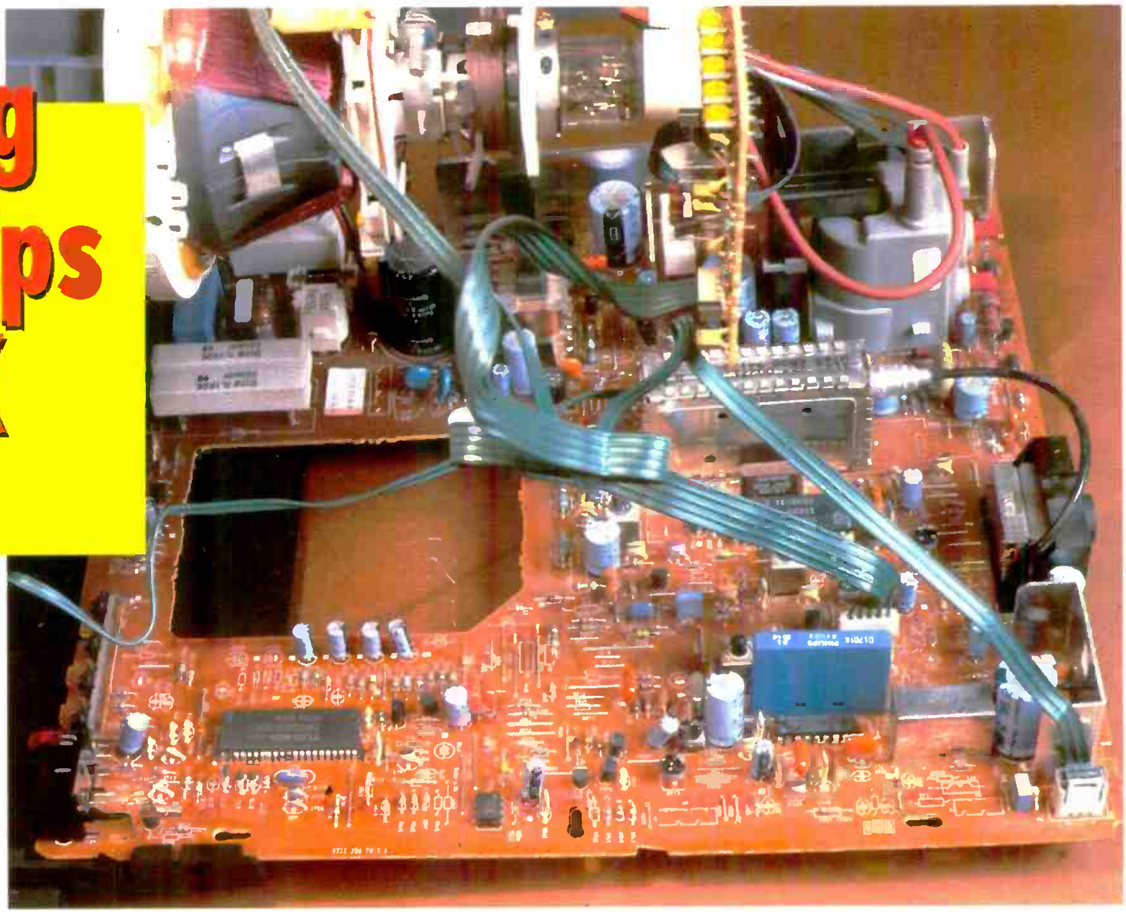
MAY 1994 £2.20

TELEVISION

SERVICING VIDEO SATELLITE DEVELOPMENTS

A REED BUSINESS PUBLICATION



Servicing the Philips GR1-AX chassis

CD PLAYER REPAIRS

THE I2C BUS

VARIABLE VOLTAGE REGULATOR CHIP

VCR clinic

TV fault finding

Long-distance tv

Camcorner

TV REMOTE CONTROL SYSTEMS

TELEVISION

MAY 1994 — **Vol. 44, No. 7 Issue 523**

On sale April 20th

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INDEXES AND BINDERS
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BC108	8p
BC109	8p
BC109C	10p
BC140	20p
BC141	20p
BC142	20p
BC143	20p
BC147	8p
BC148	8p
BC149	8p
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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
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BC212L	7p
BC213	7p
BC213L	7p
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BC214L	7p
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BC300	20p
BC301	20p
BC302	20p
BC303	20p
BC304	25p
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BC338	7p
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BC516	22p
BC537	25p
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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
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BD138	20p
BD139	20p
BD140	16p
BD144	90p
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BD166	30p
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BD238	24p
BD239	30p
BD240	40p
BD241A	30p
BD243A	40p
BD244	50p
BD245	50p
BD246A	50p
BD265	45p
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BD269	45p
BD278	50p
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BD317	150p
BD331	40p
BD332	40p
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BD362	60p
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BD410	50p
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BD435	31p
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BD437	28p
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BD535	30p
BD536	30p
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BD538	32p
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BD645	50p
BD647	50p
BD649	50p
BD675	40p
BD676	40p
BD677	38p
BD678	35p
BD679	30p
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BD682	35p
BD705	40p
BD707	40p
BD709	50p
BD711	40p
BD736	50p
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BD828	50p
BD839	40p

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BD899	50p
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BD977	45p
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	90p
BU111	100p
BU124	60p
BU126	65p
BU180	100p
BU184	100p
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BU205	70p
BU206	100p
BU208	70p
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BU208AT	200p
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BU408D	75p
BU409	85p
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BU920	100p
BU922	110p
BU930	130p
BUT11AF	60p
BUT12	80p
BUT56A	75p
BUX80	180p
BUX84	50p
BUX85	50p
BU69A	200p
BUY71	250p
BUZ71	75p
C106D	28p
MJ1000	200p
MJ1001	150p
MJ10012	300p
MJ15001	325p
MJ15002	300p
MJ15003	250p
MJ15004	300p
MJ2501	100p
MJ2955	55p
MJ3000	100p
MJ3001	100p
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	45p
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TIP29C	25p
TIP30	25p
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TIP32C	28p
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TIP34	50p
TIP34C	60p
TIP35C	65p
TIP36C	65p
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TIP41C	22p
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TIP42C	22p
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TIP107	65p
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TIP145	55p
TIP146	80p
TIP147	80p
TIP150	90p
TIP151	90p
TIP2955	42p
TIP3054	45p
TIP3055	42p
TIS44	40p
TIS61	42p
TIS90	12p
TIS91	18p
TIS93	20p
VK1010	88p
VN10KM	60p
VN66AF	100p
VN88AF	115p
ZTX107	11p
ZTX108	11p
ZTX109	12p
ZTX212	27p
ZTX300	13p
ZTX301	16p
ZTX302	16p
ZTX303	24p
ZTX304	17p
ZTX320	29p
ZTX500	13p
ZTX501	13p
ZTX502	18p
ZTX503	18p
ZTX504	18p
ZTX550	25p
2N696	26p
2N697	22p
2N698	24p
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	9p
BY210	22p
BY225	120p
BY227	19p
BY228	28p
BY296	20p
BY298	15p
BY299	18p
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 33V	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
8.0	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 x 2.5mm	
RED	5p
YELLOW	8p
GREEN	8p
LINEAR IC's	
AN203	210p
AN210	165p
AN214Q	170p
AN228	280p
AN240P	130p
AN252	150p
AN259	250p
AN262	140p
AN271	230p
AN274	250p
AN301	330p
AN303	250p
AN304	360p
AN315	210p
AN316	350p
AN360	100p
AN362	140p
AN366	150p
AN610	160p
AN612	160p
AN3312	350p
AN3320K	800p
AN3331K	900p
AN3792	400p
AN3794	450p
AN3795	500p
AN3821	800p
AN3821K	600p
AN3822K	600p
AN3830K	800p
AN3990K	300p
AN3991K	400p
AN5010	450p
AN5011	400p
AN5015	350p
AN5020	200p
AN5026	250p
AN5030	550p
AN5033	400p
AN5034	500p
AN5111	550p
AN5132	250p
AN5135	600p
AN5138	450p
AN5150	400p
AN5151	600p
AN5215	100p
AN5250	150p
AN5256	150p
AN5260	350p
AN5262	175p
AN5265	80p
AN5352	600p
AN5355	450p
AN5410	375p
AN5411	450p
AN5421	150p
AN5429	420p
AN5431	300p
AN5440	400p
AN5510	400p
AN5512	100p
AN5515	160p
AN5520	550p
AN5521	100p
AN5612	200p
AN5613	200p
AN5615	300p
AN5620	250p
AN5622	275p
AN5625	400p
AN5712	180p
AN5722	140p
AN5730	160p
AN5732	120p
AN5753	130p
AN5763	450p
AN5790	240p
AN5791	350p
AN5836	450p
AN5862	300p
AN5900	100p
AN6135	120p
AN6238	400p
AN6247	200p
AN6270	400p
AN6300	600p
AN6306	380p
AN6307	250p
AN6320	180p
AN6328	400p
AN6332	320p
AN6337	420p
AN6341	200p
AN6344	440p
AN6350	610p
AN6359	500p
AN6360	320p
AN6362	400p
AN6371	350p
AN6387	480p
AN6811	130p
AN6884	200p
AN7105	170p
AN7110	75p
AN7114	120p
AN7115	110p
AN7116	90p
AN7120	100p
AN7130	75p
AN7140	170p
AN7145	195p
AN7146	210p
AN7154	180p
AN7156	240p
AN7168	200p
AN7178	180p
AN7222	75p
AN7254	150p
AN7256	250p
AN7310	60p
AN7311	90p
AN7410	150p
AY3-1015	290p
AY3-1270	800p
AY3-1350	450p

AY3-8910	360p
AY3-8912	400p
BA301	55p
BA311	80p
BA313	60p
BA333	80p
BA340	150p
BA401	60p
BA402	50p
BA511	145p
BA514	160p
BA516	150p
BA521	100p
BA524	240p
BA526	180p
BA527	95p
BA532	100p
BA534	220p
BA536	150p
BA546	160p
BA612	120p
BA656	110p
BA658	350p
BA684	400p
BA685	400p
BA1310	160p
BA1320	75p
BA1330	120p
BA1360	160p
BA4403	220p
BA5101	350p
BA5102	140p
BA5204	200p
BA5402	180p
BA5406	180p
BA5408	180p
BA6104	250p
BA6208	175p
BA6209	85p
BA6304	120p
BA6305	140p
BA6410	220p
BA6411	250p
BA6993	150p
BA7001	150p
BA7004	200p
BA7007	200p
BA7021	180p
BA7022	350p
BA7751LS	150p
BA7752	250p
BA7755	150p
BA7767AS	155p
CX108	950p
CX134A	950p
CX136	600p
CX139	1450p
CX139A	750p
CX141	750p
CX143	800p
CX143A	1250p
CX145	725p
CX150B	325p
CX158	825p
CX170	325p
CX186	750p
CX187	825p
CX804A	775p
CX832	825p
CX867	575p
CX868	525p
CX877	300p
HA1125	120p
HA1137W	135p
HA1197	130p
HA1199	130p
HA1319	200p
HA1338	300p
HA1339A	350p
HA1377	160p
HA1388	320p
HA1389	210p
HA1392	120p
HA1394	170p
HA1397	200p
HA1398	240p
HA11219	280p
HA11221	180p
HA11225	130p
HA11235	120p
HA11251	190p
HA11423	140p
HA11724	650p
HA12002	220p
HA12003	250p
HA12005	180p
HA12017	100p
HA13001	110p
HA13002	200p
HA13006	400p
HA13007	400p
HA13108	350p
HA13118	140p
HA13412	600p
HA13432	400p
HA17524	250p
HA17805	100p
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ICL7660	240p
ICM7555	60p
ICM75556	80p
KA2101	100p
KA2102	150p
KA2130	150p
KA2206	150p
KA2209	125p
KA2210	230p
KA2212	80p
KA2213	130p
KA2214	150p
KA2261	100p
KA2263	100p
KA2264	100p
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LINEAR ICs – Cont.

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JAPANESE TRANSISTORS

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2SC3420	120p
2SC3420Y	80p
2SC3422	110p
2SC3422Y	75p
2SC3423	60p
2SC3446	150p
2SC3447	200p
2SC3450	350p
2SC3456	200p
2SC3457	125p
2SC3459	180p
2SC3460	180p
2SC3461	350p
2SC3466	225p
2SC3467	70p
2SC3468	70p
2SC3481	300p
2SC3482	275p
2SC3486	275p
2SC3502	100p
2SC3503	50p
2SC3504	120p
2SC3505	240p
2SC3506	250p
2SC3507	650p
2SC3509	750p
2SC3518	120p
2SC3519	250p

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	100p
2SC3678	280p
2SC3679	180p
2SC3680	380p
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2SC3687	600p
2SC3688	550p
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2SC3692	150p
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2SC3717	120p
2SC3719	150p
2SC3729	450p
2SC3743	270p
2SC3746	100p
2SC3747	120p
2SC3752	250p
2SC3769	700p
2SC3781	150p
2SC3783	600p
2SC3787	100p
2SC3789	75p
2SC3790	120p
2SC3795	175p
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2SC3807	120p
2SC3811	80p
2SC3832	200p
2SC3833	250p
2SC3853	220p
2SC3854	250p
2SC3856	220p
2SC3857	500p
2SC3858	550p
2SC3870	200p
2SC3883	280p
2SC3890	150p
2SC3895	400p
2SC3897	650p
2SC3907	250p
2SC3909	450p
2SC3927	550p
2SC3946	120p
2SC3950	120p
2SC3953	60p
2SC3954	150p
2SC3973	210p
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	650p
2SC4242	170p
2SC4262	50p
2SC4301	550p
2SD198	140p
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2SD201	260p
2SD257	195p
2SD313	25p
2SD315	75p
2SD325	30p
2SD330	65p
2SD348	300p
2SD357	40p
2SD358	40p
2SD371	240p
2SD380	650p
2SD381	50p
2SD388	150p
2SD389	60p
2SD400	14p
2SD401	50p
2SD402	120p
2SD415	55p
2SD424	350p
2SD426	150p
2SD427	350p
2SD438	35p
2SD467	15p
2SD468	15p
2SD471	20p
2SD525	50p
2SD526	70p
2SD545	18p
2SD549	120p
2SD551	300p
2SD555	500p
2SD560	50p
2SD571	20p
2SD575	530p
2SD600	30p
2SD601	40p
2SD602	60p
2SD612	50p
2SD613	70p
2SD636	10p
2SD637	15p
2SD638	15p
2SD639	20p
2SD640	350p
2SD642	50p
2SD655	18p
2SD661	60p
2SD666	25p
2SD667	20p
2SD668	120p
2SD669	35p
2SD673	350p
2SD676	250p
2SD716	80p
2SD717	180p
2SD718	85p
2SD722	240p
2SD725	270p
2SD734	15p
2SD-741	120p
2SD-743	130p
2SD-756	100p
2SD-757	120p
2SD-758	140p
2SD-762	100p
2SD-763	140p
2SD-768	180p
2SD-772	200p
2SD-773	20p
2SD-774	30p
2SD-777	400p

2SD-784	650p
2SD-786	100p
2SD-787	20p
2SD-788	30p
2SD-789	20p
2SD-792	400p
2SD-794	33p
2SD-795A	140p
2SD-811	450p
2SD-819	200p
2SD-820	250p
2SD-821	560p
2SD-822	290p
2SD-826	30p
2SD-836	60p
2SD-836A	60p
2SD-837	55p
2SD-838	300p
2SD-841	110p
2SD-844	200p
2SD-845	250p
2SD-850	170p
2SD-856	48p
2SD-858	250p
2SD-863	23p
2SD-864	200p
2SD-866	120p
2SD-866A	140p
2SD-868	260p
2SD-870	190p
2SD-871	300p
2SD-879	60p
2SD-880	40p
2SD-882	25p
2SD-892A	100p
2SD-894	35p
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
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2SD-1071	450p
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2SD-1088	150p
2SD-1094	520p
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2SD-1111	20p
2SD-1113	225p
2SD-1128	200p
2SD-1133	100p
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2SD-1271A	225p
2SD-1272	200p
2SD-1273	50p
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2SD-1398	120p

2SD-1399	300p
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2SD-1402	150p
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2SD-1407	60p
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2SD-1453	140p
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2SD-1457	220p
2SD-1459	150p
2SD-1468	60p
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2SD-1911	300p
2SD-1913	50p
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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
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2SK-55	100p
2SK-68	100p
2SK-73	75p
2SK-106	40p
2SK-107	40p
2SK-109	120p
2SK-118	50p
2SK-125	100p
2SK-133	650p
2SK-134	415p
2SK-135	415p
2SK-147	160p
2SK-150	150p
2SK-162	115p
2SK-163	40p
2SK-168	40p
2SK-176	800p
2SK-192	45p
2SK-195	150p

2SK 197	140p
2SK 214	170p
2SK-216	200p
2SK 217	35p
2SK 218	400p
2SK 240	140p
2SK 270	50p
2SK 294	350p
2SK-310	200p
2SK-312	750p
2SK-315	70p
2SK-320	120p
2SK-322	140p
2SK-323	130p
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	650p
2SK-903	500p
2SK-1057	600p
2SK-1058	800p
2SK-45	100p
2SK-51	100p
2SK-59	100p
2SK-73	60p
2SK-74	50p
2SK-77	50p
2SK-81	50p
2SK-86	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
8256	160p
8256	700p
8257	220p
8271	3400p
8279	270p
8283	400p
8284	440p
8287	260p
8288	650p
8748	700p
8756	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	56p
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	26p
BR81D 2A/100V	33p
BR82D 2A/200V	33p
BR84D 2A/400V	37p
BR86D 2A/600V	43p
BR88D 2A/800V	43p
BR32 3A/200V	43p
BR34 3A/400V	43p
BR36 3A/600V	44p
BR62 6A/200V	80p
BR64 6A/400V	72p
BR251 25A/100V	150p
BR252 25A/200V	165p
BR254 25A/400V	185p
BR256 25A/600V	200p
BR258 25A/800V	240p
BR351 35A/100V	185p
BR352 35A/200V	200p
BR354 35A/400V	220p
BR356 35A/600V	230p
BR358 35A/800V	260p
BY164 1.5A/100V	40p
BY179 1.5A/800V	40p

TRIACS

TIC206D 4A/400V	60p
TIC225D 6A/400V	69p
TIC226D 8A/400V	68p
TIC236D 12A/400V	85p
TIC246D 16A/400V	105p
TIC253D 20A/400V	190p
TIC263D 25A/400V	205p
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
17088	200p
17089	200p
17127	200p
15/80H	230p
15/85R	230p
SG264	800p
SG613	800p

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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	150p

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- 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
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- 8942 £23.00
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- VCR6800/6803 £16.00

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
- VBS3500/7500/7600/9800/VBS5500/7100/7600/9900/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
- GHV12321/1245/1246/8210/8215/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
- VHFS1/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 £8.50
- 4935/4943/4963/4985/4993/TR4833/4935/4985/4993 £6.50
- 4920/4927/4930 £17.00
- 4946/TR4906/4916 £16.00
- TR4994 £23.00
- TR4996 £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/VT14/16/30/33/34/330/340/503/540/5030 £11.00
- 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
- VT7/680/3000/6500/7000/8000/8030/8040/8100/8300/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
- 3292/8903/8900/8901/8902/8903/8606/8922/8923/3VO1/3V06/3V22 £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
- 8944/8943/3V42/3V44/3V45/3V46/3V47/3V52/3V54/3V55/3V56/3V57 £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 £23.00
- 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/NV450/470/480 £16.50
- NV730/NV770 (4 HEAD) £16.50
- 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
- NV760 £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 £12.50
- VR1000/VR1100/VR1200/VR1600 £14.00
- VR3300X/VR3600X/VR3650/VR3800 £15.00
- 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/VT510/VT320/VT5600/VX510/VX511/VX520/VX610/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/VX720/73/970/971/972 £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
- VC8000/VC6200/VC6300/VC7300/VC7700/VC7750/VC8000/VC8300 £20.00
- VC793 £36.00
- VC473/785/786 £25.00
- VC693/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
- V21/31/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-PB2 £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, VBS9300 £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

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VIDEO HEADS

AKAI	
VSF600, VSF650	3800P
VP7100, VP7200, VP77	1500P
VS155, VS165	2600P
VS20, VS22, VS24, VS25, VS26, VS27, VS422, VS425, VS426, VS427, VSF10, VSP8, VSP9	1700P
VS240, VSP82, VS202	1500P
VS33	2600P
VSR9	1700P
AMSTRAD	
VCR8800, VCR8804, VCR9340	2400P
DD8900, DD8904, TVR4, VCR6200, VCR8600, VCR8602, VR8700	1300P
VCR8603, VCR8604, VCR8704, VCR8714	1350P
BAIRD	
VC14L	3000P
VHS82	7000P
BLAUPUNKT	
CR1000, CR1200, CR1500	4650P
CR1800	4100P
RTV321, RTV322	1700P
RTV330	2300P
RTV333	1000P
RTV33B	2800P
RTV348	2700P
RTV404, RTV414	3000P
RTV635	3000P
RTV640	3000P
RTV750, RTV800, RTV900	3500P
RTV810	4400P
RTV910	4500P
JVC	
HRD330, HRD337, HRD440, HRD637, HRD641, HRD660, HRFC100	2200P
JVC AND FERGUSON	
8902/8903/8909/8912/8922	1000P
8923/8925/8929/8935	650P
8931/8933	750P
FV43H, HRD860	3800P
VC141L, HRD190, HRD610	3050P
FV44L	2200P
BR1600, HRD142, HRD156, HRD152	1550P
BR6200	720P
HRD154, HRD217, HRD321, HRD350, HRD521, HRD522, HRD525, HRD527, HRD550	1700P
HRD580, HRD620, HRD650	2900P
FIDELITY	
VR900, VR910	1600P
FISHER	
FVHD140, FVHD40, FVHP1, FVHP10, FVHP20, FVHP40, FVHS10	1600P
FVHP200, FVHP210, FVHP300, FVHP310	2100P
FVHP500, FVHP5100, FVHP730, FVHP830	1200P
FVHP980	2500P
FUNAI	
E1100, VIP5000	1200P
VCR5840, VCR8007, VIP2500A, VIP3000A, VIP6000, VIP150	2200P
VCR4530, VCR6000, VCR6100	1600P
VCR8103, VCR600, VCR6100	1600P
VCR8103, VCR8107	2200P
VIP300A MKII	1900P
GEC	
V4005H	2000P
GOLDSTAR	
GHV1232, 1233, 1241, 1242, 1243, 1244, 1290, 1291, 1295, 1296, 1891, VCP4130, 4300, 4301, 4305, 4306, 4310, 4311, 4315, 4316, 4320, 4321, 4326	1650P
GRUNDIG	
VS456	1700P
SE6110, SE9100, TVR4510, TVR5510, VS500, VS510, VS5180, VS6190, VS700, VS900	1800P
VS790, VS930, VS940	3800P
MVS660, SE6160, VERONA, VS660, VS6690	3500P
MVS710, MVS720, MVS910, SE9120, VS800, VSB10, VS910, VS920, SE7120, VS710, VS720	1800P
VS160, VS740	4400P
VS170	4600P
VS680	4600P
HINARI	
VCR34H, VTV200, VXL90	1850P
HITACHI	
VT15, VTP10, VTP30	1100P
VT16B, VT260, VT498	2700P
VT570, VT575, VT576, VT580, VT585, VT588	3400P
VT5600	1200P
VT60	1500P
VT660E	2600P
VT6700, VT6800	1200P
VTL30	2100P
VT522, VTM620, VTM622, VTM720, VTM722, VTM822	2000P
VTM725, VTM726, VTM72B	1600P
ITT	
VR3520, VR3701, VR3719, VR3720, VR3721, VR3759, VR9720	2000P
VR3730, VR3731, VR3749,	2700P
VR3907, VR3908	1600P
VR3918, VR3919, VR3938	1800P
VR396B	7000P
VR3984	2300P
VR3958, VR4993	650P
VR4913, VRP3833	650P
LUXOR	
9245, 9251, 9254	1225P
9255, 9256	2150P
9270, 9271, 9273	1800P
9272, 928217	2700P
9252	2500P
928017, 928077, 928097, 929107, 929117	1700P
9253	2500P
9281	2700P
9284, 9295, VR3701, VR3721, VR3731, VR3761	2100P
MATSUI	
VX600	1100P
VX750	1500P
VX990	1600P
MITSUBISHI	
HSE12, HSE22, MX1	2400P
HS411EZ, HS411GZ	2900P
HS273	1700P
HSB10, HSB20, HSE10, HSE20, HSE21, HSE41	2200P
HSB11, HSB21	2200P
HSB30	2400P
HSE31, HSB31, HSE32	2800P
HSE50	3300P
NATIONAL	
NV8050, NV8051	2800P
AG1000, AG1050, NV260	1650P
AG6010, AG6015	2500P
AG6840	2400P
NV200	850P
NVD80	5000P
NVF65, NVH75	3400P
NVF51	4200P
NVG19	2300P
NVJ33, NVL21, NVJ30	1800P
NVJ35	3000P
NVM1, NVM3, NVM5	4200P
AG2100, AG2200	700P
NVF65	3200P
N.E.C.	
DX2000	3400P
DS6000	3500P
DX1000, DX1600, N9040, N9053, N9055	2000P
DX4000, N9610, DX3000	3200P
N9052, N9530	3400P
N9110, N9120, N914C	2700p
VCP1	1700p
PVC2300, PVC240, PVC740, PVC744, PVC760, PVC764	1600P
SAMSUNG	
VM1560, VN1561	2200P
SANYO	
VHR7900	3600P
SHARP	
VC585, VC685	2300P
VC90ET	3900P
VFH815	2800P
SONY	
SLV373UB	3000P
TOSHIBA	
V660	2350P
V880MS	2600P
V700G	3700P
V500G, V509G	2500P
V9680	2900P
V300G, V301, V305, V309G	2550P
V61, V63	1700P
V110, V120, V130, V140, V210, V220	1800P

TELEVISION ON/OFF MAINS SWITCHES

Baur, Normende, Nova, Pioneer, Quelle, Saba, Salora, TEC, Thomson & Vega	375P

VIDEO MOTORS

HITACHI	
VT11, VT14, VT15, VT16, VT17, VT19, VT35, VT39, VT57, VT88 (capstan motor)	3100P
BANG & OLUFSEN	
VHS65, VHS90 (capstan motor)	3100P

LOADING MOTOR UNITS

ITT	
VR3605, VR3905, VR3955, VR3985	1500P
VP2826, VR3906, V43926, VR3976	1250P
VP3946, VR3906, VR3948, VR3986, VR3995, VR6948	1500P
JVC	
HRD110, HRD111, HRD120, HRD121, HRD225	1500P
HRD140, HRD150, HRD157M, HRD158MS, HRD160, HRD250, HRD257MS, HRD566, HRP50	1250P
HRD455, HRD725, N895	1500P
SABA	
VR6005, VR6014, VR7004, VR7011, VR8011, VR8014	1500P
VR6006, VR6007, VR608, VR6009, VR6018, VR7007, VR7018, VR9006	1250P
VR6016, VR6038, VR7016	1500P
TELEFUNKEN	
VR1925, VR1930, VR1940, VR1950, VR925, VR930, VR940, VR950	1500P
A920, VR2920, VR12970, VR7921, VR7926, VR7931, VR7971, VR975	1250P
VR1970, VR1980, VR7970, VR7980, VR970, VR980	1500P
THOMSON	
V320, V321, V323, V326, V4200, V4300	1500P
V342, V343, V352, V353, V360, V4210, V4230, V4260	1250P
V364, V368, V4400, V6000	1500P
THORN-FERGUSON	
3V35, 3V36, 3V38, 3V39, 3V49, 8943, 8944	1500P
3V44, 3V45, 3V48, 3V54, 3V55, 3V57, 8947, 8947B, 8948	1250p
3V43, 9845	1500P
TOSHIBA	
V55, V57	1500P
V65, V66, V67	1250P
V61, V63	1500P

CASSETTE HOUSING

AKAI	
VS35, VS53, VS55, VS66, VS75	2600P
FERGUSON	
FV31R	4300P
JVC & FERGUSON	
HRD515, HRD520, HRD527, HRD540, HRD550, HRD580, HRD600, HRD610, HRD620, HRD660, HRD670, HRD830, HRD840, HRD850, HRD860, HRD4050, HRD6600 & FV37H	2400P

IC TRANSISTORS

M491BB1	500P
SAA5243PE	800P
TIP112H	50P
UPC1488H	150P
STR4090A	650P

IC AND TRANSISTORS

BU506DF	120P
BUZ11	200P
BUZ80	200P
M494B1	700P
SAA5231	300P
SAA1293	550P
S2000A3	175P
S2000AF	175P
S2055A	175P
S2000AF	200P
S2530A	100P
TEA201BA	200P
UC3844	100P
UPC1185H2	400P

REMOTE CONTROLS

AKAI		
RC-V10A	RC 876	850p
RCV378	RC891	850p
V25A	RC 896	850p
AMSTRAD		
DD8900	R 65132	1400p
VCR4700	RC 2009	1400p
BUSH		
2020T, 2114T, 2321T, 2514T	RC 304	850p
2020, 2114, 2321, 2514	RC 313	900p
DECCA		
RC70	RC 894	850p
FISHER		
RC905B	RC 879	900p
GRANADA/REDIFFUSION		
UNIVERSAL, 79500C, 986700	RC 309	800p
SATELLITE	RC 550	850p
MK4 TEXT, 70115G, 70133G, 357E	RC 880	800p
MK4A TEXT, 70375C	RC 881	800p
95288E	RC 882	850p
944900	RC 884	850p

REMOTE CONTROLS

Description	Order Code	Price
GRUNDIG		
TP160E	RC 107	900p
TP200, TP300	RC 380	800p
TP400	RC 401	800p
TP590-600	RC 600	850p
TP390,TP610	RC 610	850p
TP621	RC 621	850p
TP630, TP650	RC 650	850p
TP660	RC 660	850p
TP661	RC 661	850p
HITACHI		
CLE800-CLE830	RC 140M	850p
A617402/655602	RC 192	875p
A512120/230	RC 900	800p
A514790	RC 901	850p
A5088470	RC 902	800p
A518612	RC903	900p
SCL002	RC904	850p
C2096	RC 905	850p
A511940	RC 906	800p
655602H	RC 907	850p
ITT		
IFB13, 14, 15	RC 143	875p
FS4	RC 148	850p
RG305	RC 305	825p
RG306	RC 306	825p
FS9/1-10/1	RC 307	850p
VS5 RUK	RC 308	825p
VS4-1	RC 310	850p
MULTICONTROL (17C20)	RC 311	800p
KORTING		
18279, 18396, 18460, 18521 SE	RC 108	850p
40540 VTS	RC 108	900p
LOEWE		
DC11	RC 146	850p
MATSUI		
010270601	RC 889	850p
VX770	RC 892	850p
METZ		
JAVA COLOR (6890)	RC 166	850p
COLOR (7156)	RC 183	850p
JAVA (7180)	RC 184	850p
MITSUBISHI		
939P/03607, 939P/03609	RC 140M	850p
NOKIA		
SATELLITE	RC 550	850p
NORDMENDE		
TC2336	RC 351N	850p
CMC1, TC3519	RC 356	875p
OCEANIC		
390C9500	RC 339	900p
ORION		
RC53	RC 892	850p
PANASONIC		
EUR51200	RC 200	850p
TC2200	RC 201	850p
VSQ0357/NV730	RC 202	875p
TNQ1621	RC 203	900p
PHILCO		
CARVEL, CONCORDE, MERCURY, TELESTAR	RC 108	850p
TC10	RC 152	900p
PHILIPS		
RC5002,5154	RC 134	850p
KT3 NON TEXT	RC 135	825p
69117032	RC 178	875p
69117194	RC 180	875p
RC5991-UNIV	RC 300	850p
RC38	RC 301	875p
KT3 TEXT	RC 5301	800p
RC5352	RC 5352	800p
RC5375	RC 5375	850p
RC5 STANDARD	RC 5534	850p
RC5901	RC 5901	850p
RC5903	RC 5903	800p
SABA		
T6772	RC 149	900p
TC319-320	RC 328	875p
TC356	RC 356	875p
TC358	RC 358	850p
TC360	RC 360	800p
TC365	RC 365	800p
SALORA		
SERIES L	RC 190	875p
86173	RC 882	850p
SANYO		
RC218, RC222, RC228, RC238	RC 140M	850p
JXGE	RC 878	850p
JXDE	RC 884	850p
VHR2300	RC 890	850p
RC628	RC 865	900p
SHARP		
G0121CESA, 123CESA, 204, 251	RC 140M	850p
SIEMENS		
FC616	RC 130	850p
FC631	RC 132	850p
FC742	RC 164	900p
SONY		
RM604, RM605, RM606	RC 140	850p
32 CHANNEL	RC 140M	850p
RM613	RC 141	850p
RM632, RM636	RC 160	850p
TATUNG		
FXA	RC 877	850p
RC70	RC 883	750p
FX70 FASTTEXT	RC 894	850p
TELEFUNKEN		
FB632	RC 632 ST	850p
FB639	RC 639 ST	850p
THORN/FERGUSON		
3V35-42	RC 342	850p
3V31-32	RC 344	850p
3V57-58	RC 628	900p
TX10 TEXT	RC 732	750p
TX10 STEREO TEXT	RC 738	750p
TX9-90-100	RC 740	750p
3V55, FV11	RC 783	900p
TX100 FASTTEXT	RC 785	800p
TX100 STEREO FASTTEXT	RC 789	800p
PROFESSIONAL	RC 790	800p
TOSHIBA		
CT937	RC 950	850p
CT9117	RC 951	850p
201R4B	RC 952	850p

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 TC 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 120p
Replaces Philips Part No's:
138-10229. 2.4V – 90mAh 200p

REPLACEMENT FERGUSON NI-CAD BACKUP BATTERIES
Replaces Ferguson Part Nos:
00E6-066-001, 2.4V
Used on: 3V35, 3V56, 3V58, 3V65 250p
Replaces Ferguson Part No: 00E6-067-001, 1.2V
Used on: TX10 150P

REPLACEMENT 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
FERGUSON 00D3-508-002 Fits Chassis TX99 41cm + 51cm Used On: 51K2, 51J8, 51J7, 41H3, 41H3, 41H2, 51K3	1650p	LOT38
PANASONIC TLF14567F Used On: TC2043, TC2243, TX300	1850p	LOT39
PANASONIC TLF14568F Used On: TX2231, TX2244	1850p	LOT40
PANASONIC TLF14584F Used On: TC2210, TC2160, TX1752, TX2112 TX2112, TX2162, TXC22	2350p	LOT41
PANASONIC TLF14586F TC1651, TC2051, TC2061, TC2253, TC2263, TX5500	2350p	LOT42
HINARI Used On: CT15	1600p	LOT43
HITCHI 2434274 CPT2174, CPT2176, CPT2178, 2434274	1400p	LOT44

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 3, 1994
Lists more than 4000 faults for 43 different brands
Price: £9 45p Only. No VAT
Order Code: BOOK01

Satellite Repair Manual Edition 2

A comprehensive guide to receiver reviewing, featuring stock faults and installation tips.
Price 1475p Only No VAT Postage 100p
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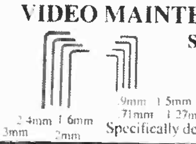
VIDEO HEAD CLEANING STICKS

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

VIDEO MAINTENANCE TOOLS



Set of 8 Allen keys packed in a plastic wallet
Order Code: TOOL9
Price 125p
Specifically designed for video maintenance

FUSES

	TIME LAG (20mm)		QUICK BLOW (20mm)	
Value	Order Code	Price	Order Code	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

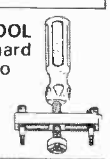
CERAMIC PLUG TOP

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**



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VIDEO SERVICE KITS

AMSTRAD

VCR700
Contents
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FERGUSON & JVC

3V42/43
HRD455/HRD725
Contents
BELT SET. PINCH ROLLER CLUTCH MECHANISM. TENSION BAND
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Economy Kit Contents
BELT SET PINCH ROLLER SUPPLY CLUTCH TAKE UP CLUTCH
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3V58/59 64/65
HRD170/180 210/230/300/320/370/400/430/530/700/750
HRS5000
Contents
BELT SET PINCH ROLLER. IDELR ARM TENSION BAND
Order Code: SK44 £8.50

3V29/3V30
HR7200/7300/7350
Contents
BELT SET PINCH ROLLER. TENSION BAND IDLER TYRES
Order Code: SK05 £6.00

3V35/36 38/39/49
HRD110 111/120/225
Contents
BELT SET PINCH ROLLER TENSION BAND. IDLER TYRES
Order Code: SK04 £5.50

3V31/3V42
HR7600 7610 7650/7655
Contents
BELT SET T/U REEL TABLE TYRE PINCH ROLLER REEL IDERL T/U CLUTCH T/U IDLER TENSION BAND VIDEO LAMP
Order Code: SK33 £12.00
Economy Kit Contents
BELT SET T U REEL TABLE TYRE. PINCH ROLLER REEL IDLER TYRE. T/U IDERL TYRE. T/U CLUTCH
Order Code: SK34 £5.50

3V35/36/38/39/49
HRD110/111/120/121/225
Contents
BELT SET. T/U REEL TABLE TYRE. SUPPLY REEL TABLE TYRE. PINCH ROLLER T/U CLUTCH. T/U IDLER. REEL IDLER. TENSION BAND
Order Code: SK35 £10.50
Economy Kit Contents
BELT SET T/U REEL TABLE TYRE SUPPLY REEL TABLE TYRE PINCH ROLLER T/U CLUTCH T/U IDLER TYRE REEL IDLER TYRE
Order Code: SK36 £5.80

3V29/3V30
HR7200 7300/7350
Contents
BELT SET T/U REEL TABLE TYRE. SUPPLY REEL TABLE TYRE. PINCH ROLLER. REEL IDLER T/U CLUTCH. T/U IDLER TENSION BAND. VIDEO LAMP
Order Code: SK31 £11.00
Economy Kit Contents
BELT SET T U REEL IDLER TYRE SUPPLY REEL TABLE TYRE PINCH ROLLER REEL IDLE TYRE T/U IDLER TYRE. T/U CLUTCH
Order Code: SK32 £5.10

3V44/45/48/53/54/55/57
HRP50/HRD140/150/158/160
HRD250 257 565 566/755
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Economy Kit Contents
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FISHER

FVHP905/906/907/908/910/911/916/918
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Economy Kit Contents
BELT SET PINCH ROLLER IDLER TYRE
Order Code: SK58 £5.00

FVHP615/618/620/622/710/711/715/716/720/721/722/725/730/830/840
Contents
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Order Code: SK68 £12.50
Economy Kit Contents
BELT SET PINCH ROLLER. IDLER TYRE
Order Code: SK69 £3.60

HITACHI

VT11/VT33
Contents
BELT SET. PINCH ROLLER. TENSION BAND IDLER TYRES
Order Code: SK08 £6.00

VT11/VT33
Contents
BELT SET T/UP REEL TABLE TYRE. SUPPLY REEL TABLE TYRE PINCH ROLLER FF/REW IDLER CLUTCH PLATE TENSION BAND
Order Code: SK45 £14.00
Economy Kit Contents
BELT SET PINCH ROLLER FF/REW IDLER TYRE. T/UP REEL TABLE TYRE. SUPPLY REEL TABLE TYRE
Order Code: SK46 £4.50

VIDEO SERVICE KITS (Cont.)

HITACHI

VT52/61/62/63/64/65/85/86/640
Contents
BELT SET PINCH ROLLER. FF/REW ARM CLUTCH PLATE. TENSION BAND
Order Code: SK49 £14.00
Economy Kit Contents
BELT SET PINCH ROLLER FF/REW IDLER
Order Code: SK50 £3.25

VT400/405/410/13/14/15/18/420/25/26/28/430/31/35/48/450/498/510 520/25/26/530/35/36 540/545/46/48/570/75/576/580/85/88
Contents
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PANASONIC

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Contents
BELT SET PINCH ROLLER IDLER UNIT. PLAY IDLER TENSION BAND
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Economy Kit Contents
BELT SET. PINCH ROLLER. IDLER TYRE PLAY IDLER TYRE
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NVG7/NVG9/VNG10 NVG11/NVG12/NVG14/NVG15/NVG16/NVG18 NVG30/NVG120/NVG130/NVG400/NVH65 (PX/AC)/AG1810 (P/K)
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Economy Kit Contents
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Order Code: SK28 £4.00

NV332
Contents
BELT SET PINCH ROLLER. PLAY IDLER. FF/REW IDLER. TENSION BAND FF/REW TYRE
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Economy Kit Contents
BELT SET PINCH ROLLER. PLAY IDLER TYRE. FF/REW IDLER TYRE
Order Code: SK30 £5.10

NV230/250/260/280/430/450/460/470/650/810/890/AG1200PK/AG1500PK
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Economy Kit Contents
BELT SET PINCH ROLLER. IDLER TYRE
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Contents
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Economy Kit Contents
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Economy Kit Contents
SLOT IN BELT LOADING BELT PINCH ROLLER IDLER TYRE
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Contents
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BELT SET PINCH ROLLER. IDLER TYRE
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Contents
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Economy Kit Contents
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Order Code: SK18 £4.00

VIDEO SERVICE KITS (Cont.)

SHARP

VC381
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BELT SET. PINCH ROLLER. REEL IDLER TENSION BAND. VIDEO LAMP
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Economy Kit Contents
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Contents
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Economy Kit Contents
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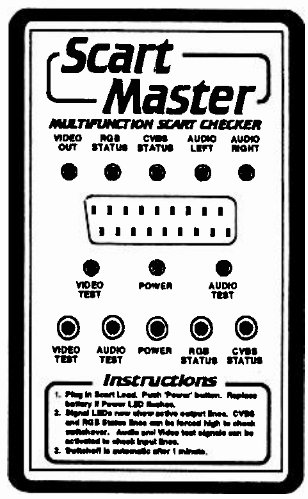

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COVER PHOTO
This month's cover photograph shows the Philips GR1-AX chassis. See servicing article on pages 472-477.

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The Look of the Thing

Do people care much about what their TV sets look like? Alain Prestat, chairman of Thomson Consumer Electronics (TCE), certainly seems to think so. As part of his increasingly successful effort to restore to profitability TCE, one of the world's largest TV manufacturers with brands that include RCA, Telefunken, NordMende, Saba, Brandt and Ferguson, he has hired the French designer Philippe Starck to oversee a product design programme. Prestat is convinced that imaginative design could give Thomson an advantage over its contemporaries Philips, Matsushita, Sony etc. in the intensely competitive consumer electronics market: he feels that consumers are bored with the "grey boxes" that overwhelmingly predominate in the market. "Appealing products with their own identities" is to be the aim at TCE.

Philip Starck has been appointed artistic director of TCE but works as a consultant to the company, feeling that it's important to be able to look at what is being done at TCE as an outsider. So far he has spent a year on the project, working in conjunction with the company's marketing and technological specialists and a new 16-strong European design team at TCE's Paris headquarters. Their first task has been the redesign of TCE's European TV ranges. The new designs will start to appear this month, with launches continuing during the coming year. So far two Starck designs have appeared, one-off Saba and Telefunken sets that were introduced last autumn. The Saba one certainly looks different. Starck aims to give each brand a different personality – Saba is supposed to be "young and funky". The set just mentioned uses green plastic for the tube surround and control panel, with recycled woodchips for the rest of the apparently moulded case. To this observer it's a strange set with virtually no appeal whatsoever. But then I can't claim to be "young and funky". Starck comments that "there's no reason why televisions should have to come in boring cardboard (that's what he's quoted as saying) boxes. We want our products to be fun to buy – just like opening a Christmas present".

Angela Dean, European electronics analyst at Morgan Stanley, is reported as commenting that "there probably is a demand for better-looking products: TCE can have a go – but it isn't going to be easy". One can feel reasonably sure about that, anyway. The fact is that design has never really had much impact in the TV market. Looking back, the original Murphy Radio company was probably the first and virtually the only UK setmaker to emphasise design. Bang and Olufsen is the outstanding European example of the design-conscious approach to consumer electronics. There have been occasional attempts at something new and innovatory, for example the Keralacolour sphere, but so far as the mass market is concerned keeping things simple and relatively inoffensive has been the basic approach in recent decades.

Design is of course a notoriously difficult subject. Something that excels in one person's eyes is plain awful to many others. Beauty is, as they say, in the eye of the beholder. Appreciating this, or maybe just not giving the matter much if any thought, setmakers and those who market own-brand sets have tended to play safe. Over the past few years the "monitor look" has been widely adopted – those "black boxes" that many view with disdain. Personally, this approach seems to me to be reasonable and acceptable. Visually, 80-90 per cent of what one sees when one looks at a TV set is the screen. There's not much one can do about that other than fit doors, which seem to be clumsy and a bit pointless. Since a blank screen is not a particularly wondrous sight, the best that can be done is to make it relatively inconspicuous. The monitor-style receiver set on a convenient shelf does just that. If you want the set to play a more dominant role as part of an interior setting, the Bang and Olufsen approach seems appropriate. But what to do if the interior is traditional rather than modern? The set can always be hidden away in an appropriate cabinet – with those doors! (What if you've a house full of pine: I've yet to see a set with a pine cabinet – Philippe Starck can have that idea for free!) The last thing, I suspect, that most people want is for their TV sets to be too intrusive. If what people want is inoffensive, inconspicuous sets, design means keeping it simple and appropriate, for example with controls that are easy to operate and do their job without fuss. Recycled woodchips, bright colours and that sort of thing is unlikely to be widely acceptable. TCE could be on to something or not, depending on how carefully design is handled.

Teletopics

INTERACTIVE-TV

British Telecom's interactive-TV system trial is now underway at Kesgrave, Suffolk, involving about seventy installations. It's called Interactive Multimedia Services and uses software developed by the US company Oracle. Oracle's Media Server is a multimedia library that stores, retrieves and manages various types of programme matter including sound, video and text. The link to the user is via existing copper telephone lines, using a system that's referred to as an asymmetric digital subscriber loop (ADSL). This simply means that a narrow-band, low bit-rate channel is used for the user requests while a wideband, high bit-rate (up to just over 6Mbits/sec) channel is used for the programme link to the user. Two different modulation systems have been used for this type of link. Carrierless amplitude/phase (CAP) modulation, developed by AT&T Paradyne, is being used by Bell Atlantic in its Washington trials. BT however is using a system called discrete multi-tone (DMT) modulation. This offers better line resilience and is being developed by a goup that includes reseachers at Stanford University, Motorola and Nothern Telecom. It now seems that cost is likely to be a problem: BT is tending to regard I-TV via copper wires as an interim technology, broadband optical-fibre technology offering a better long-term solution. The set-top decoder-receiver being used in the BT trial has been developed by Apple Computer. Companies that are providing programme material for the trial include the BBC, Carlton TV, EMI Records, Granada TV, LWT and Thames TV.

Tele-Communications, the largest US cable TV operator, is to start I-TV trials later this year in Seattle, using technology being developed jointly with Microsoft. Bill Gates, Microsoft's chairman, believes that systems offering a wider range of information than simple domestic services are more likely to succeed in the long run. Microsoft hopes to test a cable TV network dedicated to personal computing from April 1995. The aim is to develop an easy-to-use interface with a lot of applications.

Time Warner, the second largest US cable TV operator, has delayed the start of its I-TV system trial at Orlando, Florida until the end of the year. The postponement is to enable additional system software and set-top terminal refinements to be developed.

A small US company is developing a laser-based remote control unit, called the LaserMouse, as a low-cost data input device for use with I-TV set-top terminals and other interactive systems. It employs a patented process that detects angular motion, so that the user can wave the device in the air to control the position of a cursor on the screen. It does not require line-of-sight operation. Because of its motion-detecting feature the device is particularly suited to video games use.

BUSINESS NEWS

Philips is to pay its first dividend since 1990 following a return to profitable operation in 1993. Cost cutting and reduced financing charges rather than any improvement in market conditions produced the turnaround. Losses made by Philips' largest business, consumer electronics, fell to just Fl73m: continuing heavy losses at the company's affiliate Grundig prevented a return to profit in this sector. Losses at Grundig have actually increased: Philips is seeking a drastic reduction in costs, including the loss of 4,000 out of 15,000 jobs.

At the operating level Thomson Consumer Electronics, which is owned by the French government, returned to profitable operation in 1993. As a result of restructuring and debt charges however the company remained in the red. Alain Prestat expects a return to full profitability to take another eighteen months. Last year employment in the company, whose brands include RCA, Telefunken and Ferguson, fell by ten per cent to 49,000.

Scottish Power is to buy fifty superstores from the receivers of Clydesdale. The deal will safeguard about 600 of the 800 jobs at risk. Clydesdale was the UK's third largest electrical retailer when it went into receivership in January.

Marco Trading of Wem, Shrewsbury has called in the receivers.

Gooding Consumer Electronics and Grundig A.G. have set up a joint venture, Grundig Satellite Communications Ltd., to manufacture and market satellite receiving equipment. The company is owned seventy per cent by GCE and thirty per cent by Grundig. Production at its Llantrisant, Mid Glamorgan plant was due to start at the end of March. Employment is expected to reach 400 by the end of the first year and 600 by the end of year three, when production should be running at a million sets a year.

Seleco brand TV sets are to return to the UK market, where they were last sold in 1989. Owl Video Systems, 8/9 Horstead Square, Bellbrook Industrial Park, Uckfield, Sussex TN22 1QW (0825 766 123) will be responsible for distribution of the Italian manufactured sets.

SERVICE NOTES

Toshiba has available, at £33 including VAT and a free-of-charge annual update, a binder that includes in easy to refer to form all TV and VCR fault conditions known to Toshiba – not just those issued in the company's Technical Bulletins. It's called the Toshiba Technical Repair Data Book, part no. TTRD93.

We understand that spares for Huanyu products are available from Huanyu (UK) Ltd., 43 Skyline, Isle of Dogs, London E14 9TS, telephone number 071 363 0213.

Carlton Television is providing current transmitter information on ITV (London) teletext page 690. It's part of Carlton Plus, the company's ancillary broadcast support service, which started in January. There's also a clock cracker on page 699. Carlton Television is moving towards full implementation of a PDC service: at the moment there are PDC compatible listings, with sufficient data for timer control, on pages 601 and 602.

xBase Computing, 19 Great George Street, Bristol BS1 5QT (0272 290 846, fax 0272 290 807) has released at £99.95 plus VAT a budget version of its F4 service software package, which is designed for consumer electronics and electrical trade use. Called F4 Junior, the new version is intended for the small workshop or retail outlet that handles up to 500 jobs a month. All the usual job and customer tracking facilities are included.

NEW AMSTRAD SATELLITE RECEIVERS

Amstrad has launched a series of 'enhanced wideband' satellite receivers that will enable viewers to receive transmissions from the Astra 1D satellite without LNB modification or the use of a switching box. Prices of the new receivers start at £150 exluding the dish. Amstrad is also offering, at £50, an Astra 1D switching box that can be used by owners of earlier models.

Servicing the Philips GR1-AX Chassis

Steve Cannon

The GR1-AX was designed to drive 90° tubes with screen sizes from 14 to 21in. Although it was introduced back in 1989, many engineers are still not familiar with it. The unusual power supply – a self-oscillating series chopper that uses a power f.e.t. device – could be one reason for this. When it comes to repairing a switch-mode power supply with a BU508 or one with a f.e.t., the latter will tend to be put to one side.

There were several versions of the chassis, with quite a number of differences. They depend mainly on the country of origin and the serial number. The service manual lists the main component differences. There are also some differences in the plugs and sockets. The following description and service notes should however apply to all sets.

The Power Supply

The basic power supply circuit is shown in Fig. 1. It's known, curiously, as a BUCSO type. This stands for Buck Converter Self-Oscillating type. There is no sync feedback from the line output stage. Note in particular that the chassis is not mains isolated. Thus caution is required when fault-finding in the power supply or indeed anywhere in the set.

The power supply generates three outputs: a 95V h.t. supply for the line output stage, a 9V supply for the audio output stage and a 5V supply for the microcomputer control chip and related circuitry. This latter supply is derived from a potential divider network connected across the output from the mains bridge rectifier.

The main thing that stands out is the chopper transistor itself, Tr7610, since it's a f.e.t. This type of transistor is now becoming more common in power supplies. But basically, f.e.t. or no f.e.t., the power supply operates on similar lines to any other type of switch-mode power supply.

Circuit Operation

At switch on Tr7610's gate is forward biased via R3610 and R3613 and it conducts. Zener diode D6613 sets the voltage at the junction of R3610 and R3613, with R3613 and R3611 acting as a potential divider to further reduce the voltage at Tr7610's gate to approximately 4·8V. Tr7610 is connected as a blocking oscillator, with positive feedback to its gate via the secondary winding (pins 2-13) on the chopper transformer T5610, C2613 and R3612. Zener diode D6610 limits the gate voltage.

We now have to switch Tr7610 off. This is where the pulse-width modulator circuit, transistor Tr7614 and its associated components, comes in. The error sensing transistor Tr7628 sets the d.c. conditions at the base of Tr7614. Its other input consists of a sawtooth produced by the integrating circuit R3618/C2616 from the pulse developed across winding 4-11 of the transformer when Tr7610 conducts. When the sawtooth rises to a sufficiently positive value, Tr7614 conducts, shorting to chassis the gate of Tr7610 which is thus switched off. At this point the voltage at pin 2 of the transformer swings negatively and diode D6620 conducts, providing an efficiency diode action. During this part of the cycle the energy in the transformer charges the h.t. reservoir capacitor C2660. The voltage at pin 4 of the transformer also swings negatively, discharging C2616 via R3617 and D6617. Thus Tr7614 switches off.

Once the energy in the transformer has been transferred to C2660, D6620 switches off. C2620 then charges, producing a positive pulse which, via C2613, switches the chopper transistor Tr7610 on again. The cycle has thus been completed and the process continues, with Tr7610 being switched on and off. Regulation is achieved by controlling the point at which Tr7610 switches off. This is determined by the error sensing transistor Tr7628 which sets the d.c. voltage at the base of Tr7614, and can be adjusted by means of the set-h.t. control R3625.

Tr7614 is also used to provide the standby condition. When standby is requested pin 19 of the microcomputer control chip IC7700 goes low, switching Tr7631 on. The positive voltage at its collector then switches Tr7614 on and, since this shorts to chassis the gate of Tr7610, the power supply shuts down. It starts up again when Tr7631 and Tr7614 switch off. This feature is included only in sets with remote control.

Overvoltage Protection

Overvoltage protection is provided by thyristor Thy6641 and its associated components. Zener diodes D6638/39/40 monitor the h.t. voltage. If this rises above the combined zener level the diodes conduct, firing Thy6641 which thus shorts the h.t. to chassis. The power supply senses the overcurrent condition via winding 4-11 on the transformer, switching on Tr7614 to shut the power supply down. In earlier sets the conditions in the line output stage are also monitored, via zener diodes D6646/47 and the 1N4148 diode D6645 whose anode is connected to one side of the heater winding on the line output transformer.

The Microcomputer Chip

The microcomputer chip IC7700 is type TMP47C434-3559. It carries out the usual functions such as remote control and keyboard decoding, tuning control, video and sound control, standby selection and on-screen display generation, with connections via an I2C bus to the X2402 EEPROM IC7785 which stores the tuning and preset information.

For these chips to operate correctly they must be provided with a rock-steady 5V supply, a power-on-reset (POR) pulse must be correctly applied and the 4MHz oscillator must be running at the right frequency. Transistor Tr7674 in the power supply acts as a series regulator for the 5V supply. The power supply also provides the reset pulse for pin 33 of IC7700 – it's generated at the collector of Tr7673.

Once a supply voltage is present, for IC7700 to be initialised at switch on the reset line should remain low for 1msec. At switch on Tr7673 is in its off state and the reset

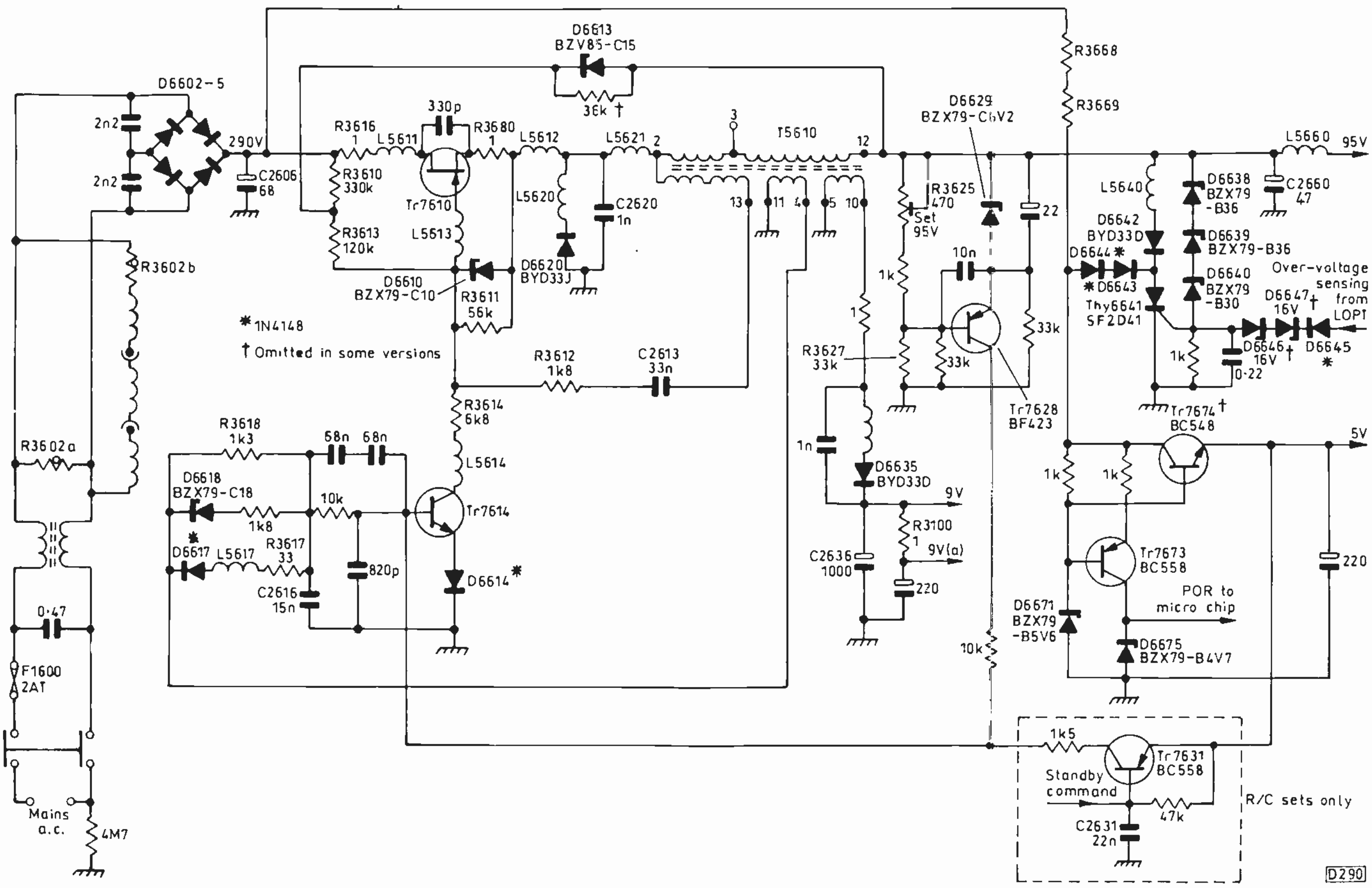

Fig. 1: The switch-mode power supply circuit used in the Philips GR1-AX chassis. Some component types/values vary and there were several alterations in circuit detail during the production run.

line is low. Once the voltage at its base rises to 5·6V zener diode D6671 and Tr7673 conduct and the reset line rises to 4·7V. By this time the 4MHz oscillator (pins 31 and 32) has been kick-started and initialisation has been completed. The following checks are made within IC7700 during initialisation:

(1) The internal RAM is tested. If a fault is found, a flashing LED displays error code F0.

(2) The presence of a diode between pins 10 and 14 is checked. This tells the chip whether or not the set has remote control. If D6737 is present the set doesn't have remote control and can't be put in standby.

(3) The presence of a diode between pins 11 and 14 is checked. If diode D6736 is fitted here only u.h.f. operation is possible.

(4) The presence of a diode between pins 12 and 14 is checked. If diode D6735 is present the set comes on with programme 2 instead of programme 1. This is apparently for Australian sets, though why the Aussies want their sets to switch on with programme 2 escapes me for the moment. . .

(5) The internal dividers and remote input are released.

(6) The status of the set when it was last switched on is checked. If it was in standby when switched off, it comes on in standby.

(7) The stored volume, brightness, colour and contrast settings are read from the EEPROM and supplied to output pins 2, 3, 4 and 5 respectively.

The chip's internal timers are tested. If they are not working correctly a flashing LED displays error code F1.

At the end of this sequence the microcomputer chip should, provided no errors have occurred, be fully operative.

Tuning

The tuning voltage data, a pulse-width modulated (PWM) signal, appears at pin 1. It's used to switch transistor Tr7706. This is connected to the 33V tuning supply and establishes the required tuning voltage output in conjunction with an integrating filter.

Once tuning has been initiated, pin 2 of the chip goes low to mute the sound. The a.f.c. action needs to be overridden, so pin 41 goes high. This switches on transistor Tr7786 which produces 6V, the nominal a.f.c. voltage, at its collector for application to the a.f.c. pin 9. The PWM tuning signal's duty cycle then starts to decrease and the tuning voltage, via Tr7705, increases. When a station is found, pin 16 receives a high input from pin 22 of IC7020 (the TDA8305 multi-function chip) via transistor Tr7046. The output at pin 41 then goes low so that the chip can measure the a.f.c. voltage. Once this reaches 4·5V fine tuning begins, i.e. the chip varies the duty cycle of its PWM tuning output at a slower rate. The tuning voltage is gradually increased until the a.f.c. voltage at pin 9 is 7·5V: it is then decreased to produce a 6V a.f.c. level. The tuning is then spot on and the micro is ready for a programme number to be entered and stored.

Other Controls

Volume, brightness, contrast and colour are adjusted via an on-screen display menu. The micro chip has four 6-bit registers available for these settings. Thus the customer controls can be at any one of 64 settings between minimum and maximum. The PWM outputs at pins 2-5 are integrated to produce the control voltages which vary between 0V (minimum) and 5V (maximum).

The chip has a sleep-timer function that operates via the remote control system. When this function is activated the set goes to standby after a given time. Maximum time, which can be reduced in steps of fifteen minutes, is ninety minutes.

On-screen Display

The green on-screen display (OSD) provides a search tuning bar, timer information, the programme number and the customer control value settings. It's synchronised by a field sync pulse that's fed in at pin 27 and a sandcastle pulse input at pin 26. The OSD output, at pin 23, is applied to Tr7760 whose output is fed to the green output stage on the c.r.t. base PCB. An LC network connected between pins 28 and 29 determines the frequency of the OSD generator. The fast-blanking output at pin 25 is used to suppress the TV signal where the OSD is to be shown.

Hotel Mode

If you're a landlord, a useful function with early sets is the 'hotel' mode. This has probably caught out many an unwary engineer, myself included. It can be switched on by selecting programme 38 then pressing the store and prog + keys at the same time. Once in this mode it's not possible to store either tuning information or the values of the customer control settings, the sound won't adjust louder than the previously stored value and when the set is switched out of standby it will come on with programme 1 rather than the last one selected. Now the useful bit. To disable the hotel mode, select programme 38 again and this time press the store and control + keys simultaneously.

Error Messages

The micro chip can generate three error messages which are displayed by the front LED flashing. The error is indicated by the LED's off time, the on time always being 50msec. These messages are as follows:

(1) F0, LED off time 50msec. Internal RAM fault – replace IC7700.

(2) F1, LED off time 100msec. Internal timer fault – replace IC7700.

(3) F2, LED off time 150msec. EEPROM fault. Either the EEPROM chip is faulty or the +5B voltage is incorrect.

Video Signal Path

After passing through the tuner and the i.f. section of the TDA8305 chip IC7020 the video signal is buffered by Tr7040 and fed to the TDA3565 colour decoder chip IC7300. Pin 3 is the chroma input, pin 8 the luminance input, pin 5 sets the colour level, pin 6 the contrast and pin 9 the brightness. Pin 6 is also used for beam-current limiting, via R3552 and D6551. The reference oscillator operates at 8·8MHz (the crystal is connected to pin 16) and the sandcastle input is at pin 7. The red, green and blue outputs appear at pins 10, 11 and 12 respectively. These are fed to class A output stages, operated with a 160V supply, on the c.r.t. base panel. Tr7402 provides a stable bias source for the RGB drives, setting the black-level.

The Timebases

The TDA8305 chip IC7020 provides i.f. amplification and demodulation, audio and sync processing and produces line and field drive outputs. For the line timebase and hence the set to get going a kick has to be delivered to the line generator part of the chip from the power supply. There's nothing new about this, but the unique thing here is that the pulse is delivered to the the volume control input, pin 11. When the set is first switched on C2058 (22μF) charges from the 95V line, applying a pulse for a short time to pin 11. This enables the line oscillator to get going, and the line output stage comes into operation. A 12V supply derived from the line output transformer then takes over, providing a feed to pin 7. The chip is now fully operational.

The composite video input signal is fed to the sync separator via pin 25. As well as going to the sync circuits the output from the sync separator is fed to an identification stage which tells the microcomputer chip, whilst tuning, whether a station has been found. This output appears at pin 22, where it's applied to the base of transistor Tr7046. A sandcastle pulse output at pin 27 goes to the colour decoder and micro chips.

The line drive output appears at pin 26 and is fed via the line driver and buffer transistors Tr7521 and Tr7523 (no line driver transformer) to the base of the line output transistor Tr7528. The type of transistor found here depends on the set's screen size. With a 14in. tube it's a BUT11AF while with a 21in. tube it's either a BUT12AF or, in later versions, a 2SC3795B.

The line output stage is very simple, with no EW modulator. The 95V h.t. is fed to pin 6 of the transformer via R3530 (4·7Ω) and L5532. Taps on the transformer produce, with the associated rectifiers and filters, 160V for the RGB output stages (pin 1), 26V for the field output stage (pin 2), the +5B supply (pin 4), the heater supply (pins 8 and 9) and a 12V supply (pin 3) which is separately filtered to provide the +12A, +12B, +12E and +12F lines. The e.h.t., focus and first anode voltages are obtained from the diode-split section of the transformer, pin 7 at the chassis end of this section providing a beam monitoring point.

Pin 3 of IC7020 provides the field drive output which is fed to the TDA3653B field output chip IC7500. Again this is all very straightforward. Pin 5 drives the field scan coils. If the voltage at pin 8 falls below 2V, indicating no flyback or deflection current, a positive voltage is produced at pin 7. This is linked via diode D6515 to the sandcastle pulse line, blanking the screen to prevent phosphor burn.

Fault Finding

As with any chassis, most faults occur in either the power supply or the line output stage. Great care must be taken around the f.e.t. chopper transistor when fault-finding in the primary side of the power supply – the transistor will probably be destroyed if an attempt is made to measure the voltages at its connections. The power supply won't run with a 60W or 100W bulb as a dummy load. But if there's no fault in the power supply it will run quite happily, producing the correct h.t. voltage, when the h.t. smoothing coil L5660 is disconnected to give an off-load condition.

Tracing the cause of a dead set when the h.t. is present can be quite perplexing. This condition usually means that there's a line timebase fault, but the cause could be in the line drive/oscillator section or the output stage. As we've

seen, the TDA8305 chip requires a start-up pulse at its volume control pin to get the line oscillator going. A scope check at pin 26 when the set is switched on should show the presence of line pulses for a brief period. If these are present, the cause of the fault is likely to be in the line output stage. If the pulses are not present, the fault is probably in the line driver stage or the line oscillator. A check should of course be made to ensure that the kick-start pulse is present at pin 11.

A fault in the line output stage derived 12V supply could be the cause of the condition just described, i.e. no results with line drive pulses present for a brief period at switch on. So D6542, C2542, R3060 and C2060 should be checked. The line oscillator will run with the set switched off and an external 12V supply connected to the TDA8305 chip (pin 7 positive, pin 6 negative), and in this condition line drive pulses will be seen at pin 26. It will also run and provide line drive pulses when the set is switched on, h.t. is present and an external 12V supply is connected to the chip. This is a helpful test to check whether the cause of the fault is in the LOPT-derived 12V supply. It can also help in determining where the cause of the fault lies when the oscillator, driver and output stages are suspect.

Faults List

H.T. variations and the volume intermittently increasing to maximum: Replace C2631 (22nF) at the base of the standby switching transistor Tr7631.

Set dead, h.t. low and the 9V rail at 5V: The line output transformer is faulty.

Blank raster and no sound after four hours or longer: Faulty TDA8305 chip.

H.T. goes high: R3627 (33kΩ) has gone high in value.

Failure to lock to a signal when sweep tuning: A.F.C. coil L5045 faulty.

Poor line sync: C2051 (10μF, 25V) associated with pin 24 of the TDA8305 chip is faulty.

Set dead, h.t. correct: Several possibilities here. C2519 (150pF) at pin 26 of the TDA8305 chip or the 12V zener diode D6030 in the kick-start circuit associated with pin 11 could be faulty. If necessary check the 1N4148 diode D6523 in the line driver stage's start-up supply.

Intermittent destruction of the line output transistor: Replace Tr7521 and Tr7523. They are both usually type BC337, but check in the relevant service manual.

Intermittent sound buzz: 6MHz filter CF1036 is faulty.

Low 5V supply to the micro chip: Diode D6644 (1N4148) in the power supply is leaky.

Intermittent loss of the picture: C2045 (22nF) in the a.g.c. circuit, connected to pin 10 of the TDA8305 chip, is faulty.

Intermittent dead set or intermittently shuts down with the h.t. line at 8V: Zener diode D6613 (15V) in the power supply is faulty.

Field collapse (blank screen): Usually caused by failure of the TDA3653B field output chip IC7500 but check for dry-joints at the scan coil plug.

Set dead, no h.t. supply: Check zener diodes D6638/39/40 and thyristor Thy6641 in the overvoltage protection circuit circuit. D6638/39 are usually 36V types and D6640 30V but check in the relevant service manual. Thy6641 is type SF2D41.

Line tearing, especially with bright scenes: Replace C2542 (220μF) and C2060 (680μF).

Set intermittently fails to come on: Replace C2058 (22μF, 100V) in the kick-start circuit associated with the TDA8305 chip.

Set dead or power supply tripping: Replace R3614 (6·8kΩ) in the power supply (primary side).

Set goes off after a couple of hours, with h.t. present: Replace D6523 (1N4148), Tr7251 and Tr7523 (both usually type BC337) and change C2523 from 6·8μF to 68μF, 63V. Any of these components can cause the fault.

Poor field and line sync from cold: Change R3052 from 1kΩ to 1·8kΩ and C2053 from 22nF to 150nF.

Sound intermittently increases or starts popping, especially with bright scenes: Change C2030 from 47μF to 22μF, 16V and fit a 6·2V zener diode in position 6031 or in place of link 9511.

Philips' Service Tips

To improve reliability D6613 was changed to type BZV85-C15, part no. 4822 130 33732.

The following production changes were introduced to prevent the set coming on in the store lock mode when switched on from standby. EEPROM IC7785 changed to type ST24C02CP, with a shield, part no. 4822 310 31886. L5786 in the 5V supply connected between pin 8 of IC7785 and R3797 instead of R3770/3767, using a spare print pad adjacent to R3793. Position the shield over the i.c. and solder in place of link 9020.

For improved reliability C2523 was changed to 68μF, 63V, part no. 4822 124 40754. Make this change whenever the line output transistor (Tr7528) has to be replaced. A rope or barber's-pole effect on the picture can be cured by carrying out this modification.

If the set won't tune to high-frequency channels and lower-frequency channels appear to be higher up the tuning band Tr7705 (part no. 4822 130 41594) could be defective, causing incorrect tuning voltages at pin 11 of the tuner.

In the event of the failure of R3616, R3680, Tr7610 or D6610 in the power supply, all four components should be replaced. Do not, when fault-finding, connect any probe to Tr7610's gate – this will destroy it.

For colour drop-out with prerecorded tapes change C2322 from 220nF to 1μF, part no. 4822 124 40242.

The following modifications will provide a considerable improvement in avoiding avoid adverse effects caused by copy-protected tapes: change C2050 to 47nF (part no. 4822 121 42491), R3050 to 75kΩ (part no. 4822 116 52301), R3051 to 1·5kΩ (part no. 4822 116 52243) and C2322 to 1μF (part no. 4822 124 40242).

To improve safety in the event of a short across the 9V supply R3100 was changed to 1·5Ω (safety type, part no.

4822 116 80691) and the following components were added: R3646 150Ω part no. 4822 116 52211, C2110 470nF part no. 4822 121 51252, Tr7100 BC558 part no. 4822 130 40941. The extra components are fitted directly to the 9V rail, wired as an over-current protection circuit to monitor the 9V supply. If excess current is detected thyristor Thy6641 is fired and the power supply shuts down. This is not intended as a service modification.

The following modification was introduced to improve the operation of the line drive circuit: R3059 changed to 1kΩ (part no. 4822 116 52204), R3520 to 33Ω (part no. 4822 116 52191), R3521 to 4·7kΩ (part no. 4822 116 52283), R3525 and R3527 to 15Ω (part no. 4822 116 82098). D6521 BYD33D (part no. 4822 130 42488) and C2521 10nF (part no. 4822 122 33307) added. Again this is not intended as a service modification.

Finally a service manual correction. In both the circuit diagram and the PCB layout the 160V supply winding on the line output transformer is shown incorrectly. The winding is between pins 1 and 6 (h.t. feed point), not 1 and 5.

Acknowledgement

I would like to thank all the engineers at the Philips Competence Centre in Heywood for their help in compiling this information, especially Brian, Tony and of course *the* Frank Bevins.

Test Case 377

This month's saga started when Mr. Smith came into the workshop to collect his newly-repaired Grundig radio receiver. Pam, who runs our office, had been watching a chat show whilst taking a rare break. As she made out his receipt, Mr. Smith's attention turned to the TV set.

"You don't seem to get the widescreen programmes here" he commented. Pam wondered what widescreen programmes he was on about. Mr. Smith, it subsequently transpired, was under the impression that the broadcasters had all gone over to the new widescreen format. But what was happening was that his set displayed letterbox-style pictures because it was faulty. Would he care to bring it along? Next day he appeared with a Sony KV2092, which is fitted with the XE4 chassis.

Now the KV2092 is something of an exception to the general rule that Sony's chassis are very reliable, safe and perform well. There has been trouble with the on-off switch, and with the connections to certain resistors. Modifications were made in other parts of the chassis, and in Television Ted's circuit diagram many components are highlighted in yellow – to remind him of previous diagnostic battles fought and won against Secret Agent XE4. Despite all this the cause of Mr. Smith's widescreen effect was not one that any of us had come across before.

The symptom indicated lack of field scan amplitude of course: there were black bands at the top and bottom of the screen. What was significant – in retrospect! – was that the workshop test pattern also showed up a barrel-distortion effect at the sides: the edges of the picture bowed out, as if someone had advanced the setting of the EW pincushion-correction potentiometer too far. If some brainy technician had at this point sat down and actually thought about these symptoms he might well have come up with the answer straight away. How about you?

Certainly the members of the workshop staff who were present that day failed to produce any such instant diagnosis. Sherlock (whose nickname we're thinking of changing – suggestions on a postcard, please) merely adjusted the height control to obtain an almost full picture and the pincushion amplitude (EW parabola amplitude) control for a reasonably linear display – provided it wasn't examined too critically while a test pattern was being shown. And there the set sat for a day or two, with only a little bit of picture height jitter to betray the fact that the symptoms had been disguised rather than the fault repaired. No doubt the easy-going Mr. Smith would have been quite happy to take the set back in this condition. But wiser workshop counsels prevailed.

Counsels are one thing, a concrete diagnosis quite another. When Sherlock returned to the set he restored the two presets to their original positions and began to bang the set's B panel, where the timebase circuits live, with the handle of a screwdriver. As this had no effect he got out his hairdryer and raised several square inches of the board to the point where you could have used it to fry an egg. He then had a go with freezer: after a few seconds the field output chip was at the centre of an icy waste, glistening under the bench light like Antarctica under a December sun. The lack of height remained.

We'll spare you a lengthy account of all the various components that were changed, save to say that some of them had more than two legs and that they included the height control and its 240kΩ, 1% series resistor. Neither will we tire you with details of the meter and scope checks that were carried out. There was however one key point in the field scan circuit where, had Sherlock ventured, he would have found more rather than less of the waveform amplitude he was so short of! Don't turn straight to page 509 for the solution to this one. . .

Amstrad SRD400 Satellite Receiver

A lot of ex-rental Amstrad SRD400 satellite receivers are around at present. When installing them we often find that where there's a long cable length between the dish and the receiver the vertical/horizontal polarisation switching doesn't work. This is because of the voltage drop along the cable, the most obvious outcome being reception of only half the channels, each one occupying the space of two channels.

The cause of this is the fairly marginal 18V feed to the LNB – it often measures 17·5V at the SRD400's F connector with no load. To cure, add a standard silicon diode, 1N4001 or whatever, in series with DP504. To avoid having to remove the board, cut the earthy end of DP504, leaving the maximum lead length at the diode. Then solder the new diode from here to the earth lead of CP507, an 0·022µF ceramic capacitor that's conveniently near. The anode of the new diode goes to DP504, its cathode to CP507.

Hugh Allison

Camcorner

Reports from Keith T. Keeton and David C. Woodnott

Sony V50

We've had two faults recently with this one, as follows:

(1) No E-E colour, no date/time, superimpose intermittent. The cause of the fault was on board RZ1P which was not providing a 5V supply for board DS24P. Transistor Q118 was faulty.

(2) The E-E display had pink colouring at the top left-hand corner. Prior to the appearance of the fault the lens had been replaced. Because its earth lead had been laid near the CCD's output pin the signal was being distorted. The cure was to move the earth lead away from the output pin. **K.T.K.**

Sony CCDF555

This camcorder produced a grainy E-E image. Checks on board VC96P showed that the EVR didn't change the voltage at pin 5 of IC301 (type M62352GP, part no. 875963527). Replacing IC301 cured the fault. **K.T.K.**

Sony ACV30

(1) This unit produced no output and the LEDs weren't lit. A voltage check at pin 4 of board CT produced a reading of 13·5V. R104 had gone high in value, a replacement curing the fault.

(2) The output was o.k. but no LEDs were lit. There was zero voltage at pin 3 of IC251 which was faulty. Board CH had to be replaced as IC251 is not available separately.

(3) This one failed to charge. The power light was out and the d.c. output was low. We found that the d.c. output socket was faulty. The cabinet top had to be replaced as the socket is not available separately.

(4) The power light was on but the unit failed to charge, its d.c. output being low. PS201 on board MA had gone high-resistance. Replacing PS201 restored normal operation. **K.T.K.**

Akai PVC40E

This palmcorder produced camera pictures but little else: no mechanical functions operated. The cause of this was damage to part of the mechanism that positions the pinch-roller assembly. We replaced cam T and lever cam T and retimed the mechanism. Then, using the Sony mode box, we found that the original cause of the damage was still present. If the audio/control head stack is set slightly too high the 'assembly stopper – TG' will mess up the loading/unloading sequence. The cure was to set things up as per the manufacturer's instructions. **D.C.W.**

JVC GR323E

This camcorder produced very poor camera pictures. Playback etc. was fine. The picture was dark and pulled to the right-hand side of the display, with colour smearing. We found that the picture signals leaving the SSG PCB were incorrect. Dry-joints around IC3 were suspected, but none could be found. During their path from source to further processing stages the signals pass through intermediate PCB layers: once again, application of hot-air rework methods in the IC3 area cured the problem. **D.C.W.**

Philips 22AV5150 Adaptor

This adaptor failed to charge: the 2A, 115°C thermal fuse TF2 had failed and switch SW2 was faulty. **D.C.W.**

JVC GRS505E

The rather unusual symptom with this S-VHS model was that the viewfinder picture became blurred, with a noticeable lack of width, after a period of use. Monitor pictures remained normal however, with no noticeable degradation. The fault condition would be followed by shut-down to power off. A 9·6V battery powers this model.

When we tried the camcorder out with a variable power supply we found that the voltage could be reduced to about 8V, at which point shut-down occurred. We also noticed that there was no battery-low indication on either the rear LCD operation display or the viewfinder when the fault occurred. The cause of all this turned out to be something quite simple. Pin 5 of the mechacon microcontroller chip IC301 is used to monitor the battery voltage, the feed being from a potential divider network across the supply. R325, a 68kΩ chip resistor in this network, was open-circuit – neither damaged nor dry-jointed. **D.C.W.**

Philips VKR6847

This camcorder is based on the Panasonic NVG1. The fault we had was no record or playback sound, though E-E was o.k. R4001 turned out to be open-circuit. **D.C.W.**

Sony CCDF355

Playback was o.k. but there was no camera picture nor were graphics available. The cause was that the trigger/standby PCB RC04 was broken. We often find that this assembly has been damaged because of excessive pressure on the trigger button. **D.C.W.**

Sanyo VMD90P

The E-E and playback colour were o.k. but there was no record colour. We found that L1361, a low-pass filter in the record chroma path via Q1361 to the head amplifier chip, was open-circuit. A replacement fixed it good and proper! This little machine is around with other brand badges on it. **D.C.W.**

JVC GR323E

Problems with the dew sensor seem to be the flavour of the month with this and similar models at present. If a replacement sensor fails to provide a cure, check the plug/socket connection to the main PCB. **D.C.W.**

The Panasonic Alpha 3 Chassis

Part 3 — ***Ray Meadows***

In this instalment we'll deal with the microcomputer chip that's the heart of the control system and the video processing circuitry. This is all on panel E. We'll also take a look at the RGB output stages which, as usual, are mounted on the c.r.t. base panel (the Y PCB).

The Microcontroller Chip

The microcomputer chip used, in position IC1213, is a Matsushita type MN1871611. Its processor section is a 6502. All Alpha 3 models use it, though the TX37A2G has a version with a different mask, suffix -TKM.

This 64-pin customised chip contains 16K of RAM and has seven control ports, an infra-red remote-control input, RGB on-screen display outputs, four seven-bit D-A outputs

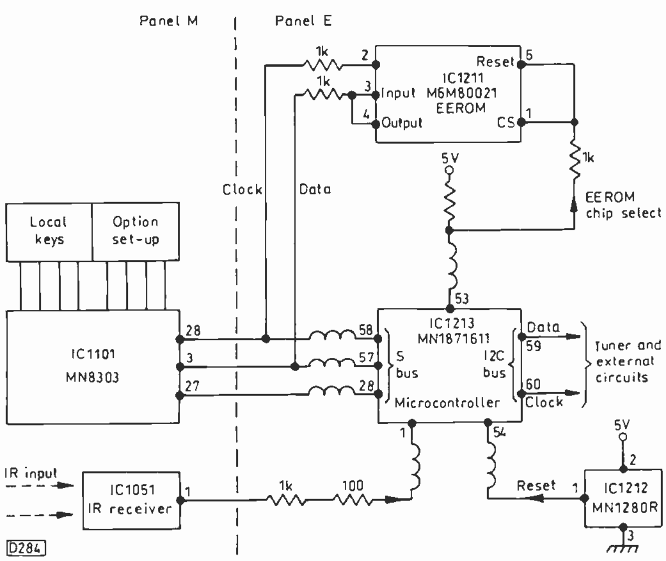

Fig. 1: Block diagram of the control system.

and eight six-bit D-A outputs. Pin connections are listed in Table 1. Peripheral components include a dual output crystal module that's connected to pins 62 and 63, a reset timer chip (IC1212) that's connected to pin 54 and an EEROM (IC1211) for factory and customer preset control information. This chip is linked to the microcontroller chip via the S bus. The input from the IR infra-red remote control system, at pin 1, comes from an amplifier chip (IC1051) on board M. Fig. 1 shows the system in block diagram form. Series inductors are included in most of IC1213's input and output control lines to provide protection.

Depending on the options incorporated in the particular model some of IC1213's pins may or may not be connected to external circuitry. Even when externally connected some functions operate only with certain models: for example pins 9 and 48 operate only with satellite-equipped receivers.

The purpose of some other pins deserves a word of explanation. Links and capacitors connected to pins 2, 3 and 4 set up the receiver's audio modes: Zweitone, Nicam and dual Zwietone/Nicam models use different combinations. With UK receivers the scart slow switch function is disabled by connecting pin 6 to the positive supply via a resistor. Pins 8, 51 and 52 select the received broadcast mode: pin 8 switches between PAL and Secam while pins 51 and 52 provide transmission standard selection, either PAL I, PAL B/G or Secam L/L'. Some sets also have manual colour and system buttons on their control panels. NTSC and modified-NTSC signals are decoded by the PAL circuitry and are handled by all sets including UK models. Pins 29 and 30 are used only with sets for the French market, pin 29 selecting positive video while pin 30 switches the sound i.f. to select the low audio carrier with Secam L' transmissions.

These functions are enabled by a diode matrix attached to IC1101 on panel M, i.e. on whether or not certain diodes are present – see Fig. 2 and Table 2. This determines a set's 'identity', i.e. whether a set will work with French or German signals, with satellite signals etc. IC1101 also manages the local key commands. Identity information and local key commands are sent from IC1101 to the microcontroller chip (IC1213, pins 28, 57 and 58) via the S bus. As we've seen, an EEROM is also connected to this bus. As some of the channel and preset information varies from country to country, differently programmed EEROMs are fitted at the factory – they usually have coloured lines or dots to indicate the program type.

Some features that the hardware makes possible are not implemented in UK models. As an example, the colour transient improvement circuitry is included in the picture signal improvement chip but the CTI option is turned off by the diode matrix: removal of a single diode will bring the CTI feature into operation should you want to try this. Most extra features will however require additional hardware to be added.

The Self-test Mode

Another feature of the microcontroller chip is the self-test mode. To bring it into operation, press the set's

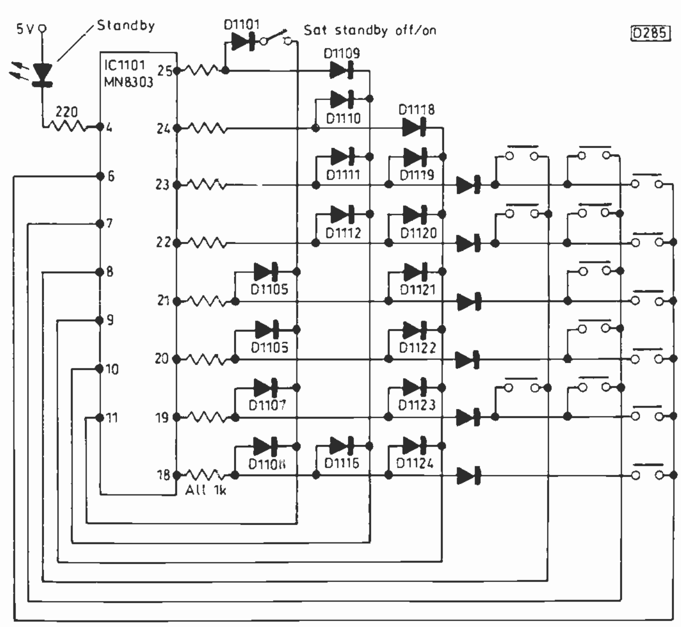

Fig. 2: Local key/options matrix.

volume down button and the remote control unit's off-timer button simultaneously. This produces five results via the on-screen display. In normal circumstances they should all read 'ok'. The first three results are followed by numbers. The test checks relate to the tuner, DBS (the satellite tuner), the picture signal improvement (PSI) chip, the teletext decoder and the EEROM. The numbers vary with tuner type, the satellite pack and how the PSI chip is set up (CTI functional or not). Note that the DBS test merely checks the path for the DBS system in the micro-controller chip: as this path is present in all micro chips the reading obtained should be 'ok' whether the set is satellite equipped or not. To exit the self-test mode, press any local or remote control unit key. The user analogue controls are then reset to their factory conditions, i.e. contrast at 80 per cent, colour and brightness at 50 per cent, bass and treble flat etc.

During production a special set up is programmed into the EEROM to pretune the programme positions to the factory's internal signals and set all the analogue remote-control functions (volume, colour etc.) to the high-speed mode so that they can be adjusted rapidly. This once-only set up is cleared by entering the normal self-test mode, which is done before the set leaves the factory.

Video Processing

Fig. 3 shows a block diagram of the video processing system. The circuit is made more complicated by the numerous AV and S-video modes and, in Continental sets, the Secam facility.

The video signal arrives at panel E from the AV switch described last month. It's first spilt into separate luminance and chrominance components by the luminance delay line/filter DL301 and the chroma bandpass filter LC601. Both filters have control pins that enable them to be switched for operation with different standards, the control signal being provided by the multistandard colour decoder chip IC601. For example the luminance delay line's trap frequency is set to 3·58MHz when the decoder senses an NTSC signal. Secam-equipped sets have an additional path for the Secam chroma signal. The outputs from LC601 and DL301 are passed via buffer stages to the colour decoder chip IC601 and the black-level expander (BLE) chip IC301 respectively.

When an S-video signal is being processed however the luminance delay line is not required. In this mode the micro-controller chip produces an output at pin 5 to forward bias

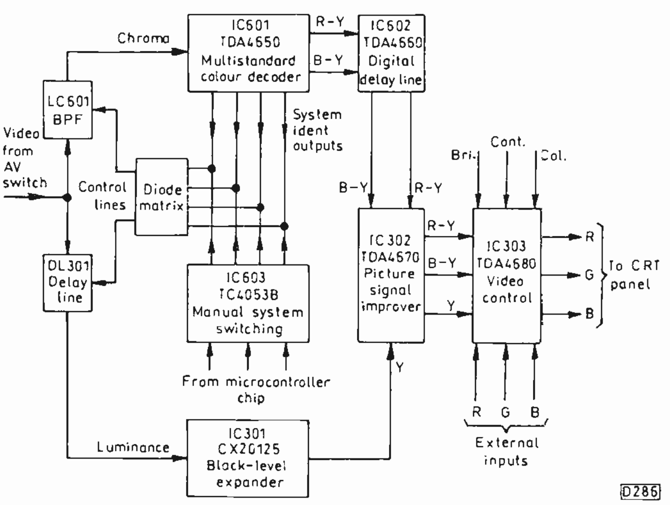

Fig. 3: Video processing block diagram.

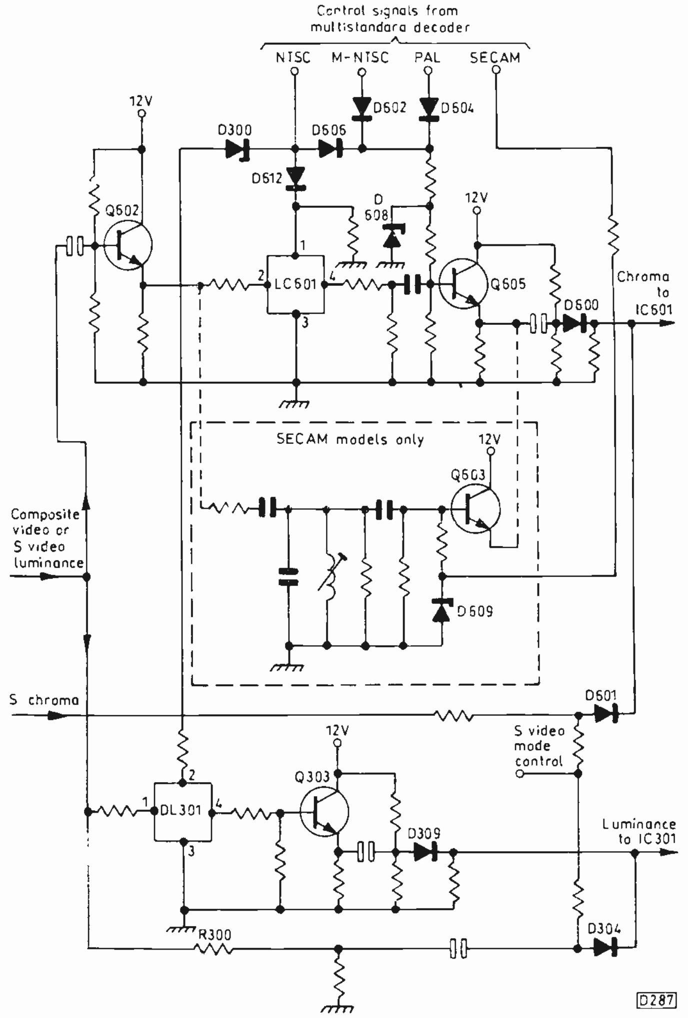

Fig. 4: The chroma, luminance and S-video input signal paths in the video processing section of the receiver.

diode D304 and reverse bias diode D309 (see Fig. 4). The luminance is thus forced to take the alternative route via R300, bypassing the delay line.

The Black-level Expander

The Sony CX20125 black-level expander chip is more commonly found in Sony sets. The idea is to 'stretch' the luminance information in dark areas of the picture artifically, enhancing its visibility. It does this by comparing the average signal black level with a sample produced during the blanking interval. The result is used to adjust the luminance gain nonlinearly.

It's really a form of variable gamma correction that works best with a grey picture but not with a picture that contains peak white and black (a test pattern for example). While the circuit is useful in many cases it can be confused when, for example, white subtitles appear on a dark picture. This can result in an undesirable 'pumping' of the average picture brightness. The value of R306 controls the BLE effect: the lower its value, the greater the effect. The value was changed during the production life of the chassis. IC301's output is buffered and then passed to the PSI chip IC302.

The Multistandard Colour Decoder

While black-level expansion is taking place in the luminance channel the chroma signal is being processed by the Philips TDA4650 (version 3) multistandard colour decoder

Table 1: Microcomputer chip pin connections

Pin	Function	Pin	Function	Pin	Function
1	Remote control input	23	Tint DAC output	44	Red OSD output
2	Nicam mode M1/2 select	24	Contrast DAC output	45	Volume DAC output
3	Nicam/f.m. select	25	Brightness DAC output	46	Mute 1 output
4	Stereo/mono	26	Sharpness DAC output	47	RGB switching control
5	Text/S-video switch	27	Chassis	48	Satellite select
6	Scart slow-switch enable	28	RC receiver bus control	49	AV2 control input
7	Search stop input	29	–/+ video select	50	AV1 control input
8	Colour system select	30	VHF low select	51	System 2 output
9	Polariser skew DAC output	31	Picture noise reduction on/off	52	System 1 output
10	AFC input			53	EEROM select output
11	50/60Hz switch	32	Standby/on output	54	Reset input
12	Chassis	33	V defeat (n/c)	55	Field sync input
13	No connection	34	Nicam/f.m. select	56	High-speed switch
14	Bass DAC output	35	Zwietone select	57	S bus data (SBD)
15	Treble DAC output	36	No connection	58	S bus clock (SBT)
16	Balance DAC output	37	+5V supply	59	I2C bus data (SDA)
17	Horiz. centre adjust (text)	38	+5V supply	60	I2C bus clock (SCL)
18	Music/speech output	39	Line sync input	61	+5V supply
19	No connection	40	Mute 2 output	62	Clock oscillator 1
20	Ambience control output	41	Blanking output	63	Clock oscillator 2
21	Colour DAC output	42	Blue OSD output	64	Chassis
22	+5V supply	43	Green OSD output		

chip IC601. This device can process PAL and NTSC signals and, with the addition of a bell filter circuit and extra bandpass filtering in parallel with the main chroma bandpass filter, Secam signals. System selection is automatic, the chip checking all new signals for 80msec in each mode to establish their type. When the chip has reached its decision, system sense output signals appear at pins 25, 26, 27 and 28 for M-NTSC, NTSC, Secam and PAL respectively. These outputs control the bandpass filtering and the luminance delay line. A CMOS switch, IC603, is also connected to these lines to provide manual system selection via the microcontroller chip's colour system, SYS1 and SYS2 outputs, by forcing the selected system pin high.

Despite the advanced features provided by this chip there are few peripheral components. Most pins are connected to capacitors to set the options or for clamping. Pins 19 and 21 are connected to the 7·16MHz and 8·86MHz crystals for the NTSC and PAL/Secam reference oscillators. IC601's outputs consist of R – Y and B – Y colour-difference signals which are passed to a digital electronic delay line.

The Digital Delay Line

The TDA4660 delay line chip uses digital, switched capacitors to adjust the relative delay between the R – Y and B – Y signals, cancelling out phase errors. The signals are clocked through the chip by a 3MHz clock signal that's synchronised with the line-frequency component of the sandcastle pulses. After passing through the delay elements the colour-difference signals are fed via an internal 1MHz bandpass filter to the next, PSI chip.

The Picture Signal Improvement Chip

The TDA4670 picture signal improvement chip IC302 contains noise coring, colour transient improvement, aperture correction and picture sharpness control.

When a colour-difference signal that will benefit from PSI is detected, i.e. one with a clearly-defined transient, a sample is differentiated, rectified and used to open a switch that isolates the output from the input. This signal isolation maintains the last transmitted value for the duration of the transient, after which the input is reconnected to the output. The result is the well-known CTI effect, i.e. sharpened colour transients.

The luminance signal is fed to a switchable delay line arranged as thirteen 90nsec cells. This selective delay enables the total luminance delay to be equalised with that of the colour-difference signals following the CTI circuit, thus helping to eliminate Y-C fringeing. After this, aperture correction is applied to the luminance signal: delayed, peaked 2·6MHz and 5MHz signals are added to the luminance signal to sharpen it (the 'aperture' is reduced). The

Table 2: Diode matrix options

Diode	Function
D1101	Sat standby off (out)/on (in)
D1105	Text (out)/no text (in)
D1106	Loudness off (out)/on (in)
D1107	AV1 RGB auto (out)/not auto (in)
D1108	SIF single (out)/multi (in)
D1109	France (in)/other models (out)
D1110	4-step sharpness (out)/64-step (in)
D1111	CTI on (out)/off (in)
D1112	OSD English (out)/symbols (in)
D1116	2 AV inputs (out)/3 AV inputs (in)
D1118	Fine tune on (out)/off (in)
D1119	No sat pack (out)/sat pack (in)
D1120	UHF tuner (out)/VHF-UHF tuner (in)
D1121	Ecom (out)/Philips (in) tuner
D1122	Secam L off (out)/on (in)
D1123	PAL/NTSC (out)/PAL/NTSC/Secam (in)
D1124	PAL/NTSC (out)/PAL/NTSC/Secam (in)

noise-coring system then filters random noise from 'flat' parts of the signal where no h.f. information is present. This works well, since noise is most noticeable in areas of the picture that don't change. A peaking circuit finally adjusts the mid- to high-frequency gain, giving the frequency response a boost.

These functions can all be controlled via the I2C bus. Note that the PNR (Picture Noise Reduction) button on the remote control unit activates the noise-coring circuit only when the picture sharpness is set above the mid position. As a result the effect may not always be obvious, especially when a set has been despatched with the sharpness control set below the mid position.

Video Control

The luminance and colour-difference signals finally pass to the TDA3505 (later TDA4680) video control chip IC303, where they are matrixed to produce the RGB tube drive signals. Switching between the off-air picture and the text, OSD generator and AV1 inputs is carried out by this chip, also adjustment of the brightness, contrast and colour levels (under the control of the microcomputer chip). Presets for factory contrast and brightness adjustment are provided: they can be readjusted in accordance with the instructions given in the service manual.

The RGB drive signals for the output stages on panel Y emerge at pins 1, 3 and 5 respectively. A feedback input is provided to enable the chip to carry out automatic grey-scale correction over the life of the tube. Flashover protection at the output pins is provided by zener diodes that are normally connected to chassis via the service switch. When the switch is opened, the RGB outputs rise and the base of transistor Q402 is earthed, blocking the field feedback and thus stopping the field scan. The resultant horizontal white line can be used to adjust the 'low-light' white balance.

RGB Output Stages

Fig. 5 shows the type of RGB output circuit employed. Cascode circuits are used, the lower transistor (Q365/6/7) in each channel having in its emitter circuit a cut-off control to set the biasing. In addition a drive adjustment preset is included in the R and G channels. Between them these controls enable correct cut-off and white balance to be achieved. The output stages are powered by a 210V supply derived from the line output stage.

White balance adjustment is straightforward. Operation of the service switch kills the field scan and the RGB signals. The first anode (screen) control on the line output transformer is then turned to minimum to extinguish the horizontal white line across the screen. Connect a high-impedance voltmeter to the tube's blue cathode and adjust the blue cut-off control for a reading of approximately 180V. Advance the setting of the first anode control until a white line is just visible. Cancel any coloured tint present by using the red and green cut-off controls. With the display restored to normal, adjust the high-lights (if necessary) using a Minolta or similar light meter.

Switch-off Spot Supression

Q354/5 provide switch-off spot suppression. The operation of this circuit makes use of the fact that at switch off the 16V supply decays faster than the 210V supply. In normal operation C361 is charged by the 16V supply, which is also applied to the base of Q354 via zener diode D375 and R380. Thus neither Q354 nor Q355 is conductive. At switch off the 16V supply decays rapidly, leaving Q354's emitter at a higher voltage than its base. Both Q354 and Q355 conduct, removing the bias from the bases of the upper transistors in the RGB output stages. Because of the high beam currents used with invar-mask c.r.t.s, it's important that the spot suppression works correctly. Otherwise spot burn can very easily occur.

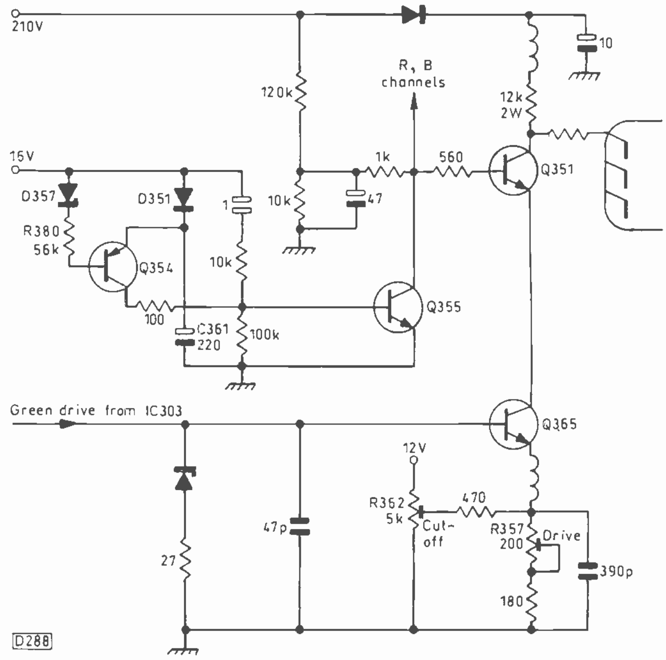

Fig. 5: The green output stage and switch-off spot suppression circuits on the c.r.t. base panel.

Next Month

In Part 4 we'll look at the audio, scan and remaining circuitry.

Soldering and Desoldering Surface-mounted Components

Part 2

Steve Beeching, T.Eng.

An advantage of the Pace system described last month is that you can start with a budget power unit and one handpiece and add to this as the need arises. I was lent a top-of-the-range MBT250 power unit (see Fig. 1) with a selection of handpieces so that I could try each one out and get a feel for its operation.

On Test

The first thing I set out to do was to remove some surface-mounted quad flatpack chips – the ones with legs on all four sides. There was a limitation to what I could do as I didn't have every type of tip available – it was not possible to tell Pace in advance which types of chip happened to be on the scrap boards I used for test purposes.

The first i.c. I tried was the main system control chip on an old Hitachi VM200 camcorder PCB. It measures 22·9 x 16·8mm and has 64 legs. The tool selected for this job was the thermopik TP65, which has a suction pad, with the correct tip. I chose this tool because it would not be possible, in view of its size, to lift the i.c. by the surface tension of the solder alone. The tip temperature was set to 300°C, with a 35°C offset to compensate for the effect of the large tip. To aid the solder reflow I coated the legs with flux and tinned the quad tip with solder. My first attempt to lift the chip was a failure, as not all the legs had been reflowed. This however illustrated the safe design of the suction pad: it was not strong enough to tear the i.c. off the PCB, letting go so that there was no print damage. My second attempt was successful and, fired with enthusiasm, I searched for another board and had a go at the same i.c., again successfully.

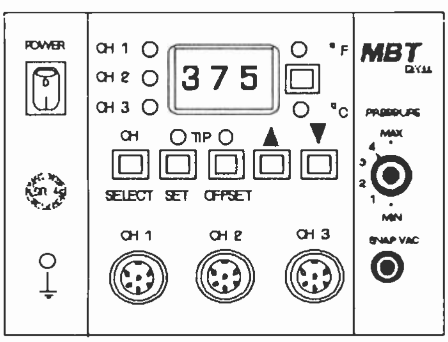

Fig. 1: Front panel, Pace MBT250 power unit.

I then used the SX70 solder extractor tool to clean the print and the legs of the chips, then neatly refitted them. Because of possible damage as a result of heat or static charges chip refitting is not recommended, but as these were not working panels I decided to try it out.

To do so I first cleaned the board with 'Micro Care' circuit cleaner supplied by Pace. A dispenser with a stiff brush attached is used to squirt the cleaner on to the PCB. The board is then vigorously scrubbed. After wiping off the excess fluid with a paper kitchen towel I brushed some flux on to the print. The i.c. was then placed on the PCB and, to maintain alignment, its corners were secured with small dabs of solder. The legs were coated with flux and solder was applied from the tip of the IR70 soldering iron: a tip of about 2mm was used, providing a solder reservoir sufficient for soldering five or six legs at a time. It was very difficult to blob two legs together but, by way of experimentation you understand, I managed to do so. I used the extractor to remove excess solder from the legs and finally tidied up the joints with the soldering iron. Resoldering without blobbing adjacent legs together was achieved because of the relatively low working temperature: the solder didn't short across to an adjacent leg as just enough flowed into the connection. The final result was perfect – as if the chip had never been removed!

I next used the SX70 solder extractor to remove some large motor-drive chips with thick legs. Although the tip wasn't quite the right one there were no problems. I was able to place the tip over the leg so that it went inside. Once the solder melted it started to flow into the tip even before I started the vacuum pump.

A good test of low-temperature working is removal of a plastic connector from a PCB. Using the SX70 solder extractor operating at 300°C I managed this with remarkable ease and efficiency – there was not a single burn mark on the connector.

The convenience of having three handpieces in operation together, so that the extractor or soldering iron can be selected immediately, cannot be overstressed.

My next test was to remove a chip from a difficult position. I selected a camera panel with a 44-pin flatpack chip in a confined space. It was in a screening can with just 10mm spacing on two sides and surface-mounted components close to the other sides. In this situation simple hot-air equipment is difficult to use as adjacent components are likely to be dislodged. This time I used the IR70 soldering iron with a 12 x 12mm tip. Again the chip's pins were coated with flux and the tip was tinned with solder. After reflowing its legs the chip, with a twist and a lift, came off in the tip.

After cleaning the print and its legs I refitted the chip, using the 2mm soldering iron tip as a reservoir for resoldering the legs. Only two legs blobbed together, where one was a corner leg on a large print land: as heat conduction via the print occurred, the solder bridged. I was able to resolve the problem by using the solder extractor and iron to clean and resolder the leg. As mentioned above, it's very helpful to have both handpieces operational at the same time.

The TT65 thermotweezers make removal of surface-mounted components easy. I fitted two flat surface-mount tips with a width of 2mm at the blade tips. All that was necessary to remove resistors and capacitors was to grip, heat, twist and lift – almost all in one go! Use of a single iron to remove large surface-mounted electrolytic capacitors has always been a problem because the relatively large PCB pads and component tabs cool quickly. The tweezers again made this easy: grip, wait to heat then twist and lift. The tip temperature with offset was about 300°C, so there was no print damage or lifting.

The same tips can be used to remove three-terminal devices. With a transistor the base and emitter can be bridged with one tip while the other is used for the collector. While playing about I whipped transistors off a surface-mounting board as if I was just picking them up.

Some of the time I didn't use exactly the right tip for the job. This illustrates the flexibility of the Pace tools in that the tips are able to cope with a wide range of tasks.

As a Grundig service centre I often encounter leadless quad chips. They are normally fitted in holders but you sometimes find them soldered directly to the PCB. These i.c.s are difficult to remove and even more difficult to replace as the legs fold back on themselves beneath the chip. One way to remove such a chip is to cut each leg with fine cutters. Another is to use the TT65 thermotweezers with triangular tips. Chip removal is the same with all types. Flux the legs, tin the tips and approach the device from opposite corners: clamp with the heated tweezers and lift.

Component Replacement

The technique to use when fitting replacement components is a matter of personal preference. I prefer to flux the legs and print, then apply the solder from a soldering iron tip used as a reservoir. If the finish is not too good the hot-air stream from the thermojet TJ65 can be used to make it look neater. My son is much happier applying solder paste from a syringe then using the thermojet hot-air pencil to reflow it. Where there are a lot of surface-mounted components close to an i.c. the use of hot air may not be such a good idea: some of them may go walkabouts!

A problem that can occur when using a temperature-controlled soldering iron at such low temperatures is rapid cooling of the tip. I've encountered this before: the soldered joint conducts heat away from the tip and then takes a long time to reflow, if it does at all. The construction of the Pace handpieces along with the SensaTemp system prevent this happening. When heat is conducted away from the tip on its application to the joint, considerable power is applied to the heater to compensate. This is done very quickly, maintaining work continuity, and may not be noticed. It is this ability to maintain a constant low tip working temperature, with an offset to adjust for the larger tip sizes, that makes working at 300°C possible.

Test Summary

For general bench use the MBT201 power unit with the IR70 iron and a range of tips to suit your needs, an SX70 solder extractor plus some tips and a TJ65 thermojet hot-air pencil is a good choice. The TT65 thermotweezers or TP65 thermopick and a range of tips could be added where a lot of work on surface-mounting boards is done: in this case however the MBT250 power unit would be more suitable.

As I already have a Weller hot-air pencil I opted for the MBT201 with an IR70 iron, SX70 solder extractor and the TT65 tweezers. While the SX70 comes with a set of tips and cleaning brushes the tweezers had no tips at all! So having spent about £1,000 on the kit I had to spend another £150 on tips. Who said you can repair a camcorder for ten quid?!!

Quad Flatpack Chips

We've so far discussed surface-mounted component removal using the least expensive method, cutters, and the more expensive method with specialised tools and tips. There are two problems when shaped tips are used to remove a quad flatpack (QFP) chip: contact and accessibility.

To remove the i.c. without print damage you have to ensure that the solder on all the pins has reflowed before the physical act of removing the chip is tried. With a large chip that has a considerable number of legs there is a greater chance of damage. And the more legs, such as with a 100-pin QFP chip, the smaller and more delicate the PCB pads will be. With regard to access, once the tool has been placed around the chip it's not possible to see whether all the connections have reflowed: 99 may have done so but one may not. If the tool is then twisted the print will suffer.

The danger is reduced, but not eliminated, when the Pace thermopick or another tip with a small suction pad is used. Unlike the chips used in computers, those used in brown goods products may be stuck to the PCB. This makes it difficult to judge whether a chip has not been fully reflowed or is just stuck.

The method outlined so far requires flux to be applied to the chip's legs and a generous layer of solder tinning on the tip. If the tip or the tinning is irregular, one or more legs may be not fully contacted and therefore not reflowed, and this cannot be seen. Some solder equipment suppliers recommend that with the larger types of QFP chips this reflow problem is overcome by first soldering all the legs together. Then, when a quad tip is applied to the four solder strips, reflow at all the legs is guaranteed. It's questionable however whether the thermal inertia of this relatively large amount of solder is good for the print pads, bearing in mind the extra heat required to remove the excess solder. I have to admit to losing a print pad or two when using shaped tips. So the chance to review the Leister Hot Jet hot-air system was welcome.

Leister Hot Jet System

I am wary of blowing hot air on to high-density surface-mounting PCBs as it's always possible for adjacent small components to go astray. So it was a challenge to be converted to this system.

The Welwyn Tool Co. Ltd. supplies the Leister Hot Jet Rework Station in a wooden case that has a preformed base with compartments to hold the various tools supplied with it. At the rear there's a metal holder for up to eight nozzles. At the front there's a compact PCB holder that consists of a horizontal bar and two clamps. The Hot Jet hot-air blower, for the removal and replacement of surface-mounted components, is on the right-hand side. At first sight it looks large and heavy, but first impressions are not always right: it's in fact deceptively light in use. The blower generator, on the left-hand side, contains the heater, motor and controls. These consist of a small on/off switch, a temperature controller and an air-flow regulator. The mains cable is connected to this unit and the air intake is here.

The Hot Jet blower has a working end that's about 20mm in diameter and 60mm long, with an output grill. On to this can be fitted the largest range of nozzles every devised. There are far too many to list. I stopped counting at ninety, but the manufacturers say that there are some 400 in all. Each nozzle (tip) is shaped to suit a particular type of device. For a QFP chip the nozzle has four side vents that match the size of the i.c. During use I found that there's a degree of flexibility here: i.c.s that are a couple of millimetres larger or smaller than a particular nozzle can be successfully removed with it.

The nozzles are made of high-grade stainless steel and are very tough. Unless you run over one with a steam roller or subject it to similar abuse a nozzle will probably last for life. This means that they are not cheap: a 16·7 x 16·7mm nozzle costs about £104. A nozzle hire service could possibly be set up by manufacturers to suit the range of chips they use.

Use

In use there is no direct contact with the chip being removed. The method is simple. Hold the tool above the chip with one hand, hold a pair of tweezers in your other hand, watch the solder reflow, then lift the chip off the PCB.

The temperature calibration is not intended to be accurate. You soon learn that a reading of 3/4 on the temperature knob is about right for the average video/audio/camcorder QFP. Air-flow control is excellent – smooth down to the lowest setting. At the other end the air flow is very high: it's unlikely that you will ever need this unless you want to clear a PCB of components in a red-hot, howling gale.

In tests I found that a fairly light air flow enabled me to remove a QFP chip that was surrounded by a large number of high-density passive components without any of them going walkabouts. As with all SMD tools there is need for practice and learning takes time.

A nozzle with a small pipe for use as a hot-air pencil is supplied with the work station. It can be used to remove and replace passive components. The hot-air pencil nozzle can also be used, with the solder paste and syringes that are supplied with the workstation, to replace QFP and DIL chips. If the chip is heat-sensitive however it would be better to use the method previously described, i.e. apply flux to the legs then apply solder via a soldering iron as a reservoir. Again it's a matter of what suits you best and the equipment available. I have to say that the Leister Hot Jet works well as a hot-air pencil.

The Leister Hot Jet system from Welwyn Tools is excellent value for money. The complete work station is less than £500, the blower on its own £243, both plus VAT. Most QFP nozzles cost about £104. This rises to £121 for the type that will deal with chips whose legs curl beneath them.

In Conclusion

With just a couple of nozzles the Leister Hot Jet work station will suit as a starter kit for SMD work. It is fair to say that the Pace and Leister equipment complement one another very well. A professional service department that does regular SMD work would do well to consider having them both.

Addresses

For details of Leister equipment apply to the Welwyn Tool Co. Ltd., 4 South Mindells, Welwyn Garden City, Herts AL7 1EH. Telephone 0707 331 111, fax 0707 372 175.

For details of Pace equipment apply to Pace Europe Ltd., Sherbourne House, Sherbourne Drive, Tillbrook, Milton Keynes. Telephone 0908 277 666, fax 0908 277 777.

Weller tools are manufactured by Cooper Tools Ltd., Sedling Road, Wear 6, Tyne and Wear NE38 9BZ. Telephone 0914 166 326, fax 0914 179 421.

The Denon SC7000 desoldering tool was described in a previous test report in this magazine, see the August 1993 issue, page 718. It's available, along with Weller equipment and general soldering tools, from Farnell Electronic Components, Canal Road, Leeds LS12 2TU. Telephone 0532 636 311, fax 0532 633 411.

Next Month in TELEVISION

SERVICING THE HITACHI C2118R/T

These colour sets were launched in 1990. Picture quality is excellent and reliability reasonably good. Like even the most reliable of sets however there are some common problems. Fortunately they are fairly straightforward and can be fixed economically. Mike Leach provides the necessary know-how.

100Hz FIELD RATE DISPLAYS

Flicker has always been a drawback with 50Hz interlaced displays. Use of a field-store memory enables the rate to be increased to 100Hz, but there is more to it than just that as Eugene Trundle explains in the concluding instalment of his Modern TV Receiver Techniques series. The field store can also be used for digital noise reduction and to implement special effects such as picture zoom and PIP.

NV QUALIFICATIONS

Dramatic changes are about to take place in Brown Goods industry training and qualifications, with the move to NVQs (National Vocational Qualifications). There is good and bad in the changes as so far proposed and much remains to be settled, but they will affect us all. Joe Cieszynski sums up the present situation.

SERVICING THE HANTAREX MTC9000

Now here's something different – an RGB monitor that's widely used in games arcades. Repairing this type of equipment could provide an additonal source of revenue for the TV service engineer. Peter Hubbard explains what's required.

TOSHIBA SERVICE BRIEFS

More know-how from Toshiba – held over from the May issue because of space problems but definitely to appear next month.

THE PANASONIC ALPHA 3 CHASSIS

There are still some novel aspects of this complex chassis to be covered, including the CCD comb filter system used in some models.

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CD Player Repairs

Les Austin

My dealer friend John asked me to fix a Pioneer PDZ82M. That same day my elder son arrived with an identical player that belonged to his pal. Probably the spindle motors, I thought: should be a couple of easy repairs. Now those of you with an interest in CD players will know that Pioneer machines and faulty spindle motors seem to go together. At another manufacturer's one-day course I attended recently the technical expert was all too keen to tell us that Pioneer has problems with spindle motors. He did admit, though only in a whisper, that his firm also had problems with spindle motors. So it's not only Pioneer then. What exactly is the problem with those Pioneer motors?

The Pioneer Spindle Motor Problem

The problem is with spindle motor part no. PYY1109. As a replacement, Pioneer now supply motor part no. PEA1233. To the best of my knowledge, it's not possible to distinguish between the two. Models that had the PYY1109 fitted when new include the PDM410/510/610/710, the PDT303, PDX950M, PDZ62M/62T/82M/83M/560T and XDZ53T/63T. There may be others.

As the motor deteriorates, it loses its ability to accelerate to the required maximum speed – about 400 r.p.m. for the innermost part of the track. This is of course where the table of contents (TOC) is to be found. So when you receive the player the ticket will probably say 'dead' or 'will not play'.

The first step to take is to enter the test mode. Do this by pressing the 'test' button then switching the player on. Some models don't have this button: instead you'll find a pair of links marked 'test'. Shorting them together with a screwdriver has the same effect. Once in the test mode press fast forward. This moves the sled towards the outer edge of the disc. Release the button when the sled is at the centre disc position. Next press PGM or, if the player doesn't have this, press the forward track-jump button. This will load the no. 1 disc, the laser will light and the focus search will begin, hopefully ending up with a locked focus servo. Press play and the disc will rotate at about 300 r.p.m. – assuming that the motor still has some life in it. When the disc has reached this speed, press pause. This will lock the tracking and spin servos and should produce some nice music. So is there really anything wrong with the motor?

Since we didn't start at the inner part of the track, it follows that the TOC won't have been read. Also, one of the advantages of the test mode, the disc motor has to spin at only 300 r.p.m., which it managed, instead of 400 r.p.m. How do we confirm that the motor is faulty?

The following procedure is recommended by Pioneer. Disconnect the motor leads and connect them to an Avometer switched to its low-ohms range. The motor should rotate and you should get a reading of more than 20Ω. Carefully stall the motor with a finger. Note the new reading, which should not be less than 10Ω. Continue releasing and stalling the motor until you're sure that the reading never falls below 10Ω. If one or more of these conditions isn't met, the motor is faulty. This test method has never let me down. It's not uncommon to get meter readings of only a few ohms: sometimes when you allow the motor to rotate you may get a dead short reading. A PEA1233 replacement motor will almost certainly provide a cure.

Sometimes you find that a player which arrives with a 'dead' ticket will not load a disc or won't unload one that's inside. When you've dismantled the player you may find that circuit protectors ICP30 and ICP31 are open-circuit. This is usually because the motor has a spot with a dead short. The circuit protectors are not fitted in all units.

It's important, when the disc motor has been replaced, to set the turntable height. This is usually for a clearance of 0·9mm beneath the turntable, but all mechanisms have a moulded-in setting tool. The exact method is clearly explained in leaflet PGB/141 which Pioneer sends out with replacement motors.

If you are not the sort of ageing engineer who possesses an Avometer you can use the following variation of the above procedure. Connect a 20Ω resistor in series with a 1·5V cell (D or R6) and your newfangled digital meter switched to its d.c. range (current). A short-circuit motor will take 75mA: 10, 20 and 50Ω readings correspond with 48, 36 and 20mA respectively.

Back to the Faulty Players

So what about my two faulty Pioneer players? The first one had a faulty spindle motor and was easily repaired. Not so the second one.

This one didn't read the TOC but was all right in the test mode. A quick Avo check showed that there was nothing wrong with the disc motor. Back to the test mode and get the machine playing again. This time I left it to run for a while. Until, that is, I realised that about every forty seconds it jumped back and repeated the music. The sled rail wasn't very clean – it was obviously a heavy smoker's machine, as the colour and smell indicated. So I cleaned the rail with swabs and isopropyl alcohol and tried again. Still the same, and time to check the sled motor.

Using the same procedure as for a spindle motor, I initially obtained 50Ω readings. Patient checking revealed an open-circuit spot however. This is the first time I've had a sled motor problem with a Pioneer machine. A replacement, part no. PXM1002, was obtained and I decided to replace the spindle motor at the same time as a precaution – I don't like bouncers.

About twenty years ago I had a problem with a Pioneer motor: new big-end rollers, piston, rings and gudgeon pin cured that one, a Model 600A chainsaw, but I don't suppose that you want to hear about that sort of Pioneer!

A Couple of Aiwas

When I took his Aiwa back John handed me an Aiwa Model DX740 midi unit with a faulty CD section. "The disc spins slowly. I think it's a faulty motor" he said. Next I called in on Stan. He presented me with an Aiwa Model CX800E midi, also with a faulty CD unit. "The disc doesn't spin. I think it needs a new motor" said Stan. It seems that things are coming in pairs at the moment. I didn't have a manual for either of these machines, but thought that I'd be able to do something.

The DX740, actually a DXM740 player, being part of a CX740K system, contained the Sanyo chip set, with an LA9201 r.f. chip and LC7863 processor. The nearest circuit I could find was for a Samsung RCD2500 which has an LA9200 r.f. chip. With this model if you locate pin 22 of the

LA9200 chip and follow through a 10kΩ resistor you come to the r.f. test point. I connected the scope to the same point in the Aiwa machine and found a nearby chassis point. After setting the scope to 50mV/div and 500nsec/div with a 10:1 probe, I inserted a disc and pressed play. As John had said, the disc rotated slowly. The scope displayed a low-amplitude, incoherent mess. There was no way that the processor was going to make any sense of that. A laser power meter check produced a reading of some 0·1mW, about right, but I was not convinced that the Sony KSS150 laser unit was o.k. I have a good second-hand spare that I use for testing. When I fitted this there was a clean r.f. signal, the TOC was read and I could listen to nice music.

Do you recall my previous comments about the Sony laser units? The KSS210 replacement that arrived cost £24 and was marked 'made in Singapore'. This unit produced an r.f. signal with an amplitude of about 3V peak-to-peak. I reduced this to 1·6V p-p with preset SFR156, which I had correctly guessed was the laser power adjustment. I cannot find a definitive figure, but think this is about right for the Sanyo chip set. By cribbing further from the Samsung manual I was able to complete the adjustments as follows.

E-F balance: Connect the scope to TP1-3 (signal) and TP1-1 (chassis), set to 50mV/div and 2msec/div with d.c. coupled 10:1 probe. Use SFR151 to centralise about the d.c. zero axis the waveform obtained during a track jump.

Focus bias: Reset the scope's sensitivity to 10mV/div, move the probe to TP2-1 (signal) and use SFR155 to set this to +200mV.

Whenever I work on a player I've not come across before and for which I have no manual, such as this one, I create a single-sheet manual which I place in a loose-leaf file for future use. In this case the player is fed from the mother unit via a 10-wire umbilical cable. I located the power supply and found that the transformer has 10-0-10V a.c. outputs to pins 1, 2 and 3 of the cable. Often I receive a CD player without the mother unit. Having this sort of information on file can save the hassle of getting the rest of the equipment brought along. The fact that this is a symmetrical supply is worth noting: it suggests that the earth reference for the r.f., focus and tracking adjustments will be at true earth level. The Samsung RCD2500 whose manual I'd been cribbing from does not have a symmetrical supply, so the reference for adjustments is not zero. Moreover the reference for the r.f. adjustment is different from that for focus and tracking. If you don't have the manual and don't appreciate this you'll never be able to align such a player.

Next to the Aiwa CX800E. This time there was a Sony chip set, also another KSS150 laser unit. The r.f. chip is the CXA1081S, which is quite commonly encountered. My crib this time was the manual for a Goodmans player (model not known but obviously, as with some other Goodmans machines, a Samsung unit with a different label). When I asked it to play the unit tried a focus search but failed to lock. I connected the scope to pin 2 of the CXA1081S chip, using a convenient adjacent chassis point and the settings described for the previous machine, and tried again. There was absolutely nothing to be seen. Time to try my spare laser unit again. Bingo, another successful diagnosis. Order a second KSS210 and set it up as follows.

First check that the r.f. output is 1·2-1·5V p-p – this shouldn't need adjustment. Next use SFR102 to set the focus bias to +200mV at pin 19 of the chip, in the stop mode. The same test point is used if you need to adjust the focus gain. This is usually for +100mV, using SFR104, during play: the waveform should just loose its 'sharpness' (h.f.) and should have a little slow d.c. wobble visible. E-F balance is checked at pin 20 of the chip, using SFR101 for adjustment. Use the same test point and SFR103 if the tracking gain needs to be adjusted.

Both John and Stan were hoping for motor replacements. Instead they got laser replacements.

A Kenwood Discman

A little Kenwood discman, Model DPC55, awaited my attention. The ticket said "doesn't work – repair only if not more than £25". My first reaction was to send it straight back to its owner, but a combination of curiosity and not too many outstanding jobs led me to insert a disc and ask it to play. The result was a funny whirring noise accompanied by failure to read the TOC. I held the machine in my hand, removed the disc and saw the optical unit move quickly to the outer edge. When I moved it so that I could see it better the sled moved back to the inner edge. I realised that gravity was involved here somehow – tilting the machine set the sled off on its unrequested traverse. When I dismantled the player I saw that a plastic arm was fixed to the Toshiba manufactured laser unit: this was shaped so that as the traverse worm shaft turned the laser would move across to the required position. But the threads in the plastic had worn away.

Kenwood supplied a replacement, part no. 21W8184, for the princely sum of 39p. When I fitted it the player worked perfectly. This time the customer got his way – at just £25 (plus VAT of course).

The Soap Bit

And now for the soap, episode one.

I think I was about twelve. I was playing about with the electric kettle plug. It was a Wylex type which, some of you might remember, had a circular central earth pin and two rectangular-section outer pins for the supply. I'd connected it piggyback on to the 15A Wylex plug for the boiler. When I unplugged it I forgot to switch off and, since for some reason the plug's cover had been removed, I received my first real 'grand-daddy' of a shock. You might expect someone so young to be put off electricity for life – I very nearly was, permanently. But like everyone else in this trade I must be just too stupid: I suppose, without realising it, I was getting my first addict's fix.

I continued to get shocks from the loudspeaker grille of our Raymond radio receiver, without knowing the cause. And I played with batteries, bulbs, electric motors and suchlike, never having a clue about what was actually going on. I think I was thirteen when I built the mandatory crystal set: the first sound I heard was Eartha Kitt singing 'I love Paris' – I can almost hear it now. Next came a one-valve (3S4) radio receiver. It was, I seem to recall, a kit that another lad in my class never touched. This was followed by a three-valve kit. It had been bought by my unbelievably rich brother (he was a boy entrant into the RAF, and certainly seemed rich at the time) who had sent for it then left it alone. So I got it working.

A school pal and I then each bought an ex-WD no. 38 transceiver. His worked properly but mine would only receive – and not very well at that. It had cost me all my hard-earned wages as a paperboy. My inadequate skills at servicing were now evident: I never did fix it.

I might have done but I started work, and next came the first of a succession of love affairs. I bought my first motorcycle, and dirty oil-stained hands took over from electric shocks.

Modern TV Receiver Techniques

Part 17: Control and Communication

Eugene Trundle

For many years TV sets managed perfectly well without any form of 'intelligent' internal control. The knobs on the front turned them on and off and regulated what we've now come to call the analogue functions, such as volume, brightness and contrast: originally the actual signal or bias voltage was taken to the controlling potentiometer. Even when cordless remote control began to be used, all that was required at the receiving end was a simple command-decoder chip that could close say eight channel selector switches plus an on-off or standby switch and provide three-four voltage control lines for the analogue functions just mentioned.

Enter the Micro

With the advent of such features as voltage- and frequency-synthesis tuning systems, described last month, and advanced forms of teletext it became essential to provide TV sets with the sort of control system that VCRs had to have from the start. Working with a set of built-in instructions, a microcomputer chip can control and co-ordinate all the TV set's functions in accordance with viewer commands and feedback it receives from within the set. Use of such a chip in conjunction with a memory store enables a comprehensive and flexible control system to be devised, tailored to the set's price, type and features specification.

Microcomputer Basics

All digital computers operate in the same way, whether they are used in a pocket calculator, a missile tracking system or a TV set. The work is carried out by the central processor unit (CPU), alternatively known as an arithmetic and logic unit (ALU), which consists of gates, inverters, adders and some registers to store the results of calculations.

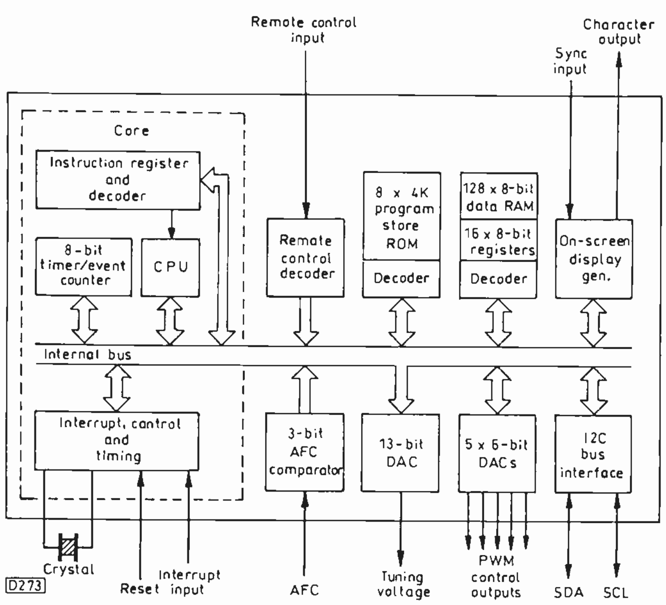

Fig. 1: Internal arrangement of a typical TV microcomputer chip: some of the custom blocks are optional.

Ports are required to enable data to enter and leave the CPU. Operating instructions have to be provided: these are stored in a read-only memory (ROM) within the chip. The ROM, programmed by the chipmaker, tells the microcomputer what to do, in what order, how to respond to the data and commands it receives and how to control the system, in this case a TV set, of which it forms a part. A certain amount of random-access memory (RAM) is incorporated – this is the basic difference between a microcomputer/microcontroller chip and a microprocessor – giving the device increased flexibility and in fact making it self-contained as a computing system (though additional external memory, and extra expansion port chips to increase the number of connections to the system, may be required). The internal RAM enables instructions and in-bound/out-bound data to be stored temporarily. Microcontroller chips for use in TV sets and VCRs go further than this, incorporating such things as serial-data interfaces, DA converters, instruction decoders and key-scan generators. On-screen display generators are often included nowadays.

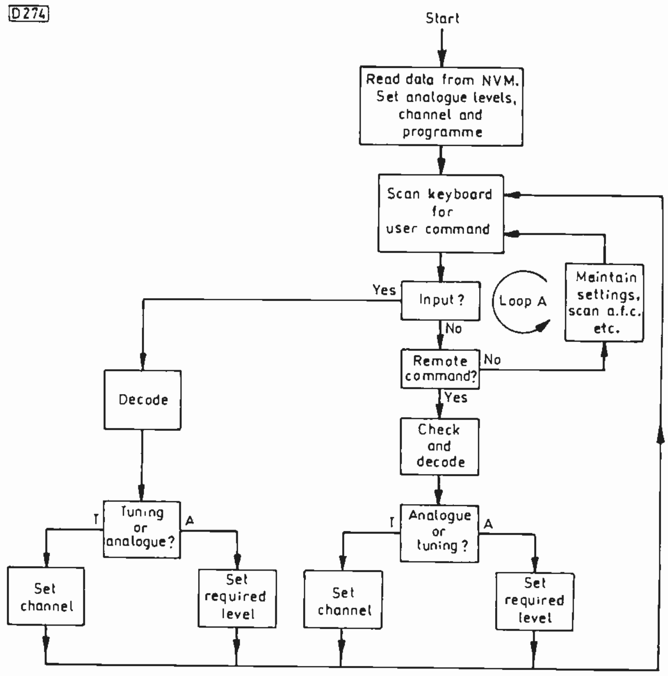

Fig. 2: Basic software program for TV system control.

Fig. 1 shows a typical TV microcomputer chip in simplified block diagram form. The internal data is in 8-bit byte form and is shunted around via a main highway that's referred to as a bus. A master oscillator has to be provided to time the control logic. This is called a clock and is controlled by an external crystal. The ROM's program is fixed during manufacture of the chip. One of the masks used during the fabrication of the i.c. does this, giving the chip its particular characteristics – each version of the i.c., distinguished by a suffix number, is made using a different mask at one or more stages during its manufacture. In sets that employ frequency-synthesis tuning, part of the ROM is used as a look-up table for the standard CCIR carrier frequencies.

A typical microcomputer chip for TV receiver use contains 4Kbyte of ROM and 128 bytes of RAM: generally eight or sixteen of the 8-bit registers in the RAM are used for internal working purposes, leaving the rest free for the temporary storage of data. The ROM program configures the input/output ports as required by the setmaker and governs the operation of the internal system.

The Reset

When the microcomputer chip is first powered the data in its RAM and the conditions at its input/output port latches and instruction decoder will all be randomly arranged. Thus something has to be done to prevent the behaviour of the set being unpredictable. This is the purpose of the externally-generated reset pulse, which is applied after the chip's correct supply voltage has been established. The pulse lasts for several cycles of the CPU's operation and sets the program counter to zero to initialise the operation of the chip and thus the whole of the TV set.

Flowchart

Fig. 2 shows a generalised software flowchart for a TV microcontroller chip, providing an idea of its mode of operation. At switch on the power supply is brought out of standby and the contents of an external EEPROM (electrically erasable and programmable read-only memory) are read, its data with respect to preferred analogue settings and the last programme number being passed to the relevant signal processing chips around the set. The memory has to be erasable and programmable so that preset control settings, channel selection etc. can be changed as required. Nowadays the memory is a non-volatile type, i.e. one that retains its data when the power has been switched off: with some earlier memory devices a back-up battery had to be provided. After this initial procedure the microcomputer chip operates as a control loop, with a main routine (loop A) and several subroutines that are triggered when user instructions arrive.

With sets in which a text decoder is controlled by the main microcomputer chip there are further subroutines for text acquisition and channel change to provide initial page entry etc. In sophisticated sets like these and those that incorporate software setting up (service) data, up to 8Kbytes of ROM are provided,

Application-specific Blocks

A TV microcontroller chip incorporates, as Fig. 1 shows, application-specific blocks to configure the input/output ports for specific purposes. Six DACs (digital-to-analogue converters) are shown in Fig. 1: they take the form of pulse-width modulation (PWM) generators whose duty cycle (the relative output pulse on/off times) is set by a binary number that's derived from the EEPROM or a user command. Five of them have 64 possible output levels, corresponding with their 6-bit data inputs. Externally, the PWM outputs are passed to RC integrators that produce the d.c. control voltages required by the sound and video processing chips to set the volume, brightness etc. level. The user keys, local or remote, increment or decrement an internal counter, which takes about eight seconds to go from zero to the maximum count. During this period the chip can if required generate an on-screen display, in bar or dot form, along with a caption. The on-screen display generator shown in Fig. 1 is synchronised to the normal line and field scan rates by the

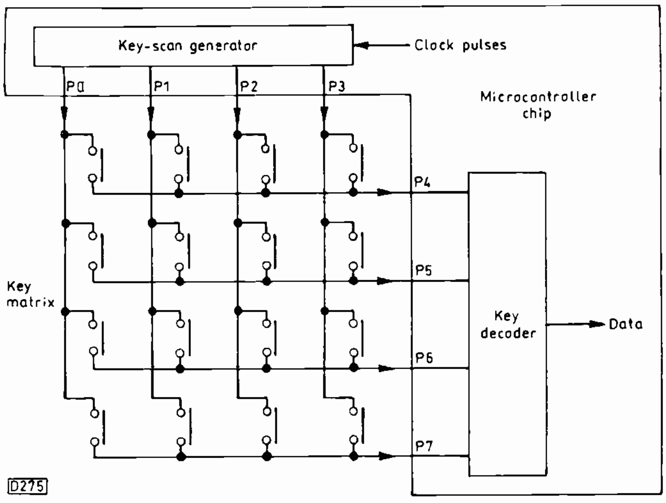

Fig. 3: Basic key-scan arrangement.

set's sync pulses. The fifth PWM DAC typically operates with a 13-bit data input to provide 8,192 possible output levels for varicap tuning, as described last month.

A very common assignment for one input/output port is the provision of key scanning. This is done to reduce the number of chip connections required for use with an on-board keypad. The arrangement is shown in Fig. 3. An internal key-scan generator produces sequential output pulse

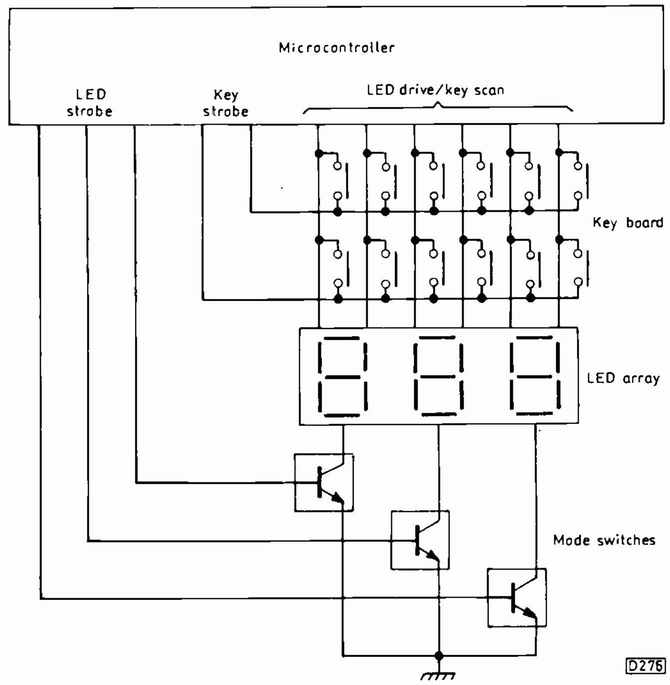

Fig. 4: Key-scan combined with LED drive and strobe. The keys are scanned at about 10msec intervals.

trains at connections P0 to P3. When a key is pressed, one of the pulse trains is returned via connections P4-P7 where it's fed to a decoder. This identifies the command, which is referred to the instruction register then processed and carried out. Further economy in pin use can be achieved by arranging for the key-scan port connections to have a dual use. They can be used to drive a multiplexed LED display as well, as shown in Fig. 4.

Other microcomputer input/output connections are arranged as 1-bit input or output status and control lines. Typical inputs are a.f.c. high/low, TV signal identification and scart pin 8 status for AV switching. Typical outputs drive LEDs, provide audio and/or video muting and control signal routing, TV standard switching and standby operation. If the on-screen display is multicoloured, three output pins are required for R, G and B signals (plus a blanking output pin). Alternatively the OSD generator may, as described in Part 15 (March), be in the teletext decoder chip, under the control of the microcomputer, or a separate character-generator chip may be used.

Another input/output arrangement shown in Fig. 1 is the

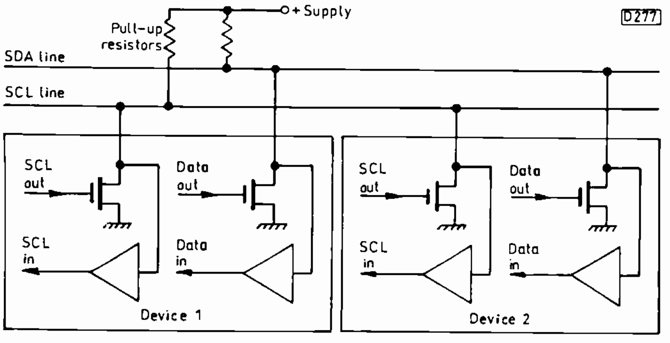

Fig. 5: Open-drain I2C bus configuration. In the rest state all the chips present a very high impedance to the data and clock lines.

I2C bus interface. The I2C system can be regarded as the ultimate port-expansion arrangement. It enables a two-track serial data bus to control scores of external chips and hundreds of functions. But before we go on to describe this, let's round up our description of basic TV microcontrollers.

Microcontroller chips are generally powered by a 5V supply that needs to be held within ±0·5V for reliable operation. They are generally fabricated in CMOS or NMOS form, which makes them vulnerable to damage by static charges built up during handling, transportation or use. Reliability is good however, though when a replacement is required it's vital to ensure that the new chip contains the correct (or updated) software, identified by the suffix to the basic type number. So long as the full type number or part number is quoted, replacements should be available from the setmaker or an authorised distributor. Correct operation of a microcontroller chip depends on three vital factors: that the supply voltage is present and within the specified limits, that a reset pulse is provided at switch-on and that the clock oscillator is up and running.

The I2C Bus

Unlike the lines in a true computer system the control lines in a TV set are quiet for most of the time. Thus an eight-track parallel bus system would be hard to justify. It would add greatly to the number of control and peripheral pins required by each chip connected to the system. The board area required for the connections and chips and the wire/plug/socket count would all increase, as would the cost, complexity and risk of failure. The I2C bus provides an appropriate solution. It's a simple two-track system, along which data is sent in serial form.

One I2C line is called SDA (serial data). The other one, which carries clock pulses for synchronisation, is called SCL (serial clock). When the bus is not carrying information both lines are held in the logic one condition by means of pull-up resistors connected to the positive supply line. All the devices linked to the I2C bus must have open-drain or open-collector connections so that the wired-and function can be used, which simply means that turning on any one (or more than one) device can pull down the line. Fig. 5 shows the basic arrangement.

Addressing

The I2C bus is bi-directional and allows more than one device to be used as the master. The master device starts the data transmission on the bus and generates the clock signals for transmission along it. It addresses another chip which, until the end of the transaction, remains the slave – even though it and the master may be the transmitter and receiver in turns. Thus all the chips that use the bus for communication must have individual addresses: the address for the SAA5241 computer-controlled teletext chip for example is 00100010. The last bit is the read/write command, zero for write (feed data into) and one for read (extract data from). Thus for data fed to the SAA5241 chip the address is 00100010 while for read out the address is 00100011. Naturally the microcontroller chip has its own I2C read and write addresses. Storage chips have programmable addresses: the first four bits of the byte are fixed by the hardware while the next three are pin programmable at the chip, the final bit being the read/write indicator. All the data on the I2C bus is in 8-bit serial form, partitioned off by stop and start bytes.

The addressing procedure is such that the first 8-bit byte of data sent along the data line determines which slave chip has been selected by the one acting as the master. The most significant seven bits of the byte convey the slave address, the least significant bit indicating whether data reading or writing is required. If two chips try to use the bus as masters simultaneously an arbitration process takes place. This gives priority to the master addressing the slave with the lowest address: when the transaction has been completed, the second master device is allowed to use the bus.

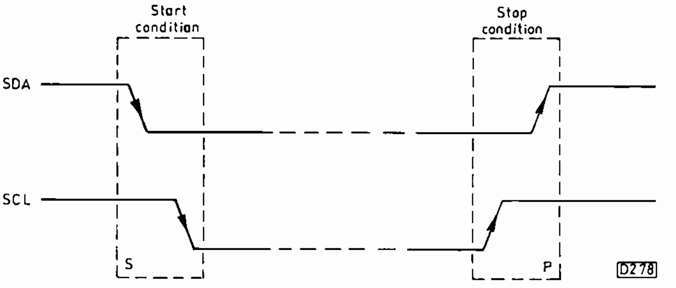

Fig. 6: How I2C messages are started and terminated by the master device.

For each clock pulse on the SCL line there's a corresponding pulse on the SDA line. When the SCL line is at logic one, the level on the SDA line must be stable: thus SDA data can change only when the SCL line is at zero. If the SDA level changes when SCL is high, a start or stop condition is indicated. This is illustrated in Fig. 6.

Thus the beginning of a message is indicated by the master device (whichever chip this may be, usually in practice the microcomputer chip) pulling down the SDA line while the SCL line is high. At this point all chips connected to the bus are alerted in readiness for the first byte, the address word that indicates which device is being called up. All the chips compare the first seven bits with their own addresses. Unless coincidence is found, they go back to sleep. The selected slave chip comes to life and at the eighth bit switches to read or write. On the ninth bit it signals its presence and readiness to the master chip by pulling the SDA line low during a one period on the SCL line. If this acknowledgement signal is not received by the master it knows that the message is either not being received or that there is no slave at the address used. In either case the master device generates a stop condition (see Fig. 6 again) to terminate the message. Thereafter the bus is free for other business.

The Data Format

Fig. 7 shows the I2C bus data format. Everything is done in 8-bit bytes: at the end of every byte the master gets an acknowledgement from the slave as just outlined. A message starts with the slave address and the read/write bit, followed by data. The first data byte may well consist of a register address within the slave chip, after which the actual

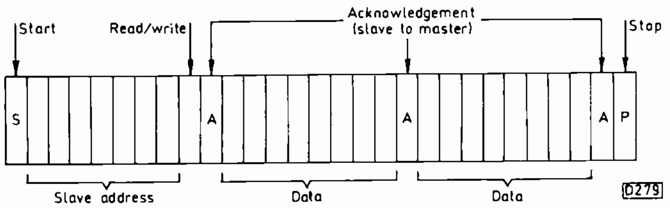

Fig. 7: I2C data format. When a read command occurs data flows from the slave to the master device.

data that carries the information comes. There is no limit to the number of bytes that can be used for a message. At the end of the transaction, business is terminated by the master generating a stop condition.

Fig. 8 shows how this works in practice. Should the viewer want to increase the picture brightness by remote control, the microcomputer chip detects the request then sets up the start condition and puts on the data line the address of the video-processing chip, say 10001010, Fig. 8(a), the last bit indicating the write (data in) condition. This is acknowledged by the slave chip, inviting further data. It comes in the form of sub-address 00100010, see Fig. 8(b), which is the location of the register for brightness data. Acknowledgement comes during the next clock pulse after the 8-bit word. Finally the data for the brightness level requested by the user is loaded into the selected register,

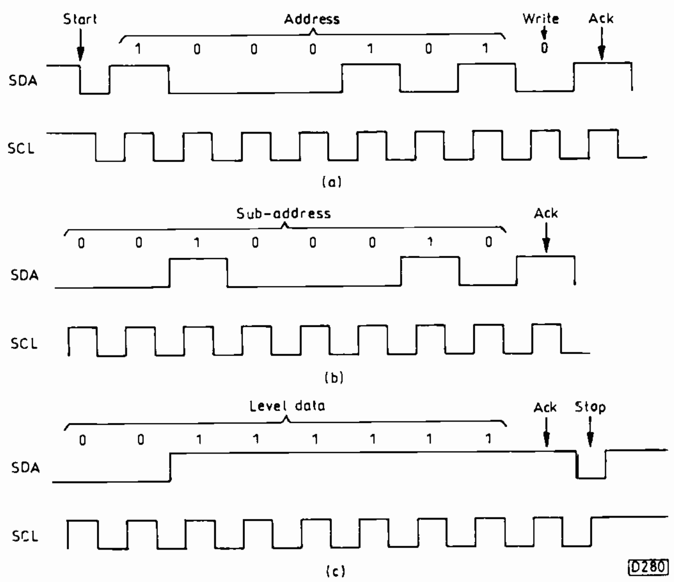

Fig. 8: A typical I2C bus transaction: (a) start and address data; (b) sub-address for the brightness register; (c) brightness level data.

overwriting the information previously held there. In this case the request, shown in Fig. 8(c), is for maximum brightness which corresponds with 00111111. It's loaded during the eight clock pulses of the word and acknowledged on the ninth. Stop (end of message) is indicated by the master chip releasing the SDA line which goes high during the next SCL line high. The new information in the brightness control data register raises the d.c. voltage fed to the luminance clamp within the slave chip and up goes the brightness level.

I2C Network

Almost any number of devices can be connected to an I2C bus, the main limiting factor being that the bus capacitance per track must not exceed 400pF. The maximum data rate is 100kbits/sec – slower devices and transmission rates can be used. While any chip connected to the bus can take the role of master and address any other chip, most TV chips act as slaves, passing data to the microcomputer only when asked. Some devices are by their nature passive, without any need to send data elsewhere, for example character-generator and video-processing chips. Others have constant two-way communication with the microcomputer

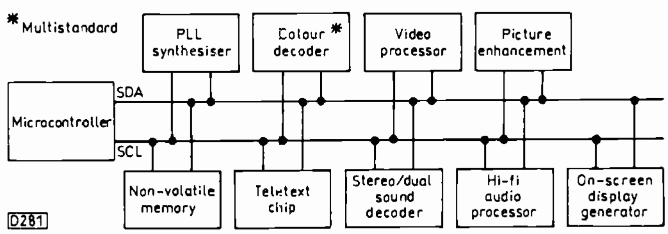

Fig. 9: An I2C bus network. Chips can be omitted or added, and updated, as required. The arrangement shown here would form part of a current high-specification TV set.

chip, e.g. the tuning system, while the EEPROM, though never taking over the role of master device, talks to the microcomputer at switch-on and when a channel change takes place and is addressed during set-up and memorisation. In some sets the EEPROM data is regularly sent to appropriate slave registers during normal operation. A typical I2C network in a modern TV set is shown in Fig. 9.

I2C Developments

The I2C system, which was devised by Philips Components, has been very successful and is popular with setmakers both within and beyond Europe. The latest generations of I2C chips have an increased data rate capability of 400kbits/sec and an address word upgrade, which is compatible with earlier designs, to ten bits. This enables up to 512 bi-directional or 1,024 passive chips to be connected to the same bus system.

Remote Control

A remote control system has to use serial data because the link between the transmitter and the receiver is via a beam of infra-red (IR) radiation that's switched on and off.

Handset Circuit

A typical IR remote-control transmitter employs a circuit like that shown in Fig. 10. The chip is a low-voltage device,

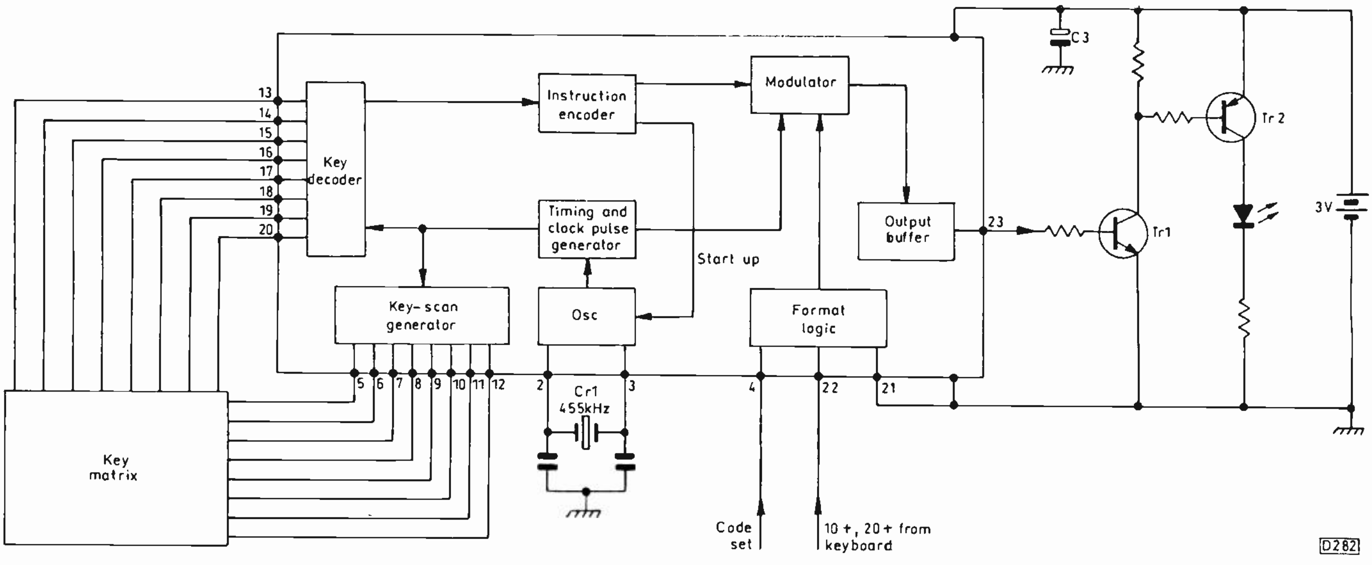

Fig. 10: Typical remote-control handset circuit. All modern RC transmitters operate on the same principle.

powered by a 3V battery. In the quiescent state it consumes less than 10μA. When a key is pressed one of pins 13-20 goes low and the oscillator, based on the 455kHz ceramic resonator connected to pins 2 and 3, starts up. As a result, scanning pulses appear at pins 5-12. Depending on which key has been pressed, one of pins 13-20 receives a key-scan pulse which is decoded and then passed to the instruction encoder to produce the appropriate code to apply to the modulator. The 455kHz clock frequency is divided by twelve in the timing section to produce a 38kHz carrier for the modulator.

The circuit connected to pins 4, 21 and 22 of the i.c. sets the transmission code: it's programmable by means of hardware (wire links, diodes or a slide switch) connected to pins 4 and 21, setting the code for the type of receiver with which it is to be used, while the 10+ and 20+ channel selection keys operate via pin 22 to set the sixth bit of the function-code byte to one (more on this below).

The chip's output, at pin 23, drives Tr1 and Tr2 on and off, pulsing the GaAs IR-emitting LED D1. The peak current is over 1A, and up to four such LEDs may be used in a single handset. Such a current cannot easily be provided by the small batteries used, but the large reservoir capacitor C3 helps out. As the pulse duty cycle is short however the average current demand when the handset is operated is only 14-20mA.

The IR Link

The wavelength of the IR carrier is about 940nm. Typically the –6dB beamwidth of the LED is 60°. The control range is about 12m on the beam's axis, some 8m at 45° off-beam.

Precautions must be taken at the receiving end against the many forms of interference present: incandescent and fluorescent lamps, sunlight and heat sources all produce outputs in the 940nm band. The first line of defence is a low-pass optical filter that's placed in front of the photodetector diode. As Fig. 11 shows, the photodiode current is modulated by the IR radiation, the wanted signal being selected by a sharply-tuned LC filter that's resonant at 38kHz. An IR preamplifier chip is mounted close to the photodiode: the tuned amplifier can provide a gain of over 100dB and has a wide-range a.g.c. loop. The slicer/limiter in the chip produces a clean, squarewave output for the microcomputer chip.

The remote-control pulse train is generally fed to the latter's interrupt input pin. The appearance of the first (start) pulse diverts the microcomputer chip from whatever it's doing and routes the following data to the remote-command decoder's input register.

IR Command Codes

There are many ways in which the IR data can be arranged to provide coded commands. Generally, pulse-position modulation is used. Each pulse consists of a burst of the 38kHz carrier, with a spacing of say 7·6msec representing one and 5msec zero. The first byte in the data stream is a custom code that identifies the make, group and type of equipment being addressed. The next byte conveys the

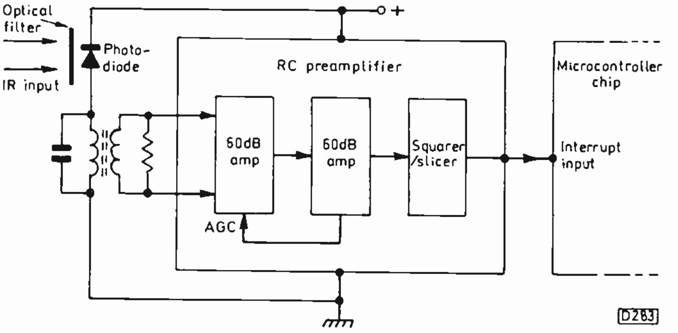

Fig. 11: Typical remote-control receiver arrangement.

control data. These two bytes are repeated continually, at intervals of about 100msec, while the key is held down.

Typical codes may include a.g.c. and corruption check systems. With Philips RC5 codes a digital one is represented by a rise in potential during a one-bit period while zero is represented by a similar fall. Transmissions begin with two start bits to set the operating point of the a.g.c. circuit in the IR receiver. These are followed by a control/toggle bit that indicates the start of a new transmission. Next come a 5-bit address and a 6-bit command. A coding system used by Toshiba and Panasonic amongst others commences with a start pulse which is followed by custom and data codes in normal and inverted form: this provides a simple corruption check by inverting all the bits in each byte and comparing this with its predecessor. An alternative, later format uses 48 bits per message: in theory it can cater for four billion different product codes! With this format the final 8-bit parity code is used for truth checks by the microcomputer chip.

Variants

The more exotic types of handset all use the technologies we've described in this and the previous instalment. Switchable (VCR1/VCR2/TV) units have programmable digits in the address word. Bar-code scanners log the digital code picked up from the paper, store it in an internal register and transcode it to produce IR commands. 'Learning' handsets store the sampled code in a sustainable memory and then use it as necessary. 'Universal' remote-control units, and the VideoPlus stand-alone unit, contain a vast range of control codes in a ROM: once the right code has been found and locked in (usually by trial and error) the appropriate section of the look-up table is thereafter used. With the VideoPlus unit every combination of date, time, programme length and channel is given a unique code consisting of up to seven digits. These are published in the programme guides, banged in by the user and then translated, when the moment comes, into IR coding by reference to a ROM look-up table that's separate from the one which determines the custom code.

The type of handset that offers LCD programming for timed VCR recordings incorporates an on-chip LCD segment decoder/driver and a 'long' register in the handset chip, with a corresponding decoder chip at the receiver. A typical stored data stream, released when the transmit key is stroked, starts with the usual custom code and truth check then provides a date byte, mode byte and a day/week byte to indicate timer, daily/weekly cycle, clock mode and programme number. The following five bytes convey channel and stop/start time data. Subsequent byte groups carry similar data for the other programmed events as necessary. On receipt by the microcomputer the data is decoded for display (user confirmation) then logged in protected memory for release (perhaps along an I2C bus) when coincidence between real time and memorised start time is detected.

Next Month

In the next instalment we'll be taking a look at digital picture processing, mainly in relation to 100Hz flicker-free displays.

CORRECTION AND SERVICE TIP

CD Player Casebook, page 435, April: Nick Beer tells us that as a result of computer corruption the Sony CDX5080 fault report was incorrect as published. The error display was ER4, not ER$. This indicates a focus problem, not low output from the laser unit, though checks proved that the laser's output was in fact low.

Ferguson ICC5 Chassis: With reference to David C.J. Tilley's letter (April, page 396) Nick Beer points out that if the PIN is not known the child lock can be released by pressing the four fastext buttons on the handset in sequence, holding the last, yellow one in for four seconds.

VCR Clinic

Reports from Philip Blundell, AMIEIE, Eugene Trundle, John Edwards, Richard Newman, Mike Leach, Michael Dranfield, Dave Mackrill and Keith Evans

Toshiba V110B

If the machine won't take in a cassette (no capstan rotation) check whether transistor TT68, type BC557, is open-circuit. **P.B.**

JVC HRD640

If the machine is dead with 'Set Clock *' in the display the child lock is set. To clear it use the remote control handset to send a power-on command – the customer did send you the remote control unit, didn't he? **P.B.**

Sharp VCH84

This is a newish machine that boasts a single-chip (TB1204F) Nicam decoder. Unfortunately for most of the time the output from the right-hand channel was lost in a sea of crackle and hiss. Resoldering a bad joint at pin 24 of the TB1204F wonder-chip IC1701 restored good sound. **E.T.**

Mitsubishi HSB31/41

This machine would be brought into the workshop about once a month with its mechanism jammed in the fully-laced position. One touch was sufficient to release it, after which the machine would be o.k. for another month. The mode switch can cause this but had already been replaced. Cleaning, degreasing and then lightly lubricating the loading mechanics, including the half-loading arm pivot, joint gear, main cam and the vertical shafts that carry the pinch roller and pinch roller spiral cam, provided a permanent cure. **E.T.**

JVC HRD830

This was a strange and unusual fault! The capstan motor would rattle and roar in the play mode, the playback picture showing that there was no capstan phase lock (noise bars cycled over the picture at a rate of about three a second). If the CTL pulses were removed – by playing a blank tape, lifting the tape from the ACE head or shorting out the CTL head winding – the motor would settle down. After a long search we found that C405 in the servo circuit was leaky – it read about 800Ω. **E.T.**

Akai VS22

The design of the power supply section of this machine is not of the best. As they age, we are getting lots of these VCRs in for repair with symptoms that range from ripple, hum and interference on the picture to intermittent and 'weary' deck operation or complete loss of functions. Akai can supply a reasonably-priced replacement PSU board, part no. 99002209, but I find it less trouble to replace all the electrolytics on the board. There are lots of them, but they are small, inexpensive ones. No machines have bounced after this treatment. **E.T.**

Hitachi VT520

Printed flexible ribbons are used to link the tape-end sensors to the main PCB in this model. A common cause of problems, mainly concerning the end sensors, is poor contact with the edge connector at one end or other of a ribbon. The usual symptom is failure to accept a cassette or retraction of the cassette after ejection; or alternatively deck shutdown a few seconds after entering the forward mode. The cure is to clean the connectors and ribbon ends.

We are now starting to find worn audio/control heads in these machines. The first indication of this is loss of capstan servo lock with a machine's own recordings. **E.T.**

Philips VR6470

There was no i.f. output from the tuner. Checks showed that the tuner and SAB3036 CITAC chip supply voltages were o.k. but the tuning voltage remained at zero. 33V was present at pin 9 of the CITAC chip but there was no output at pin 8. As the I2C bus lines were o.k. we changed the chip. That did the trick, and the tuning points were still stored in the memory – all four channels were available straight away. **E.T.**

Amstrad VCR6000

If the complaint is that the machine keeps changing from SP to LP at random, replace the 14DN363 chip IC402. It's the control pulse amplifier. If the customer complains that the sound is also poor, suspect the audio/control head. Mind you, it could be both! **J.E.**

Panasonic NVJ35/G Deck

This G deck machine came in with a jammed mechanism. Thanks to Nick Beer's excellent article on the deck (May 1991) I now rebuild them with confidence. It's important to check the rack assembly on the right-hand cassette housing side. With the arm in the down (horizontal) position, the arrow on the nylon gear should line up with the one on the rack. If it's out by just one tooth you can get nasty crunching noises when ejecting the cassette because the switch on the side piece is in the wrong position and the capstan motor isn't switched off in time. As a result it tries to force the housing beyond its stop, crunching the gears. This occurs with any machine that uses the G deck.

With this particular machine the rack was two teeth out. This is the reason why a complete rebuild was required. The right-hand side piece is also prone to damage: it's available as a complete assembly. **R.N.**

Philips VR6542

This Sharp based machine was in permanent rewind. After checking the light sensors I removed the cam assembly to get at the mode switch and found that it had fallen apart. When a new mode switch had been fitted the machine would wind and rewind but wouldn't play as the capstan refused to turn in this mode. I made various checks and was beginning to suspect the system control chip IC801, though I've never known one of these to fail.

There were some peculiar voltages around pins 25-28 – they were varying slightly up and down. A look at the print side of the board showed that these pins are covered with a piece of sticky foam that's used to isolate a couple of capacitors from the PCB. I decided to remove the foam to check whether the chip's pins were dry-jointed. They weren't, but when I checked the voltages at pins 25-28 they were now correct. Not only that, but the machine now worked. I looked at the piece of foam and checked it with a meter: it had a resistance of a few kΩ!

There was another fault with the machine: the counter didn't work (though pulses were present) and it wouldn't change channels. The cause? You've guessed it! A similar piece of foam fitted to the back of the front control panel. Once this had been removed the machine worked perfectly. **R.N.**

Samsung SI1260

This machine could be switched on and produced normal displays. It wouldn't respond to any key operation or accept a tape however. IC206 has given trouble in these machines, so voltage checks were made here. A low supply voltage led us back to D212 (1N4001) which was open-circuit. Normal operation was restored after fitting a replacement. **R.N.**

Saisho VR905S

This ageing machine produced very poor E-E and recorded pictures. It gave the impression that there was an a.g.c. fault somewhere in the i.f. strip. This turned out to be the case: when heat was applied to C10 (0·47μF, 50V) on the i.f. panel the E-E and record pictures were o.k. All was well after fitting a replacement capacitor. **M.L.**

Philips VR6460

The display lit but there was no other operation. If the machine was powered up it would immediately shut down. There was also no capstan motor shuffle when the mains voltage was applied. As a tape couldn't be inserted, I started by making some cold checks in the power supply. Basically the 12V supply was missing, or rather it was being dragged down to approximately 1·2V, because of a short on the audio board. The cause turned out to be C2024 (330μF, 16V) which was very leaky. Replacement of this item cured the power supply problem and restored normal operation. **M.L.**

Hitachi VTM830E

The customer's complaint was of not being able to get a tape out and poor pictures. As an aside, why is it that when a customer complains about failure to eject tapes there's hardly ever a cassette inside the machine? I think we all know the answer to that one! Anyway, back to the fault. The loading was very slow, and when the cassette had reached its down position in the carriage the machine immediately started a slow rewind. We connected it to a monitor and found that a very bad hum bar was present in all modes. The cause was traced to C857 (4,700μF, 25V) on the power supply panel. It had become very leaky. A replacement restored normal eject operation without having to dig the cassette out with a screwdriver or whatever else it is that customers use! **M.L.**

Ferguson FV43H

There was intermittent loss of the signals from the tuner, leaving only snow. As fitting a replacement tuner (very expensive) failed to provide a cure further investigation was carried out. This showed that during the fault condition the 5V supply to the tuner's internal prescaler dropped to 2·5V. No single component in the 5V regulator circuit seemed to be responsible for this, so to be on the safe side we replaced the lot – Q2, R7, D4, C16, D3 and C15. This cured the fault. **M.Dr.**

Toshiba V110

This machine was dead with no 12V standby supply. We found that resistor RP14 in the power supply was hot: well it would be with a dead short across the 12V rail. The cause was the 15V zener diode DP011, which is connected across the 12V line to provide protection in the event of TP03 going short-circuit. A check showed that TP03 was all right, and a long soak test brought no other possible cause of DP011's failure to light. **M.Dr.**

Ferguson 3V29/30/JVC HR7200/7300

One of these machines intermittently refused to load. All the usual things – the load switches, sliding plate under the supply reel and of course the loading motor and belt – were checked and it was only when, in desperation, I was about to replace the complete loading block that I noticed several broken strands on one of the motor leads. Presumably it had become fatigued over the years, during successive belt changes, reducing the motor current.

I find that with these machines it pays to remove and inspect, with a magnifying glass, the mechacon panel: you will usually find several ringed and crystalised joints. Resoldering these will prevent a number of confusing, intermittent fault symptoms. **D.M.**

Sharp VC750HM

Our friend Malcolm reported that the playback picture would sometimes disappear, leaving a fuzzy display. He said that initially the picture would return to normal when he tapped the top, front left-hand side of the machine. More recently he'd found it necessary to place a house brick on the right-hand side of the metal case, with a 3lb club hammer on top of that! As this no longer restored normal operation and no amount of banging, thumping or leaning on the case would do the trick he decided that it was perhaps time to seek professional assistance.

When I checked the machine with a test tape it worked normally for some time. Then, during an assault on the right-hand corner of the case, the display suddenly disappeared behind a sheet of noise. I whipped off the top and tapped the f.m. preamplifier can at the rear of the lower drum assembly. As this brought the picture back I removed the module and found that all the connections to plug ZA, which fits on to the lower drum, were fatigued. The soldered joints had fractured, leaving a ring between the pins and the print. After resoldering these and the connections, which appeared to be almost as bad, to plug XA none of Malcolm's efforts would bring the fault back. He departed happily with the poor old machine tucked under his arm. **D.M.**

Sony EVA300

We don't see many of these very nicely engineered Video 8 machines so there was some headscratching when this one appeared with an inoperative cassette compartment door. On a hunch, and without the aid of a service manual, we checked a couple of the more obvious circuit protectors (PS101 and PS102) mounted at the rear of the top PCB. The N5 value protector was open-circuit. **K.E.**

ECONOMIC DEVICES 32 TEMPLE STREET, WOLVERHAMPTON, WV2 4AN

15/80H	3.83	2SC1398	0.80	2SD401	3.46	BAX14	0.28	BD189	0.48	BF870	0.23	BYV96D	0.27	LM393N	1.19	SDA2112	11.00	TA7122BP	0.63	TDA1170N	1.38	TDA9503	2.13
15/85R	3.84	2SC1413A	2.70	2SD438	0.34	BB105B	0.24	BD190	0.31	BF959	0.18	BYW56	0.46	M192B1	1.86	SG264A	10.62	TA7146P	7.70	TDA1170S	1.16	TEA1002	4.98
17052	3.85	2SC1509	0.72	2SD476	0.97	BC107B	0.20	BD201	0.40	BF960	0.27	BYX55600	0.20	M21C	1.65	SG613	18.79	TA7176P	1.78	TDA1190Z	4.08	TEA1009	1.61
17053	2.38	2SC1520	0.54	2SD525	1.27	BC108	0.15	BD203	0.46	BF966	0.61	CA1310E	0.78	M293	14.63	SGSIF344	6.93	TA7193AP	6.77	TDA1200	0.91	TEA1014	1.87
17088	2.38	2SC1573	0.36	2SD551	3.58	BC109A	0.16	BD232	0.45	BF970	0.30	CA3094	3.06	M490	15.30	SKE4F104	0.97	TA7193P	7.09	TDA1270	1.79	TEA1039	2.15
17089	3.39	2SC1573Q	0.26	2SD613	0.94	BC109B	0.15	BD234	0.34	BFR39	0.43	CD4001	0.21	M491	7.94	SKE4F210	0.87	TA7205AP	1.68	TDA1412	0.77	TEA2018A	1.49
17127	1.77	2SC1675	0.09	2SD636	0.19	BC117	0.14	BD237	0.30	BFR41	0.44	CD4011	0.21	M50115AP	3.24	SKE5F310	1.68	TA7207P	1.68	TDA1506	4.59	TEA2164	2.68
1N4001	0.04	2SC1685	0.21	2SD637	0.16	BC139	0.33	BD238	0.24	BFR90	0.61	CD4013	0.34	M51102L	1.77	SL1430	1.57	TA7210P	1.50	TDA1510	3.40	TEA2165	6.26
1N4002	0.07	2SC1740	0.14	2SD667	0.39	BC140	0.21	BD239	0.29	BFR90A	0.77	CD4016	0.14	M51231P	2.03	SL1431	1.70	TA7214P	3.74	TDA1512	3.17	TIC106D	0.82
1N4003	0.05	2SC1741	0.17	2SD669	0.63	BC141	0.34	BD241	0.41	BFR91	0.60	CD4021	0.43	M51393AP	4.64	SL1432	8.54	TA7217AP	1.37	TDA1515A	2.54	TIC106M	0.75
1N4004	0.07	2SC1815	0.17	2SD669A	0.63	BC147A	0.06	BD243	0.39	BFR96	0.53	CD4052	0.29	M51515L	2.01	SL471	1.70	TA7222	1.60	TDA1516Q	3.56	TIC45	0.59
1N4005	0.09	2SC1826	0.72	2SD716	1.46	BC148	0.12	BD243A	0.43	BFW92A	0.48	CD4053	0.39	M51521L	0.54	SL490	2.64	TA7222AP	1.87	TDA1518Q	3.32	TIL100	0.52
1N4006	0.06	2SC1827	1.00	2SD718	2.21	BC148A	0.06	BD243C	0.44	BFX85	0.55	CD4066	0.30	M5218L	1.59	SN29764AN	1.99	TA7227P	2.29	TDA1670A	2.81	TIP110	0.36
1N4007	0.06	2SC1845	0.26	2SD734	0.24	BC148B	0.04	BD244A	0.34	BFY50	0.34	CD4069	0.17	M5231L	0.55	SN7474N	0.38	TA7230P	1.80	TDA1701	3.67	TIP112	1.71
1N4148	0.04	2SC1846	0.51	2SD762	1.78	BC149	0.04	BD244C	0.42	BFY51	0.34	CD4070	0.21	M53216P	2.78	SN76013ND	7.99	TA7233P	1.95	TDA1870	3.37	TIP112H	0.58
1N4448	0.06	2SC1923	0.14	2SD774	1.15	BC149C	0.04	BD245C	0.92	BR100	0.27	CNX62A	3.83	M54543L	1.97	SN76227N	1.07	TA7240P	2.46	TDA1904	1.21	TIP120	0.57
1N5061	0.38	2SC1942	3.57	2SD787E	0.46	BC157	0.13	BD246C	0.97	BR101	1.15	CR3CM	3.44	M54544L	2.41	SN76666N	2.20	TA7241	2.30	TDA1905	1.27	TIP121	0.42
1N5402	0.12	2SC1959	0.11	2SD837	0.90	BC159	0.06	BD278A	0.56	BR103	0.53	CRD2AM	2.17	M54548L	4.95	SN76705AN	1.70	TA7250	4.03	TDA1908A	3.42	TIP126	0.48
1N5404	0.13	2SC1969	2.46	2SD841	1.45	BC161	0.27	BD317	1.20	BR303	1.22	CV12E	4.49	M54644BL	3.30	STA341M	2.54	TA7267P	2.02	TDA1940	2.77	TIP132	0.46
1N5406	0.12	2SC1983	1.87	2SD856	1.03	BC167	0.42	BD318	1.29	BRX44	1.02	CX10910	7.05	M54648L	6.87	STA401	4.10	TA7270	1.00	TDA1950	1.86	TIP137	0.48
1N5408	0.12	2SC2001	0.22	2SD869	5.18	BC171B	0.30	BD380	0.34	BRY56	0.43	DTA124EF	0.13	M54898AP	20.45	STA441C	2.80	TA7270P	1.95	TDA2002	0.85	TIP2955	0.83
1N914	0.04	2SC2073	0.77	2SD870	3.81	BC177	0.14	BD433	0.29	BSS38	0.33	DTA144EF	0.17	M58485P	5.95	STK0029	12.04	TA7271P	2.65	TDA2004	1.44	TIP29C	0.30
1S1555	0.22	2SC2078	0.85	2SD871	5.08	BC178	0.25	BD4348	0.34	BT120	1.28	ER1400	6.45	MB3730	2.38	STK0039	7.11	TA7273	3.64	TDA2005	1.44	TIP29E	0.46
1S2076	0.29	2SC2141	1.48	2SD880	0.48	BC182L	0.06	BD435	0.38	BT129	4.38	HA11235	1.95	MB3731	2.88	STK0040	7.40	TA7274P	2.72	TDA2006	1.06	TIP3055	0.94
2N2219A	0.27	2SC2166	1.27	2SD882	0.43	BC182LB	0.06	BD436	0.32	BT139600	1.87	HA11244	5.04	MB3732	3.05	STK0059	9.75	TA7280	2.69	TDA2009	2.29	TIP30C	0.17
2N2222	0.22	2SC2168	0.85	2SD898B	7.78	BC184	0.09	BD437	0.32	BT151/500R	1.10	HA1124A	0.98	MC13002P	7.69	STK025	10.58	TA7299	2.63	TDA2020	3.72	TIP31A	0.32
2N2905	0.21	2SC2236	0.36	2SD904	5.95	BC184L	0.06	BD438	0.31	BT151800	1.15	HA11423	2.81	MC1310P	0.85	STK3042	7.19	TA7313AP	0.62	TDA2030H	1.94	TIP31B	0.30
2N2926G	0.37	2SC2271	0.36	2SD973	0.38	BC184LC	0.10	BD441	0.34	BU205	1.07	HA11440	3.46	MC1327AP	1.62	STK3062	8.88	TA7317P	0.93	TDA2030V	1.05	TIP31C	0.44
2N3053	0.36	2SC2274	0.31	74LS00	0.21	BC204	0.14	BD442	0.29	BU208A	1.44	HA1166X	3.43	MC1330AIP	1.26	STK4131	7.79	TA7325P	1.83	TDA2170	3.81	TIP32A	0.39
2N3054	0.98	2SC2274K	0.31	7805	0.49	BC207B	0.23	BD510	1.34	BU208D	1.61	HA11713	2.12	MC1350P	1.82	STK4141	12.46	TA7343AP	0.72	TDA2270	3.03	TIP32C	0.38
2N3055	0.86	2SC2314	0.33	7808	0.51	BC212B	0.06	BD529	1.61	BU326A	1.36	HA11741	9.48	MC1352P	1.45	STK4142	8.21	TA7358P	0.78	TDA2530	4.24	TIP33A	0.92
2N3442	1.00	2SC2335	1.43	7812	0.30	BC212L	0.06	BD530	1.10	BU406	0.68	HA11745	5.49	MC1358P	1.59	STK4162M	9.51	TA75358P	0.68	TDA2540	1.12	TIP33C	0.80
2N3702	0.11	2SC2458	0.12	7815	0.82	BC213	0.11	BD535	0.43	BU406D	1.02	HA13001	1.89	MC14528BCP		STK4171	13.20	TA7607AP	2.83	TDA2541	1.10	TIP34C	0.89
2N3704	0.14	2SC2482	0.34	7818	0.41	BC214L	0.09	BD536	0.48	BU407	0.53	HA13108	3.56		1.70	STK4181 II	15.97	TA7609P	2.99	TDA2560	4.81	TIP41A	0.38
2N3773	1.27	2SC2547E	0.24	7905	0.34	BC237	0.10	BD675	0.30	BU407D	0.97	HA13118	1.87	MDA2062	3.89	STK4181A	12.46	TA7630P	1.87	TDA2576A	5.95	TIP41C	0.43
2N3819	0.55	2SC2565	6.01	7912	0.43	BC237B	0.08	BD677	0.32	BU426A	0.96	HA13119	2.03	MJ29550	0.97	STK4332	5.98	TA7640AP	0.68	TDA2577A	4.25	TIP42A	0.42
2N3904	0.11	2SC2570A	0.29	AA119	0.36	BC238	0.11	BD707	0.51	BU426E	2.13	HA13403	5.98	MJ802	2.37	STK4352	1.70	TA7676P	4.25	TDA2578A	2.55	TIP42C	0.43
2N4444	3.22	2SC2577	9.99	AA143	0.13	BC238B	0.05	BD839	0.68	BU500	2.00	HA1377	2.62	MJE13005	0.85	STK437	10.58	TA7680AP	4.50	TDA2581	7.52	TIP47	0.51
2N6292	0.62	2SC2581	3.05	AC127	0.11	BC239	0.04	BD901	0.51	BU508A	0.95	HA1388	2.63	MJE2955	0.68	STK4392	5.92	TA7698AP	5.93	TDA2581Q	14.54	TIPL791A	1.24
2SA1015	0.10	2SC2632	0.43	AC141K	0.46	BC252B	0.07	BD902	0.51	BU508AF	1.37	HA1389	2.52	MJE3055	0.51	STK441	14.43	TA7705P	1.68	TDA2582	1.95	TIS43	0.99
2SA1016	0.26	2SC2655	0.31	AC176K	0.38	BC300	0.48	BD911	0.41	BU508D	1.27	HA1392	1.61	MJE340	0.50	STK459	11.17	TA7769P	3.01	TDA2591	2.27	TL011CP	1.36
2SA1020	0.43	2SC2671	0.68	AC187	0.16	BC301	0.28	BD912	0.63	BU508DF	1.67	HA1397	2.63	ML923	14.76	STK461	12.29	TA8205	3.89	TDA2593	0.75	TL071CP	0.38
2SA1020Y	0.43	2SC2688	0.52	AC187K	0.33	BC302	0.36	BDV65B	1.16	BU508V	1.65	HA1398	2.33	MN1405VKF	14.58	STK4843	15.46	TA8210H	4.74	TDA2594	2.21	TL494	1.61
2SA1095	7.44	2SC2785	0.36	AC188	0.36	BC303	0.22	BDW84C	1.28	BU526	1.61	HA1452	4.86	MN1435VX	14.35	STK5211	15.78	TA8215	4.57	TDA2595	3.19	TMP47C432AP	
2SA1102	2.54	2SC2791	5.44	AC188K	0.82	BC307	0.06	BDW93C	0.59	BU536	1.60	HM6232	10.46	MN1435VXB	10.66	STK5322	6.35	TA8691N	7.01	TDA2600	5.98		11.24
2SA1143	0.17	2SC3150	1.53	AD149	0.52	BC307A	0.06	BDW94C	0.60	BU608	1.44	HM6251	9.52	MN650	3.23	STK5325	59.15	TAG626	1.35	TDA2611A	0.64	TMP47C434N–	

SPECIAL OFFERS – ENDS 30/05/94 OR WHILE STOCKS LAST

BU208A x 5	3.99	TDA 3654 x 2	2.50
BU 426A x 5	3.75	TDA 4601 x 2	2.55
BU 508A x 5	3.60	STR 54041 x 2	6.00
BU 508AF x 5	5.00	STANDARD VIDEO SENSOR LAMP x10	2.50
BUT 11AF x 5	3.25	STANDARD VIDEO SENSOR LAMP PLUG x 10	4.00
TV FAULT FINDING GUIDE	9.99		
VIDEO FAULT FINDING GUIDE	9.99	VTIIE ETC. BELT KIT x5	5.50
SATELLITE FAULT FINDING GUIDE	14.95	3V29 ETC. BELT KIT x 5	4.50
CO AXIAL AERIAL PLUGS x 25	3.75	3V35/6 ETC. BELT KIT x 5	4.25

2SA1175	0.25	2SC3153	2.37	AD161	1.02	BC307B	0.06	BDX32	1.70	BU705	1.61	HM7103	16.44	MPSA42	0.23	STK5326	6.76	TBA120	0.53	TDA2611AQ	2.57	3555	17.87
2SA1186	7.20	2SC3156	6.61	AD162	0.96	BC308	0.11	BDY20	2.13	BU806	0.82	ICH28I	0.26	MPSA56	0.12	STK5331	2.31	TBA120AS	0.90	TDA2640	4.13	UC3844	4.19
2SA1208	0.34	2SC3182	2.49	AF124	0.77	BC308A	0.09	BF115	0.41	BU806A	0.80	KA2101	0.83	MPSA93	0.09	STK5332	2.99	TBA120S	0.89	TDA2652	14.32	UPA81C	1.12
2SA1265	2.96	2SC3225	0.50	AF127	0.77	BC308C	0.06	BF179	0.31	BU80796	0.51	KBL08	0.47	MR854	0.65	STK5333	12.63	TBA120T	0.51	TDA2653A	3.26	UPC1181H	6.80
2SA1286	0.55	2SC3795	1.95	AF139	0.29	BC327	0.10	BF184	0.41	BU826A	2.40	KSR1004	0.09	MSM5840H	15.36	STK5372	3.40	TBA120U	0.39	TDA2680	5.10	UPC1182H	5.95
2SA473	0.71	2SC380	0.12	AF239	0.43	BC327B	0.17	BF185	0.29	BU908	1.17	L200CV	2.19	MVS240	0.53	STK5421	2.60	TBA2800	3.30	TDA3190	1.27	UPC1185H	10.20
2SA562	0.17	2SC388A	0.59	AF279	0.34	BC328	0.07	BF194	0.22	BUK444	2.38	LA1201	0.56	NE545B	3.20	STK5422	6.38	TBA395	0.68	TDA3190P	1.36	UPC1188	3.83
2SA634	0.54	2SC458	0.10	AL102	6.35	BC337	0.09	BF196	0.15	BUT11	0.89	LA1230	1.95	NE555	0.21	STK5451	5.77	TBA520	0.85	TDA3300B	20.88	UPC1212C	0.83
2SA639S	0.83	2SC536	0.14	AN3821K	7.23	BC337L	0.22	BF197	0.34	BUT11A	1.05	LA1385	2.51	NE555N	0.37	STK5466	5.66	TBA540	1.97	TDA3330	10.78	UPC1228HA	0.56
2SA673	0.09	2SC710	0.12	AN5265	1.75	BC338	0.06	BF198	0.17	BUT11AF	0.85	LA3161	0.40	NE592	1.85	STK5471	4.87	TBA540Q	0.77	TDA3541	0.95	UPC1230	2.82
2SA684	0.60	2SC867A	5.25	AN5435	1.45	BC368	0.25	BF199	0.04	BUT12A	1.13	LA4140	0.37	NE646N	3.39	STK5476	5.00	TBA560C	2.02	TDA3560	3.65	UPC1230H	3.95
2SA733	0.17	2SC945	0.12	AN5512	1.83	BC369	0.17	BF200	0.39	BUT56A	1.19	LA4182	1.75	NP1106	11.86	STK5481	7.55	TBA570A	1.77	TDA3561A	4.79	UPC1278H	2.66
2SA769	1.27	2SD1051	0.48	AN5515	2.79	BC372	0.62	BF240	0.11	BUW11	0.99	LA4192	1.59	DA47	0.25	STK5482	6.41	TBA651	1.01	TDA3562A	4.91	UPC1318	2.96
2SA798	0.56	2SD1128	1.02	AN5521	2.14	BC546A	0.06	BF244	0.43	BUW11A	0.90	LA4220	N/A	DA90	0.59	STK6962	4.91	TBA750Q	5.10	TDA3565	2.85	UPC1335V	3.91
2SA872	0.14	2SD1138	0.94	AN5612	4.15	BC547	0.11	BF245A	0.19	BUW41B	1.02	LA4261	2.29	DA91	0.15	STK7216	7.28	TBA800	0.51	TDA3566	3.40	UPC1351C	1.70
2SA872A	0.28	2SD1207	0.35	AN5900	1.44	BC547A	0.04	BF245B	0.41	BUW81A	2.29	LA4270	2.73	R2540	2.98	STK7226	8.14	TBA810P	1.66	TDA3571B	3.40	UPC1353	1.34
2SA940	0.82	2SD1265	0.77	AN6310	4.69	BC547B	0.11	BF255	0.11	BUW84	1.11	LA4282	2.65	R2540X	1.92	STK7308	5.50	TBA810S	0.66	TDA3576	11.90	UPC1363C	1.06
2SA952	0.17	2SD1273	1.14	AN6326	5.08	BC548A	0.29	BF256	0.24	BUX84	0.44	LA4422	1.36	R2M	1.15	STK7348	4.91	TBA820	0.85	TDA3640	5.92	UPC1363CA	2.13
2SA958	1.44	2SD1275	0.88	AN6341	3.20	BC548B	0.18	BF256LC	1.67	BUX85	0.92	LA4440	2.40	R3297	6.06	STK7356	8.31	TBA820L	0.55	TDA3650	11.11	UPC1365C	1.70
2SA966Y	0.41	2SD1276	0.85	AN6610	0.93	BC548C	0.12	BF257	0.36	BUZ71	0.52	LA4445	1.61	R4050	2.38	STK7358	5.81	TBA820M	0.44	TDA3653AQ	1.92	UPC1378H	2.52
2SA970	0.36	2SD1279	7.62	AN6671K	8.66	BC549	0.11	BF258	0.04	BY127	0.17	LA4460	1.48	R4051	3.18	STR1096	4.67	TBA920	2.75	TDA3653B	1.86	UPC1391H	0.52
2SA984	0.38	2SD1292	0.41	AN7158	3.30	BC556B	0.15	BF259	0.31	BY133	0.08	LA4461	1.48	RB156	2.24	STR40090	8.71	TBA950	1.68	TDA3654	1.89	UPC1394	1.55
2SB1010	0.34	2SD1308	0.94	AN7161	3.56	BC557	0.07	BF324	0.12	BY164	0.67	LA4475	3.09	RGP15	0.41	STR4090	16.36	TBA970	4.08	TDA3810	2.55	UPC1420CA	7.69
2SB546	0.94	2SD1397	1.89	AN7171K	4.68	BC557B	0.06	BF337	0.34	BY179	0.80	LA4476	2.79	RGP15J	0.35	STR4211	4.72	TCA270S	1.03	TDA4420	1.27	UPC1488H	1.78
2SB633	1.31	2SD1398	2.13	BA145	0.11	BC557C	0.11	BF338	0.43	BY184	0.42	LA4500	2.17	RGP30M	0.30	STR440	11.54	TCA440	2.73	TDA4427	3.18	UPC2002	2.08
2SB643S	0.29	2SD1426	2.54	BA156	0.06	BC558B	0.06	BF355	0.48	BY206	0.20	LA4505	2.52	RM11C	1.71	STR441	15.95	TCA660B	0.43	TDA4442	3.49	UPC324C	4.03
2SB644	0.34	2SD1427	2.89	BA157	0.07	BC559	0.11	BF392	0.23	BY207	0.18	LA4508	2.29	S2000AF	1.46	STR451	15.13	TCA800Q	1.65	TDA4500	4.66	UPC4558C	0.65
2SB688	1.61	2SD1432	4.88	BA158	0.07	BC560C	0.21	BF393	0.17	BY210400	0.19	LA4520	1.49	S2055AF	1.81	STR50020	9.02	TCA910	1.21	TDA4501	5.08	UPC574	1.07
2SB772	0.43	2SD1439	3.05	BA159	0.25	BC635	0.19	BF422	0.19	BY224600	5.10	LA4700	4.27	2530A	1.98	STR50103	6.92	TCA940	3.40	TDA4503	3.38	UPC580C	2.55
2SB772Q	0.43	2SD1453	1.87	BA317	0.19	BC637	0.15	BF423	0.14	BY226	0.16	LA5112	5.89	SAA1004	N/A	STR54041	5.99	TD3F900H	6.57	TDA4505E	4.64	UPD1937C	3.15
2SB793	0.43	2SD1497–02		BA318	2.03	BC639	0.14	BF435	1.97	BY227	0.14	LA5512	0.61	SAA1121	11.22	STR5412	6.15	TDA1004A	4.35	TDA4600	2.29	X0065CE	2.20
2SB819	0.48		8.03	BA5102A	2.00	BC640	0.06	BF450	0.19	BY228	0.38	LA7223	2.54	SAA1174	5.10	STR58041	6.35	TDA1011	1.27	TDA4600/2	2.72	X2402	4.62
2SB861	1.10	2SD1497–06		BA536	2.00	BC879	0.39	BF458	0.30	BY229	1.64	LA7520	2.75	SAA1250	2.92	STR6020	10.15	TDA1011A	1.47	TDA46002D	3.54	ZPY120	N/A
2SB891	0.52		7.06	BA5406	2.12	BC880	0.38	BF459	0.29	BY229600	0.92	LA7800	1.44	SAA1251	6.30	STR6020KIT	15.05	TDA1013A	1.56	TDA4600F	1.70	ZTX650	0.51
2SC1008	0.24	2SD1541	5.56	BA6109	1.85	BCY70	0.07	BF469	0.34	BY229800	1.02	LA7801	1.27	SAA1351	8.23	T6064V	2.63	TDA1015	1.37	TDA4601	1.80	ZTX753	1.12
2SC1061	0.83	2SD1555	2.80	BA6209	1.46	BD131	0.28	BF470	0.33	BY238	0.31	LA7820	2.71	SAA3027P	7.62	T6076V	5.45	TDA1020	1.27	TDA4601D	2.42		
2SC1096	0.50	2SD1577	4.64	BA6219	1.76	BD132	0.21	BF480	1.10	BY255	0.14	LA7830	1.27	SAA5010	4.60	T9013V	9.33	TDA1035SB	4.15	TDA4605	3.00		
2SC1114	1.16	2SD1649	2.03	BA6222	1.61	BD135	0.33	BF493S	N/A	BY298	0.15	LM13D3N	0.88	SAA5012	4.85	T9034V	1.45	TDA1035T	1.87	TDA4950	1.71		
2SC1162	0.31	2SD1650	2.47	BA656N	0.84	BD136	0.20	BF597	0.16	BY299	0.19	LM1877	1.45	SAA5030	6.42	T9035V	1.50	TDA1037	8.50	TDA7240A	2.36		
2SC1213	0.14	2SD1876	6.07	BA718	0.77	BD137	0.45	BF757	0.43	BY476A	0.68	LM317T	0.52	SAA5050	0.49	T9038V	6.09	TDA1044	1.43	TDA7270S	10.17		
2SC124	0.44	2SD1877	2.12	BAS11	N/A	BD139	0.41	BF758	0.32	BYD14J	0.31	LM324N	1.48	SAB3013	5.81	T9053V	0.92	TDA1060	1.73	TDA8140	2.38		
2SC1306	1.16	2SD1911	5.06	BAV18	0.07	BD140	0.24	BF759	0.36	BYD33G	0.68	LM339N	0.15	SAB3021	6.15	T9054V	1.65	TDA1082	4.25	TDA8153	3.61		
2SC1318	0.19	2SD234	0.89	BAV20	0.26	BD168	0.76	BF760	0.24	BYD33J	0.27	LM358	0.60	SAB3035	6.35	T9064	1.39	TDA1083	1.19	TDA8170	2.58		
2SC1364	N/A	2SD313	0.56	BAV21	0.19	BD175	0.29	BF762	0.29	BYV10–40	2.20	LM358N	0.42	SAF1032P	11.11	T9065V	6.06	TDA1151	0.51	TDA8180	4.87		
2SC1384	0.34	2SD350A	1.73	BAW62	0.17	BD179	0.34	BF869	0.25	BYV95C	0.44	LM380N	1.03	SAF1039	2.44	TA7063P	1.14	TDA1170	1.95	TDA8190	3.30		

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TV Fault Finding

Reports from Philip Blundell, AMIEIE, Nick Williams, John Edwards, Geoff Fardon, Brian Storm, Terry Lamoon, Richard Newman, Nick Beer, Michael Dranfield and Chris Watton

Philips CP90 Chassis

For a dead set with no standby LED or channel indicator display, check for oscillation at pins 31 and 32 of the TMP47C432 microcontroller chip IC7840. If there's no oscillation check C2934 and C2935 (both 27pF) which can become leaky. **P.B.**

Toshiba 219T9B

For a dead set with the STR54041 chopper chip IC801 in the power supply inactive, check for 5V at pin 6 of connector P587. If this is missing R843 (15Ω) is probably open-circuit. Note that it's a safety resistor. **P.B.**

Philips 2A Chassis

For a dead set with the over-voltage thyristor firing, check whether C2698 (4·7µF) is open-circuit.

For field cramping at the bottom of the picture, replace C2575 (4·7µF).

If the problem is ragged verticals and the 140V h.t. supply is low, replace the h.t. reservoir and smoothing capacitors C2697 and C2701. They are both 47µF types. **P.B.**

Ferguson TX99 Chassis

This set suffered from either loss of colour or intermittent colour when warm. A new TDA3301B colour decoder chip appeared to cure the fault but the set came back next morning. The cause of the trouble turned out to be 4·433MHz oscillator drift. We replaced the crystal XL1, R60 (100Ω) and C63 (22pF). **N.W.**

Ferguson TX100 Chassis

There was a bright raster with flyback lines. Checks showed that the 200V and first anode supplies were correct so we decided to investigate the beam-limiter circuit where transistor TR60 (BC308) was found to be short-circuit. **N.W.**

Bush 2714 (11AK03 Chassis)

If you get a dead set with the 2·5A mains fuse blown you will find that the BU508A chopper transistor TR801 is short-circuit and the 2·2Ω, 5W surge limiter resistor R801 is open-circuit. In addition to these items replace R809 (270kΩ), the TDA4601 chip IC801 and thermistor TH802 (CHS part no. 12001GT) in the start-up circuit. Failure of the thermistor is usually the basic cause of this fault. You get the same thing with Grundig, Hitachi and other types of receiver that use a TDA4601 chip in the power supply. **N.W.**

Sony KV1460 (GP1 Chassis)

There was neither picture nor sound and the channel indicator LEDs were not alight. User controls such as channel preset, tuning etc. had no effect. The h.t. and e.h.t. voltages were o.k., and increasing the first anode voltage produced a blank raster with flyback lines. Scope checks showed that there were no key scan pulses at pins 5, 6, 32 and 33 of the M50431-511SP microcontroller chip. As its 5V supply was present we replaced the chip. This restored normal operation. **J.E.**

Philips 2A Chassis

The job card read 'bang, dead!' There was a short-circuit across the mains bridge rectifier's reservoir capacitor C2659 but the chopper transistor Tr7687 was all right. The short-circuit was caused by diode D6664 (BYD33J) and pulse capacitor C2664 (1·5nF, 1kV) – the capacitor had split in half. **J.E.**

Philips CTX-E Chassis

The symptom with this set was insufficient width with bowing at the right-hand side of the screen. We found that the fusible resistor R3483 (6·2Ω) was open-circuit. As a result there was no drive to the EW diode modulator. **J.E.**

Toshiba 175R9B

This set was dead with just a faint whine coming from the power supply. We found that there was a short-circuit in the line output stage, the culprit being C464 (680pF, 2kV). It's connected in parallel with the line output transistor. **J.E.**

Sony KVM2121 (BE1 Chassis)

Field collapse was the fault with this set. We found that the µPC1488H field output chip IC501 had failed, taking with it R801 (0·47Ω), the surge limiter in the line output stage derived 24V supply. The circuit diagram shows protector PS501 connected to pin 3 of this chip. In fact it's connected to pin 4 – and was open-circuit. **J.E.**

Grundig CUC2201 Chassis

Tripping off/on, sometimes very intermittently, is usually caused by a faulty set-h.t. control (R637, 1kΩ). We renew this item as a routine measure whenever one of these sets comes into the workshop. **J.E.**

Fidelity CTV2022 (ZX3000 Mk 2 Chassis)

This set suffered from field jitter. It would sometimes start at switch on and continue until the set was switched off. At other times the display would be o.k. for about an hour, then the fault would appear. Its cause was the TDA1170S field timebase chip IC4. **J.E.**

Toshiba C2020B

When the set was cold there was a noise bar that looked like an interference line across the centre of the screen: it cleared as the set continued in operation. To start with the line would be about 3/8ths of an inch high, gradually decreasing. Use of heat and freezer led us to C317 (2·2μF, 50V) in the field output stage. **G.F.**

Ferguson TX86 Chassis

This set suffered from lack of height. A check at the collector of the upper transistor TR8 in the field output stage showed that only 39V was present here. Its 27Ω feed resistor R62 was open-circuit. **G.F.**

Panasonic TX28W2 (Alpha 3 Chassis)

This set's fault proved to be a bit of a problem. R822, the 4·7Ω, 10W surge limiting resistor associated with the mains bridge rectifier, had blown. As no obvious shorts could be measured I fitted a replacement. Then, filled with apprehension, I switched on. Instead of the friendly rustle of e.h.t. as the set came on it squeaked and blew R822 again. This time the safety resistor R555 in the feed to the line output stage had also expired. So R822 was again replaced but R555 was left open-circuit. Up came the 150V h.t. supply, but when the line output stage was reconnected both resistors blew again.

The growing pile of 10W resistors convinced me that I had to be brief with my next checks. R822 was replaced but the line output stage was left disconnected. The line drive waveform was then checked. It was bizarre, consisting of just high-frequency spikes. A new TDA2579A timebase generator chip (IC501) was fitted and another quick check was made: the waveform was as before. Eventually I found that C501, a friendly 0·1μF brown Mylar capacitor in the line oscillator circuit, was leaky. A replacement, along with a new line output stage feed resistor, restored normal operation and an excellent picture. **B.S.**

Mains Fuse Problem

Sets that produce the no results symptom intermittently certainly add to my grey hairs. This Panasonic TC1485 (Z4 chassis) was no exception. After an hour on the soak test bench it would splutter, go off and on then die. I hooked a meter to the main 100V line and awaited developments. After a few minutes the voltage started to vary all over the place then the set shut down. The obvious thing to do was to replace the power regulator chip IC801. But, much to my disgust, this made no difference: after a suitable interval the set coughed and died again. While casting murderous glances at various ceramic capacitors I tried checking the voltages around IC801. All that happened was that the set sprang to life! It later transpired that no voltages at all were present in the fault condition. Why? Because the 13A mains fuse was intermittent, that's why! The set was entirely blameless. **B.S.**

Matsui 1436

For the first ten minutes after switch on this set displayed a bright white raster. The contrast then slowly increased until a nice picture was present. Use of freezer soon took me to the culprint, the TA8691N multi-function chip. A replacement restored normal operation. **T.L.**

Toshiba 140E4B

Good sound and a good picture were present when this set was switched on. After a few seconds however the picture disappeared. I had a quick tap around (the blunt end of a screwdriver, wisely wielded, produces amazing results) and the picture reappeared. A check on the print side of the panel then revealed a nice dry-joint at pin 2 of the line output transformer. After this and a few more connections that looked dodgy had been resoldered the set worked perfectly. **T.L.**

Matsui 1422

If there's no display and no tuning with one of these portables it's worth checking D403 on the front panel and the associated circuitry. **T.L.**

Matsui 1466

Intermittent failure to switch on was the problem with this set. I decided to replace the STR50103 chip in the power supply and the 330kΩ start-up resistor. After that it wouldn't switch on at all. As checks on the rest of the components in this area failed to reveal anything amiss I refitted the original power supply chip. The set then worked normally at every switch on. Next time I do it the simple way. **T.L.**

Matsui 209

There was a nasty i.f.-type buzz. I tend to be wary of these 20in. sets and look first for dry-joints. Sure enough a visual check in the i.f. area showed that filter CF101 had never been soldered in. Once this had bee put right the sound was as clear as a bell. **T.L.**

Philips Anubis A Chassis

A squeaking noise came from the line output transformer and the h.t. was low at about 40V. As the power supply worked correctly when the line output stage was disconnected and a dummy load was substituted we decided to carry out some checks in the line output stage. For want of something better to do we changed the transformer. This made no difference at all. We drew a blank with various other components, then hit on the idea of disconnecting the scan coils. This produced the line scan collapse symptom. It couldn't be the scan coils, could it? It was, and the c.r.t. had to be replaced as well – they come as an assembly. **R.N.**

Philips 2A Chassis

This set came in with a short-circuit chopper transistor. The usual repair job put that right but there was a standby problem. When the set was cold it would go into the standby mode but the LED flickered. When the set was warm it would still go into standby but wouldn't come out: the power supply would buzz loudly and the LED's flicker rate was faster. We eventually found that R3689 (39Ω) was open-circuit. It's in series with D6689 in the chopper transistor's drive circuit. Both components were replaced, though the diode measured o.k. on test. **R.N.**

Granada C20DZ4 (Salora L Chassis)

There was no sound or vision, just a blank raster. Replacing the TDA4505 signal processor chip cured that, but we then found that the set couldn't be programmed. BBC–1 and Channel 4 could be stored in memory, but we couldn't store ITV and BBC–2. They could be tuned in manually, but no amount of button pressing would store them or the personal preferences. As I've not dealt with many of these sets and thought that I might be doing something wrong, I sought the advice of an expert. After replacing the MDA2062 memory chip all channels and preferences could be stored. My thanks to Nick Beer for his help with this one. **R.N.**

Philips G110 Chassis

This set had been fitted with the recommended power supply kit and worked well – unless you put it in standby. You would then, after two to three seconds, be rewarded with a pop and a short-circuit BUT18AF chopper transistor. There was obviously a drive problem in the standby mode, but how would one check this? We switched to normal operation and carried out some scope checks in the power supply. These showed that the BUT18AF's base drive waveform was incorrect – the switch-on delay was missing. Replacing D6612 and D6614 again cured that (they are part of the kit, so maybe we had a dud one). But the set still failed in standby. We eventually replaced D6646, D6649, Tr7655, Tr7656 and Tr7654 together. This cured the fault. There remained the problem of the bill. . . **R.N.**

Samsung CI537V

We've had an interesting fault with some of these sets recently: no vision, just a blank raster, as the set is permanently taking its vision input from the AV phono input sockets. Inject a video signal here and up comes the picture. The cause of the fault is in the tuner, where the video switching is carried out. A different tuner is supplied as a replacement. Two of its pins have to be cut off before insertion. **N.B.**

Hitachi CPT2082

The customer said that there was an intermittent buzz over the sound. I listened to the set for several minutes in the house but didn't hear anything untoward. When I dismantled it and poked around the fault appeared. PL401 in the audio section hadn't been pushed home properly – in fact it had barely been fitted at all. I was told that the set had recently been repaired by a national company. **N.B.**

Bang and Olufsen MX2000 (31XX Chassis)

Because of the link between the line and field output circuits in these sets, intermittent field collapse is commonly caused by dry-jointed EW modulator diodes. Another cause is now becomming quite common – a dry-joint at the top end of CL12 in the EW circuit. **N.B.**

Panasonic TX28W3 (Euro 1 Chassis)

Although this is a digital TV chassis I feel that the picture it produces is inferior to that provided by its analogue predecessor, Model TX28W2 (Alpha 3 chassis). Interesting that it produces the same faults! If the set comes on with no sound or picture, returning to standby a few seconds later, R561 (ERQ12HJ1R5) is open-circuit: it's the fusible resistor in the supply to the TDA8175 field output chip IC561, which goes short-circuit. **N.B.**

Toshiba 215T8B

Intermittent line or field collapse – or both – is becoming increasingly common with these sets. The cause is dry-joints at the scan coil connector. They can be quite a problem, with arcing and print burning. **N.B.**

Bang and Olufsen MX2000 (31XX Chassis)

The symptoms were familiar: the channel number was displayed atop the front of the set but there was no sound or raster. This usually indicates that the fuse or RP14 is open-circuit because of a short-circuit in the line output stage, usually the transistor or the transformer. Not this time however. The fault was misleading: when the set was switched off h.t. was present and could be seen decaying at the collector of the line output transistor, but when it was switched on there was no h.t. at this point. All was explained by a dry-joint at one end of LL04, which is in the h.t. feed to the line output stage. **N.B.**

Philips K35 Chassis

There was no field scan. It didn't take us long to find that the 1·2Ω safety resistor R590 in the supply to the field output stage was open-circuit. The field output transistors tested o.k., but we replaced them nonetheless along with R590. At switch-on R590 immediately went open-circuit. The culprit turned out to be the 1,500μF, 25V field scan coupling capacitor C521 which was dead short. **M.Dr.**

ITT CVC1175 Chassis

The output from the power supply was low at about 50V. When the feed to the line output stage was disconnected and a 100W bulb was connected as a dummy load it lit up and the h.t. rose to around 100V. From this you might suspect that there was a fault in the line output stage, but the actual cause of the problem was the 10μF, 350V h.t. reservoir capacitor C716 which had dried up. **M.Dr.**

Philips System 4 Chassis

There was sound but no raster. A check in this case is to connect a 1kΩ resistor between one of the tube's cathodes and chassis. When we did this the cause of the fault was revealed – field collapse. If you find that the 3·9Ω safety resistor R3168 in the feed to the field output stage has gone open-circuit, replace it along with the TDA3650 field output chip IC7110 and the 100μF, 50V field flyback boost capacitor C2017. The heat from R3107 dries out C2017, with the result that IC7110 fails. **M.Dr.**

Panasonic TX1752 (U5 Chassis)

The power supply was squealing and the h.t. was low at only 55V. When the feed to the line output stage was disconnected and a 60W bulb was connected as a dummy load the power supply worked correctly. Various items in the line output stage were checked before we condemned the transformer, which had an internal short. **C.W.**

Huanyu 37C3

This set was dead with a blackened mains fuse. As no shorts could be detected I fitted a new fuse and powered the set via a variac. It worked fine, so I left it on soak test for a couple of hours then switched in off and on a few times. It continued to work normally. I then left it switched off for an hour. When it was switched on again from cold the fuse exploded. The cause of this fuse blowing was eventually traced to a faulty thermistor in the degaussing circuit. **C.W.**

Tuning Satellite Receivers the Easy Way

Gordon McCrea, B.Sc.

With the ever increasing number of channels in use, more and more satellite TV installations are being slowed by the need to tune the receiver's presets to suit the customer's requirements. If it's necessary to rename presets and add radio channels this retuning can sometimes take as long as the rest of the installation. Even if you manage to persuade the customer that the factory presetting is the most suitable arrangement, the introduction of new channels will lead to calls for retuning – as with Astra 1C and 1D when this one eventually arrives. Thus a quick, easy method of updating a receiver's tuning to include all the latest frequencies would be a very useful addition to the installer's armoury.

With some of the receivers now on the market the memory contents can be transferred from one to another identical one by using a fully-wired scart cable to connect the decoder scart sockets. But to take advantage of this possibility the installer would have to have available a considerable number of different receivers – and keep them all regularly updated. And this approach would rapidly become much too expensive for most installers as new models replace older ones.

The more elegant solution described below is for use with one popular upmarket receiver, the Nokia SAT1700. A very simple memory unit for connection to the receiver can be built in the service department: it enables the channel setup to be stored and carried in the tool case to each installation job, where the tuning can be unloaded into the customer's receiver. If a new channel arrangement is required the memory can be reprogrammed and the process repeated.

Enter the EEPROM

Fig. 1 shows the circuit of the memory unit, which employs a 24C164 EEPROM (Electrically Erasable and Programmable Read Only Memory). According to the data sheet for this device, it's guaranteed for 100,000 erase/write cycles and data retention for a hundred years (no backup batteries are required). Communication with it is via the standard two-wire I2C serial bus link. The device is readily available at a price that should enable the complete unit to be built for £10 or maybe less.

The circuit can be built using a small piece of Veroboard, with a short 4-way ribbon cable taken to a plug for connection to the receiver. The board could be enclosed in a plastic case smaller than a matchbox or, even simpler, a piece of heat-shrink sleeving could be used.

The Nokia SAT1700

A 4-pin connector that provides connections for clock (SCL – serial clock), data (SDA), 5V and chassis lines is included on the Nokia SAT1700's main PCB. Software in the receiver's microcontroller chip makes it possible to use this connector to feed data to an external EEPROM for storage – it's just a nuisance that you have to remove the top cover to gain access to the connector. The procedure is as follows.

Disconnect the receiver from the mains supply, then remove the top cover – you'll need a Torx T10 screwdriver to do this. Find connector XC23, which is located towards the front at the left-hand side – it's often obscured by a ribbon cable. Plug in your memory unit (take care about the polarity) then reconnect the receiver to the mains supply. The letters 'dp' should appear in the front display. If they don't, switch off immediately and double-check everything.

Now press the following buttons, in the order listed, on the remote control handset: store, -/--, TV-SAT. This should

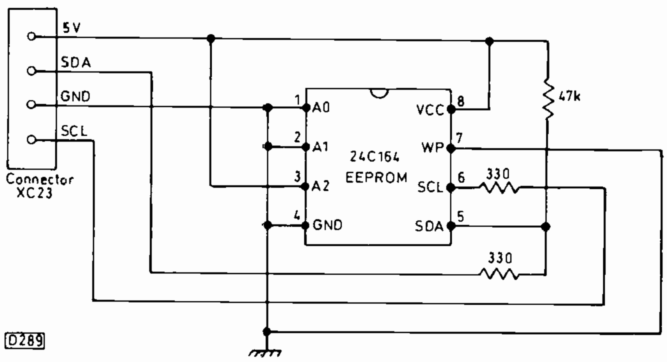


Fig. 1: Circuit diagram of the 24C164 memory unit.

change the front display to read 'out'. Congratulations! You are now copying the receiver's entire memory into your external EEPROM – you did of course make sure that you had up-to-date channel presetting. When this process has been completed the front display will read 'oc'. Disconnect the mains supply before you remove the connector from XC23.

If you next make a few changes to the contents of the receiver's memory you'll see how easy it is to restore the original contents. Disconnect the mains supply, reconnect the external memory unit, reconnect the mains supply then press the 'p+' button under the central flap. The front display will read 'in'. This indicates that the memory unit is feeding its contents back into the receiver: the display will read 'oc' when the operation has been completed.

Want more set-ups? Build a few more units or, better still, put them all on one piece of Veroboard with a selection switch. You can connect all the clock and data pins to common clock and data lines, switching an address pin to select the required chip: say one set-up for the movie buff, another for the sports fan, one for teenagers and one for the geriatrics!

Parts

The 24C164 EEPROM chip is available from RS under part number 311-366. This company also stocks a connector that fits on to XC23 in the SAT1700: part number 467-611 is the shell housing and part number 467-598 the crimp terminal. TV sets use lots of these connectors, so you may find one on the junk shelf.

What Next?

A follow-up article will explain how the computer buffs amongst you can connect your memory unit to a PC and read/write information as required.

Long-distance Television

Roger Bunney

Although there was a slight increase in reception, February was again a quiet month. Perhaps the most exciting moments reported by enthusiasts were some more sustained meteor-scatter pings and an aurora on the 6th. Two letters from down under indicate that the sporadic E season in Australia has been extremely good: we'll keep our fingers crossed for a similar season in the northern hemisphere. The rather sparse February SpE log is as follows:

6/2/94	TVE (Spain) ch. E3; DR (Denmark) E3.
8/2/94	RAI (Italy) IA.
12/2/94	TVE E2, 3.
13/2/94	Unidentified ch. E2/R1/E3 signals (late morning).
19/2/94	NRK (Norway) E2.
23/2/94	SVT (Sweden) E3.
27/2/94	TVE E2, 3.
28/2/94	TVE E2, 3.

During the late afternoon aurora on the 6th Brian Williams (Penarth) received back-reflection signals from Austria, the Czech Republic and Scandinavia of the usual 'hummy', poor quality.

A Set for DX Reception

Recently a 14in., PAL system I Nokia TV receiver, Model 3724, has been on sale in the UK at prices from about £164 upwards. Fastext is included and I've bought one intending to use it for satellite TV reception via the scart connector. The receiver should however be excellent for terrestrial DX-TV reception: it has full Band I/III coverage and the 59 memory positions should make it easy to program the main Band I channels for selection via the remote control handset. There's also a scan facility with on-screen graphics. The handbook is clearly written, and a degree in computer programming shouldn't be necessary to get the beast to do what you want.

Satellite Reception

Developments in Bosnia have led to increased SNG activity. A new uplink appeared via Intelsat 603 (34·5°W) on the 19th, from Pale to the south east of Sarajevo at 10·970GHz (vertical), providing feeds to various European networks. Apart from the usual Sarajevo airport source at 11·142GHz (V), Pale was also noted at 11·006GHz. Eutelsat II F4 (16°E) has been used for US bound output from Bosnia. An Italian SNG truck with the identification 'ITA57 AVIANO' appeared via Eutelsat II F2 (10°E) at 11·006GHz (V), just above the RAI Uno transponder: Aviano is an air force base used by planes patrolling over Bosnia.

The Israeli massacre at Hebron on the 25th also fired up the satellite feeds: Jerusalem Capital Studios used the Reuters 12·521GHz transponder aboard Eutelsat II F1 (13°E).

For me personally the most unusual sighting this month was 'UKI-312 Lundy' via Eutelsat II F4 at 12·523GHz – camera shots of the island and VTR material.

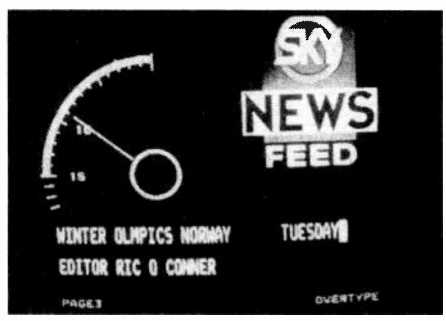
Alan Smith has equipped himself for C and Ku band reception in Thailand. He missed the opening ceremony for the Thaicom 1 satellite on the 1st but saw weak test transmissions on the 2nd. Alan has been campaigning to get Star TV to provide stereo sound with its transmissions. He's received a new C-band satellite at between 125-128°E carrying an Indian channel, Sun TV, in Tamil. The source could have been Statsionar-15 at 128°E. Further to the west, Intelsat 505 (66°E) has been busy carrying the Winter Olympics from Lillehammer.

John Locker has been busy with the Jason educational project at the Liverpool Maritime Museum. Maxat has provided a 2·4m dish and PanAmSat (owner of the PAS-1 satellite) has been very helpful with material and information. The PAS-1 satellite at 45°W is being used to provide a link from South America to Europe with compressed video.

Ian Waller (Lincoln) reports that Eutelsat I F4 (25·5°E) has been carrying CNNI via its east spot beam at 11·092GHz, thought to be for a Turkish cable system. Ian has also seen the Sky coverage of the West Indies cricket tour via Intelsat (50°W) at 4·18GHz.

Geoff Stocks (Plymouth) has been enjoying Italian football via Eutelsat II F3 (16°E) at 11·163GHz (H) on Sundays from 1230-1600GMT. He's using a 1·2m offset dish with a Connexions 8220 receiver and would be delighted to hear from other West Country enthusiasts. You can phone him on 0752 668 015 – he has several Continental sound carrier conversion boards for sale.

Bandula Gunasekera reports that u.h.f. transmissions from the Russian Ekran satellite are being enthusiastically received in Sri Lanka – the Orbita-1 (Secam) service at 714MHz and Indian Asianet (PAL) service at 754MHz. In response to local enquiries a simple but effective receiver has been designed (see Fig. 1): he tells us that it really works, giving excellent results. An ELC1043 or ELC2004 u.h.f. tuner is used (others would do), followed by two transistors that provide voltage gain and then an NE564 amplifier/demodulator chip. The



Feeds from the Lillehammer Winter Olympic games received by John Locker at the Wirral. Left via Telecom 2B at 5°W, centre via Kopernikus at 28·5°E and right via PAS-1 at 45°W.

output from this chip, at pin 14, is fed to a video emitter-follower stage and a sound amplifier/demodulator circuit – the video and audio outputs can be fed to a monitor, a VCR or an r.f. modulator. Bandula uses a fifteen-turn helical aerial with this receiver. Alternatively crossed Yagis (mounted at 90° to each other) with 14 or more director elements could be used, phased for circular polarisation.

News Items

UK: Successful digital audio broadcasting (DAB) tests in Bands III and IV have been carried out by the BBC in London at fixed locations and with moving vehicles. The DTI has confirmed that DAB will operate within the band 217·5-230MHz and it's possible that services could start as early as mid-1995. To encourage listeners to adopt the new technology there will be some simulcasting of Band II f.m. transmissions in DAB form in Band III. As a TV spectrum Band III seems to be doomed in the UK. A review of mobile radio (PMR) in Band III is to be undertaken with a view to increasing the number frequencies in use: there are to be three extra regional licences.

The Netherlands: DAB is also being tested in the Netherlands, using ch. E7 (189·25MHz). A 1kW transmitter at Haarlem and a 40W transmitter at Hilversum are being used. Tests are soon to be extended to Rotterdam. Polarisation is vertical. ZH-TV (Zuid-Holland TV) is now in operation on ch. E49, using a 10kW e.r.p. transmitter at Rotterdam. Polarisation is horizontal.

Germany: PRO 7 has been awarded a terrestrial service licence for the Schleswig-Holstein region.

Israel: Plans for a Palestinian TV station have been delayed as a result of a dispute between the Jordanian and the Israeli governments over the location of the studio.

Bangladesh: A second TV service is to be opened later this year in Dhaka. It will be primarily educational.

Ireland: There have been discussions between RTE and the UK authorities over the possible extension of RTE-1 and -2 coverage, also the new Telefis na Gaeilge service, to Northern Ireland. Des Walsh (Co. Cork) reports that there is considerable hostility to the use of high-powered MMDS transmitters in southern Ireland, on health grounds. Some run at 1kW.

Czech Republic: TV Nova is now in operation, using the former CT2 network and PAL colour. CT2 now uses the CT3/OK3 network which will be supplemented later this year with transmitters at Brno (ch. R46, 200kW), Chomutov (R35, 50kW), Hradec Kralove (R57, 200kW), Jesenik (R50, 200kW), Jihlava (R42, 100kW), Plzen (R48, 200kW) and Trutnov (R40 200kW). Transmitter powers e.r.p.

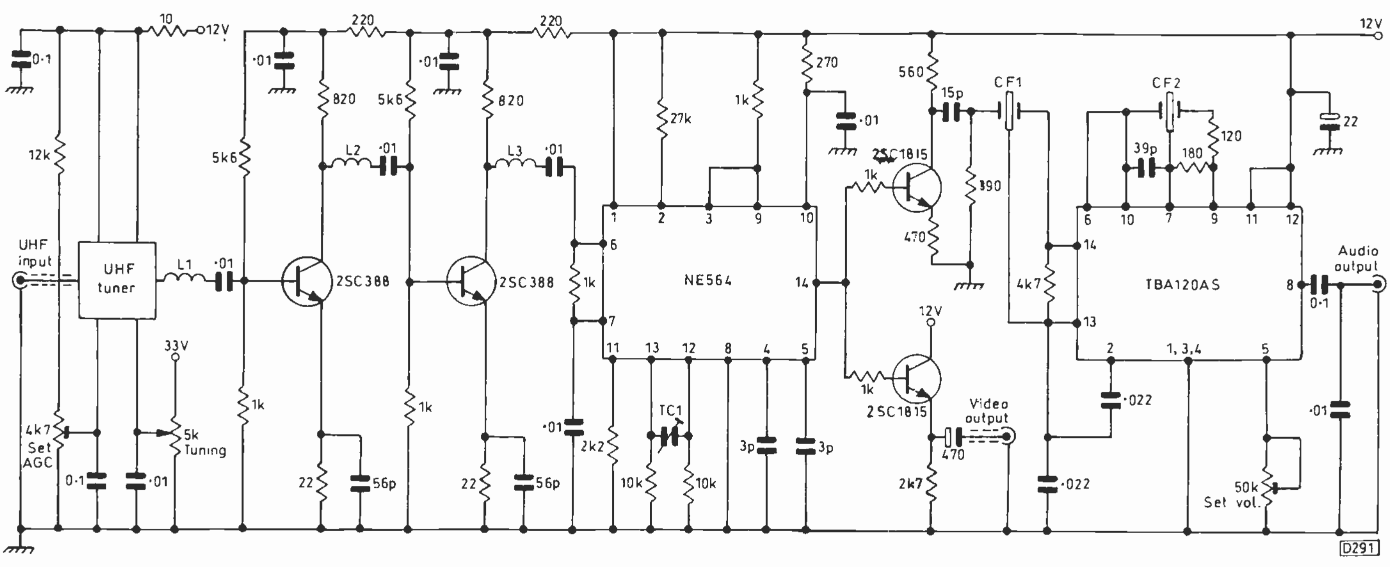


Fig. 1: Simple circuit for reception of the u.h.f. transmissions from the Ekran satellite. CF1/2 are 6·5MHz ceramic filters. TC1 is a miniature 2-20pF trimmer. The three coils consist of six 2·5mm diameter turns of 40 s.w.g. wire.

Slovakia: TV Sever (Zilina) is in operation on ch. R52 at 1kW, with PAL colour.

Russia: There are plans to change to a single national public TV service plus three national commercial services.

Sri Lanka: ETV-1 (BBC WSTV) ch. E33 and ETV-2 (Prime Sports) ch. E56 are now in operation at Kandy. Coverage is to be extended later this year. Rupavahini Sri Lanka (ch. E5) is to reopen two relays in the north, at Kokavil and Palali.

Satellite TV

The Marco Polo-1 satellite has been renamed Sirius after being sold to the Swedish Space Corporation. It has been moved to 5·2°E, next to Tele-X. The following transponders are in operation: 4 (11·785GHz), 8 (11·862GHz), 12 (11·983GHz), 16 (12·015GHz) and 20 (12·092GHz), all with right-hand circular polarisation and, to date, clear PAL. Because of the tight beamwidth centred on Scandinavia the signal levels in the UK are weak.

Loss of the Ariane V63 rocket was apparently caused by damage to an immersed bearing in the third stage engine because of insufficient cooling of a liquid oxygen pump. Rectifying this defect will delay planned launches. Eutelsat II F6 may now be launched prior to Astra 1D, which may have to wait until Christmas or early 1995.

Music Choice Europe is now on air with CD quality digital audio free from advertising. It's uplinked from the USA via Intelsat K for cable distribution in Europe. All 56 music programmes are compressed for transmission.

The UN has leased additional Intelsat links for communications with troops in trouble areas. Much use is being made of 22 portable stations operating in the Ku band via the Intelsat craft at 63°E.

France has been testing Nicam via the Telecom 2B TF1 and TMC channels. A 5·58MHz subcarrier is used, with the f.m. mono audio moved from 5·8MHz/J17 to 6·6MHz/50µsec. RTL via Telecom is likely to use Smartcrypt, a cut and rotate system. The subscriber requires two cards, one with the control access code and the other with the algorithm. Decoders are expected to cost the equivalent of about £100, including a three-year free access period to the channel.

Knife-edge Refraction

Last month we mentioned propagation of distant signals via refraction at the top of high ground/mountains that otherwise provide screening. This has been experienced in the Rocky Mountains, with propagation over hundreds of miles. George Gaskin writes from Gibraltar to suggest that short-range refraction can produce similar effects. The Gibraltar fire brigade installed a 70-80MHz repeater at the top of the Rock. At the northern end of the Rock there's a sheer 1,300ft drop, which should have meant that contact with mobiles below would be impossible. In fact it was found that contact, though not one hundred per cent, was possible in many places. The repeater now operates in the 150MHz band, with similar results.

I recall that during the mid-Fifties/early Sixties signal refraction at Ventnor, Isle of Wight, via the 750ft St. Boniface Down resulted in aerials being sited in the oddest of places.

The Versatile LM317T

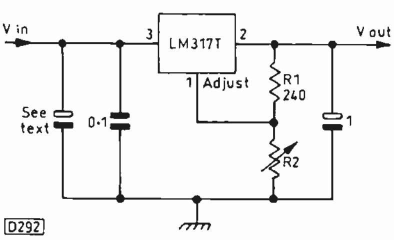
Gordon Haigh

The adjustable-output, three-terminal LM317T positive voltage regulator has been available for a good many years now. You find it advertised for as little as 50p plus VAT. Since it can get you out of some tricky situations it's worth keeping some in stock. For repair work we usually have in stock the standard positive 5V and 12V regulators, and maybe also the 15V and 18V versions: but could you lay your hands on an 8V or 10V regulator if you needed one? Keep some LM317Ts on the shelf and you won't have to worry. We'll also mention one or two other uses for the device in this article.

Features and Basic Application

Motorola and National Semiconductor have been the principal producers of the LM317T chip, which features internal current limiting, thermal shutdown and safe-area compensation – these make it difficult to blow the device. The LM317T (TO220 case) superseded the earlier steel-pack LM117 version. Some other common versions are as follows: the LM317K is a 1·5A type in a TO3 case, while the LM317MT and LM317MP are 0·5A plastic types. There's also a version that provides a negative output voltage, type LM337T. But the following notes apply to the LM317T.

Fig. 1 shows the basic circuit for providing any output voltage between 1·2V and 37V. The input voltage range is from 4V to 40V and the regulator can handle up to 1·5A. R1 is nearly always the value shown, 240Ω, though many users bend the rules a bit and make it 220Ω, a value that's more



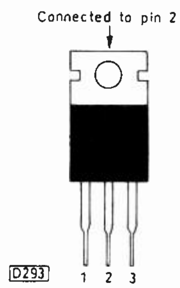


Fig. 1 (left): Basic regulation circuit.

Fig. 2 (right): Pin connections.

widely stocked. You can of course use two 120Ω resistors connected in series. The output is set by R2, which can be a small preset or a fixed resistor – the required value can be determined by using a temporary preset and a dummy load. If a value of 1kΩ provides the required fixed output voltage, use of a 2·2kΩ preset would be appropriate so that the wiper can be set at a nearly central position. As the value of R2 is increased, the output voltage rises.

When an LM317T is used for replacement purposes the electrolytic capacitor on the input side can be an existing capacitor, e.g. a mains bridge rectifier's reservoir capacitor or a reservoir capacitor on the secondary side of a chopper circuit. The 0·1μF capacitor is required only where the regulator is an appreciable distance from the input electrolytic capacitor. The 1μF output electrolytic capacitor can also be an existing component. Its presence improves the transient response rather than the stability. This capacitor also improves the output impedance.

Pin connections are shown in Fig. 2, some electrical characteristics in Table 1.

Use as a Motor Regulator

Some motors in audio cassette players have a regulator chip in series, taking its input from an unregulated supply. An LM317T can be pressed into service if the original device has failed. To obtain the correct motor speed an

Table 1: Electrical characteristics at 25°C

Output voltage	1·2-37V
Output current (max.)	1·5A
Input voltage range	4-40V
Maximum dissipation	15W
Typical load regulation	0·1%
Ripple rejection	65dB
Typical line regulation	0·01%
Current via pin 1, typical	50μA

unusual voltage may be used, while the type code on the original device may be meaningless. No problem with a LM317T! Retain the interference suppression capacitors.

With some motors the regulator chip is in the steel motor case instead of being separate. Motor faults such as bearing or winding troubles etc. can turn the chip into a low resistance or a piece of wire. The motor then runs fast or erratically. An LM317T should never be added externally to mask this condition.

The LM317T can be used in a similar manner as a low-voltage d.c. audio turntable motor regulator. A strobe pattern, if present, can be used with R2 to set the speed correctly. Two switched presets are required in position R2 for 33/45 r.p.m. operation.

Bench Uses

As an inspection lamp (also as a dummy load) a 60W mains bulb on a wooden base has disadvantages. If you point it into a VCR the infra-red radiation it gives off confuses the sensors. The VCR may then shuttle about! In addition the lamp flicker at close range does you no good over a period of time. It's far better to use a c.r.t. heater transformer winding with full-wave rectification and smoothing followed by an LM317T to supply a pocket torch. With its reflector, the

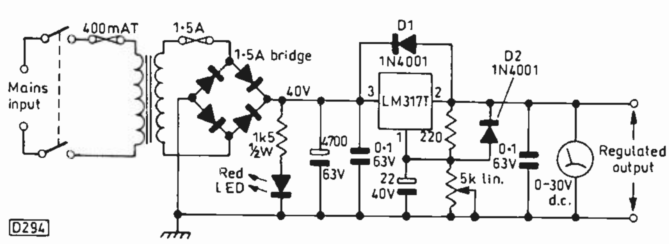


Fig. 3: Adjustable 1·5A power supply.

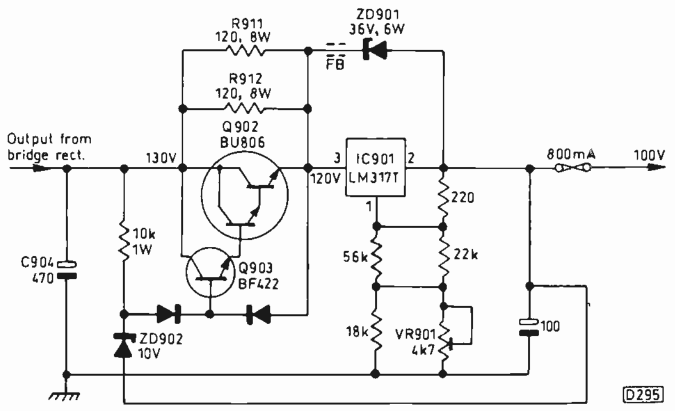


Fig. 4: Use of the LM317T in the Hitachi NP84CQ chassis (Models CPT1444, CPT1644 etc.). In some sets a single 62Ω, 15W resistor is used in positions R911/2.

torch is much more directional. For this application R2 would need to be around 600Ω to supply a 4·5V flashlamp.

Older variable bench power supplies like the Amtron kits used a discrete series regulator transistor such as a 2N3055 plus many other components. Although mine has been quite reliable, because of wear and tear a fair number of replacement BC107s have had to be fitted. Anyone starting afresh might care to consider using an LM317T as the basis of a variable bench supply. Fig. 3 shows a circuit devised by Marshall's. The LM317T should be mounted on a heatsink. D1 and D2 are incorporated to provide protection when the output is connected to an inductive load.

High-voltage Use

A customer of mine lost part of his metal watch (one of the metal bars, where the strap fastens) inside an Hitachi CPT1646R television receiver (NP84CQ chassis). In addition to blown fuses the BU806 series regulator transistor was short-circuit, zener diode ZD901 was also short-circuit and the LM317T regulator chip IC901 appeared to have been damaged (a comparison was made with a new one). On obtaining the circuit diagram I was surprised to find that although 40V is quoted as being its maximum input voltage the LM317T is used in the regulated 100V supply. Fig. 4 shows the circuit. The trick here is to arrange that the voltage across the LM317T is only about 20V. An industrial quality zener diode (ZD901) connected in parallel with the LM317T prevents the voltage across it exceeding 36V. The LM317T is used as a second regulator – the following description is based on that given in the Hitachi manual.

The mains bridge rectifier produces about 130V across C904. Q902, a Darlington power device, and its associated components form a preregulator. With a high mains input voltage, most of the current flows via R911/2, IC901 then being the main regulator. As the mains input voltage falls, R911/2 are progressively bypassed by Q902 until, at 220V a.c. (the lower limit of operation), they pass little current. The output from the preregulator varies from approximately 111V with a low mains input voltage to approximately 120V with a high input – these figures apply with normal beam currents. IC901 provides a regulated 100V output, set by VR901. ZD901 provides protection under certain fault conditions.

Incidentally, after repairing the power supply in the faulty set I found that the programme buttons didn't respond correctly. The set needed reprogramming (see page 732, *Television* August 1991).

Ni-Cad Battery Charger

Ni-Cad batteries are best charged from a constant-current source. The LM317T can be used for this purpose, as shown in Fig. 5. Up to seven 1·2V cells can be charged at rates up to 375mA, up to ten cells at lower current rates. Charge rates can be calculated from I = 1·25/R(Ω).

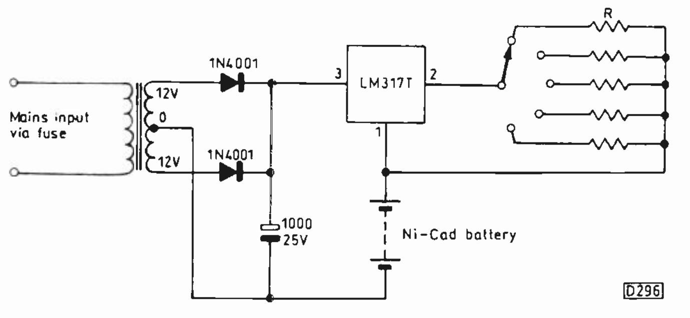


Fig. 5: Simple Ni-Cad battery charger circuit.

Rate (mA)	Specification for R
10	120Ω, 0·5W
25	47Ω, 0·5W
50	27Ω, 0·5W
100	12Ω, 0·5W
200	6·2Ω, 0·5W
250	4·7Ω, 0·5W
375	3·3Ω, 2W

Answer to Test Case 377

– see page 477 –

Sherlock got there in the end – with a little help from his friend. The lack of height was obviously caused by insufficient current in the field scan coils. The drive to these comes from pin 2 of the μPC1378H field output chip IC552. As usual the scan current path includes a coupling capacitor, C527 in this case, and a low-value sampling resistor, R567. This 1·8Ω, 1W resistor has a series-connected resistor and thermistor combination across it to provide compensation for temperature changes. Indeed the thermistor was doing its job correctly, keeping the display virtually constant while Sherlock thermally cycled the timebase board.

The sampling resistor serves two purposes: the waveform generated across it provides negative feedback for field linearity correction while, in conjunction with the coupling capacitor C527, a parabolic waveform is produced for the EW pincushion correction circuit. What had happened was that the value of R567 had increased somewhat. This had detracted from the scan-coil current not only directly, by increasing the resistance in series with the coils, but also indirectly via the feedback circuit. Since the increased-value resistor produced a larger sample waveform, the feedback circuit was being given the false impression that the scan current was too great.

In addition to R567, which has to be exactly the right type obtained from Sony or one of its agents, the electrolytic capacitors in this area – C521, C527 and C537 – were replaced, if only because the set is several years old and our test meter wasn't sure about them.

The result of all this was an excellently-proportioned picture and a delighted Mr. Smith.

What a Life!

Donald Bullock

When I started in this trade there were no transistors. There were wireless sets, electric gramophones with pick-ups that weighed a ton, and radiograms – a wireless set and a gramophone in one huge box. There were a few television sets as well of course. They were full of valves, had tiny screens and also weighed a ton. And they received just one programme, BBC, 'cos that's all there was.

I had no idea at that time what I was letting myself in for. These thoughts came to me the other day when I heard Steven happily accepting a CD player for repair. It's sometimes hard to appreciate how the trade has managed to cope with the dozens of complex developments and the ever-increasing multiplicity of domestic electronics equipment.

The Hitachi DA58

The CD player, an Hitachi DA58, would read a disc only once in about ten attempts. I was trying to read a B & O circuit diagram and claimed to have a headache (that would figure!) and to be too busy to even think about it. So Steven took down the manual and went about it with no apparent concern. He found some dry-joints around a clutch of transistors – Q007, Q008, Q011 and Q012. When he'd resoldered these the player worked correctly.

An Amstrad STV20

He next applied himself to an Amstrad STV20, which is a 20in. TV set with a built-in satellite receiver and decoder. The job card said 'intermittent blue screen'.

In this model the satellite receiver/decoder is vertically mounted at the right-hand side (viewed from the back), with the cable connections and the card insert slot at the back. The main panel and power circuitry are on separate panels on the floor of the cabinet, in plastic slots. Steven soon found that the tube's voltages varied when the signal panel was pressed and lifted. The power and signals panels have to be pulled out together, then separated for service attention. In this particular set the PCB slots were very rough, so much so that the print at the extreme edges of the panels had worn shiny through ordinary cabinet movement.

It's quite a new model. Working without a circuit diagram, Steven concentrated on the circuit connector that links the signals panel to the tube's base panel. He found that a 170V voltage at pin 2 disappeared when the fault was present. Steven could find no hairline cracks but noticed that the rear, right-hand corner of the panel showed signs of running hot. Resoldering the components in this area – C75, C86, R85 and D15 – cured the intermittency.

"Didn't like that Amstrad" he said as he boxed it up. "You can do the next one."

An Old Bush

While he was lifting the set down, quiet Norman Glutton glided in with an old Bush TV set – one fitted with the T22A chassis. I saw that it was one which had been adapted for remote control operation, and prayed that I wouldn't have to take out the mass of ironwork and circuitry behind the front cabinet controls. Norman works at the local pub, mainly because he gets all the unsold pies and pasties and something to wash them down with. I've never seen him without a pie.

"You seem to be coming here a lot recently Norman" I said, "you must have a television set and a VCR in every room!"

The Bush set displayed three obvious symptoms. What there was of the raster was green, it had collapsed into a bright horizontal line, and there was no digital display. Were there three separate faults, or one that caused all these symptoms? Surely there had to be a single fault. I made for the 12V line, which is derived from the line output stage and is stabilised by an LM7812 regulator, IC701. It feeds the field generator and the signals circuitry, the LM7812 being mounted on a large heatsink at the rear, right-hand side of the chassis, close to the edge. It had originally been dry-jointed, probably because of stress due to its position. But the solder had melted and shorted the 12V line to chassis. As a result the 2Ω, 2W fusible resistor R422 had given up. The resultant voltage loss was the cause of the various symptoms.

As Norman doesn't have much income, I felt kindly towards him when he returned. "Here it is Norman" I said, "good as new – but no better I'm afraid. Fifteen quid to you!"

"Oh good" he mumbled through a piece of pork pie. "I'll charge old Woody thirty quid. He'd reckoned on having to pay about forty."

A Ferguson 14M2

Meanwhile Steven was working on a Ferguson 14M2 (TX89 chassis) whose display symbols flashed and constantly changed. Most of the time the display was nonsense, but when it did make sense and settled on a local channel a good picture came up. Then the set would switch itself to standby. Steven stood their poleaxed.

"What's up with this one then?"

"God knows" I replied, "but remember – adopt a logical approach." Then I slunk out to make the tea.

A big murder enquiry was going on in our area at the time. Umpteen bodies had been found and more were being sought. I stayed in the house awhile to see all about it on the box, which I normally never watch. Then I took Steven's cold tea out to the workshop. He'd got the set working and was also watching the murder enquiry.

"What was it?" I asked, pointing to the Ferguson.

"Someone seems to have done in a lot of women" he answered.

"No – the fault on the Ferguson" I said.

"Oh, that. A carbonised on-off switch. I've wired one in temporarily and have ordered the right one from HRS."

"Yeah" I said, "I suppose it had to be that."

"No. It could have been caused by IC13 and IC14: as they're data linked, you have to replace them both. Another possibility could have been e.h.t. arcing, particularly under the e.h.t. cap."

"You've been on to Ferguson!" I exclaimed.

"Wouldn't speak to me" he said.

"Then where did you get all that?"

"Worked it all out and tried the most likely thing first. You did say to be logical!"

I'm still puzzled about how much he's picked up in such a short time. The bits I know took me a lifetime to absorb.

Letters

POSSIBILITIES

The report on the Las Vagas CES was interesting. But it seems that the gismo manufacturers are overlooking one point: how many different formats can one fit into the average home?

Here's something that might be more worthwhile. Computer programs that claim to be able to provide good translation between French and English, English and German etc. have been advertised recently. By using the teletext subtitles for the hard of hearing it's possible to get a foreign language into ASCII form quite easily. A computer could then do the translation so that foreign subtitles could be replaced with English ones and vice versa. Unfortunately not many broadcasters use teletext, let alone subtitling, but the possibility is there. The software packages are not expensive. If the technology was incorporated into a TV set one could truly claim to have a multistandard receiver!
D. Benyon,
Bude, Cornwall.

LEADS IN CASSETTE PLAYERS

A while ago a reader wrote in complaining about the leads used in cassette players to connect the heads to the electronics. The lead used to connect the heads in most floppy disc drives makes a good replacement. It's generally a four-core screened cable about 20cm long, which should do for most players. Drives are easy to obtain as scrap units from local computer repair depots – they are generally free as non-workers. A source for longer leads is the old 8in. drives, but these are very difficult to find.
S. Beukes,
Durban, South Africa.

TECHNICAL BACK-UP

Two letters in the April issue refer to the subject of technical back-up (or lack of it). There are several reasons why manufacturers that decide not to provide technical advice to independent workshops are not doing themselves any favours.

First, during an average week I'm asked three or four times for advice on which make of TV set or VCR to buy. I base my reply not only on reliability and price but also on the help I'm likely to get should I have to do any servicing. This must be quite an influential factor taken nationwide.

Secondly there's customer frustration when an intermittent fault takes weeks to rectify, though quick reference to a manufacturer's fault information may be all that's required. The setmaker may say "take the equipment to one of our service centres for repair". But for various reasons including distance, cost and convenience the customer may not wish to do this.

Next there's the possibility that some engineers may declare a product to be beyond economic repair, or provide a high quotation, simply because of lack of manufacturer support. This doesn't generate brand loyalty.

Last year I contacted all the major manufacturers prior to launching the monthly *Fault-Fact-Files* system (advertised in *Television*), inviting them to contribute for the benefit of all engineers. Some adopted a very positive attitude, but two in particular decided against participation, giving as reasons the need for specilised training and the investment in equipment their agents are expected to undertake.

My thoughts however are that if one engineer has spent several hours diagnosing the cause of a fault, or if a component was initially underrated and has since been up-graded, why can't we all be told about it? If fault information is readily available, engineers won't have to phone manufacturers' service departments so often, taking up their engineers' valuable time. Media such as *Television* and *Fault-Fact-Files* can disseminate this information.
Paul S. Smith, Vision-On,
Newtownabbey.

PROGRAMME DELIVERY CONTROL

In dealing with programme delivery control in his Modern TV Receiver Techniques article in the March issue Eugene Trundle refers to the MV1820 chip from GEC Plessey Semiconductors. His description of its function was not quite accurate however.

The chip doesn't compare the data on the incoming label with the preset recording instructions. Comparison is carried out by the software within the VCR. This also turns the VCR on and off to make the recordings. The MV1820's function is to extract packet 8/30 format 2 from the teletext data stream. This contains the programme information and the timing data. The MV1820 converts this into a format that the VCR can recognise, storing it in the output registers where the VCR's software constantly checks it for a match with the preset recording instructions.

GEC Plessey Semiconductors also has the MV1821 VPS/VDC chip that automatically checks which system is being broadcast. Use of this dual-standard device means that VCR manufacturers don't have to produce two separate designs to cover the European market.
Jim Wallace, Teletext Products Marketing Manager,
GEC Plessey Semiconductors, Cheney Manor,
Swindon, Wilts SN2 2QW.

FEEDBACK FROM SAMSUNG

In the March TV Fault Finding column Michael Dranfield mentions a no teletext sync fault with the Samsung Model CI-5013T. He says that he has devised a simple modification which is not recognised by Samsung. I write to confirm that there has been no reference to such a fault in our warranty labour claims or returned goods since this model was first launched. In fact the only reference to it we have is in a letter to me from Michael Dranfield dated 2nd December 1992.

I have to make it clear that, since the modification has not been approved by our Technical Division, Samsung cannot accept any liability when it has been carried out following Michael Dranfield's instructions.
A.C. Coton, Commercial Operations Manager,
Samsung Electronics (UK) Ltd., Euro Service Centre,
Stafford Park 12, Telford, Shropshire.

ELECTRONICS AT SCHOOL

I am 16 and intend, after leaving school, to go to technical college to do the City & Guilds 224 course. My purpose in writing is to comment on a recent letter about young people's interest in electronics. I think that the number of those interested is underestimated. What puts many young people off is the way in which electronics is presented at

school. We either use a breadboard or a preassembled board, simply connecting a wire to form different gates. There would be greater interest if we could make our own PCBs and deal with circuits that would be of use to us (a radio, timer etc., not just a gate). The emphasis at school is on digital circuits: the national curriculum doesn't seem to appreciate that analogue circuits are just as interesting as digital ones. It is not the school's fault for failing to make electronics interesting. It's the government's failure to provide the cash required.
Tony llewelyn Jones,
Bangor, Gwynedd.

SERIES REGULATORS

In reply to K.J. Treeby, the type of series regulator circuit shown and described in Modern TV Receiver Techniques (Part 13 January) was selected simply because it's so widely used. The emitter-fed system does in practice have certain advantages over a collector-fed system. The error sensing system that can be used, with the reference zener diode connected directly to the output, improves the loop gain and the ripple reduction performance – the zener diode's low impedance at ripple frequencies feeds any ripple directly to the error sensing point (Tr2's emitter). Furthermore, because the series regulator transistor is operated as a common-emitter stage the value of R1 can be much lower: thus the voltage across it will be much less before regulation is lost – this is an advantage where the input is from a 12V battery.
Eugene Trundle,
St. Leonards on Sea, East Sussex.

STEVE REPLIES

Ooops! At least Ray Porter isn't asleep. In may article on auto grey-scale faults (March) Q4 is in fact a voltage-reference source. In answer to Michael Dranfield, who referred to no playback colour in LP cue and review (letters April), what can one expect for £210? A special 'jump circuit' is required to compensate for the massive colour errors in LP picture search. Most low-cost VCRs are low cost because the manufacturers have saved by not incorporating correction circuits. Fair enough?
Steve Beeching,
Barnby in the Willows, Notts.

Help Wanted

The aim of the Help Wanted column is to assist readers who require a part, circuit etc. that's not generally available. Requests are published at the discretion of the editor. Send them to the editorial department – do not write to or phone the advertisement department about this feature.

Wanted: U4 (Z86E21) for the Grundig GIRD2000 satellite receiver; capstan PCB for the Hitachi VTF70; IC503 (BU2735AS) for the Akai VS23EK. P. Lowe, 5 Lingfield Green, Darlington, Co. Durham DL1 1DD.

Wanted: Service manuals for: JVC timer/tuner TU20E; JVC U-matic CR6060ET VCR; Panasonic AG6200 VCR; Funai/Technicolor 212E VCR. T. Martini, 6 Levant House, Mile End Road, London E1 4RB. 071 790 6807.

Wanted: Stand-alone teletext decoder. Mike Barnett, 15 Iris Avenue, Birstall, Leicester LE4 4HP. 0533 671 076.

Wanted: Manual or circuit diagram for the Ferguson 3V37 2 3/4in. colour monitor. J. Farrer, 37 Priory Grove, Ditton, Maidstone, Kent ME20 6BB. 0622 716 294.

Wanted: Circuit diagram (photocopy would do) for the Toshiba Model IK-1900PFD camera. S. Beukes, PO Box 5963, Durban, South Africa, 4000.

Wanted: Operating or service instructions for the Sky Scan K1 satellite receiver. Could photostat and return. I have several multistandard receivers for disposal for nominal sums. G.D. Stocks, 62 Ridge Park Avenue, Mutley, Plymouth, Devon PL4 6QA. 0752 668 015.

Wanted: Operating panel for the Philips receiver/audio amplifier Model 70FR260 – or a scrap machine. Jim Littler, 363 Atherton Road, Hindley Green, Wigan, Lancs WN2 3XD. 0942 58 794.

Wanted: Good home for a Sony Profeel monitor/component TV system. G. Baskerville, 33 Chapel Street, Warminster, Wilts BA12 8BZ. 0985 216 488.

Wanted: Circuit diagram for the Telequipment S51 scope, also any spares, PCBs and drum motors for the Philips VR6462 and Ferguson 3V54 VCRs. E.J. Edwards, 43 Hoose Court, Market Street, Hoylake, Wirral L47 5AB.

Wanted: Circuit diagram or technical information for the Panasonic TX1450 and TX1424 monitors. S. Lemon, 186a Farnborough Road, Farnborough, Hants GU14 7JL. 0252 546 398.

Wanted: Signal panel (part no. 503-372D) for the GoldStar GHV1246I VCR and a 16DB22 6in. colour tube for the Saisho CTR6. Peter J. Lane, Frost Industrial Estate, Bidewell Close, Drayton, Norwich NR8 6AP. 0603 867 264.

Wanted: Two µEC1817 transistors for the Telequipment D1011 scope. John Hibbs, PO Box 816, Amanzimtoti, 4125, Natal, S. Africa.

Wanted: Manual for the Philips VR6470, also replacement drum. Manual and YM2201K chip for the Mitsubishi DP107 CD player. Ian Ruddock, 294 Willow Field Tower, Harlow, Essex CM18 6SD.

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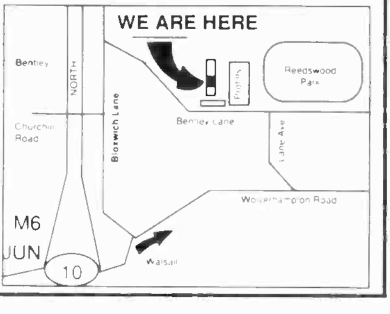

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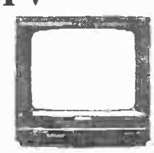

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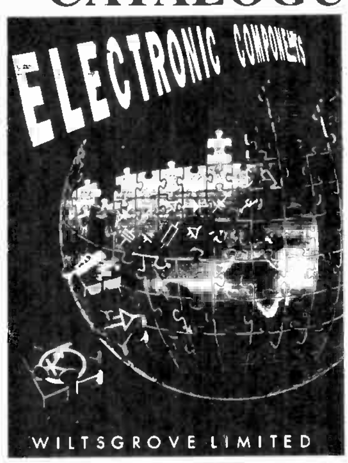

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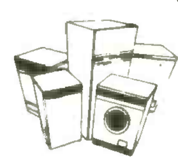

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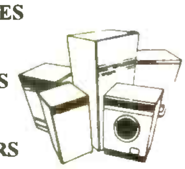

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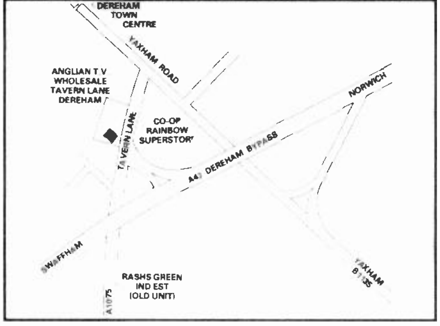

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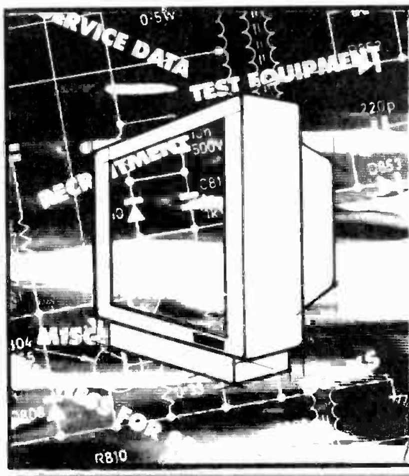

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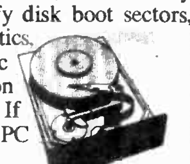

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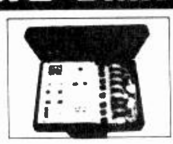

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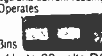

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TDA3651	£3.00
TDA3651AQ	£3.50
TDA3652	£3.50
TDA3653AQ	£2.00
TDA3654	£2.00
TDA3654Q	£2.00
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