICC7	£4.00

ICC5 Main ICs

ICC Remote I.C.	
CCUFRG07	£7.00
CCUFRG09	£8.00
IC FERG TX982	£3.00
1K7 ST6391 B1	£3.00
ST 6393 B1 1M	£3.00
BYX 10	10p
BYX 38/300	25p
BYX 55/350	10p
BYX 55/600 (Bead)	10p
BYT 71/600	15p
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
2SC3795	30p
2SC3973B	30p
2SC7350	15p
2SD180 TO3 80v/6A	15p
2SD200	£2.00
2SD401	£1.00
2SD716	£1.00
2SD787	30p
2SD789	30p
2SD820	£1.00
2SD868	75p
2SD880	30p
2SD1264	£1.00
2SD1266	£1.00
2SD1415	£1.00
2SD1427	£1.00
2SD1432	£1.00
2SD1576	£1.00
2SD1577	£2.00
2SD1878	£1.00
2SK30A	10p
BFX29	30p
BFX84	25p
BFY50	15p
BFY52	20p
BFY90	25p
BLY49	25p
BFW41	25p
BRC116	25p
BRX43	15p
BRX48X	10p
BRY56	30p
BSS68	10p
BSY79	10p
BSY95a	10p
BTY80	20p
BSX19	17p
BSX20	17p
FT3055	30p
TCE82	30p
TCE520	30p
2N930	5p
2N2221	8p
2N2222	8p
2N2906	10p
2N3055	40p
2N3566	10p
2N3702	10p
2N3711	10p
2N3583	50p
2N3904	15p
2N4355	10p
2N4442	£1.00
2N4444	£1.00
2N5278	20p
2N5296	40p
2N5983	30p
2N6099	40p
2N6109	40p
2N6130	50p
2N6133	20p
2N6348	20p
2N6399	10p
2SA437	20p
2SA673P	10p
2SA844P	10p
2SC643A	£1.00
2SA992	10p
2SB474	30p
2SB566	10p
2SB686	75p
2SC515A	£1.00
2SC772	20p
2SC381	10p
2SC458	10p
2SC491	50p
2SC732	10p
2SC733	10p
2SC940	£1.00
2SC1030	£1.00
2SC1061	30p
2SC1162 C/18	30p
2SC1514	30p
2SC1520	25p
2SC1546	20p
2SC1617	£1.00
2SC1725	20p
2SC1740	20p
2SC1756	50p
2SC1942	£1.00
2SC2068	20p
2SC2073	8p
2SC2229	15p
2SC2688	20p
TAA7750	50p
HA411485	£1.00
UPC1373	50p
M586577	£1.00
M491BB1	£3.00
M50441/550	£1.00
M58658P	£1.00

2436792	£10.00
2436797	£10.00
AT2078/25	£10.00
TFB4032BD	£10.00
TFB4110BD	£10.00
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	15p
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

S.W. Filters

HW2011	50p
HW2013	50p
SW453	50p
SW150	£1.00
HW2013	50p
RW303	50p
SY2153	50p
SW185	£1.00
SW153A	50p
SW154	50p
SW173	50p
F1035B	50p
F1045A	50p
Philips Handset IC	£3.00
SAA3010F	£3.00
MAB8461-WO63	£3.00
MAB8420P-C031	£3.00
MAB8420OB-6	£3.00
MAB8440P-D070	£3.00
MAB8440P-DO33	£3.00
MAB8440P-D056	£3.00
MAB8441P-1001	£3.00
MAB8441P-T132	£2.00
BCX31	25p
BCX32	25p
BD116	25p
BD124	30p
BD124 (metal)	30p
BD130Y	25p
BD131	30p
BD132/238	30p
BD135	25p
BD136	30p
BD138	30p
BD140	30p
BD176	25p
BD182	£1.00
BD183	70p
BD202	30p
BD204	30p
BD207	60p
BD221	20p
BD222	20p
BD228	30p
BD226	20p
BD233	30p
BD234	25p
BD235	30p
BD238	30p
BD239	15p
BD240	50p
BD243c	30p
BD244	50p
BD250a	30p
BD252	50p
BD253B	50p
BD331	30p
BD373b	20p
BD416	20p
BD433	25p
BD437	25p
BD438	30p
BD139	30p
BD439	50p
BD544D	40p
BD650	50p
BD678	30p
BD681	30p
BD682	30p
BD507	50p
BD508	30p
BD509	30p
BD510	30p
BD517	30p
BD519	30p
BD534	30p
BD535	30p
BD544D	30p
BD562	30p
BD610	40p
BD676A	30p
BD807	20p
BD826	50p

BD646	50p
BD933	30p
BD939	30p
BD948	30p
BDT31A	50p
BDX75	20p
BDV64B	50p
BDU65	50p
BF761	30p
BF769	30p
BF788	20p
BF819A	30p
BF858	30p
BF869	30p
BF871	30p
BFR52	7p
BFR81	15p
BFS60	10p
BFT42	20p
BFT57	20p
BFW11	30p
BFX85 100V. 1 amp	30p
BSD215	50p
MR1366	20p
AN6350	£2.00
BRC-M-200	40p
BRC-M-300	50p
BRC 1693	£1.00
BRC 3064	£1.00
BT1822	£1.00
BT16016	£1.20
BT16018-ML237B	£1.50
BT18218	£1.50
BT18124	£1.00
BT18224	£1.00
BUP22A	£1.00
CA270AE	50p
CA270CW	50p
CA270CE	50p
CA920AE	£1.00
CA1310	50p
CA3046	50p
CA3065Q	50p
CA3094AE	50p
CA3123	40p
CA3146	£1.00
CA3189	40p
CBF16848	50p
CD4510	30p
CD4555BE	30p
DM7492	50p
HA1124A	40p
HA1196	40p
HA1377	£2.00
HA1377	£3.00
HA11223	40p
HA11423	£1.00
HA11440	50p
HA11484	£3.00
HA11485 Am	£1.00
HA17458	50p
HEF4001	10p
HEF4518B	25p
HBF4011AF	10p
HEF4053B	30p
HEF4066BP	20p
HEF4528	20p
HD3890C	£3.00
K5731D 1001012	£1.00
LA3220	50p
LA4102	£1.00
LA4261	£1.00
LA7830	£2.00
LA7831	£2.00
LM1111N	£1.00
LM1017N	25p
LM8361	£3.00
PCF8571P	£5.00
M913	£2.00
M1024=SAA	£2.00
M1025=SAA	£2.00
M5840A-84RS	£3.00
MC476p	£1.00
MC1307	75p
MC1312	
MO1330 GN76530	£1.00
MC1352	£1.00
MC1358	£1.00
MC1377	£1.50
MC1496	50p
MC14002	15p
MC14013	25p
MC14016	25p
MC14066	30p
MC14514	50p
MC1748	80p
MEM4956	£1.00
ML231	£2.50
FT16016	£2.00
ML232	£1.00
ML236E	£1.00
ML237B	£1.00
ML238B	£4.00
ML239	£2.00

THYRISTORS

Philips Kits OT121	50p
IR106A	30p
BT151/500	20p
BT106 Plastic	30p
BY106 Metal	£1.20
BT119	£1.00
BT120	£1.00
BRC4443	75p
GTI Tyristor	60p
Decca 80-100	60p
2N4444	£1.00
MCR72-6	25p
OT112	£1.00
TF320M	£1.00
HC6441	£2.00
17052	£2.00
17088H	£2.00
17089R	£2.00
17053R	£2.00
SP2M	50p
RCA Line Thyristor	
CC0240H	£2.00
CC0240R	£2.00

Thermistors

PTHBG180M	75p
G8 Degausing	35p
Philips type VA1104	70p
ITTP7266312	15p
P1H451 AOR	15p
P137P Fits Pye & P134	20p
Degausing Thermistor (fits most sets)	20p
POS 009 Philips	50p
POS 016 Philips	50p

ML926	£1.00
MAB8400B-C	£2.00
MAB8440P-D070	£2.00
MAB8441PT001	£5.00
MAB8420PC035	£2.00
MAB8422P-Q005	£2.00
MAB8440P	£2.00
MAR8400XX	£3.00
M708LB1	£2.00
MM5387	£1.00
MM5611	£1.00
MM5840	£3.00
PCD8571P	£3.00
K35 Philips Receiver IC	
MA1250 BJC	£3.00
M491BB1	£3.00
M5840H-84RS	£5.00
MM5290N-4	75p
MM53108N	£4.00
MN650	£1.00
MN1250BJC	£2.00
MR1366	20p
NE646	50p
HD38980C	£3.00
PH2369	10p
PCD8571P	50p
PCD8572P	£2.00
SAA611	£1.00
SAA661	£1.75
SAA1073	£3.00
SAA1074	£3.00
SAA1075	£3.00
SAA1124	£2.00
SAA1174	£3.00
SAA1176	£2.00
SAA1250	£3.00
SAA1251	£4.00
SAA1272	£3.00
SAA1274	£3.00
SAA1276	£3.00
SAA1292	£10.00
SAA1293	£6.00
SAA3027P	£1.00
SAA5000A	£1.50
SAA3049	£3.00
SAB3013	£2.00
SAB3205	£3.00
SAB3210	£2.00
SAB4209	£2.00
TBO0124	£1.00
SAA3008P	£3.00
SAA5000A	£2.00
SAA5010	£2.20
SAA5012A	£5.00
SAA5020	£3.50
SAA5025D	£3.00
SAA5030	£4.50
SAA5040A	£3.00
SAA5042A	£3.00
SAA5043	£4.00
SAA5050	£4.50
SAA5051	£2.00
SAA5052	£2.00
SAA5053	£2.00
SAA5240	£5.00
SAA5241 P.A TEX IC	£5.00
SAE1032p	£2.50
SAE1039	£2.00
SAS5701	75p
SAS660	£1.00
SAS670	£1.00
SAS580	75p
SAS590	75p
SAS3210	£2.00
SL437F	£4.00
SL471	50p
SL480	£1.00
SL918	£4.50
SL1430	£1.00
STK4793	£3.00
STK5471	£3.00
STR58041	£5.00
TA7122	£1.15
TAA320A	50p
TAA470	£1.50
TAA570	75p
TAA611B	£1.00
TAA621	£2.00
TA7108P	£1.00
TA7117	50p
TA7120P	50p
TA7315AP	50p
TA7137P	50p
TA7193AP	£3.00
TA7240AP	£3.00
TA7265	£3.00
TA7227P	£1.00
TA7265AP	£3.00
TA7608AP	£3.75
TA7680AP	£3.00
TA7750P	30p
TBA120A	40p
TBA120AS	40p
TBA120SA	40p
TBA120B	40p
TBA120SB	40p
TBA120T	50p
TBA120SQ	£1.00
TBA120U	75p
TBA120Q	30p
TBA120C	40p
TBA1440	£1.00
TBA1441	£2.00
TBA231	75p
TBA395Q	50p
TBA396Q	£1.00
TBA396	75p
TBA440P	£1.00

TV CRYSTALS

4MHz	
4,433-619	
6MHz	
8.867238	
11.059.000	
Large or small	50p each
Antistatic Isolators	
Disc Type Black	10p
Filters	
CSA 3.97M	15p
6MEGtCDA	25p
6MHztSFE	25p
SFE 5.5MHz	20p
CDA5.5	25p
SFD460B	15p
CSB455A	15p
TA8662	£2.00
CCU3000	£1.00
AN5836	£3.00
BA6219	£2.00

HITACHI

U/V Video Hand Set	£14

TBA1440C	£1.00
TBA480Q	£1.00
TBA520	£2.00
TBA530	£2.00
TBA540	£1.00
TBA560CQ	£1.00
TBA570	£1.50
TBA625	50p
TBA651	£2.00
TBA673	£1.00
TBA750Q	£2.50
TBA780	£1.50
TBA800	50p
TBA810AP	60p
TBA810S	60p
TBA820	60p
TBA820M	25p
TBA920	£1.50
TBA920Q	£1.50
TBA990Q	£1.00
TMS1000NL	£2.00
TMS1943 N2L (clockchip)	£1.00
TMS9980	£4.00
TMS9901	£1.00
TMS2708JG45	45p
TMS2716JL	£1.00
TMS3529	£1.00
TMS3720ANS	£3.00
TMS4014	70p
TX-012	£1.00
TMS9902	£1.20
ULN2004P	£1.50
ULN2216	75p
UPC566H	£1.00
UPC585C	£1.00
UPC1009C	£2.00
UPC1031H	£2.00
UPC1353C	£1.00
UPC1363C	£2.75
UPC1364C	£2.00
UPX1365C	£2.00
UPC1366C	£1.00
UPC1378H	£2.00
UPC1514C	£3.00
UPC2002	35p
UPD1943G	£2.00
UPD8049HC	£2.00
SN29848	50p
SN29770BN	£2.00
SN29771BN	£2.00
SN29772BN	£2.00
SN76001	£1.00
SN76013ND	£2.00
SN76018	£1.00
SN76110N	£1.00
SN76115AN	50p
SN76131	50p
SN76141N	£1.00
SN76226	£1.00
SN76227N	£1.00
SN76228N	£1.00
SN76270	£1.00
SN76532N	£1.00
SN76545N	£3.00
SN76546	£3.00
SN76550	30p
SN76552	30p
SN76570	£1.00
SN76620	50p
SN76660N	40p
SN76620AN	50p
SN76666	£1.00
SN76705N	£1.00
SN76707N	75p
SN76708AN	75p
SN76720	£1.00
SN76709N	£2.00
UA783P3C	40p
BT100A/02	40p
BT138/10A	70p
BT146	30p
TBA540Q	£1.50
TCA270	£1.00
TCA270Q	£1.00
TCA270S	£1.00
TCA270SQ	£1.00
TCA800	£1.50
TCE120CQ	£1.00
TCE520	30p
TD6306P	£3.00
TDEA440Q	50p
TDA1003A	£1.00
TDA1010	£1.00
TDA1013	£1.00
TDA1012	£1.00
TDA1013A	£1.00
TDA1060A	£1.50
TDA1035SB	£1.00
TDA1072	£1.00
TDA1150	50p
TDA1151	30p
TDA1154	50p
TDA1170S	£1.00
TDA1180	£2.00
TDA1190	£1.00
TDA1200	75p
TDA1270	£1.50
TDA1327A	69p
TDA1365	£3.00
TDA1512	£2.00
TDA1540P	£3.00
TDA1670A	£2.00
TDA1908A	£1.00
TDA2002	£1.00
TDA2003	25p
TDA2004	£2.00
TDA2006	£1
TDA2008	£2.00
TDA2010	£1.00
TDA2020	£1.00
TDA2030	£2.00
TDA2140	£3.50
TDA2160	£1.00
TDA2320	50p
TDA2545A	£1.00
TDA2600	£3.00
TDA2640	£2.00
TDA2522	£5.00
TDA2530	£1.50
TDA2532	£1.00
TDA2540	80p
TDA2541	£1.00
TDA2542	£1.00
TDA2545	£2.00
TDA2546	£2.00
TDA2556	£1.00
TDA2560	75p

I.C.s

MA721PC	£1.00
M50430-8505P	£1.00
TD6359P	£1.00
M58657P	£1.00
PCD8572	£1.00
HD74HC86P	£1.00
UPD114LC-2	£1.00
MN1250BJC	£1.00
M50441-5505P	£1.00
M491BB1	£4.00
HA513385	£1.00
14DN 728A	£4.00

TDA3565	£3.00
TDA2575A	£1.00
TDA2577A	£2.00
TDA2578A	£2.00
TDA2579A	£2.00
TDA2581	£2.00
TDA2591	£1.00
TDA2593	£3.00
TDA2560	50p
TDA2556	£1.50
TDA2600	£3.00
TDA2611A	£1.00
TDA2611AQ	£1.00
TDA3651A	£1.00
TDA2653	£4.00
TDA2640	£2.00
TDA2593	£1.00
TDA3047	£1.00
TDA3048	£3.00
TDA3083	£2.00
TDA3190	£1.00
TDA3300B	£5.00
TDA3301	£3.00
TDA3505	£3.00
TDA3506	£3.00
TDA3561	£3.00
TDA3560	£4.00
TDA3561A	£3.00
TDA3566	£3.50
TDA3564	£4.00
TDA3565	£3.00
TDA3571A	£2.75
TDA3581	£3.00
TDA3590	£3.00
TDA3591	£1.00
TDA3592A	£3.00
TDA3650	£7.00
TDA3651	£3.00
TDA3651AQ	£3.50
TDA3652	£3.50
TDA3653AQ	£2.00
TDA3654	£2.00
TDA3654Q	£2.00
TDA3710	£3.50
TDA3800	£4.00
TDA3180	£2.00
TDA4260	50p
TDA4501	£3.00
TDA4505NE	£3.00
TDA4420	£2.00
TDA4439	£2.00
TDA4600	£3.00
TDA4601	£2.00
TDA8190	£3.00
TDA8703	£3.00
TDA8349	£3.00
TDA9403	£1.50
TDA9503	£3.00
TDB2033	£1.00
TDD1610S	50p
TD6306P	£2.00
TDA1060	£3.00
TEA1009	50p
TEA1039	£2.00
TEA1060	£2.00
TEA2017	£2.00
TEA2029C	£3
TEA5114	£1.00
TDA3300B	£6.00
SIL4516	50p
SN16861NG	50p
SN16862AN	£1.00
SN16964AN	50p
SN29764AN	£1.00
UA721	40p
UA7300	40p
MPS43A	25p
MJ13005	30p
MJE51T	25p
MJE340	28p
MJE660	25p
MJE661	25p
MJE3055	£1.00
MJE2801	30p
MJE2955	50p
MJE13005	50p

Transistors

A1222	25p	BF181	20p
A1223	25p	BF182	20p
A1233	25p	BF184	20p
AC106	25p	BF194	10p
AC121	25p	BF195	10p
AC124	25p	BF196	10p
AC128	25p	BF197	12p
AC137	25p	BF198	10p
AC151	25p	BF199	10p
AC131	25p	BF200	20p
AC138	25p	BF222	10p
AC152	25p	BF224	15p
AC153K	25p	BF238	20p
AC142K	25p	BF240	16p
AC169	25p	BF244	40p
AC176	25p	BF245b	20p
AC178K	25p	BF255	20p
AC179	25p	BF256	20p
AC186	25p	BF257	20p
AC188	25p	BF258	25p
ACY21	25p	BF262	15p
AD143	50p	BF263p	25p
AD149	50p	BF264	15p
AF17A	25p	BF271	10p
AF139	25p	BF273	10p
AF181	£1.00	BF274	10p
AF239	25p	BF324	25p
AF367	25p	BF337	50p
AL102	£1.75	BF355	30p
BLY49	50p	BF362	20p
BF115	20p	BF363	15p
BF121	20p	BF367	15p
BF127	20p	BF391	15p
BF137	20p	BF394	10p
BF157	20p	BF419	30p
BF160	20p	BF422	15p
BF161	20p	BF423	15p
BF164	60p	BF448	30p
BF179	30p	BF470	30p
BF180	20p	BF471	30p
		BF597T	10p
		BF694	10p

Thorn Transformers

DT2076/78	£10.00
90D3-035-003	£10.00
90D4-106-003	£1.00
90D3-038-001	£5.00
OT204130	£3.00