

THE LEADING UK CONSUMER ELECTRONICS TECHNOLOGY MAGAZINE

# TELEVISION

SERVICING · VIDEO · SATELLITE · DEVELOPMENTS

FEBRUARY 1996 £2.35

A REED BUSINESS PUBLICATION

## Digital radio from space

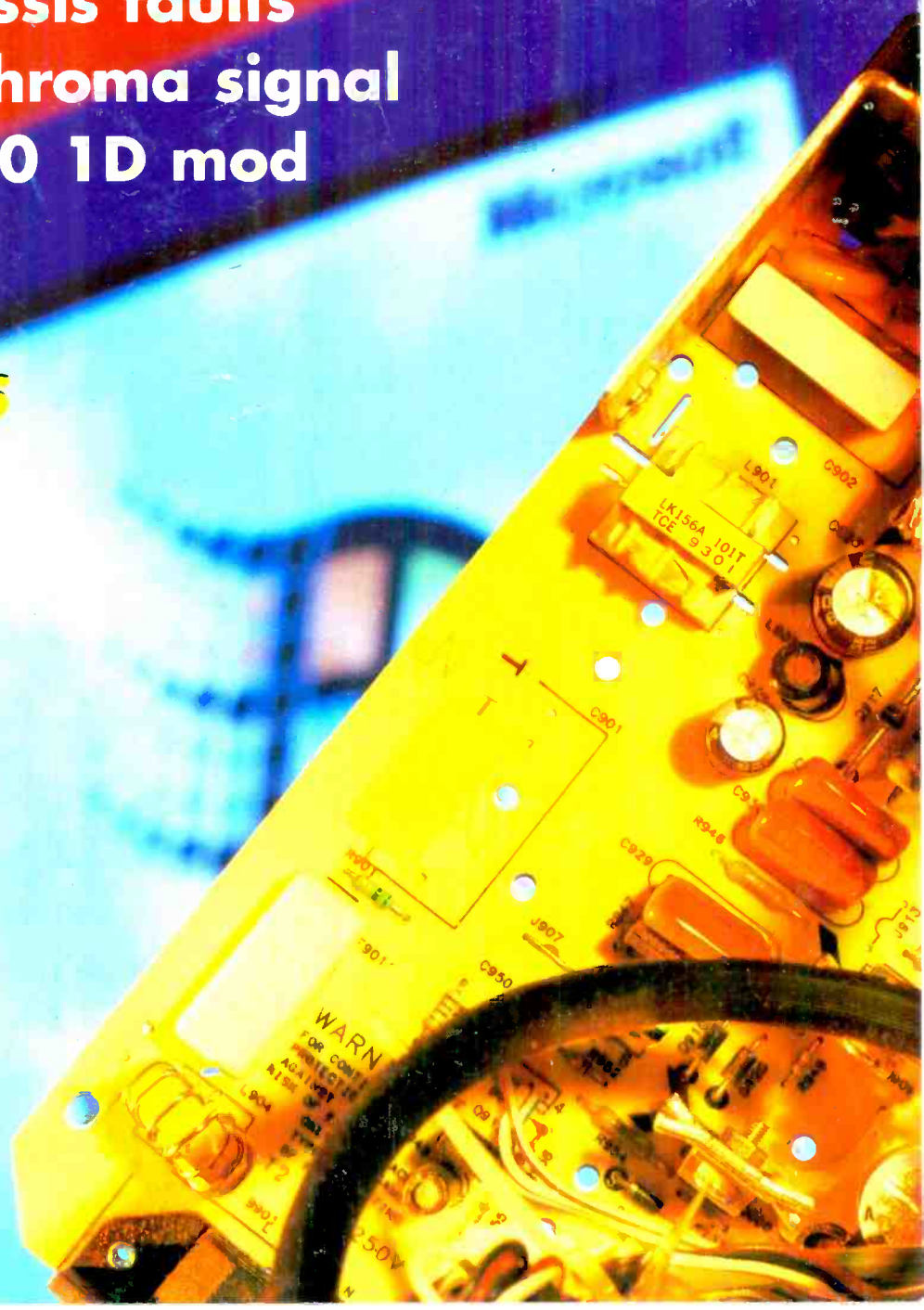
Tatung 190 chassis faults

Recording the chroma signal

Amstrad SRD510 1D mod

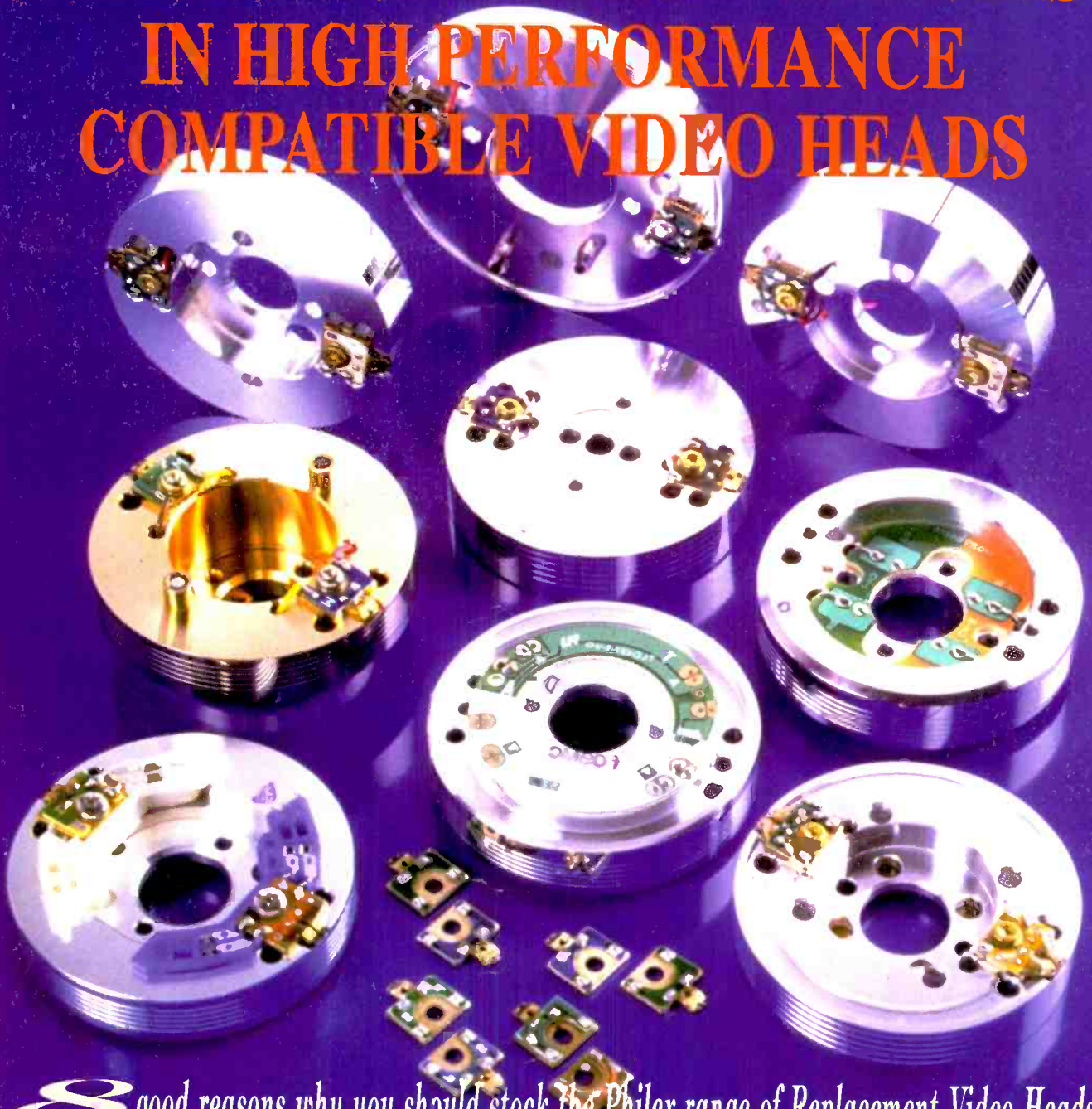
*Servicing  
PC monitors*

**Fault  
reports  
Satellite  
Video  
TV**



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## Technology

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Sharp's largest and newest LCD plant at Mie, Japan.

## Monitors

### Servicing PC monitors 252

More PCs than TV sets are now being sold in many markets, representing a major prospective market for service engineers. The monitor side should present no great problems for the tellyman. Peter Shoreland provides some introductory advice.

## Satellite

### Digital radio from space 260

The Astra Digital Radio (ADR) system has been designed to exploit spare spectrum space between satellite video channels. Up to twelve high-quality stereo radio signals can be accommodated per transponder and a pay radio service is about to be started in the UK. Eugene Trundle on the technology.

### Converting the Amstrad SRD510 for Astra 1D reception 280

P. Haylor found that it's quite simple to obtain Astra 1D reception by adding a board link and incorporating an ADX block converter.

## NEXT MONTH

**Servicing the Panasonic Z1 Chassis** John Coombes on fault-finding with this popular chassis that's found in 14, 16 and 21in. models. **The Problem of Pre-echo** This is a problem that can arise in strong-signal areas. It is often unexpected and can cause a variety of strange symptoms. The basic cause is direct signal pick-up within the set. Communal systems are particularly likely to be affected by pre-echo problems. Bill Wright provides guidance on how to tackle the situation. **More on the Toshiba V3**

## Video

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Joe Cieszynski on the basic problems involved in recording and playing back the chroma signal, in particular phase jitter, frequency shift and crosstalk, and the techniques used to deal with them.

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Michael Maurice with further information on this recent VCR range, including some fault hints. **A Visit to the Bowling Alley** The monitors were the problem here, all out of adjustment and difficult to get at. Chris Watton let himself in for the job – and didn't even get a free game! **VCR Signal Processing** A closer look at the techniques used in chroma signal recording. **Toshiba Service Briefs** More know-how from Toshiba Technical.

**Our March issue will be published on February 21st**

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This month's cover.



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John A. Reddihough  
**Production Editor**  
Tessa Winford  
**Consultant Editor**  
Martin Eccles  
**Publishing Director**  
Susan Downey  
**Advertisement Manager**  
Carol Nobbs  
0181 652 8330  
**Advertisement Sales Executive**  
Pat Bunce  
0181 652 8339  
FAX 0181 652 8931  
**Editorial Office**  
0181 652 8120  
FAX 0181 652 8956  
**Newsagent Enquiries**  
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AC125	30p	BD267	45p	BLY48	85p	MJ2955	55p	2N1893	30p	5.0	140p	BR86D	43p	AN7178	180p	AN7178	180p	HA13432	400p
AC126	30p	BD269	45p	BR100	140p	MJ3000	100p	2N2102	50p	10.0	140p	2A/600V	43p	AN7222	75p	AN7222	75p	HA17524	250p
AC127	30p	BD278	50p	BR103	37p	MJ3001	100p	2N2218A	24p	11.0	250p	BR88D	43p	AN7254	150p	AN7254	150p	ICL7160	650p
AC128K	40p	BD311	100p	BR303	85p	MJE29A	30p	2N2219	24p	12.0	250p	2A/800V	43p	AN7256	250p	AN7256	250p	ICL7660	240p
AC141K	45p	BD314	100p	BSS74	33p	MJE30A	30p	2N2221	23p	14.756	200p	BR32	43p	AN7310	60p	AN7310	60p	KA2102	150p
AC176	22p	BD315	150p	BSSX20	70p	MJE340	25p	2N2222	23p	15.0	160p	2A/200V	43p	AN7311	150p	AN7311	150p	KA2130	150p
ACY18	48p	BD317	150p	BT100A	70p	MJE350	80p	2N2263	15p	24.0	250p	2A/40V	43p	AN7410	150p	AN7410	150p	KA2206	150p
AD149	48p	BD331	40p	BT106	180p	MJE520	30p	2N2484	15p			2A/40V	43p	AY3-1015	290p	AY3-1015	290p	KA2209	125p
AF139	50p	BD361	60p	BT109	90p	MP8112	45p	2N2646	45p			BR36	44p	AY3-1270	800p	AY3-1270	800p	KA2210	230p
AF139	50p	BD362	60p	BT119	100p	MPSA05	15p	2N2904	20p			BR62	80p	AY3-1350	450p	AY3-1350	450p	KA2212	80p
AF239	30p	BD370	30p	BT146	99p	MPSA06	15p	2N2905	20p			BR62	80p	AY3-8912	400p	AY3-8912	400p	KA2213	130p
BB105B	18p	BD371	30p	BT179	140p	MPSA13	15p	2N2906	18p	7805	25p	6A/20V	72p	BA301	55p	BA301	55p	KA2214	150p
BB205B	24p	BD410	50p	BU105	80p	MPSA20	15p	2N2907	18p	7808	25p	6A/40V	150p	BA301	55p	BA301	55p	KA2261	100p
BC107	8p	BD433	28p	BU108	100p	MPSA42	15p	2N3019	28p	7808	25p	6A/40V	150p	BA313	60p	BA313	60p	KA2263	100p
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BC140	20p	BD437	28p	BU124	80p	MPSA93	20p	2N3055H	50p	7824	25p	25A/200V	185p	BA402	50p	BA402	50p	KA2412	350p
BC141	20p	BD438	28p	BU126	65p	MR510	35p	2N3442	85p	7905	25p	BR254	200p	BA511	145p	BA511	145p	KA2912	125p
BC142	20p	BD439	40p	BU138	100p	MR955	35p	2N3702	9p	7908	30p	2A/200V	200p	BA516	150p	BA516	150p	KA2914A	300p
BC143	20p	BD440	40p	BU184	100p	OC28	350p	2N3703	9p	7908	30p	BR256	200p	BA516	150p	BA516	150p	LA1130	240p
BC147	8p	BD441	40p	BU204	65p	OC29	250p	2N3704	9p	7912	30p	25A/600V	200p	BA521	100p	BA521	100p	LA1150	150p
BC149	8p	BD533	38p	BU205	70p	OC35	350p	2N3705	9p	7915	30p	BR258	240p	BA524	240p	BA524	240p	LA1185	150p
BC159	8p	BD534	38p	BU206	100p	OC36	250p	2N3706	9p	7918	30p	25A/800V	185p	BA526	180p	BA526	180p	LA1201	75p
BC160	30p	BD535	38p	BU208	70p	OC45	50p	2N3707	9p	7924	30p	BR351	185p	BA527	95p	BA527	95p	LA1210	140p
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BC172	10p	BD537	40p	BU208D	130p	R2008B	100p	2N3711	12p	7808	25p	BR259	200p	BA534	240p	BA534	240p	LA1364	200p
BC177	14p	BD538	40p	BU209	90p	R2010B	100p	2N3712	12p	7812	25p	35V/200V	220p	BA546	160p	BA546	160p	LA1365	120p
BC178	14p	BD543	50p	BU225	120p	S2000AF	175p	2N3773	100p	7818	24p	BR354	230p	BA612	120p	BA612	120p	LA1368	220p
BC179	14p	BD545	50p	BU226	120p	S2055A	175p	2N3799	18p	7824	24p	BR356	230p	BA656	110p	BA656	110p	LA1385	170p
BC182	7p	BD567	50p	BU312	90p	S2055AF	200p	2N3819	29p	7905	25p	35V/600V	260p	BA658	350p	BA658	350p	LA2000	150p
BC182L	7p	BD569	50p	BU326A	65p	S2055AF	200p	2N3903	11p	7808	25p	BR259	200p	BA658	350p	BA658	350p	LA2000	150p
BC183	7p	BD575	40p	BU406	70p	S2800M	72p	2N3906	11p	7912	35p	35V/800V	260p	BA685	400p	BA685	400p	LA2200	190p
BC183L	7p	BD576	40p	BU406	70p	TIP29	25p	2N4031	25p	7915	35p	BY164 1.5A	40p	BA1310	160p	BA1310	160p	LA3160	120p
BC184	7p	BD577	38p	BU406D	85p	TIP29A	22p	2N4401	12p	LM309K	100p	100V	40p	BA1320	75p	BA1320	75p	LA3210	65p
BC184L	7p	BD578	38p	BU407	55p	TIP29C	25p	2N4403	12p	LM317T	100p	BY176 1.5A	40p	BA1330	120p	BA1330	120p	LA3300	140p
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BC212L	7p	BD580	40p	BU408	80p	TIP30	20p	2N5088	20p	LM309K	100p			AN252	150p	AN252	150p	LA3361	190p
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BC214	7p	BD705	50p	BU426A	70p	TIP31C	20p	2N5245	45p					AN262	140p	AN262	140p	LA4031	140p
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BC237L	7p	BD711	50p	BU505D	90p	TIP32B	21p	2N5448	12p	DAF96	100p			AN301	130p	AN301	130p	LA4508	200p
BC239	7p	BD736	50p	BU505DF	90p	TIP33	50p	2N6107	40p	DY87	80p			AN303	250p	AN303	250p	LA4102	80p
BC300	20p	BD826	50p	BU506	100p	TIP33C	60p	2N6292	40p	EBF80	60p			AN304	360p	AN304	360p	LA4101	100p
BC301	20p	BD828	50p	BU506D	70p	TIP34	50p	2N6385	120p	ECC84	80p			AN315	210p	AN315	210p	LA4110	120p
BC302	20p	BD839	55p	BU506DF	120p	TIP34C	60p	2N6403	160p	ECI84	90p			AN316	350p	AN316	350p	LA4120	270p
BC303	20p	BD897	50p	BU508A	70p	TIP35C	65p	ECI84	100p	ECI84	100p			AN360	100p	AN360	100p	LA4140	60p
BC304	25p	BD899	50p	BU508B	70p	TIP35E	65p	ECI84	100p	ECI84	100p			AN360	100p	AN360	100p	LA4140	60p
BC327	7p	BD977	50p	BU508D	90p	TIP41A	20p	EL500	100p	EL500	100p			AN366	150p	AN366	150p	LA4182	180p
BC328	7p	BDX33	60p	BU508DF	115p	TIP41C	22p	EL500	100p	EL500	100p			AN366	150p	AN366	150p	LA4182	180p
BC328L	7p	BDX65	80p	BU508V	110p	TIP42A	20p	BY127	8p	EY86	70p			AN366	150p	AN366	150p	LA4182	180p
BC338	7p	BDW24	55p	BU508VF	100p	TIP42C	22p	BY133	8p	EY87	80p			AN366	150p	AN366	150p	LA4182	180p
BC341	28p	BDW93	50p	BU526	75p	TIP47	40p	BY164	40p	EY88	80p			AN366	150p	AN366	150p	LA4182	180p
BC344	28p	BDW94	50p	BU536	100p	TIP48	40p	BY164	40p	EY88	80p			AN366	150p	AN366	150p	LA4182	180p
BC347	18p	BDY92	100p	BU546	125p	TIP50	60p	BY164	32p	PC87	60p			AN366	150p	AN366	150p	LA4182	180p
BC351	22p	BF137	30p	BU608	120p	TIP51	80p	BY164	32p	PC87B	60p			AN366	150p	AN366	150p	LA4182	180p
BC357	25p	BF167	30p	BU626	120p	TIP52	80p	BY207	9p	PCF80	110p			AN366	150p	AN366	150p	LA4182	180p
BC354	8p	BF181	18p	BU705	130p	TIP54	85p	BY227	19p	PCF806	110p			AN366	150p	AN366	150p	LA4182	180p
BC354	8p	BF183	20p	BU708DF	175p	TIP105	65p	BY228	28p	PCH200	100p			AN366	150p	AN366	150p	LA4182	180p
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BC355	8p	BF225	30p	BU807	60p	TIP111	40p	BYX10	15p	PFL200	110p			AN366	150p	AN366	150p	LA4182	180p
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LM723	40p	STK457	470p	STK5444	570p	STR30123	450p	TA8205	250p	TA1578A	210p	TA3591	360p	TA18173	280p	UPC1180C	200p	2SA940	50p
LM741DIL	45p	STK459	460p	STK5436	500p	STR30125	550p	TA8210	250p	TA1579	200p	TA3592A	300p	TA18174	300p	UPC1185H	400p	2SA942	60p
LM741MET	45p	STK460	660p	STK5441	400p	STR30130	250p	TA8215	300p	TA1596	200p	TA3640	200p	TA18175	300p	UPC1191C	80p	2SA949	70p
LM747	55p	STK461	620p	STK5451	390p	STR40090	350p	TA8216H	375p	TA1598	250p	TA3651	200p	TA18178	400p	UPC1187	150p	2SA950	18p
LM1889	300p	STK463	950p	STK5461	500p	STR41090	400p	TA8227	250p	TA1600	275p	TA3652	500p	TA18185	300p	UPC1188H	350p	2SA952	50p
LM1894N	200p	STK465	720p	STK5462	500p	STR44115	550p	TA8691N	550p	TA1607A	230p	TA3652TX10	800p	TA18190	200p	UPC1197	140p	2SA953	70p
LM3900	40p	STK501	550p	STK5466	300p	STR45111	550p	TA8718N	550p	TA1675	250p	TA3653	150p	TA18191	425p	UPC1198H	200p	2SA954	65p
LM3909	60p	STK561	450p	STK5478	380p	STR50020	450p	TA8719	300p	TA1701	300p	TA3654	90p	TA18192	275p	UPC1222	130p	2SA959	60p
LM3914	160p	STK563	415p	STK5467	400p	STR50092	550p	TA8720	250p	TA1705	250p	TA3655	150p	TA18193	150p	UPC1225H	220p	2SA963	120p
LM3915	160p	STK568	500p	STK5468	300p	STR50103A	260p	TA8721	200p	TA1707A	200p	TA3720	100p	TA18214E	225p	UPC1230	200p	2SA965	40p
LM3916	270p	STK760	600p	STK5471	330p	STR50113	500p	TA8722	120p	TA1872A	275p	TA3724	500p	TA18215B	300p	UPC1238	120p	2SA966	35p
L200	200p	STK770	400p	STK5473	480p	STR50115	500p	TA8723	100p	TA1904	80p	TA3725	500p	TA18303	350p	UPC1270H	250p	2SA968	55p
LM491BB1	50p	STK772B	480p	STK5478	350p	STR51041	500p	TA8724	100p	TA1905	80p	TA3730	400p	TA18304	600p	UPC1274V	250p	2SA970	25p
M49481	700p	STK780	510p	STK5479	380p	STR50213	500p	TA8725	90p	TA1908A	90p	TA3740	480p	TA18305	500p	UPC1277	240p	2SA979	35p
M50106P	320p	STK789	460p	STK5480	400p	STR50241	300p	TA8726	225p	TA1909	40p	TA3742	220p	TA18306	200p	UPC1278	240p	2SA986	85p
M50117P	500p	STK1040	640p	STK5481	520p	STR54041	350p	TA8727	200p	TA1910	180p	TA3760	350p	TA18311	250p	UPC1288V	230p	2SA985	60p
M50119P	525p	STK1049	700p	STK5482	285p	STR55041	500p	TA8728	55p	TA1941	300p	TA3771	460p	TA18380	200p	UPC1298V	320p	2SA988	25p
M50784	300p	STK1050	650p	STK5483	440p	STR56041	550p	TA8729	35p	TA1950	175p	TA3791	300p	TA18390A	650p	UPC1318	300p	2SA992	30p
M50786	500p	STK1060	700p	STK5486	450p	STR58041	325p	TA8730	100p	TA2002	50p	TA3800	350p	TA18405	550p	UPC1335V	320p	2SA993	50p
M50790	800p	STK1070	850p	STK5488	400p	STR59041	475p	TA8731	100p	TA2003	65p	TA3803A	500p	TA18415	650p	UPC1350	115p	2SA999	30p
M51151	300p	STK1080	940p	STK5495	500p	STR60001	525p	TA8732	60p	TA2005	80p	TA3804	200p	TA18417	550p	UPC1363	190p	2SA1006	90p
M51381P	800p	STK2025	620p	STK5632	450p	STR61001	550p	TC5C20	200p	TA2005	150p	TA3825	225p	TA18421	500p	UPC1363C	300p	2SA1008	125p
M51387P	800p	STK2028	500p	STK5725	450p	STR80145	550p	TC5081AP	80p	TA2006	70p	TA3840	300p	TA18425	500p	UPC1364C	350p	2SA1009	200p
M51544	150p	STK2029	480p	STK5730	450p	STR81145	600p	TC9106	500p	TA2007	120p	TA3843	200p	TA18432	550p	UPC1365	250p	2SA1010	225p
M51848	150p	STK2038	700p	STK6316	300p	STRD1206	600p	TC9125BP	410p	TA2008	100p	TA3845	325p	TA18433	600p	UPC1370C	300p	2SA1011	100p
M54523P	200p	STK2048	950p	STK6324B	500p	STRD1406	600p	TC9134	750p	TA2009	160p	TA3846	400p	TA18440	300p	UPC1373	85p	2SA1012	85p
M54563P	200p	STK2110	940p	STK6326	275p	STRD1702	450p	TC9142	320p	TA2010	750p	TA3857	350p	TA184702	200p	UPC1377C	200p	2SA1013	100p
M5484A	500p	STK2125	580p	STK6732	725p	STRD1806	400p	TC9143	300p	TA2020	120p	TA3950	225p	TA18484	650p	UPC1378	180p	2SA1015	15p
M51516	260p	STK2129	750p	STK6732	1000p	STRD1816	400p	TC9145	150p	TA2030	80p	TA4050	150p	TA18485	400p	UPC1382	110p	2SA1016	30p
M51518	200p	STK2139	675p	STK6822	900p	STRD3035	300p	TC9148	200p	TA2040	140p	TA4092	350p	TA184852	200p	UPC1384	425p	2SA1018	100p
MB3712	140p	STK2155	900p	STK6922	500p	STRD4412	500p	TC149	225p	TA2048	600p	TA4100	225p	TA184853	350p	UPC1387C	250p	2SA1020	300p
MB3713	130p	STK2230	470p	STK6932	525p	STRD4512	400p	TC9150	425p	TA2054M	110p	TA4180	145p	TA184890	350p	UPC1394	120p	2SA1021	35p
MB3714	750p	STK2240	470p	STK6962	275p	TA7054	190p	TC9152	425p	TA2107	250p	TA4190	180p	TA184902	275p	UPC1397	350p	2SA1023	60p
MB3715	250p	STK2250	650p	STK6972	490p	TA7061	115p	TC9153	300p	TA2148	350p	TA4203	360p	TA184903	500p	UPC140CA	650p	2SA1026	300p
MB3722	280p	STK3041	370p	STK6981B	600p	TA7066	120p	TC9156	300p	TA2151	375p	TA4280	320p	TA184908	900p	UPC1420CA	450p	2SA1029	60p
MB3730	160p	STK3042	375p	STK6982	600p	TA7089	300p	TC9163	375p	TA2170	260p	TA4282	360p	TA184932	400p	UPC1421CA	650p	2SA1036	60p
MB3731	220p	STK3044	500p	STK7216	420p	TA7119	150p	TC9164	400p	TA2220	200p	TA4290	200p	TA184945	400p	UPC1423CA	550p	2SA1037	50p
MB3756	160p	STK3062	500p	STK7217	400p	TA7120	55p	TC9172P	300p	TA2270	250p	TA4400	175p	TA184980	550p	UPC1470	200p	2SA1038	40p
MB3759	200p	STK3082	550p	STK7225	500p	TA7137	60p	TC91940	100p	TA2320	80p	TA4420	120p	TA184983	180p	UPC1488H	150p	2SA1048	25p
MB3719	360p	STK3102	530p	STK7226	500p	TA7138	60p	TC9195	100p	TA2322	80p	TA4421	180p	TA184984	180p	UPC1490H	150p	2SA1049	20p
MC1455	45p	STK3152H	900p	STK7251	500p	TA7157	100p	TC9196	115p	TA2303P	200p	TA4426	170p	TA184985	300p	UPC1514CA	200p	2SA1060	120p
MC1496	65p	STK3156	500p	STK7308	350p	TA7193	320p	TC9197	200p	TA2503	200p	TA4427	200p	TA184986	200p	UPC1515CA	250p	2SA1069	150p
MC3401	45p	STK4017	400p	STK7309	400p	TA7200	200p	TC9198	200p	TA2505	300p	TA4431	150p	TA184987	100p	UPC1520CA	250p	2SA1076	230p
NE555	20p	STK4019	480p	STK7310	470p	TA7205	110p	TC9199	200p	TA2506	500p	TA4437	300p	TA184988	100p	UPC1536C	550p	2SA1077	300p
NE556	40p	STK4021	380p	STK7348	400p	TA7207	60p	TC9200	200p	TA2510	450p	TA4439	220p	TA184989	280p	UPC1537	100p	2SA1081	80p
NE556B	40p	STK4024H	380p	STK7349	400p	TA7208	120p	TC9201	200p	TA2512	450p	TA4440	220p	TA184990	280p	UPC1538	100p	2SA1082	80p
NE565	110p	STK4025	530p	STK7358	440p	TA7214	220p	TC9202	200p	TA2515	450p	TA4442	240p	TA184991	280p	UPC1539	100p	2SA1083	100p
NE567	115p	STK4026	480p	STK7402	560p	TA7217	145p	TC9203	200p	TA2530	450p	TA4443	250p	TA184992	280p	UPC1540	320p	2SA1084	100p
NE571	290p	STK4028	550p	STK7404	400p	TA7220	220p	TC9204	200p	TA2532	120p	TA4445	220p	TA184993	280p	UPC1541	250p	2SA1091	100p
NE592	85p	STK4032H	510p	STK7406	650p	TA7222	90p	TC9205	200p	TA2540	85p	TA4450	225p	TA184994	280p	UPC1542	215p	2SA1094	190p
NE5532P	140p	STK4036	470p	STK7408	675p	TA7223	210p	TC9206	200p	TA2541	120p	TA4452	250p	TA184995	280p	UPC1543	190p	2SA1095	300p
SA1106	200p	STK4240	510p	STK7409	675p	TA7224	210p	TC9207	200p	TA2542									









# The Broadcasting Bill

Because of technological developments, great changes in broadcasting have become possible and are already taking place. In particular satellites whose transmissions are not amenable to control by national governments are now vying worldwide with terrestrial transmissions that are amenable to such control. When there were few satellites capable of providing quality signals for domestic viewers, and these signals were in analogue form, the situation was perhaps something that governments could choose to ignore. With the increasing population of satellites aiming their wares at the domestic viewer, and the imminent arrival of digital transmissions that will vastly multiply the signals available, the situation is becoming one that governments are likely to feel they should address. It is in this context that we have to consider the government's Broadcasting Bill.

There are several fundamental approaches, all logical, that can be adopted on the control of broadcasting. You may feel that there should be no control at all. Let broadcasters get on with it: if they can't find a market for their wares, they will simply go out of business. Fair enough. At the other extreme there is the view that broadcasting makes use of a public asset, spectrum space, and is therefore answerable to the public through its elected representatives, i.e. the government. Equally logical. In practice of course the situation is rather more complex than that assumed by these simplistic views. Because of this, most people probably feel that some policy between no control at all and tight government control (if this remains possible) is the correct approach to adopt. This leads to such tricky questions as what sort of and how much control, who by, who should appoint the controllers, who they should be answerable to, etc.

The great problem is to ensure that good use is made of spectrum space for the public benefit. It is this concern that is the basis of the elaborate arrangements inherited by the ITC from its predecessors. The aim is to use supervision to ensure that varied, quality broadcasting remains available. Complete freedom of the skies, as found in some parts of the world, has hardly been a success – in some countries the choice is rubbish, rubbish or rubbish.

The difficulty is that quality costs money. Rather a lot of it. So frequency franchising becomes essential – to provide

companies and broadcasting organisations with adequate motivation to invest in the programming and services they provide.

The Broadcasting Bill is to some extent a tidying up operation, to give a legal basis to the forthcoming terrestrial digital TV services. In this respect there is little to quibble about. The Bill could become law this summer, taking effect from the start of 1997. What one can complain about is its relaxation of the law relating to the ownership of ITV companies. The effect here would be to allow greater concentration of ownership of the network. To allay fears that this might give excessive power to a small number of broadcasters, the ITC is to be given greater powers to ensure that regional TV requirements are adequate, and will be given the task of deciding on whether or not changes in broadcasting company ownership are in the public interest. The government has decided to abolish the rule that no company can own more than two franchises. Instead, no ITV company may broadcast to more than fifteen per cent of the total audience. "Market share is", according to national heritage secretary Virginia Bottomley, "a more reliable measure of influence." Up to a point, yes. But audience ratings can vary substantially over quite short periods – and is success to be penalised? This proposal does not appear to have been well thought out.

Some of the larger UK broadcasters have been maintaining that their long-term future depends on their ability to compete with vast international broadcasting operations, and that they must therefore grow. This doesn't really follow. Smaller operations should be able to survive – it depends on their ability to produce and sell to other broadcasters quality programming. On the whole this aspect of the Bill appears to be a way of accommodating the wishes of a few larger broadcasters, a dubious exercise.

The Bill also tackles the subject of the change from analogue to entirely digital transmission. Instead of setting a final date for "switching off analogue", the government says it will review the situation when fifty per cent of households can receive digital TV, or five years after the start of the first digital licence, whichever occurs first. That is to put off the decision, which in the present uncertain circumstances is as well.

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# A visit to

**George Cole** takes a look at the latest developments in LCD technology

# SHARP

**S**harp's name has become synonymous with liquid-crystal display (LCD) technology. The company is the world's largest manufacturer of LCD panels, accounting for around 44 per cent of a worldwide market that's forecast to be worth about £4 billion this year. Hundreds of millions of pounds have been invested by Sharp in LCD production plants, which supply many other electronics companies.

During a recent visit to Japan I got to

see and hear about Sharp's current LCD plans, which include new types that will be larger, stronger and even better than today's displays.

At the company's museum Sharp has a display of some of its older technology. This includes its first 21in. TV receiver, Model CV2101, which was launched in 1960. At the time it cost 500,000 Yen, which is around £2,900 at today's rate. The average monthly wage in Japan was then just £63!

Also on show is the VC6000, the first front-loading VCR, which was launched in 1979. Its features include a tape remaining counter, a 12-channel tuner and index search, which works by recording an electronic pulse between each recording.

With the current interest in computers that incorporate TV facilities (PCTVs), it's noteworthy that Sharp was offering the C2-8000 TV and computer back in 1982.

## LCD Background

Before looking at what Sharp is doing in the LCD field, we'll take a brief look at how the technology works. Liquid crystals were discovered in the nineteenth century. Most are organic compounds with long, rod-like molecular shapes. They get their name from the fact that they can behave like both

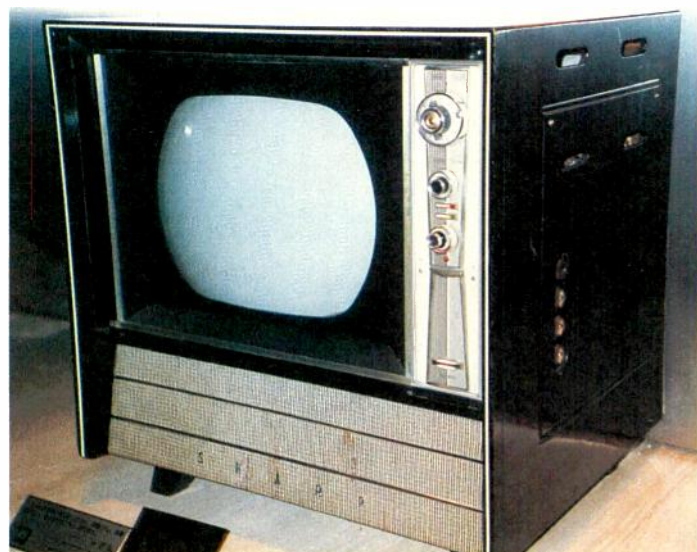
a liquid and a crystalline structure. There are over 10,000 types of liquid crystals.

LCDs are made by blending different combinations of liquid crystals to achieve the best results. The blending process is a mixture of science and black art.

Researchers at RCA discovered in 1963 that the application of a voltage across an LCD cell changed the way in which light passed through it, by altering the alignment of the molecules. Five years later, RCA made the first LCD device.

The basic structure of an LCD cell consists of a pair of glass plates, which have to be 2,000 times smoother than ordinary glass, with the liquid crystal material sandwiched in between. The liquid crystals are arranged in grooves, light passing through in the direction of molecular alignment. In most LCDs the molecules are aligned in a twisted state. Thus light is twisted as it passes through. If a voltage is applied, the crystals take up a vertical alignment and light passes straight through. The passage of light can be blocked or allowed through by adding polarising filters (ordinary light is non-polarised, the filter allowing through only light with the relevant polarisation). These work in conjunction with voltage con-

*Sharp's first 21in. TV receiver, Model CV2101, launched in 1960.*



trol of the LCD cells.

Thus varying the voltage controls the passage of light. The principle is shown in Fig. 1.

Colour can be introduced by putting an RGB filter over the display. With a TV or video display, each liquid crystal cell represents one pixel, the pixels being arranged in rows that correspond with the phosphor arrangement on a TV or monitor screen.

In the so-called passive display (also known as a duty-drive LCD) each row is switched on sequentially. The disadvantage is the blurring that can occur when a fast-moving object is being displayed, because of the time taken to switch on each pixel. With an active-matrix display, each pixel has its own control transistor to switch it on. The result is much better image quality. There are two types of active LCD, the thin-film transistor (TFT) type and the two-terminal element type such as the metal-insulator-metal (MIM) structure. Unlike a c.r.t., which produces light, an LCD controls the passage of light. It therefore requires a backlight or a mirror to reflect ambient light.

**Types of LCD**

There are many types of LC display. The first, released in 1973, used the dynamic scattering mode (DSM). They were used in calculators. A mirror provided the backlight, and the display had a curious milk-like appearance. DSM displays were replaced by the twisted nematic (TN) type in 1975. This has the molecules arranged, in the rest state, with a 90° twist. Image quality is improved, but the snag is that the contrast decreases as the display is made larger.

A number of displays were subsequently developed, including the super twisted nematic (STN), the double super twisted nematic (DSTN) – and the triple super twisted nematic (TSTN)! Simple TN displays are generally used for calculators and electronic organisers. TV and monitor screens and projectors use TFT and MIM arrangements.

**Developments**

Sharp is working on various new types of LCD. One is the ferroelectric LCD (FLCD) which doesn't, like an active-matrix display, require expensive switching elements and has the curious ability to retain the last screen display when the power is switched off.

Low-temperature polysilicon TFT LCDs will make it possible to incorporate drivers, memory, CPU and other elements within the display, heralding a new generation of ultra-thin computers. Low-temperature relates to the substrate processing.

Other developments include plastic LCDs that can be rolled up, and more robust displays that can withstand mechanical shocks (dropping an LCD camcorder or computer can be an expensive accident!).

There are moves to reduce LCD power consumption. A current 10.4in. display consumes around 2.4W, but 11.3in. displays that consume just 1.5W are expected to be announced this spring.

A new type of LCD, the Double Metal Guest Host (DMGH), blends a dye into an LCD. When no voltage is applied the dye absorbs the light, giving a black display. When a voltage is applied the liquid crystals realign and the light passes through, being reflected by an aluminium electrode – see Fig. 2. The process enables easy-to-read displays to be produced without the need for a backlight. Power consumption is much less at around 60mW, while the viewing angle is 100°. Production of the DMGH LCD is scheduled to begin this April.

Another development is the reflective NH (New Hysteresis) STN LCD, which uses a system known as electrically-controlled birefringence (ECB). This enables a single pixel to display white, black, red, blue and green light successively without the need for a backlight and colour filters. ECB works by voltage control, modifying the angle of the molecules in the liquid-crystal layer. The birefringence change in the crystal layer is detected by two polarisers (see Fig. 3). Production of NH STN LCDs is due to start in March. The new display will be aimed at cellular phone, electronic organiser and multimedia ter-

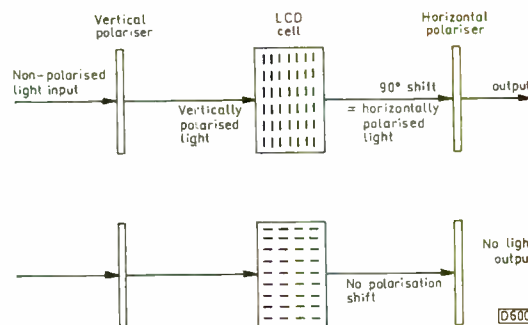


Fig. 1: Basic principle of using polarising filters and a voltage-controlled LCD cell to control the transmission of light.

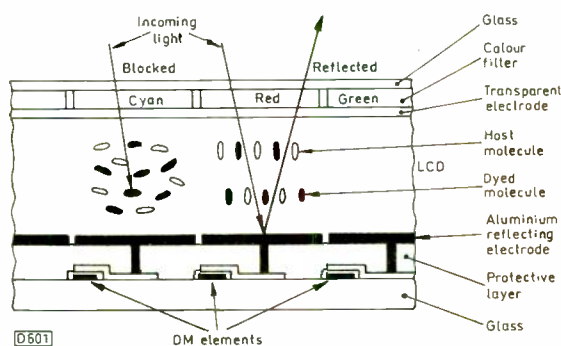


Fig. 2: Diagrammatic representation of a section through a reflective DMGH colour LCD.

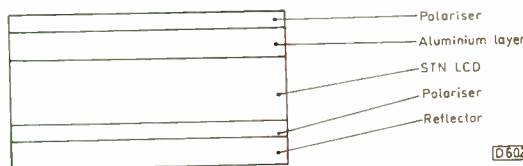


Fig. 3: Component layers of a colour ECB reflective STN LCD.



The World's largest direct-viewing TFT LCD display at 28 inches.

The stylish "Window Series" range of 8.4in. and 10.4in. personal LCD TVs from Sharp.



minal applications.

LCDs are already used in a wide range of devices, including watches, calculators, test equipment, VCR displays and camcorder monitors. But Sharp's largest market (around 66 per cent) is the computer one. Other possible markets include car navigation systems, entertainment machines and hand-held information devices. Sharp's biggest goal however is to replace the c.r.t. as the major display device in TV sets and monitors. This will be no easy task.

#### LCD Production

Sharp began work on LCDs over twenty years ago and holds over 1,225 patents in Japan and over 500 worldwide. It has three LCD production plants in Japan: the largest and newest, Mie, began mass production last October, producing around 250,000 LCD panels a month (150,000 TFT and 100,000 passive display types). Production is expected to increase to 320,000 units a month from April. The

first phase of the Mie plant, which covers 344,000 square metres and employs some 650 people, represents an investment of around £353 million by Sharp.

The Nara plant produces 160,000 passive display a month. I visited the third plant, Tenri, which produces 140,000 8.4in. and 160,000 10.4in. TFT panels a month. The first production line was built four years ago: the latest line, just opened, uses up to the minute computer-controlled systems. Sharp also produces LCDs in China, the USA and Taiwan.

#### Production and Yield

The production process for a TFT LCD is complex, involving seven separate film-deposition steps. The electrodes are formed during the same process. To start off, a glass substrate is covered with a photo-sensitive resist and then exposed to light, using a photolithographic process. Any excess material is washed away, then the process is repeated for each layer.

Care is required to prevent dust con-

tamination: at Tenri, TFT production takes place in a Class 10 clean room, which means that there are fewer than ten dust particles, each no larger than 0.3 microns, per cubic foot of air. In comparison normal air has one million dust particles per cubic foot. Workers have to wear special suits to trap any flaking skin particles. Even so, faulty panels are produced and have to be junked. The yield rate is a closely guarded secret: Sharp simply says that it is "much better than 50 per cent".

#### Comparisons

The high cost of LCD production puts a question mark over the possibility that LCDs will replace the c.r.t. in large-screen TV sets and monitors. Although LCD costs are understood to be falling by fifteen per cent a year, they are still much higher than c.r.t. production costs.

Sharp markets a 14in. LCD TV set in Japan, but the price is around £4,000. Most LCD TV sets have 8.4 or 10.4in. displays and cost about £640 and £870 respectively. That's why other electronics companies are looking at different flat-screen technologies. Sony for example has opted for its Plasma Addressed Liquid Crystal (PALC) technology, which uses a plasma discharge instead of a transistor to switch on each pixel. Sony claims that PALC displays are cheaper and easier to produce than conventional TFT LCDs.

Other companies are developing gas-plasma displays, arguing that the production of large LCD panels is difficult. Sharp has developed a 28in. LCD panel however, made by joining together two 21in. panels. The junction between the two panels is just 440 microns, or half the pixel pitch, so the join is not visible. The panel has 921,600 pixels, 24-bit colour and a consumption of about 100W. Contrast ratio is more than 100:1 and the weight 18kg. A 42in. version is being developed by Sharp, based on four 21in. panels.

Despite all this effort, flat-panel display manufacturers will find it hard to overhaul the c.r.t., which continues to provide the best colour, brightness, contrast, resolution, viewing angle and cost. The signs are that LCDs will continue to eat into areas previously dominated by the c.r.t. however, and if companies such as Sharp can continue to drive LCD costs down the large, flat-screen TV may reach our living rooms sooner rather than later.

#### Acknowledgement

My special thanks to Mr Isamu Washizuka, senior executive of Sharp's liquid-crystal display business, for his help in the preparation of this article. ■

The first front-loading VCR, Model VC6000, was released by Sharp in 1979.



# VCR BELT KITS / REPLACEMENT VIDEO LAMPS

Model	Price	Model	Price	Model	Price	Model	Price
HRD520, 600, 620, 637, 641, 650, 830 HRD540, 550, 580, 660, 860, 960, HR55800	95p 130p	VR6010, VR9010 VR6020, VR6022, VR6023, VR6028, VR7730 VR6024 VR6520, VR6540, VR6560 VR6710, VR6720, VR6735, VR8720 VR6720, VR6730, VR6760, VR6775, VR6780	70p 75p 75p 90p 130p 160p	<b>Models &amp; Description</b>	<b>Order Code</b>	<b>Price</b>	
<b>KENWOOD</b> KV901 KV903	70p 90p	<b>SAISHO</b> VR2000, VHL3 VR3800	90p 75p	UNIVERSAL VIDEO LAMP 9V 80mV (310mm WIRES)	VL01	25p	<b>ON/OFF MAIN SWITCHES</b>  <b>GRUNDIG</b> PART NO: 29703, 29102 C7500, C7500TT, C8500, C8502, C8712, C8714, C8894, M68-190, M68-190/99, M70-195, P40-345, ST66-1602, T55-340, V7722  PRICE: £2.25  <b>ITT</b> PART NO: 13/1074 USED ON: CP0200, 0211F, 0323, 0323/1, 0341/14, 0345F, 0351/1, 0361, 0361/1, 9350, CT0500, 0500/1/T, 0500T  PRICE: £3.00 PART NO: LFC 005 USED ON: CVC40 PRICE: £2.00  <b>MATSUI/SAISHO</b> USED ON: MATSUI-2190, SAISHO- PST2130TX  PRICE: £2.00  <b>PHILIPS</b> USED ON: K30, K35, K40, K T3, K T4 PRICE: £0.95  <b>SONY</b> PART NO: (POWER SWITCH + REMOTE SWITCH) USED ON: KV1612 MK1, KV1612 MK2, KV1614, KV2052, KV2056, KV2062, KV2068, KV2212, KV2216, KV2252, KV2256, KV2704, KV2705, KV2706, KV2752PE3, KX20PS1, KX20PS2, KX27PS1  PRICE: £2.75 PART NO: (POWER SWITCH + REMOTE SWITCH) USED ON: KV2022, KV2024  (POWER SWITCH) PART NO: KV1810 MK1, KV1810 MK2, KV1820, KV1822, KV2000 MK1  PRICE: £8.00 PART NO: (POWER SWITCH 26mm) USED ON: KV1400, KV1440, KV2040, KV2060  PRICE: £2.00 PART NO: (POWER SWITCH 21mm + REMOTE SWITCH) USED ON: KV2020  2 PIN (FUNCTION SWITCH) PART NO: KV1612 MK1, KV1612 MK2, KV2052, KV2056, KV2212, KV2215, KV2216, KV2252, KV2256, KV2704, KV2705, KV2706, KV275PE3, KV2756PE3  PRICE: £0.40 PART NO: (4 PIN FUNCTION SWITCH) USED ON: VARIOUS PRICE: £0.50
<b>LOEWE</b> OC11, OC40 OC410, OC420, OC440, OC460 OC50, OC55, OC60, OC65, OC70, OC75	95p 130p 120p	<b>SALORA</b> SV6500 SV6600 SV8000 SV8100 SV8500, SV8520, SV9500 SV7400, SV8400, SV8420, SV8550 SV6700, SV8710, SV8750, SV9700 120p SV6800, 6900, 8810, 8820, 8870, 8910, 8920, 8970 SV8600, 8620, 8700, 8720, 8830, 9600, 9810	100p 150p 120p 60p 150p 120p 90p 130p	PANASONIC VIDEO LAMPS	VL02	35p	
<b>LOGIK</b> VR955	180p	<b>SAMSUNG</b> SV716, 717, V1616, V1621, V1626, VX616, VX617, VX619, VX626, VX627, VX629 85p VB520, 510, 610, 616, 617, 619, 620, 626, 627, 629, V1510, 520, 611, 616, 621, 626, VX510, 520 VB900, VB910, V1900, V1910 PX980, 981, 982, SE9001, SV9001, SVX307, 319, 322, VB770, 8220, 8225, V1770, 790, 8220, 8225, VK8220, VPX31, VX750, VX790, 8220, 8225 SVX301, 303, 305, SX7301, VB710, 971, V1730, 710, VX712, VX720, 730, 970, 971, 972 VX9880	100p 150p 120p 60p 150p 120p 90p 130p	SHARP VIDEO LAMPS	VL02	35p	
<b>LUXOR</b> 9245, 9251 9252 9253 9254 9255 9256 9270, 9271, 9273, 9274 9272, 9280 9281, 9284, 9285, 9292, VR3701, 3721, 3731, 3761, 3781	130p 140p 140p 100p 130p 130p 115p 140p	<b>SHARP</b> VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50 VTC5300, VTC5350, VTC5400, VPR5800 VTC5500 VTC9100, VTC9300 VTC1100, 1300, 1500, 1100, 1150, 1200, 1300, 1500 VHR2100, VHR2300, VHR2500, VHR2700 VHR3100, 3300, 3310, 3400, 3700, 3800, VHRD500, 700 VHR160, 4150, 4200, 4300, 4350, 4770, 5100, 5200, 5300, 5350, 5700, 7100, 7200, 7500, 7530, 7540, 7800, 7810, 8100, 8200, 8250, 8500, VHRD4400, 4410, 4500, 4600, 4610, 4710, 4890, 6700	100p 95p 220p 90p 150p 110p	HITACHI 5381682 (VT63, VT64) VIDEO LAMPS	VL04	135p	
<b>MATSUI</b> VX850	75p	<b>SANYO</b> VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50 VTC5300, VTC5350, VTC5400, VPR5800 VTC5500 VTC9100, VTC9300 VTC1100, 1300, 1500, 1100, 1150, 1200, 1300, 1500 VHR2100, VHR2300, VHR2500, VHR2700 VHR3100, 3300, 3310, 3400, 3700, 3800, VHRD500, 700 VHR160, 4150, 4200, 4300, 4350, 4770, 5100, 5200, 5300, 5350, 5700, 7100, 7200, 7500, 7530, 7540, 7800, 7810, 8100, 8200, 8250, 8500, VHRD4400, 4410, 4500, 4600, 4610, 4710, 4890, 6700	100p 75p 100p 95p 220p 90p 150p 110p	AKAI, GRANADA (VHSTJ2), HITACHI (VT3000), ITT (VR3912, VRP3833), JVC (HR2200, 3300, 3330, 3660), MITSUBISHI (HS200), TELEFUNKEN (VR510, 519, 610), THOMSON (VK300, 305, 306, 3301), FERGUSON (3V00, 16, 22, 24, 3292, 8900, 8901, 8902, 8903, 8909, 8912, 8922, 8925)	VL01	25p	
<b>MITSUBISHI</b> HS200 HS300, 301, 302, 307, 310, 337, 338, 347, 349, 411, 412, 421, HSB10, 20, 30, HSE10, 20, 30, 70 HS303, HS304, HS306, HS307, HS330, HS400, HS700 HS318, HS319, HS410	200p 150p 150p 130p	<b>SHARP</b> VC200, 384, 385, 386, 388, 390, 9300, 9700 VC7300, VC7700, VC7750, VC7800, VC8000 VC8300 VC300, 387, 471, 473, 481, 482, 483, 486, 488, 496, 8481 VC402, 500, 571, 573, 581, 582, 583, 584, 585, VCSF3 VC600, 651, 682, 684, 685, 693, 783, VC6F3, VC6V3 VC772, 779, 781, 782, 785, 786, 793, 800, 7810, 7822, VCA100, VCA102, 104, 131, 140, 170, 202, 203, 234, 501, 602, 5011, VCD806, 810, 815, VCH80, 865, 910, VCS100, VCT310, 410, VCT1314, VCT5312	100p 150p 150p 80p 80p	BLAUPUNKT, ORION (VH1, 2A), NATIONAL (NV200, 2010, 3000, 7000, 8150, 8200, 8400, 8600, 8610, 8620), SHARP (VC2300, 6000, 6200, 6300, 7300, 7700, 8000, 8300)	VL02	40p	
<b>NATIONAL PANASONIC</b> NV300, NV332, NV333, NV340, NV366 NV777, NV788 NV2000, NV2010, NV3000 NV7000, NV7200, NV7800 NV8600, NV8610, NV8620 NV230, 250, 280, 430, 431, 433, 450, 460, 465, 470, 730, 770, 810, 870, 890, AG1000, 1050 NV370, NV380, NV480, NV630, NV780, NV830, NV850 NV600, NV688, AG6010, AG6015 NVG7, 10, 12, 14, 15, 18, 30, 130, 400, NVH70	125p 100p 130p 95p 145p 150p 125p 100p 100p 70p	<b>SIEMENS</b> FM350, FM352, FM355 FM484, FM485 FM391, FM392, FM394, FM462 FM461, FM464, FM468, FM561 FM361, FM362, FM363, FM364	60p 55p 100p 150p 120p	AKAI (vS10), GRANADA VL06 40p (VHSXJ3), ITT (VR3993, 3994), JVC (HR2650, 7600, 7610, 7650, 7655), TELEFUNKEN (VR530, 535, 539, 550, 630, 650), THOMSON (V309, 316, 357, VK309, 411, TX8000), FERGUSON (3V31, 8941, 8942)			
<b>NORDMENDE</b> V100, V140 V1000M, 1005M, 1205, 1215, 1235, 1245, 1305, 1403, 1405, V1500P, 1503, 1505K, 1805K, 2000D, 2405, 2500H, 3000H, V3405H, 3105, 4405H, 5000, 8005, 900, 905 V1001, 1005, 1015, 1025, 1035, 1041, 1055, 1065, 1105, 3005, 304, 5005, 502, 503 V101, V102, V103, V112, V141, V142, V301, V302 V110, V333 V1500T, V2000B, V2000P, V400H V250, V460, V9460, V20035542, V20035543 V300, V303, V380 V500	70p 125p 130p 95p 145p 150p 125p 100p 100p 70p	<b>SONY</b> SLC6, SLJ10, SLT6ME 140p SLC6, SLC7, SLJ7, SLJ9 140p SLC9, SL8000, SL8080, SLT50 165p SL8000E, SL8080E, SL8200, SL8600 175p SLV255 95p		BLAUPUNKT, ORION (VH1, 2A), NATIONAL (NV200, 2010, 3000, 7000, 8150, 8200, 8400, 8600, 8610, 8620), SHARP (VC2300, 6000, 6200, 6300, 7300, 7700, 8000, 8300)	VL07	40p	
<b>ORION</b> COMB15000, 16000, NEVHM, TYP230RC, 900MVH1012, VH1030, 1040, 1060, 1070, 1100, 1120, 1440, 1500, 1660, 1800, 2150, 2308, 2400, 2500, 2700, 2960, 300, 359, 360, 362, 4010, 4015, 4016, 4020, 4300, 5010, 5015, 530, 535, 536, 630, 635, 640, 730, 735, VP220, 225, 245, VR1032, 2966, 2980, 821, 925, VXL25 30p NEVHL, VCP, VH1204, 2004, 2204, 3050, 3060, 4008, 400, 4012, 412, 512, 600, 666, 744, 774, 7905, 800, 820, 900, 974, VP200, VR2949, 2956, 2957, VXL20 90p VC150, 180, VH1000, 200, 201, 205, 212, 250, 254, 288, 300, 303, 3030, 312, 33, 3312, 404, 555, 700, 704, 708, 712, 770, 780, 844, 900, VHF2, VH3 80p VH1, VH2A 150p	140p 140p 165p 175p 95p	<b>TELEFUNKEN</b> VR400, VR410, VR440, VR449 130p VR450, VR540, VR549, VR640 70p VR520, VR529, VR620, VR920 70p VR530, VR535, VR539, VR550, VR630, VR650 75p A940, VR1925, 1930, 1940, 1950, 2960, 925, 930, 940, 950 90p A920, VR1970, 1980, 2920, 2925, 2930, 2970, 7921, 7926, 7931, 7970, 7971, 7980, 970, 9981, 975, 980 65p A1200, 930, 932, 935, 960, 980, 990, VR2931, 2935, 2941, 2971, 3935, 3945, 3950, 3965, 3975, 4935, 4940, 4942, 4945, 496, 5VR4970, 6000, 7932, 7959, 7979 65p VR1935 100p VR2915 90p		GRANADA (VHSAY3), SHARP VL08 60p (VC200, 381, 384, 385, 386, 388, 390, 393, 9300, 9500, 9700)			
<b>PHILIPS</b> VR6460, VR6920 VR6540 DV186, 286, 291, 292, 468, 471, 562, 571, 761, VR201, 202, VR20DV1, 20DV2 20RW7, 25B01, 25B02, 302, 303, 305, VR30DV2, 35B02, 35B03, 635B7, 715B4, 715B5, 715B8, VR865B2, 915B2, 925B3, VR6180, 6185, 6285, 6290, 6291, 6293, 6367, 6390, 6391, 6393, 6467, 6468, 6470, 6561, 6570, 6581, 6670, 6676, 6760, VR685B4, 865B1, 925B3 85p VR6442, VR6542 70p VR2025, VR2580 100p VR445B9, BR445B920, VR445B922, BR6843 100p VR6548, VR6648, VR495B620, VR6448695 110p	170p 100 80p 150p	<b>THOMSON</b> SV1000, V410, 430, 450, 510, 520, 530, 540, 620, 630, 640, 4240, SV5540 65p TX8000, 3309, V357, VK411 75p TX8000, V342, 343, 351, 352, 353, 360, 364, 368, 4210, 4230, 4260, 4400, 5500, 6000, 8564 90p V320, V321, V323, V326, V4200, V4300 90p V333 100p V340 90p V4100, VK308, VK309, VK410 120p VK300, VK301, VK302, VK303, VK305, VK3301 135p VK312 65p		<b>PANASONIC MODE SWITCHES</b> NV2000, 2010, 7000, 7200, 7800 (VSS0048) £3.50 NV230, 260, 430, 810, 870, 2300, 4300 (VSS0110) £2.25 NV830 (VSS0091) £2.10 NV300, 333, 340, 366, 688, 777, 773 (VSS0060) £3.75 NVG21, 25, NVH65, NVD80 (VSS0175A) £2.00			
<b>SABA</b> VR6420, 6435, 6440, 6460, 6480, 6620, 670, 7200, 8420, 2A10, 70, 2B20, 3B20, 4A10, 4B20, 6A10, 6A70, 6B20, 8B20 65p VR6004, 6005, 6011, 6014, 7004, 7011, 7014, 8011, 8014, BERLIN 90p VR2000, VR6000, VR6012, VR7000, VR7720, VR6660 130p VR5005, VHR7000 135p VR6006, 6007, 6008, 6009, 6015, 9016, 9018, 6038, 7006, 7007, 7016, 7018, 9006 65p	65p 90p 130p 135p 65p	<b>TOSHIBA</b> V55, V57 V33, V31, V51, V53, V9600, V9680 V61, V63, V65, V66, V67 150p DV80B, DV80D, V71, 73, 74, 75, 81, 83, 85, 86 120p V108, V109, V199, V209, V609 120p V91C, V95G 115p		<b>REPLACEMENT IDLER TYRES</b> AKAI M132773 IT01 M2366960J2 IT02 GOLDSTAR VXP0521 IT17 HITACHI 6861471 IT03 6861482 IT04 6886971 IT05 JVC PU 48967B IT06 FERGUSON PU 51380 IT07 PU 51402A IT08 PU 55373 IT09 PU 55374 IT10 NATIONAL VXP 0329 IT11 PANASONIC VXP 0343 IT12 VXP 0344 IT13 VXP 0401 IT14 VXP 0433 IT15 VXP 0463 IT16 VXP 0521 IT17 VXP 0581 IT18 SANYO 1430662T15620 IT19 SHARP NIDL005GEZZ IT20 NIDL0006GEZZ IT21 NPLV0107GEZZ IT22  PRICE 20p EACH 16p EACH FOR A PACK OF 5 FOR EACH MODEL 13p EACH FOR A PACK OF 10 FOR EACH MODEL			

**GRANDATA LTD**  
**Tel: 0181-900 2329**  
**Fax: 0181-903 6126**

## VIDEO SERVICE KITS

### AMSTRAD

VCR700

#### Contents

BELT SET PINCH ROLLER REEL IDLER VIDEO LAMP

Order Code: SK41

£5.50

### FERGUSON & JVC

3V42/43

HRD455/HRD725

#### Contents

BELT SET PINCH ROLLER  
CLUTCH MECHANISM TENSION  
BAND

Order Code: SK37

£16.00

#### Economy Kit Contents

BELT SET PINCH ROLLER  
SUPPLY CLUTCH TAKE UP  
CLUTCH

Order Code: SK38

£9.00

3V58/59/64/65

HRD170/180/210/230/300/320/370/400/430/530/700/750

HR55000

#### Contents

BELT SET PINCH ROLLER IDLER ARM TENSION BAND

Order Code: SK44

£7.00

3V29/3V30

HR7200/7300/7350

#### Contents

BELT SET PINCH ROLLER TENSION BAND IDLER TYRES

Order Code: SK05

£5.00

3V35/36/38/39/49

HRD110/111/120/225

#### Contents

BELT SET PINCH ROLLER TENSION BAND IDLER TYRES

Order Code: SK04

£5.00

3V31/3V42

HR7600/7610/7650/7655

#### Contents

BELT SET T/U REEL TABLE  
TYRE PINCH ROLLER REEL  
IDLER T/U CLUTCH T/U IDLER  
TENSION BAND VIDEO LAMP

Order Code: SK33

£11.00

#### Economy Kit Contents

BELT SET T/U REEL TABLE  
TYRE PINCH ROLLER REEL  
IDLER TYRE T/U IDLER TYRE  
T/U CLUTCH

Order Code: SK34

£5.00

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

£10.00

#### Economy Kit Contents

BELT SET T/U REEL TABLE  
TYRE SUPPLY REEL TABLE  
TYRE PINCH ROLLER T/U  
CLUTCH T/U IDLER TYRE  
IDLER TYRE

Order Code: SK36

£5.50

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

£10.00

#### Economy Kit Contents

BELT SET T/U REEL IDLER  
TYRE SUPPLY REEL TABLE  
TYRE PINCH ROLLER REEL  
IDLER TYRE T/U IDLER TYRE  
T/U CLUTCH

Order Code: SK32

£5.00

3V44/45/48/53/54/55/57

HRP50/HRD140/150/158/160

HRD250/257/565/566/755

#### Contents

BELT SET PINCH ROLLER  
CLUTCH MECHANISM TENSION  
BAND

Order Code: SK39

£15.00

#### Economy Kit Contents

BELT SET PINCH ROLLER

Order Code: SK40

£9.50

### FISHER

FVHP905/906/907/908/910/911/916/918

#### Contents

BELT SET PINCH ROLLER  
IDLER GEAR IDLER UNIT  
TENSION BAND

Order Code: SK57

£13.00

#### 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

BELT SET PINCH ROLLER  
IDLER GEAR IDLER UNIT  
TENSION BAND

Order Code: SK68

£11.00

#### Economy Kit Contents

BELT SET PINCH ROLLER  
IDLER TYRE

Order Code: SK69

£3.00

### HITACHI

VT11/VT33

#### Contents

BELT SET PINCH ROLLER TENSION BAND IDLER TYRES

Order Code: SK08

£5.00

## VIDEO SERVICE KITS (Cont.)

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

£13.00

#### Economy Kit Contents

BELT SET PINCH ROLLER  
FF/REW IDLER TYRE T/UP REEL  
TABLE TYRE SUPPLY REEL  
TABLE TYRE

Order Code: SK46

£3.75

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

£3.00

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

TIMING BELT PINCH ROLLER FF/REW ARM CLUTCH BASE  
TENSION BAND

Order Code: SK52

£9.75

VT100/110/111/113/115/118/120/125/128/130/135/138/145/150/

175/220/225/250/255/258/260/VTL30

#### Contents

BELT SET PINCH ROLLER FF/REW ARM CLUTCH PLATE  
TENSION BAND

Order Code: SK51

£14.00

### PANASONIC

NV2000/NV2010

#### Contents

BELT SET PINCH ROLLER  
TENSION BAND IDLER TYRES

Order Code: SK03

£5.00

NV7000/NV7200/NV7800

#### Contents

BELT SET PINCH ROLLER  
TENSION BAND IDLER TYRES

Order Code: SK02

£5.00

NV300/NV330/NV333/NV340/NV366

#### Contents

BELT SET PINCH ROLLER TENSION BAND IDLER TYRE

Order Code: SK01

£5.00

NV2000/NV2010

#### Contents

BELT SET PINCH ROLLER FF  
IDLER PLAY IDLER TENSION  
BAND VIDEO LAMP

Order Code: SK13

£6.00

#### Economy Kit Contents

BELT SET PINCH ROLLER  
IDLER TYRE PULLEY TYRE

Order Code: SK14

£3.50

NV7000/NV7200/NV7800

#### Contents

BELT SET PINCH ROLLER  
IDLER UNIT PLAY IDLER  
TENSION BAND

Order Code: SK11

£8.50

#### Economy Kit Contents

BELT SET PINCH ROLLER  
IDLER TYRE CLUTCH TYRE

Order Code: SK12

£3.25

NV300/NV330/NV333/NV340/NV366

#### Contents

BELT SET PINCH ROLLER  
IDLER UNIT PLAY IDLER  
TENSION BAND

Order Code: SK15

£7.00

#### Economy Kit Contents

BELT SET PINCH ROLLER  
IDLER TYRE PLAY IDLER  
TYRE

Order Code: SK16

£3.25

NVG7/NVG9/NVG10/NVG11/NVG12/NVG14/NVG15/NVG16/

NVG18/NVG30/NVG120/NVG130/NVG400/NVH65 (PX/AC)/

AG1810 (PIK)

#### Contents

LOADING BELT CAPSTAN  
BELT PINCH ROLLER IDLER  
TENSION BAND

Order Code: SK27

£6.00

#### Economy Kit Contents

LOADING BELT CAPSTAN  
BELT PINCH ROLLER IDLER  
TYRE

Order Code: SK28

£3.00

NV332

#### Contents

BELT SET PINCH ROLLER  
PLAY IDLER FF/REW IDLER  
TENSION BAND FF/REW TYRE

Order Code: SK29

£12.00

#### Economy Kit Contents

BELT SET PINCH ROLLER  
IDLER TYRE

Order Code: SK30

£5.10

NV230/250/260/280/430/450/460/470/650/810/890/

AG1200PK/AG1500PK

#### Contents

BELT SET PINCH ROLLER  
IDLER TENSION BAND

Order Code: SK23

£6.00

#### Economy Kit Contents

BELT SET PINCH ROLLER  
IDLER TYRE

Order Code: SK24

£3.25

NV600/NV688

#### Contents

BELT SET PINCH ROLLER  
PLAY IDLER FF/REW IDLER  
TENSION BAND

Order Code: SK25

£12.00

#### Economy Kit Contents

BELT SET PINCH ROLLER  
PLAY IDLER TYRE FF/REW  
IDLER TYRE

Order Code: SK26

£6.00

NV730/NV770

#### Contents

SLOT IN BELT LOADING BELT  
PINCH ROLLER IDLER UNIT  
TENSION BAND

Order Code: SK19

£5.00

#### Economy Kit Contents

SLOT IN BELT LOADING BELT  
PINCH ROLLER IDLER TYRE

Order Code: SK20

£3.00

NV370/NV380/480/630/780/830/850/AG2100PK/AG2200PK

#### Contents

BELT SET PINCH ROLLER  
IDLER TENSION BAND

Order Code: SK21

£5.00

#### Economy Kit Contents

BELT SET PINCH ROLLER  
IDLER TYRE

Order Code: SK22

£2.75

NV777/NV788

#### Contents

BELT SET PINCH ROLLER  
IDLER UNIT TENSION BAND

Order Code: SK17

£6.00

#### Economy Kit Contents

BELT SET PINCH ROLLER  
IDLER TYRE

Order Code: SK18

£4.00

## VIDEO SERVICE KITS (Cont.)

### SHARP

VC381

#### Contents

BELT SET PINCH ROLLER  
REEL IDLER TENSION BAND  
VIDEO LAMP

Order Code: SK47

£8.00

#### Economy Kit Contents

BELT SET PINCH ROLLER  
REEL IDLER TYRE

Order Code: SK48

£3.25

VC500/VC57

**IDLERS & PULLEYS REPLACEMENT**

<b>AKAI</b>					
VS1-2, VS4-5, VS15	FF-REW IDLER	M1327773	400p		
VS3, 6, 12, 56, 58, 59	T-UP IDLER	BV327815	500p		
VS3, 6, 12, 59, 59	IDLER	BV321979	600p		
VS125, 126, 155,	IDLER ASSY	M2368960J2	900p		
VS165, 240, 244, 245, 247, 248, 250, 512, 515, 516					
VS15, 105, 112, 115, 116, 205, 220	T-UP IDLER	PU47752	£4.50		
VP7100, VS9300					
VS9500, VS9800	UNLOADING IDLER	PU46381	£4.00		
VP7100, VS9300	REW IDLER	PU46380	£4.00		
VS9500, VS9800					
VP88	IDLER	BV336067	£5.00		
VS1, 3, 4, 9, 12	REEL TABLE	BR347731	450p		
VS15, 58					
VS23, 35, 37, 53, 55	CLUTCH	ML373043	1100p		
VS66, 75, VSA77					
VS9700	FF IDLER	BV321761	£3.20		
VS9700	REW IDLER	W321762	£4.25		
<b>AMSTRAD</b>					
VCR7000	IDLER	150280	£1.50		
TVR1, VCR4500	CLUTCH	150873	£3.75		
VCR4600, VCS200, VCR9000					
TVR1, VCR4500	GEAR HOLDER	151284	£3.50		
VCR4600, VCRS200, VCR9000					
TVR1, VCR4600	REF CLUTCH		£3.50		
VCR5200					
VCR6000, VCR6100	CLUTCH	153202	£3.80		
VCR4500, VCR9000	CLUTCH		£4.00		
VCR4500, VCR4600	MOD KIT	(TAPE CREASING)	300p		
VCR7400					
MOD KIT TAPE CREASING FOR AMSTRAD					
VCR4500, 4600, 4700			£3.00		
<b>FERLUGSON</b>					
3V00, 3V01, 3V16	T-UP IDLER	PU47752	£4.50		
3V22, 3292, 8900, 8901, 8904, 8906					
3V16, 3V22	T-UP IDLER	PU49280	£5.50		
8903, 8909, 8912, 8922					
3V23, 3V29, 3V30	REEL IDLER	PU48967	175p		
3V31, 3V32, 3V35, 8923, 8924, 8929, 8930, 8931, 8940, 8941, 8942					
3V23, 3V31	ROLLER ASSY	PU49042A	350p		
3V29, 3V30, 3V31	T-UP IDLER	51402	100p		
3V32, 3V35, 3V36, 3V38, 3V39, 3V49, 8930, 8931, 8940, 8941, 8942					
3V29, 3V30, 3V31	T-UP CLUTCH	PU51380	200p		
3V32, 8930, 8931, 8940, 8941, 8942					
3V35, 3V36, 3V38	REEL IDLER	PU55374	200p		
3V39, 3V49, 8943, 8944					
3V35, 3V36, 3V38	T-UP CLUTCH	PU55373	150p		
3V39, 3V49, 8943, 8944					
3V58, 3V59, 3V64	IDLER ARM	PU58645	£2.25		
3V65, FV10, FV11, FV12, FV13, FV14, FV20, FV21, FV22, FV26					
FV30, FV32, FV33, 8950, VC141L					
3V42, 3V43	CLUTCH ASSY	PU55822	1200p		
3V43, 3V44, 3V45	CLUTCH ASSY	PU57658	1050p		
3V48, 3V53, 3V54, 3V55, 3V57, 8947, 8948					
3V42, 3V43, 3V44	T-UP CLUTCH	PU56043-1-4	240p		
3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 8947, 8948					
3V42, 3V43, 3V44	SUPPORT CLUTCH	PU56044-1-5	160p		
3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 8947, 8948					
3V00, 3V01, 3V16	LOADING IDLER	PU43681	£4.00		
3V22, 3292, 8900, 8901, 8902, 8903, 8904, 8906, 8909, 8912, 8922					
3V00, 3V01, 3V16	REW IDLER	PU46380	500p		
3292, 8900, 8901, 8904, 8906					
3V16, 3V22, 8902	IDLER	PU49281	£1.70		
8909, 8912, 8922					
<b>HSHER</b>					
FVHP420, 520, 530	FF REW PULLEY	H1638531	80p		
FVHP615, 618, 620	COMP IDLER ASSY	F1430420400300	£220p		
FVHP622, 710, 711, FVHP720, 721, 722, FVHP725, 730, 830					
FVHP840, 905, 906, FVHP906, 910, 911, FVHP915, 916, 918					
FVHP615, 618, 620	GEAR IDLER ASSY	F1430490400900	380p		
FVHP622, 710, 711, FVHP720, 721, 722					
FVHP725, 730, 830, FVHP840					
FVHP615, 618, 620	REEL T-UP ASSY	F1430410400900	£5.50		
FVHP622, 710, 711, FVHP720, 721, 722					
FVHP725, 730, 830, FVHP840					
FVHP905, 906, 908	GEAR IDLER ASSY	F1430490402400	275p		
FVHP910, 911, 915, FVHP916, 918					
FVHP975, 980, 985	IDLER	F1430420400700	300p		
FVHP999, 5000, 5005					
FVHP050, 5075, 5100					
FVHD40, 55, 140	REEL DRIVE ROLLER		£6.00		
FVHP1, 10, 20					
FVHP975, 980, 990	CLUTCH	F12430510400200	£9.50		
FVHP420, 520, 530	IDLER		£2.80		
FVHP420, 520, 530	TAKE UP IDLER		290p		
FVHP990	LOADING GEAR		90p		
VBS3500	REEL DRIVE PULLEY		£3.20		
VBS3500	IDLER		250p		
VBS7000	REW IDLER		95p		
<b>GOLDSTAR</b>					
GHV1221, 1232, 1240	CLUTCH GEAR	435038A	£2.50		
GHV1241, 1242, 1243, GHV1244, 1245, 1246, GHV1247, 1248, 8000,					
GHV8200, 8210, 8215, GHVPS1, VCP4100, 4130					
GHV1221, 1232, 1240	IDLER		110p		
GHV1241, 1242, 1243, GHV1244, 1245, 1246, GHV1247, 1248, 8000,					
GHV8200, 8210, 8215, GHVPS1, VCP4100, 4130					
<b>HNARI</b>					
VXL3, VXL20	REEL IDLER	40000009	110p		
VXL2	IDLER		110p		
VXL4, VXL35	IDLER		£2.75		
VXL4, VXL35	CLUTCH		£6.50		
VXL4, VXL12, VXL25	LIMITER POST		£1.30		
VXL30, VXL35, VTV300					
VXL5, VXL6	CLUTCH		£3.75		
VXL5, VXL6	GEAR HOLDER		£3.50		
VXL7, VXL8, VXL9	CLUTCH		£3.80		
<b>HITACHI</b>					
VT11-33, VT63-64	CLUTCH ASSY	6879515	£7.50		
VT14, 17, 19, 38, 57, 86, 88, 34, 35, 39, 52, 61, 62, 65, 85, 330, 640, VT165					
VT120-220, 100, 110	CLUTCH ASSY	6886824	£7.50		
111, 113, 115, 118, 200		6886872			
125, 128, 130, 135, 138, 145, 150, 175, 225, 250, 255, 258, 260, VTL30					
VT8000-8300, 7000	FF-REW IDLER	6413663	£2.80		
VT8500-8700					
VT8000-8300, 7000	PLAY IDLER	6414221	290p		
VT8500-8700					
VT8000-8300, 7000	FF REW PULLEY	6383531	80p		
VT8500-8700					
VT9300-9500, 6500	FF-REW IDLER	6861471	250p		
VT880, 6800, 9700, 9900					
VT9300 9500, 6500	PLAY IDLER	6861482	230p		
VT680, 6800, 9700		6861481			
VT 9900					
VT9300-9500, 9700	IDLER	681505	230p		
VT9900, 6500, 680, 6800	IDLER	687043	£3.80		
VT11-33, VT63-64	FF-REW IDLER	6886971	125p		
VT14, 16S, 17, 19, 34, VT35, 38, 39, 52, 61, 62					
VT65, 85, 86, 88, 330, 640					
VT1000, 110, 111, 113	FF-REW ARM	6886792	240p		
VT115, 118, 119, 120, 125, 128, 130, 135, 138, 145, 150					
VT175, 220, 225, 250, 255, 258, 260, VTL30					
VT400, 405, 410, 413	FF REW ARM	6887094	£1.30		
VT414, 415, 418, 420, 425, 426, 428, 430, 431, 435					
VT438, 450, 490, 510, 518, 520, 525, 526, 530, 535					
VT538, 540, 545, 546, 548, 570, 575, 576, 580, 585					
VT588, VTM625, 626, 630, 635, 636, 640, 645, 646, VTS80, 85					
VT400, 405, 410, 413	CLUTCH BASE	6896951	£3.25		
VT414, 415, 418, 420, 425, 426, 428, 430, 431, 435					
VT438, 450, 490, 510, 518, 520, 525, 526, 530, 535					
VT538, 540, 545, 546, 548, 570, 575, 576, 580, 585					
VT588, VTM625, 626, 630, 635, 636, 640, 645, 646, VTS80, 85					
VT3000	T-UP IDLER (LARGE)		£4.50		
VT3000	REW IDLER		£8.00		

VT680, 6500, 6800	FS-BRAKE	6861505	230p		
VT9700, 9900					
<b>HITACHI</b>					
OUTPUT MODULE HM 6251			£5.50		
OUTPUT MODULE HM 6232			£8		
<b>JVC</b>					
HR330, 3680, 4100	T-UP IDLER SML	PU49280	£5.50		
HR7200, 7600, 7650	T-UP CLUTCH	PU53462A	220p		
HR7655, 7900, 7350, 7610					
HR7200, 7300, 7350	REEL IDLER	PU48967	175p		
HR7600, 7610, 7650, 7655, 7700					
HR7600, 7610, 7650	ROLLER ASSY	PU49042A	350p		
HR7655, 7700					
HR9300, 3680, 4100	T-UP IDLER LRG	PU47752	£4.50		
HR7200, 7600, 7650	T-UP IDLER	PU51402A	100p		
HR7655, HRD110, HRD111, HR7300, 7350, 7610, HRD120-121, 225					
HRD110, HRD120-121, 225	T-UP CLUTCH	PU55373	150p		
HRD225, HRD111					
HRD110, HRD120-121, 225	IDLER ARM	PU55374-3-8	200p		
HRD225, HRD111					
HRD170, 180, 210, 230	IDLER ARM	PU58465	£2.25		
HRD320, 370, 400, 430, 470, 530, 700, 750, 950, 3000					
HR55000, HR55500					
HRD455, HRD725	CLUTCH MECH	PU558822	1200p		
HRD140, 150, 157, 158	T-UP CLUTCH	PU57658	1050p		
HRD160, 250, 257, 565, 566, 755, HRP50					
HR3300, HR3330	REW IDLER	PU46380	500p		
HR3660, HR4100					
HRD140, 150, 157, 158	TAKE UP CLUTCH	PU56043-1-4	240p		
HRD160, 250, 257, 465, 565, 566, 725, 755, HRP50					
HRD140, 150, 157, 158	TAKE UP CLUTCH	PU56044-1-5	160p		
HRD160, 250, 257, 465, 565, 566, 725, 755, HRP50					
<b>MATSUJI</b>					
VX730, 735, 750, 755,	CLUTCH	850A00005	420p		
VX810, 820, 850, 880, 990					
VX730, 735, 750, 755	LIMITED POST LEVER ASSY		£1.30		
VX770, 800, 810, 880					
VX990					
VX800A, VX900	IDLER REEL		£1.50		

# JUST ARRIVED!!! NEW ITEMS

## Satellite PSU Repair Kits

Experience shows that 50% of all receiver power supplies 'bounce' unless the correct precautionary measures are taken when being serviced. A kit of all the recommended parts is supplied for the 4 most popular models, which when fitted should overcome this.

MAKE & MODEL	ORDER CODE	PRICE
PACE PRD800, PRD900	SATPSU1	650p
PACE SS9000, 9200, 9010, 9020, 9220	SATPSU2	650p
AMSTRAD SRD510, SRD520	SATPSU3	650p
AMSTRAD SRD500	SATPSU4	650p

## Replacement Video Heads

MAKE	MODELS	PRICE
HITACHI	VT570, VT575, VT576, VT580, VT585, VT588, VTF70	3100p
I.T.T.	VR3761	3100p
JVC & FERGUSSON	HRD950, HRD960, HRD980, FV46	5000p
LUXOR	VR3761	3100p
MITSUBISHI	HSE51	3000p
NATIONAL	NVFS200, NVFS90, NVV8000	4600p
PANASONIC	NVHD100, NVHD101, NVHF100	3100p
	NVSD	1400p
	AG7330, AG7350, AG7355, AG7450	5000p
	NVFS100	5000p
N.E.C.	D5600	3500p
SANYO	TLS1000P, TLS1001P, TLS1100	3100p
	VHR7800, VHR7810, VHR8000SP, VHR8801SP, VHRD4800	3100p
SHARP	VCH80, VCH81, VFH815	2800p
	VCA33, VCA36, VCA43, VCA44, VCA46, VCA49	1500p
	VCA55, VCA63	2200p
SONY	SLV656, SLV715, SLV757, SLV777, SLV815, SLV825	4600p
	SLV353UB	3200p
	CCDF340E, CCDF500E, CCDV90E, CCDV95E, CCDSP5E	4800p

## Original Video Heads

MAKE	MODELS	PRICE
NATIONAL	NVG20, NVG21, NVG22, NVG25	3000p
PANASONIC	NVG25, NVG28, NVG200, NVD48	
	PART NO: VEH 0343	
	NVG33, NVG45, NVG46, NVL23	2900p
	NVL25, NVL28	
	PART NO: VEH 0417	
	NVJ30, NVHJ33, NVL20, NVL21, NVG30, NVG31, NVG40, NVG130	2700p
	PART NO: VEH 0416	

## Audio Control Head

**AMSTRAD ORIGINAL NO: 150751**  
 Used on: AMSTRAD TVR1, 2, 3, VCR4600, 4600MKII, 4700, FUNAI VS2, VCR4600, 4800, 5200, 5600, 6600, VIP3000, 5000  
 Also fits: FIDELITY, FUNAI, HINARI, PROLINE, SCHNEIDER, TOWADA, UNIVERSUM ORDER CODE: AH01 PRICE: 1350p

**AMSTRAD ORIGINAL NO: 153134**  
 Used on: AMSTRAD DD8900, 8904, VCR2000, 6000, 6100, 8600, 8602, 8603, VCR8604, 8700, 8704, 8714, 8800, 9005, 8244  
 Also fits: ANITECH, BONDSTEC, CASIO, CROWN, FIDELITY, GOLDHAND, GRANADA, HINARI, MARQUANT, OMEGA, PROFEX, SCHNIEDER, SEG, SENTRA, SHINTOM, TASHIKO, TATUNG, TOWADA, UNIVERSUM ORDER CODE: AH02 PRICE: 1450p

## Replacement Audio Control Video Sound Head for National Panasonic

PART NUMBER	MODELS	PRICE
VBR 0091	NVG7 etc	875p
VBR 0050	NV300, NV340 etc	875p
VBR 0061	NV777 etc	875p
VBR 0103A	NV250, NV450 etc	625p
VBR 0125		625p

## 8 way Preprogrammed Universal Remote Control

A single remote control to operate Televisions, Videos and Satellite Receivers. Plus Auxiliary Options!!  
 \* Replaces up to 8 remotes with one \* Simple 4 digit setup routine  
 \* Controls 1000s of models \* Teletext functions with Fastext  
 \* Clear (large key) layout \* Code Search Facility  
 \* Stylish and easy to operate \* Replace broken or lost remotes  
 \* Original Remote not required

Order Code: 8 WAY Price 1450p + VAT

## Replacement Video Cassette Housings

MAKE	MODELS	CODE	PRICE
AKAI	VS35, VS53, VS55, VS56, VS75	CH18	2600p
GRANADA	VHSDP1	CH05	1100p
	VHSYJ2	CH01	2600p
GOLDSTAR	GHV1290P, 1291P, 1295P, 9400, 73401, GSE1295P, GSE1891P, 20001Q, 20051Q, VCP4200, 4300, 4301, 4305, VCP4306, 4311, 4315, 4316, 4320, 4321, 4325	CH25	2000p
	GHV51, 1221, 1232, 1240, 1241, 1242, 1244, 1246, 1248, GHV8000, 8200	CH26	2900p
FERGUSON & J.V.C.	3V38, 3V39, 8943, 8944, 8951, 3V35, 3V36, 3V49, HRD110, 111, 120, 121, 225	CH01	2600p
	3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57, 8945, 8947, 8948, HRD140, 141, 150, 157, 158, 160, 250, HRD257, 455, 565, 566, 725, 755	CH02	2600p
	8948, 8950, FV10B, 12L, 13H, 14T, 20R, 21R, 22L, 26, 395, HRD230, 430, 530	CH03	2600p
	3V58, 3V59, 3V64, 3V65, FV11R, 8950, 8951, HRD170, HRD180, HRD370	CH04	2600p
	FV31R	CH19	4300p
	HRD515, 520, 527, 540, 550, 580, 600, 610, 620, 660, 670, HRD830, 840, 850, 860, 4050, 6600, FV37H	CH20	2400p
	HRD540, 580, 830, 860, 910, 960, HRD970, HRDX20, FERGUSON FV57H	CH27	2400p
I.T.T.	VR3605, VR3905	CH01	2600p
	VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2600p
	VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2600p
NATIONAL PANASONIC	NV730	CH06	4300p
N.E.C.	N830EG, N831EG, N832, N833EG	CH01	2600p
	N895	CH02	2600p
PHILIPS	CASSETTE LIFT ASSEMBLY (69120366) DV186, 190, 286, 471, 562, 761, VR6180, 6182, 6185, 6285, VR6290, 6291, 6293, 6362, 6367, 6393, 6467, 6468, 6470, VR6561, 6670, 6760, 6761, 6870, 6970	CH05	1100p
	VR6443	CH22	2900p
	VR6448	CH23	2500p
	49SB6	CH24	2500p
SHARP	VCA100, VCH851, VCH852	CH22	2900p
	VCA103, 103GV, 106, 106GVM, 254GVM	CH23	2500p
	VCS211, 244, 5055, 605, VCB230, VCD806G, 810G, VCT212, 310, 410G, 610	CH24	2500p
TELEFUNKEN	VR2970	CH02	2600p
THOMSON	V320, 321, 323, 326, 4200, 4300	CH01	2600p
	V342, 343, 352, 353, 360, 364, 368, 4210, 4230, 4260, 4400, V5500, 6000, 8540	CH02	2600p
TOSHIBA	V55, V57	CH01	2600p
	V65, V66	CH02	2600p

## Service Aids

DESCRIPTION	VOLUME	CODE	PRICE
VIDEO HEAD CLEANER	75ML	SP01	140p
SWITCH CLEANER	176ML	SP02	150p
SILICONE GREASE	200ML	SP03	170p
FREEZE IT	170ML	SP04	220p
FREEZE IT	400ML	SP16	350p
FOAM CLEANER	400ML	SP05	170p
ANTI STATIC	150ML	SP06	170p
AEROKLEANE	135ML	SP07	200p
AERO DUSTER	150ML	SP08	220p
AERO DUSTER	400ML	SP17	425p
PLASTIC SEAL	200ML	SP09	200p
GLASS CLEANER	250ML	SP10	160p
COLDKLENE	250ML	SP13	200p
EXCEL POLISH 80	250ML	SP18	150p
ADHESIVE 120	400ML	SP19	190p
LABEL REMOVER 130	200ML	SP20	240p
REFURB 140	400ML	SP21	240p
TUBE SILICON GREASE	50 GRAMMES	SP11	200p
TUBE SILICON SEALANT WHITE	75ML	SP22	280p
TUBE SILICON SEALANT CLEAR	75ML	SP23	280p
TUBE HEAT SINK COMPOUND	25 GRAMMES	SP12	150p
DRIVE CLEANER	200ML	SP24	150p
SCREEN CLEANER	200ML	SP25	150p
COMPUTER CARE KIT		SP26	2100p

All the above items are manufactured by Servisol  
 If you purchase more than one Servisol Product, postage & package will be charged as follows:  
 300p for 5 cans 450p for more than 5 cans

## CD Pick Ups

SONY OPTICAL PICK UP  
 PART NO: KSS210A SONY CDPC 301M, CDPC 305M 2200p  
 Fits most Sony, Akai & J.V.C. Portable Hi-Fi and Midi Systems

PART NO: KSS210B  
 USED ON MODELS:  
 CFD100, 105L, 120, 300, 440, 454, 455, 50, 500, 55, 58, 60  
 CFD68, 750, 755, 760, 765, 770, 775, 440S, W100, 100S 2200p

## Cassette DC Motors

MOTOR TYPE	PRICE
6V MOTOR	170p
9V MOTOR	170p
12V CW MOTOR	170p
12V CCW MOTOR	170p
13.2 CCW MOTOR	290p

## Cassette Tape Heads

HEAD TYPE	PRICE
MONO HEAD	90p
STEREO HEAD	110p
MINI HEAD	150p
AUTO REVERSE HEAD	200p

## Soldering Accessories

DESCRIPTION	CODE	PRICE
<b>ANTEX SOLDERING IRONS</b>		
25 WATT 240 VAC (XS25W 240V)	S101	900p
15 WATT 240 VAC (XS15W 240V)	S102	900p
25 WATT SPARE ELEMENT	S103	450p
15 WATT SPARE ELEMENT	S104	450p
<b>SOLDERING STAND &amp; SPONGES</b>		
SOLDERING STAND (MADE BY ANTEX)	S108	350p
SPARE SPONGE	S109	55p
<b>SOLDER</b>		
18 SWG 500 GRAMMES	S110	500p
20 SWG 500 GRAMMES	S111	650p
22 SWG 500 GRAMMES	S112	700p
<b>DESOLDERING AIDS</b>		
SOLDER MOP STANDARD GAUGE 1.2mm x 1.5M	S107	70p
SOLDER MOP 1.2mm x 10M	S113	400p
DESOLDERING PUMP	S105	320p
SPARE NOZZLE	S106	60p

## Transistors & ICS

BU 508A (PHIL)	80p	MJE 13009	100p	25C 3885A	350p
BU 810	110p	MJE 18004	125p	25D 633	70p
BUZ 90A	180p	STK 6982H	600p	25D 1680	225p
CXA 1044P	550p	STK 7253	450p	25K 793	400p
HA 13408	350p	TEA 2039H	100p	25K 956	1400p
IRFBC40	400p	TEA 2019	200p	25K 1023	550p
L272	200p	TMP 47C434N	1250p	25K 1342	750p
L6210	250p	SA 1300	200p	25K 1358	600p
MC 3423P	100p	2SA 1540	55p	68000	500p
MJ 15015	250p	2SC 3788	60p	82S147	450p
MJ 15016	350p	2SC 3885	350p		

**GRANDATA LTD**  
**Tel: 0181-900 2329**  
**Fax: 0181-903 6126**



# REMOTE CONTROLS

Description	Order Code	Price	Description	Order Code	Price
<b>GRUNDIG</b>					
TP160E	RC 107	900p	<b>PHILIPS (continued)</b>		
TP200, TP300	RC 380	800p	RC38	RC 301	750p
TP400	RC 401	675p	KT3 TEXT	RC 5301	750p
TP590-600	RC 600	850p	RC5352	RC 5352	800p
TP390, TP610	RC 610	850p	RC5375	RC 5375	850p
TP621	RC 621	850p	RC5 STANDARD	RC 5534	850p
TP630, TP650	RC 650	850p	RC5901	RC 5901	850p
TP660	RC 660	850p	RC5903	RC 5903	700p
TP661	RC 661	850p	<b>SABA</b>		
<b>HITACHI</b>					
CLE800-CLE830	RC 140M	700p	T6772	RC 149	900p
A617402/655602	RC 192	875p	TC319-320	RC 328	875p
A512120/230	RC 900	800p	TC356	RC 356	875p
A514790	RC 901	800p	TC358	RC 358	850p
A5088470	RC 902	800p	TC360	RC 360	800p
A518612	RC903	900p	TC365	RC 365	800p
SCL002	RC904	850p	<b>SALORA</b>		
C2096	RC 905	850p	SERIES L	RC 190	875p
A511940	RC 906	750p	86173	RC 882	850p
655602H	RC 907	800p	<b>SANYO</b>		
<b>ITT</b>					
IFB13, 14, 15	RC 143	875p	RC218, RC222, RC228, RC238	RC 140M	700p
FS4	RC 148	850p	JXGE	RC 878	850p
RG305	RC 305	675p	JXDE	RC 884	850p
RG306	RC 306	825p	VHR2300	RC 890	850p
FS9/1-10/1	RC 307	850p	RC628	RC 865	900p
VS5 RUK	RC 308	825p	<b>SHARP</b>		
VS4-1	RC 310	850p	G0121CESA, 123CESA, 204, 251	RC 140M	850p
MULTICONTROL (17C20)	RC 311	800p	<b>SIEMENS</b>		
<b>KORTING</b>					
18279, 18396, 18460, 18521 SE	RC 108	850p	FC616	RC 130	850p
40540 VTS	RC 108	900p	FC631	RC 132	850p
<b>LOEWE</b>					
DC11	RC 146	850p	FC742	RC 164	900p
<b>MATSUI</b>					
010270601	RC 889	850p	<b>SONY</b>		
VX770	RC 892	850p	RM604, RM605, RM606	RC 140	700p
<b>METZ</b>					
JAVA COLOR (6890)	RC 166	850p	32 CHANNEL	RC 140M	700p
COLOR (7156)	RC 183	850p	RM613	RC 141	750p
JAVA (7180)	RC 184	850p	RM632, RM636	RC 160	675p
<b>MITSUBISHI</b>					
939P/03607, 939P/03609	RC 140M	850p	<b>TATUNG</b>		
<b>NOKIA</b>					
SATELLITE	RC 550	850p	FXA	RC 877	850p
<b>NORDMENDE</b>					
TC2336	RC 351N	850p	RC70	RC 883	750p
CMC1, TC3519	RC 356	875p	FX70 FASTTEXT	RC 894	850p
<b>OCEANIC</b>					
390C9500	RC 339	900p	<b>TELEFUNKEN</b>		
<b>ORION</b>					
RC53	RC 892	850p	FB632	RC 632 ST	850p
<b>PANASONIC</b>					
EUR51200	RC 200	800p	FB639	RC 639 ST	850p
TC2200	RC 201	850p	<b>THORN/FERGUSON</b>		
VSQ0357/NV730	RC 202	875p	3V35-42	RC 342	650p
TNQ1621	RC 203	900p	3V31-32	RC 344	800p
<b>PHILCO</b>					
CARVEL, CONCORDE, MERCURY, TELESTAR	RC 108	850p	3V57-58	RC 628	800p
TC10	RC 152	900p	TX10 TEXT	RC 732	575p
<b>PHILIPS</b>					
RC5002,5154	RC 134	850p	TX10 STEREO TEXT	RC 738	575p
KT3 NON TEXT	RC 135	825p	TX9-90-100	RC 740	675p
69117032	RC 178	875p	3V55, FV11	RC 783	800p
69117194	RC 180	875p	TX100 FASTTEXT	RC 785	650p
RC5991-UNIV	RC 300	580p	TX100 STEREO FASTTEXT	RC 789	650p
			PROFESSIONAL	RC 790	650p
			<b>TOSHIBA</b>		
			CT937	RC 950	850p
			CT9117	RC 951	800p
			201R4B	RC 952	800p

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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
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4A	FUSE42	100P
5A	FUSE43	100P
6.3A	FUSE38	100P
8A	FUSE39	100P
10A	FUSE40	100P
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10A	FUSE45	210P
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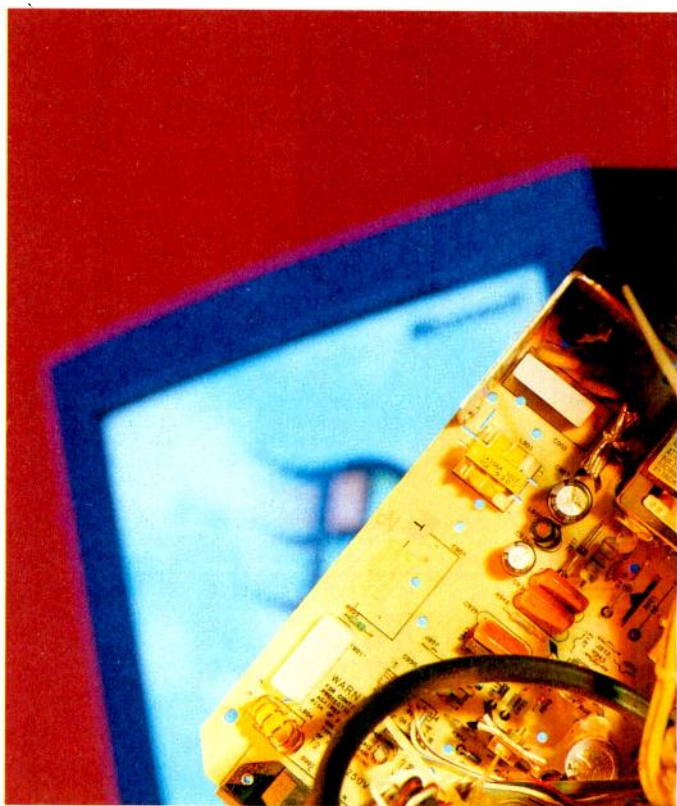
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# Servicing PC Monitors

The first obstacle one meets when servicing monitors is getting the back off! Peter Shoreland has hopefully started the ball rolling with his findings on this and other aspects of monitor servicing. We follow up with a number of fault reports sent in by readers. Further reports and information will be welcome



The first time someone asks you to repair a computer monitor will start as a day of trepidation and end with you wondering what all the fuss was about. You are likely to be asked to do the job because large companies charge a hundred pounds or so just to look at a monitor while other large companies, which have no one to do repair work, willingly pay up. Here's where you come in. If the big boys charge two hundred pounds or more to replace a tube, and a new monitor costs much the same, you can establish a nice little repair service. Monitors you can't repair will provide you with a supply of spare parts – the big boys simply put old monitors in the crusher!

I attend liquidation sales where computer equipment is sold off by business consultants who double as insolvency practitioners. The auctioneer is usually happy to get a bid and give you an option on the lot!

### Problems

So what are the problems with monitors? As with a well-known Japanese manufacturer's large-screen TV sets,

getting the back off is a major one. Fig. 1 shows a typical arrangement. The first thing to do is to take off the base pedestal – this applies to virtually every monitor, no matter who made it!

The PC installation consists basically of one box (the PC) with a mains input and one monitor sitting on top, again with a mains input. Both have delicate switch-mode power supplies. As a TV service engineer you know about these already, so you are on familiar ground. The pin connections for a typical cable that joins the PC box to the monitor are shown in Fig. 2. This will enable you to make up a test box. Better still, buy a PC at an auction and load up Eurats on the 3.5in. floppy disc. This will give you a permanent test box. The pin connections shown are actually for the Olivetti 250/290/500/750 range. But these sockets are very much of a muchness whatever the make of equipment.

Fig. 3 shows the switch-mode power supply circuit used in Amstrad 1600 range monitors. These will be by far the most common source of work for you, since they were budget machines though generally quite reliable and are often still going at third or fourth hand.

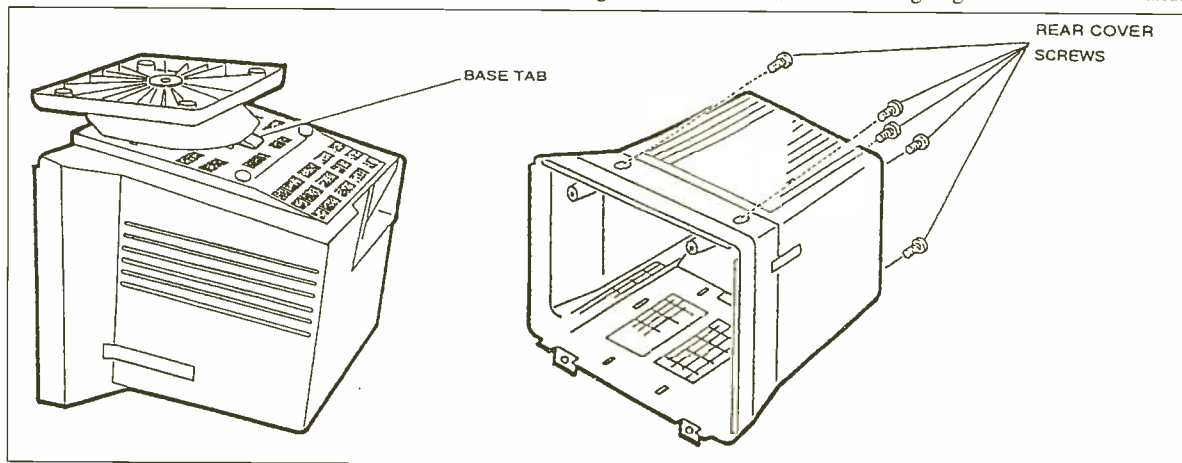


Fig. 1: Gaining access: remove the swivel base then the rear cover.

Actually the mains bridge rectifier feeds two separate switch-mode power supplies in this range, one for the monitor itself and the other for the PC, linked via a 15-pin plug. We've shown the monitor power supply, which follows conventional lines.

The active devices are contained within the STK7356 chopper chip IC501. Q5 is the chopper transistor, which is connected as a blocking oscillator with feedback to its base via C512. Q3 sets the d.c. conditions at its base, which is biased via R505-7. It is preceded by Q2, whose base voltage is set by the error detector transistor Q1. The latter's collector voltage depends on the difference between its base and emitter voltages. Zener diode D1 provides a fixed emitter bias. Rectifier D3 with C508 produces a voltage that's dependent on the mains input and circuit loading, being fed from a close-coupled secondary winding on the chopper transformer T501. A second rectifier, D2 with C507 as its reservoir, provides an emitter supply for Q3.

Q4 provides excess current and voltage protection. The chopper transistor's emitter current flows via R502, the voltage developed across this resistor being sensed at Q4's base. In the event of excessive chopper transistor conduction, the voltage across R502 will switch Q4 on, shorting out the drive to Q5's base. Under excess voltage con-

ditions zener diode D508 will conduct, with the same result.

Willow Vale can supply most of the components you will need for monitor repairs, including line output transformers. There are many other suppliers, as the advertisements in *Television* show. Handy if you don't have a Willow Vale account or live down the road from them as I do.

A study of the average monitor circuit will show that protection devices abound. Most are three-pin devices with a triangular presentation. They also come as silver fusible devices rated at one or two amps. If the mouse or keyboard is dead, go to the motherboard in the PC: you'll find these fuse

devices where the keyboard and mouse connectors link up.

Line timebase circuits generally follow conventional practice. A study of the field timebase will also make you feel at home. In the Compaq range of monitors for example you'll find a TDA1170 chip, though with a much larger copper heatsink. If you don't have the circuit diagram, take a note of the values of the small resistors in this area when a good monitor comes your way. Next time you may well find that they have turned to charcoal. This is a common fault brought about by the relevant winding on the line output transformer taking an away day. Sadly, everything else goes with it!

- 1 Red video
- 2 Green video
- 3 Blue video
- 4 NC
- 5 Self-test
- 6 Red earth
- 7 Green earth
- 8 Blue earth
- 9 NC
- 10 Logic earth
- 11 Mon ID bit 0
- 12 Mon ID bit 1
- 13 Line sync
- 14 Field sync
- 15 NC

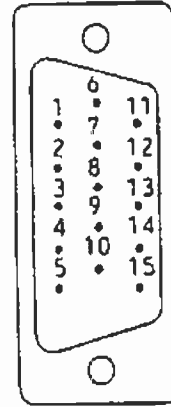


Fig. 2: Typical 15-pin PC/colour monitor plug connections.

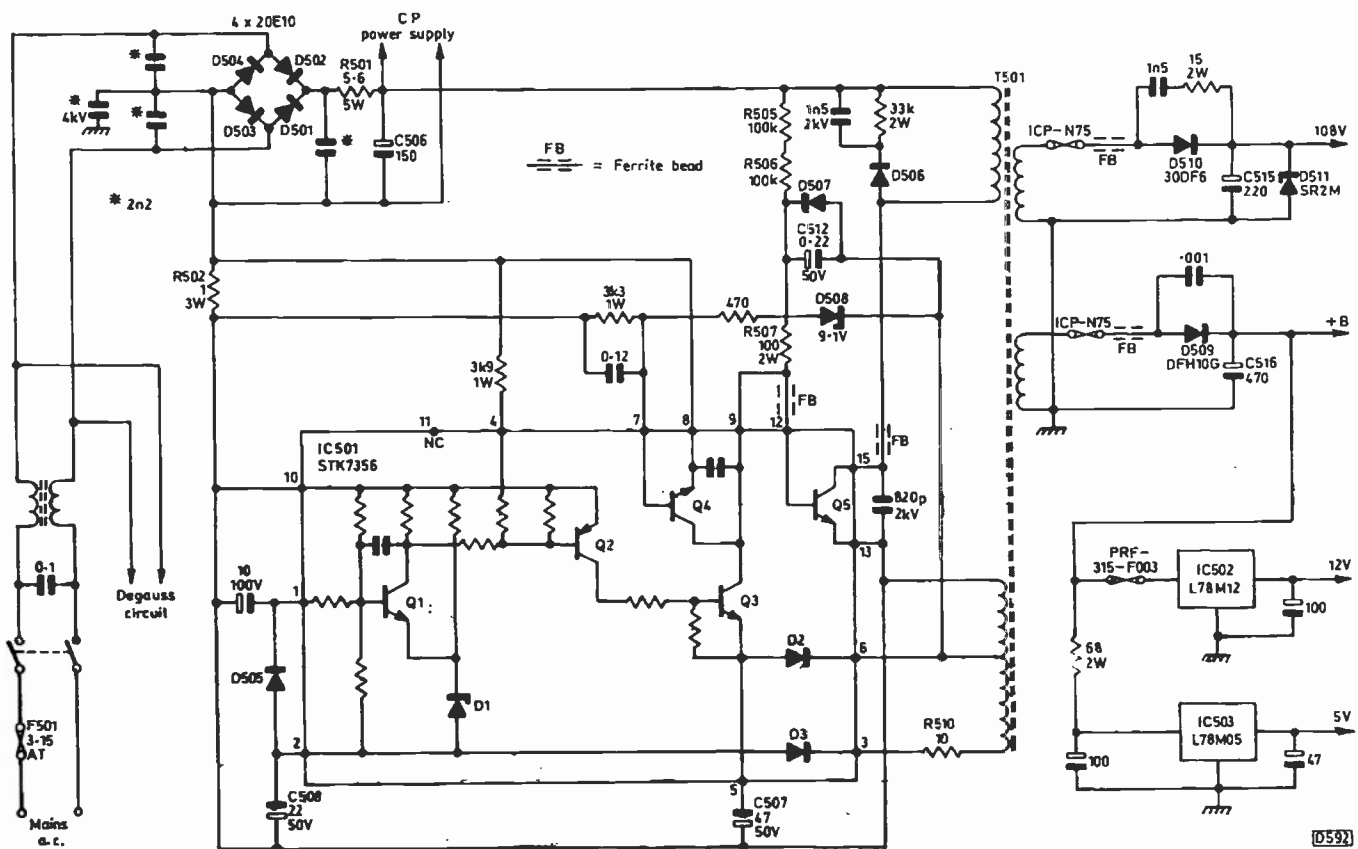


Fig. 3: Monitor switch-mode power supply circuit used in Amstrad 1600 series equipment.

**The Tube**

It's wise to drill a hole in the cabinet so that you can reach the focus control on the line output transformer. The focusing tends to drift off over a period of time and, as I have already mentioned, getting the back off can be something of a problem.

Tube life can be short. The outfit I work for give their monitors a hard life, some being on for eighteen to twenty

hours a day, so a screen-save program can be useful to prevent phosphor burn. If you have to change the tube, it's easy. Off with the lid, unscrew the four screws on the metal surround and the tube with the plastic surround will come away. But the quote you have to give for doing the job is often more than the customer will bear – a new monitor may be cheaper. Invariably you end up with the monitor for spare

parts. If you don't attend the auctions, this will be your best way of getting spares.

Keep your degaussing baton handy. Weird colours on the screen is a common complaint in offices: the cleaner has just been through with the vacuum, or the screen has been swivelled so that everyone can see the latest share prices!

Well that's enough for a starter. Let's see what others can come up with.

*Reports from  
Dave Lawrence  
Philip Blundell  
Chris Watton  
Nick Beer  
Chris Avis  
David Mawtus  
Chris Hawkins*

**Readers' Monitor Fault Reports****Tulip Colour VGA Monitor**

This monitor is a derivative of the Philips 9CM082. A common problem we get is that there is no colour, just a monochrome display. It happens only when the monitor is connected to a Tulip computer. Connect a pattern generator and the monitor works perfectly: connect a different monitor to the PC and this also works correctly.

It seems that when the PC is switched on it decides to produce a colour display only if the d.c. impedance of the three RGB lines to their respective earth lines (pins 1 and 6, 2 and 7, 3 and 8 respectively of the 15-pin sub-D connector) is in the range 65-85Ω. Correct operation can be restored by cleaning the pins of the connector for the interface cable on the monitor's motherboard. In practice slightly increasing the size of the pins by tinning them seems to provide a permanent cure.

If one colour is prominent or the raster is at full brightness, check for dry-joint at the tube base connector.

The tubes used in these monitors seem to lose emission or develop poor focusing sooner than those in other makes, requiring regeneration – in fact we've never to date had to use our rejuvenator on any other VGA or Super VGA monitor. Conversely my Philips colour TV set is still going strong after fifteen years, the only repairs in all this time being to the remote control unit! **D.L.**

**GoldStar I470SSI**

This SVGA monitor produced a dim picture. There was a fracture on the main board near the front centre. **D.L.**

**Digital VT320**

A faulty line output transformer is often the cause of the no picture symptom. **D.L.**

**IBM PC Monitors**

If you have ever tried to remove the back from certain IBM monitors you will have realised that a special tool is required to release the internal latch. Jensen Tools (01604 787 060) has a monitor opening kit for IBM PS/2 monitors. It contains five different tools, including the latch opener. Order code number is IB991. **P.B.**

**Enta CKI420**

For a dead monitor check whether R531 (560kΩ) is open-circuit. **P.B.**

**Taxan MV870**

A dark picture with a bend in the top third of the display suggested a problem in the power supply. We didn't have a circuit diagram, but fortunately the output voltages are

shown on the component side of the board. The main h.t., shown as 138V, was found to be low at only 105V. Replacing C927 (100μF, 160V, 105°C) brought the voltage up to 117V, but attempts to set up the h.t. by means of the control made no difference.

As the monitor, and the workshop, warmed up the h.t. rose to 129V and the picture and its crispness improved. So we decided to try freezing some likely components. Q903 (2SD763) seemed to be very sensitive to this treatment, but a replacement made no difference. Applying some Tellyman's wisdom, we replaced the small electrolytics C919 (10μF, 50V) and C920 (47μF, 50V). The result, perfect regulation and a bright picture.

Note that most monitors are made to a higher standard than most TV sets. All electrolytics should be 105°C rated types. **C.W.**

**Amstrad CTM644**

This monitor had previously operated intermittently: it was now dead. The cause of the fault was loss of the h.t. feed to the line output stage as ICP-N20 had failed. It had undoubtedly done so because of a huge dry-joint at the collector of the line output transistor. **N.B.**

**Amstrad PCW9256**

This wordprocessor was dead. We didn't have the service manual, but who needs one when you know these classic, basic power supply circuits? The 180kΩ start-up resistor R506 was open-circuit. **N.B.**

**Hitachi CM2187ME (C77M Chassis)**

This is a 21in. luxury monitor. There were faint vertical striations on the left-hand side of the screen, with north-south distortion for about the first four inches of the scan, producing about one and a half cycles of sinewave-shaped vertical displacement of the raster. Armed with the service manual and strong coffee, we waded patiently through the elaborate scan and correction circuitry without success. Then a little preset was spotted amongst a group of components on a PCB fitted astride the scan coils: one touch with an adjusting tool and the fault cleared.

To be on the safe side we decided to replace this 470Ω preset. It proved to be a difficult task, with all the scan coil leads having to be unsoldered before we could lift the PCB. It is typical of the perverse irony of this trade that the board, with its offending preset, is not shown anywhere in the service manual! **C.A.**

**Wyse WY50**

The most common fault is simply a defective on/off switch. Other common faults are as follows:

(1) **Terminal is completely dead.** Replacing transistors Q101 (2N2222) and Q102 (2SC3150) will usually put this right. It is wise to check zener diode D106 (TL431C) and optocoupler U103 (4N35 or CNX35) as well since if either of these is faulty Q101/2 will again blow.

If replacing these items fails to bring the terminal to life, check the following (in the order given): R101 (1.2Ω, 3W), BR101 (KBPS06), R105 (750kΩ, 0.5W), U102 (7812 regulator) and the 5.1V zener diode C17, which is on the logic board.

(2) **Slow start – the image appears several minutes after switch on, the screen remaining blank initially.** The cause has always been C120 (4,700μF, 10V) which becomes leaky.

(3) **Unstable image.** I've quite often had terminals which produce an image that 'wobbles' about on the screen. Replacing C112 (220μF, 35V) usually cures the fault. If not, the cause is either C117 (100μF, 25V), U101 (L200 regulator) or U102 (7812 regulator).

(4) **Only the status line appears on the screen. Nothing else comes up, even in the 'block' mode.** Changing EPROM 7B (ER1400) usually cures this. Note that this chip is in position 5J in the less common gate-array version of the terminal. If changing the EPROM fails, the cause of the fault is the 27C64 row buffer 5C. D.M.

### Tatung TM340T

Breaks in the fine PCB tracks are a common cause of trouble with these monitors. For missing colours, check around the c.r.t. base pins. If the power supply is tripping and there are no obvious shorts, check for breaks at connector SK202 on the main PCB and connector PL202 on the tube base panel. C.H.

### ADC/RDI MM211D

If the e.h.t. rises from 16kV to 20kV, with arcing around the tube base, check C301 (220μF, 63V) which may be shorted or leaky. C.H.

### Ultrasys/Chuntex DMI4350

If there's no e.h.t. though the power supply is o.k., check whether diode D411 (DD75) is short-circuit. A BY228 can be used as a replacement. Note that L451 normally goes open-circuit at the same time, and that the line output stage tuning capacitor is also suspect. C.H.

### Mitsubishi HF1200E

This tip applies to most monitors that use STK7402/7406/7408/7410 series switching regulators. Before condemning the regulator, a quick check on the condition of the internal chopper transistor can be carried out by measuring the resistance between pin 16 (collector) and pin 14 (emitter). If there is no short-circuit, check for continuity between the mains bridge rectifier's reservoir capacitor and pins 16 and 14 (chassis return).

Common faults are failure of the start-up resistor (generally 3.3kΩ) connected to pin 1, or the oscillator supply resistor (2-3MΩ) connected to pin 6: they tend to go high in value.

Finally, it's best to replace the 220μF, 16V capacitors connected to pins 8 and 11. C.H.

### Amstrad PC CM

The cause of intermittent operation of these weighty monitors can often be traced to dry-joints around the STK7356 and STK7358 chopper chips. C.H.

### Kaizo EMI428

If the monitor is dead with the 2A fuse F501 open-circuit, check whether R501 (2.2Ω, 7W) is open-circuit and bridge rectifier BD501, its reservoir capacitor C509 (50μF, 400V) and the 2SK790 FET chopper transistor Q501 for shorts.

For repeated failure of the line output transistor, check the 6.8nF, 2kV flyback tuning capacitor C619. C.H.

### Hyundai HMM413

When there's no e.h.t. it's advisable to replace both IC7 (MC1391/LM1391) and the IRF740/IRF840 MOSFET line output transistor. C.H.

### Arche 217AXL

This monitor's power supply had failed during an electrical storm. We had to replace the following items: C102 and C103 (both 22nF, 400V), R102 (1.5Ω), Q101 (2SK955), D105 (15V, 1.3W) and the UC3842AN chopper driver chip. C.H.

### Commodore 1084S

This monitor's power supply was tripping. We found that D207 was short-circuit. It had in turn damaged L207. C.H.

### Hyundai HCM1420

The power supply in this monitor is based on the STK7309 chopper chip. For no or low output, or a high-pitched whistling, it's best to replace C709 (47μF, 25V), C710 (22μF, 63V), C711 (1μF, 63V), C716 (47μF, 63V) and C724 (220μF, 63V). Use 105°C series capacitors.

It's common to find that R711 and R712 (both 18kΩ, 0.5W) have increased in value. Also check the two 3-6V, 1.3W zener diodes D703 and D704 which tend to short.

For field collapse check the TDA1675 chip U401 and/or diode D401 (BA159). C.H.

### Amstrad PCW8256/8512

For intermittent changes in picture size, check the 2SD1666 12V regulator transistor Q5003. A BUT11AF works in this position.

For slow disc functions or disc errors, check the condition of the disc drive belt. C.H. ■

## David Botto

It is with deep regret that we report the untimely death, from cancer, of David Botto, who had been a regular contributor to *Television* for many years. David's involvement with the radio/TV trade started in the early Forties, when he entered as a trainee. He was keenly interested in new equipment, technologies and developments, and was anxious to share his findings with others. He also wrote for *Electronics Australia* and other publications. During a long life in the trade he spent some time in Germany, where he was involved with technical publications and translation.

David was a helpful and warm personality. He will be greatly missed by his friends and associates. J.A.R.

# Camcorner

Reports from  
David C. Woodnott

## Sony EVS550

The complaint was no mechanical operation. In fact loading was partially o.k., but the take-up coaster assembly was detached from its linkage. After dismantling the unit to reach the assembly we refitted the coaster, using Loctite to replace the linkage pin which had fallen out. **D.C.W.**

## Sony CCDF500

This F series unit had no mechanical functions and there was no EVF picture. The E-E pictures were o.k. The cause of these problems was a chafed EVF connecting cable, which had shorted the supply rail to the earthed metal bracket. As a result PS990 (1.6A) on the power supply PCB (PA-24P) had failed.

Unfortunately the EVF connecting lead is only available with a new EVF PCB (VS41). Rather a high price to pay for a damaged lead! It was not possible to repair the lead as this had been done before. We got round the problem by fitting a lead from a scrap EVF. The customer was happy to accept the lower cost! **D.C.W.**

## JVC GRAX2

The symptoms were confusing to say the least. When a battery was connected the PWR ON LED lit, as usual, but then stayed on despite operation of the on/off button. Everything appeared to be o.k. in the playback mode, but when the machine was switched to the camera mode a picture with noise lines that moved around in the background was displayed. If the record trigger was pressed, the noise lines would disappear and recording would continue normally. But playback of the recording would be marred by

incorrect drum speed (no servo lock). The main d.c.-d.c. converter was the cause of these diverse symptoms. It provides several outputs, including switched 8V and 5V supplies. The latter was permanently on and not regulated (it would read about 5V with a 6V battery connected, rising to 8V or so when the camcorder was run from an adaptor or power supply). A replacement converter restored normal operation. We've since had another GRAX2 with a similar d.c.-d.c. converter problem. **D.C.W.**

## Sanyo VMD6P

This camcorder would power up then do nothing. On inspection we found that another party had had a go and had fitted connector CN312 on the SYSCON 2 PCB incorrectly. CN312 is a two-pin plug that connects the trigger switch to the syscon circuit's key-scan matrix. By reversing the plug CN312's live pin was effectively earthed, thus locking up the micro-controller chip. Remember the effect – it might happen to you! **D.C.W.**

## Panasonic NVR50B

No mechanical functions and shut down was the problem with this machine. The cause was a detached pinch roller assembly. The roller arm is, on earlier models, made of plastic and can break off. A replacement restored normal operation. **D.C.W.**

## Sharp VLC6400E

This camcorder produced distorted pictures, with the white areas of the picture crushed and loss of sync. There was also pulling of the highlights and rolling, in both the E-E and playback

modes. As the chroma signal seemed to be o.k. we investigated the luminance signal path. As usual, the signal processing circuitry is largely common to both record and playback operation, IC201 being at the heart of things.

Various capacitors that we felt might be suspect were replaced, to no avail. After a lot more checking we decided that IC201 itself was probably the cause of the trouble. So a replacement was ordered. When it arrived we found that instead of a single i.c. there was a kit of parts: it consisted of a replacement i.c. (not the original type, which is no longer available) and about twenty chip components that had to be fitted to enable the new i.c. to function. Who estimated for this one?! To be fair to Sharp the kit was well marked, with each component individually bagged and a circuit diagram showing the modifications required. Unfortunately there was no PCB layout.

Thoughts about the likely time required to fit this little lot led us to make some further checks in case the chip wasn't the cause of the trouble. In the event we didn't have to replace the i.c. The cause of the fault was C211 (8,200pF) which was open-circuit. It acts as a reservoir capacitor in the composite sync separator stage, being connected to pin 4 of IC201. **D.C.W.**

## Sony CCDTR50

The electronic viewfinder display consisted of a blank white raster, all other functions being o.k. The cause of the trouble was on board VF41, where C965 (2.2µF, 35V) was open-circuit. **D.C.W.**

## JVC GRAX7

No pictures were being recorded, though the E-E pictures and playback of prerecorded tapes were fine. The sound was also o.k. We found that the REC 8V supply was not being switched by Q524 because R599 (1.5kΩ) was open-circuit. **D.C.W.**

## Canon E640E

There was no viewfinder picture. We found that C2931 (47µF) and C2933 (100µF) had failed. They are both 16V can type electrolytics. **D.C.W.**

## Sony CCDTR805

There was a rather worrying symptom in the E-E mode: the screen was covered with white spots (CCD failure?). Over the course of a minute or so however the spots would gradually disappear, leaving a normal picture. Playback and all other functions were o.k. If the machine was switched off then on again, the spots would reappear.

When a bench power supply was used instead of a battery the symptom was slightly different: any adjustment of the supply voltage around 6V either increased or decreased the picture's 'spottiness' and the length of time the spots remained. This led us to the power supply PCB, where the MC4600FU switch-mode drive chip IC231 was failing to regulate its output and produced severe hash on the camera supplies – hence the variable white spots. A replacement chip and power supply set up cured the trouble. **D.C.W.**

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# Satellite WORKSHOP

Though I don't do them myself, I'm often called to sort out installation problems. In a recent case the customer had had his 60cm dish changed for an 80cm Lenson Heath dish with two LNBS on a bracket. The problem was very sparkly pictures on some Astra channels, also picture and sound interference on UK Gold.

The 'expert' installer had aligned the dish for the Eutelsat Hot Bird at 13°E. This meant that the Astra signals were probably 6dB down. In addition side-lobe pickup was producing interference, increasing the sparklies by swamping the tuner with unwanted signals from other satellites.

## Solutions

As a better compromise I realigned the dish for Eutelsat II F3 at 16°E, using just one LNB mounted on the standard bracket. Then I fitted the Lenson Multi-LNB brackets – one at each side of the arm – and screwed the LNBS in place (a fiddly task that requires ultra-thin fingers!). Aligning the dish in this way can reduce Astra and Hot Bird losses to just 1.5dB.

Pictures of a sort were produced

when each LNB was moved along its bracket. Final alignment called for the use of a spectrum analyser to obtain the best compromise between maximum signal input and a minimum noise floor. Most 'experts' use an ordinary signal-strength meter, which for this purpose is about as useful as a piece of wet string. If you align the dish for the maximum reading, you are certain to get maximum noise as well – the meter can't tell the difference!

The LNBS had to be twisted slightly off vertical to match each satellite's skew, and I had to bend the brackets for best readings on the analyser and minimum co-satellite interference from the side lobes – this was clearly visible on the spectrum display. Once this had been done there were nearly perfect pictures from Astra and Hot Bird, though I had to warn the customer that he would see sparklies in bad weather – there was no need for a Link Budget calculation to predict that an 80cm dish was a compromise up here in Yorkshire!

## A Mimtec Premiere

A dead Mimtec Premiere was brought in recently. Since there are about fourteen components that can fail in the power supply, it saves time to order from Davenham Satellite Systems (1 Firths Fields, Davenham, Northwich, Cheshire CW9 8JB – 0160 649 085) the power supply repair kit for this model and follow the instructions.

Unfortunately the customer had failed to bring along the remote control unit. As a result I was unable to test the receiver, though it now lit up. I sent it back, knowing full well that it would soon return. Sure enough I received a call the following week to say that there were no horizontally polarised channels. Back came the receiver, this time with the remote control unit.

It took only a few minutes to trace the cause of the problem to TR4 (BC547), which was leaky. It's in the LNB supply circuit. I don't know whether this is a common fault, but it's always worth checking out all functions after a power supply failure. The last Mimtec receiver I repaired needed a new power supply and had killed off TR16 and TR17 on the

decoder interface board. The Sorensen power supply used in these receivers really does go with a bang! The latest replacement power supply is made by Nokia and appears to be more reliable. Unfortunately satellite receiver owners simply don't want to pay, so we end up repairing the old ones.

## An Estimate

The customer who brought in this dead Pace MSS1000 receiver wanted an estimate. At first I thought the only problem was that the front panel display didn't light up, but a quick voltage check confirmed that the receiver was indeed dead. A replacement STP5N90 MOSFET chopper transistor appeared to be all that was required, but at switch on the power supply just ticked, with pulses appearing on the secondary side.

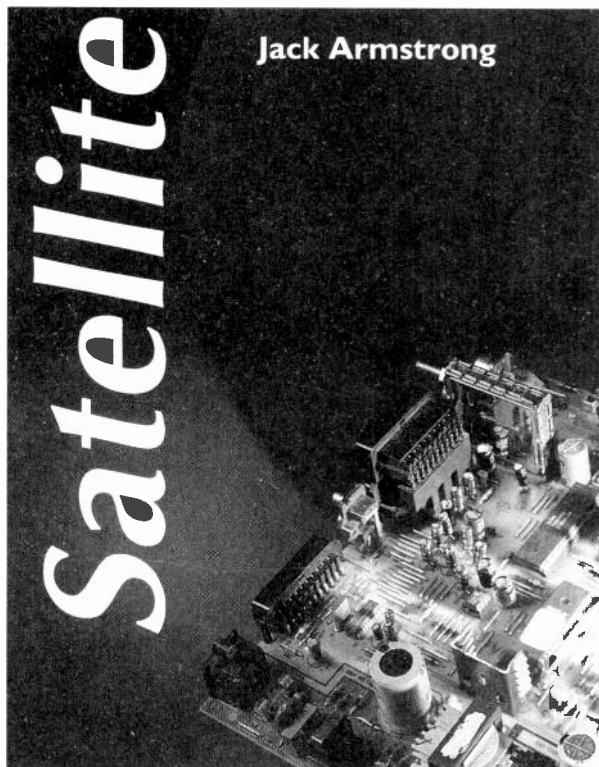
This symptom is often caused by a shorted amplifier chip on the audio board, but disconnecting the supply had no effect. My diagnosis was not far out however, since the cause of the fault was the relevant rectifier diode D54. When it was removed the receiver worked nicely – without the speaker function of course. I couldn't tell whether the audio output chips were damaged, so I simply quoted for a replacement diode. Fully expecting the estimate to be accepted, I ordered a replacement.

On his return the customer complained that my price was far too high for a receiver that had cost only three hundred in the first place, and insisted on taking it away! I charged him my standard estimate fee and he marched off with the receiver under his arm. I'd taken the precaution of putting the faulty diode back and removing the mains fuse.

I do a lot of repair work for local TV shops. A week later an MSS1000 came in. Sure enough it was the same one. This time my estimate was accepted. All that was required was to replace D54, the audio board having survived intact. I still don't know what the owner paid in the end, but I bet he wished he'd accepted the original estimate!

## A Glued up SRD510

The Amstrad SRD510 has a download facility that enables you to connect it to another one, via a scart





lead, to transfer the contents of the memory. Transfer is initiated by holding the standby button whilst applying mains power. The red and green LEDs will then begin to flash alternately.

When it was plugged into the mains supply one of these receivers did just that – but I didn't need to press the standby button. A quick inspection revealed that someone had already had a go – they'd been looking for a microcontroller chip fault.

It occurred to me that one of the two standby buttons might be damaged. So I removed the front panel and took a look. The buttons operated freely, but measured less than  $1k\Omega$  when open! A lot of glue, which had become completely black with the heat, was spread across the little PCB. Scraping off this carbonised glue cured the fault.

The receiver had another fault however – don't they always! The picture was fine, but the screen remained blank for four seconds after each channel change. In addition the menu graphics were superimposed on a grey background instead of the picture.

I checked for a line sync pulse input at pin 5 of the microcontroller chip, but there was nothing. In this model

the microcontroller chip 'knows' that a good picture is present when it receives good, clean sync pulses at pin 5. The sync separator circuit is simple. It consists of discrete components, with an input from a TEA2029C chip. The cause of the fault was traced to TR16 – but I've known TR13 and TR14 cause the same symptom.

### **Pace Apollo**

This model had been part of a Sky promotion. I can see satellite receivers going the way of mobile phones: subscribe and get one free! Unfortunately people think that because a receiver is low priced it will cost pennies to repair, but no one is subsidising the poor repairman.

The one that was brought to me came because the customer wasn't prepared to wait even three days for the Pace warranty repair! His loss was to be my gain. He described the fault as "horizontal streaks on the picture with all satellite channels". Just to make it a little more interesting, the fault was intermittent. I was able to instigate the fault by tapping the unit gently. It affected only the picture from the u.h.f. modulator – the scart outputs were fine. By poking and prodding with a plastic knitting

## **??? Query Service ???**

Jack Armstrong is willing to try to sort out readers' satellite TV receiver problems via e-mail. You can reach him via the Internet at his CompuServe address:

INTERNET: 100613.2105@compuserve.com

No letters or phone calls please: he can cope with e-mail requests only.

needle I discovered that the track to C51 in the modulator was broken. I carried out a neat repair and the customer got his unit back in slightly less than three days at a very reasonable price.

### **Sticky Problem**

I wonder how many times I've seen "goes off when hot" on a fault report? Often it's the picture or sound that goes off, not the receiver itself. This time it really was the receiver, though it went to standby rather than off. This was another case of carbonised glue forming a short-circuit across the standby switch in the Amstrad SRD510. The receiver switched to standby after about four hours' operation. You'll find the glue across the standby button solder joints.

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## **Test Case 398**

Cathode Ray's heart sank when he read the job card attached to the old Sharp VC787 that sat on the waiting-repair rack. He was all too familiar with the machine, having repaired it last month when, at great trouble and expense, he had fitted a new lower drum assembly. The original problem had been intermittent shut down in the cue and review modes because of excessive friction between the tape and the surface of the lower drum. The only cure for this (once cleaning and a go with Duraglit metal-polish wadding had failed!) is to replace the lower drum. The owner had sanctioned the work on this rather old machine for the sake of its excellent still-frame and frame-advance performance – better than that of many later models.

Here it was back, boldly labelled "recent repair, bounce, no charge". A scribbled and rather rude note from the customer indicated that the symptom was "wobbly sound". Warily, Ray carried the machine to his bench and removed its top cover. How a new lower drum could upset the sound while curing the previous fault was beyond him – but doubtless he would soon find out. . . .

Tests started using a workshop tape with a 1kHz test tone. When the Sharp machine, which does not feature hi-fi sound, played this back it produced a clear, steady tone. The same thing happened when the machine played back its own recording from a pattern generator with 1kHz modulation. Further tests established that the trouble was confined to LP operation – half an hour would have been saved had the customer's note mentioned this! – and that it consisted of audio flutter. This was quite noticeable during playback of an LP recording made by another machine. It was even worse with playback of the machine's own recordings.

The fact that the sound flutter effect was confined to LP operation hampered the diagnostic process somewhat. Apart,

possibly, from one or two odd peripheral components in the capstan servo circuit everything else, both mechanical and electrical, is common to both SP and LP operation. But a start had to be made somewhere. So Ray replaced the pinch roller and cleaned and polished all the components in the tape path. The result of this was discouraging – the flutter effect was still present. Remembering the nasty effect caused by excessive friction in the reel drive clutch in an Amstrad machine he'd struggled with recently, Ray measured the take-up torque. It was normal at about 100g/cm. In fact the flutter was not caused by a fault in the take-up spool drive system.

Fortunately there was an identical machine on the scrap pile. Its capstan motor was next transplanted into the machine being repaired. Again this had no real effect on the symptom. Could the cause be a faulty or worn audio/control-track head? Ray vaguely recalled something of the sort with an old Ferguson machine that Sage had dealt with when they sat together during the training sessions in the early days of video. Anyway in for a penny, in for a pound. The ACE head was removed from the scrap machine (fortunately it was fitted with plug/socket connections and was secured by a single nut). After a clean and polish it was installed in the recalcitrant Sharp machine. You've guessed it: this didn't cure the trouble either!

Could the new lower drum assembly have caused or exacerbated the problem? This seemed unlikely: indeed fitting it should have cured rather than caused a symptom of this type. But though it was not directly responsible, it may have brought forward the real cause of the trouble. If only Ray had taken a long look at the deck and the tape motion while it was running in the LP mode! All is revealed in the solution on page 294



# Digital radio from space

**F**rom the start of the compact disc era in 1982, digital audio has spread into all areas of home entertainment and communication. The analogue transmission and storage systems that we continue to use are

retained primarily because of their compatibility with existing equipment and networks. The inroads of digital audio can be expected to increase, since the processing and memory chips required for receivers and decoders are now easy to manufacture and cheap to buy. With the use of various types of compression and the availability of more spectrum space, there is no problem about finding sufficient bandwidth for digital audio. We are now used to digital audio storage on discs and in memory chips, to Nicam at u.h.f. and DAB at v.h.f. These are being complemented by digital radio at s.h.f.

## Digital Radio from Astra

The first satellite sound transmissions for domestic reception were in analogue form, consisting of an f.m. mono carrier that was spaced at 6.5MHz from the accompanying f.m. video transmission. Before long stereo carriers were added alongside, at 7.02 and 7.2MHz, using the Wegener-Panda-1 analogue compression system to provide a better dynamic range and signal-to-noise ratio. The spare space in each satellite transponder's baseband spectrum, up to

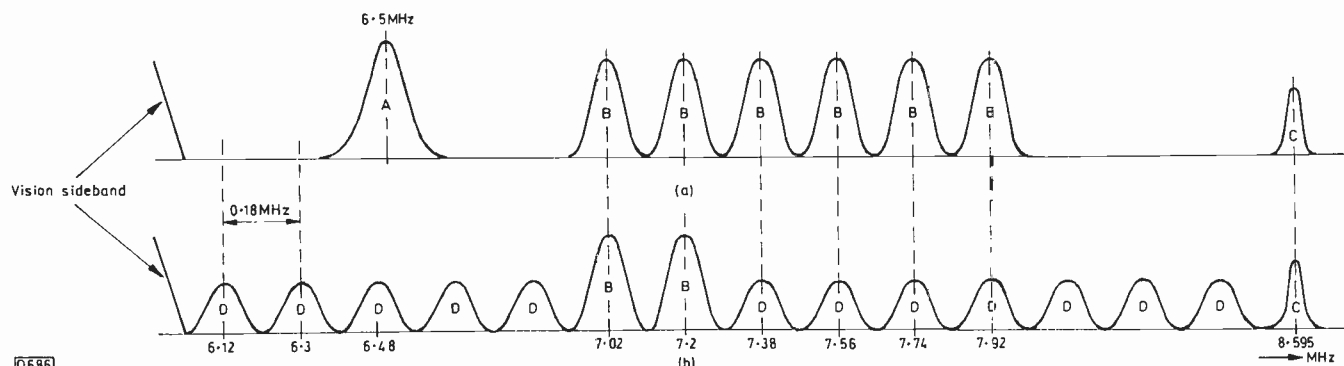
The spectrum space above the video signal in a satellite TV channel can be used for a number of digital stereo radio channels. Astra's Digital Radio (ADR) system has been designed to exploit this otherwise spare bandwidth. Subscription services are due to start in the UK shortly. Eugene Trundle describes the technology involved

8.6MHz or so, can be put to use for TV related (for example multilingual) or radio broadcasting purposes, using a series of single (mono) or paired (stereo) carriers spaced 180kHz apart. The available spectrum has been used in this way for some years. Fig. 1(a) shows a typical spectrum allocation for the region above the video signal in an Astra transponder's demodulated output, with a mono carrier at 6.5MHz, two TV stereo sound carriers at 7.02 and 7.2MHz and two pairs of stereo radio carriers, all in analogue f.m. form.

Fig. 1(b) shows how the audio sub-carrier slots can be rearranged to provide a number of digital stereo radio channels. Each carrier handles a digital stereo pair, using quadrature phase shift modulation. The 6.5MHz mono carrier has gone – stereo has been standard in satellite receivers for many years. The main analogue stereo carriers at 7.02 and 7.2MHz are retained, to provide compatibility with existing equipment: any additional analogue subcarriers required for, typically, multilingual sound on the sports and cartoon channels could also be retained. The other carriers, spaced at 180kHz intervals, are

**Table 1: ADR transmission parameters.**

Audio frequency range:	20Hz-20kHz
Sampling frequency:	48kHz
Dynamic range:	90dB
Audio coding:	ISO/IEC 11172-3 Layer II (Musicam)
Stereo channels:	Up to 12 above video, 48 with full transponder use
Modulation:	Differential QPSK
Data rate:	192kbts/sec (including ancillary data at 9.6kbts/sec)
Protection:	CRCC for data and scale factor
Bandwidth:	130kHz (between -3dB points)
Channel spacing:	180kHz
Threshold:	9.5dB carrier-to-noise ratio with 26MHz bandwidth
Scrambling:	IDR/IBS implementation of CCITT V.35



**Fig. 1: Demodulated Astra transponder signal spectrum in the region above the vision signal. (a) Typical current allocation, with a non-companded, 200kHz bandwidth mono TV sound carrier (A) at 6.5MHz, six carriers (B) for companded stereo TV and radio sound, and a network control subcarrier (C) with a 14.4kbits/sec data rate signal. The sound subcarriers all carry analogue signals. (b) The same region with the same two analogue stereo TV sound signals (B) and control subcarrier (C), and twelve subcarriers (D) modulated with digital stereo sound - the bandwidth for these is 130kHz.**

available for relatively low-level digital radio signals. A maximum of twelve such carriers can be fitted in with a transponder that carries an f.m. video transmission. Alternatively 48 subcarriers can be used, spaced at 180kHz intervals between 0.18-9MHz, if the transponder's full capacity is devoted to radio transmissions.

The four Astra 1A-D satellites have sixteen transponders each. This gives a maximum capacity, alongside the video and companded stereo TV sound pairs, of  $64 \times 12 = 768$  digital stereo radio channels. Some transponders already carry individual 'free' digital radio programmes - German broadcasters use this digital system as a trunk-carrier of radio transmissions to the eastern region.

**Modulation and Transmission**

The Astra Digital Radio (ADR) system has much in common with the Nicam system (a lengthy description of this appeared in the September and October 1990 issues of *Television*). The sampling frequency with the ADR system is 48kHz, which with 16-bit resolution ensures a level audio frequency response over 20Hz-20kHz, with a dynamic range of over 90dB and a signal-to-noise ratio of typically 96dB. This means that the transmission system imposes fewer limitations on the sound quality than most of the equipment at either end of the chain. The audio bit rate is 192kbits/sec, of which 9.6kbits/sec are reserved for 'ancillary data'. This provides a caption service at the receiving end, similar to that of RDS (Radio Data System) - it can be used for a read-out of the station name, programme category, music title, artist, album and order number.

As with Nicam, QPSK (Quadrature Phase-Shift Keying) is used to modulate the carrier, see Fig. 2. Pay channels are scrambled, using a system known as CCITT V.35. This can be sorted out at the receiving end by using a smart

card similar to that now used for Sky TV programmes. An abridged list of the transmission parameters is shown in Table 1.

**ADR Reception**

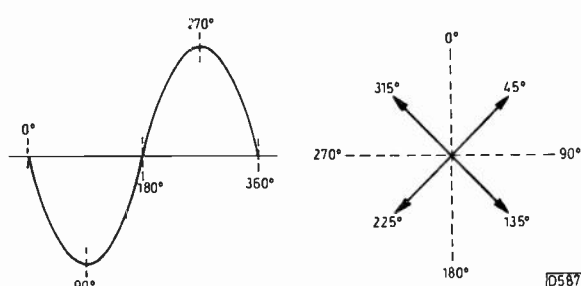
Several different receiving equipment arrangements can be used. The simplest, see Fig. 3, is to have a satellite TV receiver that's also equipped with a digital audio decoder and smart-card reader. It can provide TV and digital radio reception simultaneously but can be tuned to only one transponder at any time, confining the choice of digital radio channels to those (if any) carried alongside the TV transmission being viewed. With the TV set switched off, there is full sound only reception capability.

Alternatively a separate ADR receiver, taking its input from the same standard LNB as the vision integrated receiver-decoder (IRD), could be used, see Fig. 4. In this arrangement the i.f. signal from the LNB is looped through the ADR receiver before going to the vision IRD. When the latter is switched on it overrides the operation of the sound receiver, which now relays the polarisation and 22kHz-tone switching commands of the vision IRD. The ADR receiver can function fully only when the vision system is not in use.

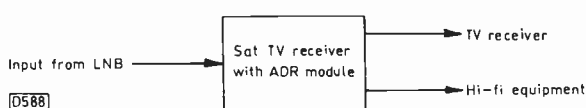
Optimum versatility is obtained with separate ADR and vision IRD receivers fed via separate downloads from a twin LNB, see Fig. 5. The two receivers can now operate simultaneously and independently, selecting their own transponders and signal polarisations as required: you could have The Simpsons in the kitchen and Beethoven in the lounge if you want, or QVC Home Shopping downstairs with Easy Listening in the boudoir.

**Receiver Design**

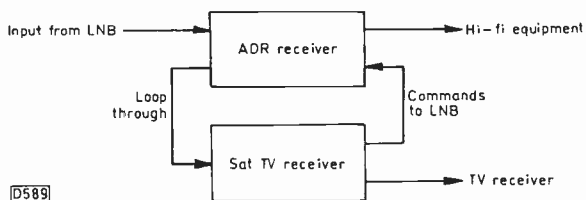
About five satellite receiver manufacturers make ADR equipment at present,



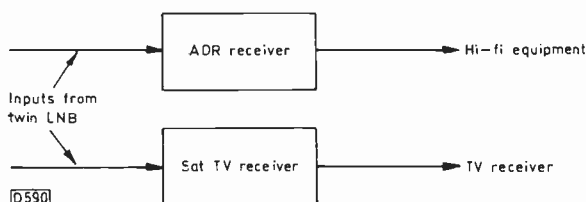
**Fig. 2: Principle of quadrature phase shift key modulation. Phase modulation of the carrier conveys different signal values.**



**Fig. 3: Use of a combined satellite TV/radio receiver.**



**Fig. 4: Use of separate satellite TV and ADR receivers, with r.f. and control signal loop-through.**



**Fig. 5: Use of separate satellite TV and ADR receivers fed from a twin LNB. The separate receivers have independent access to all transponders.**

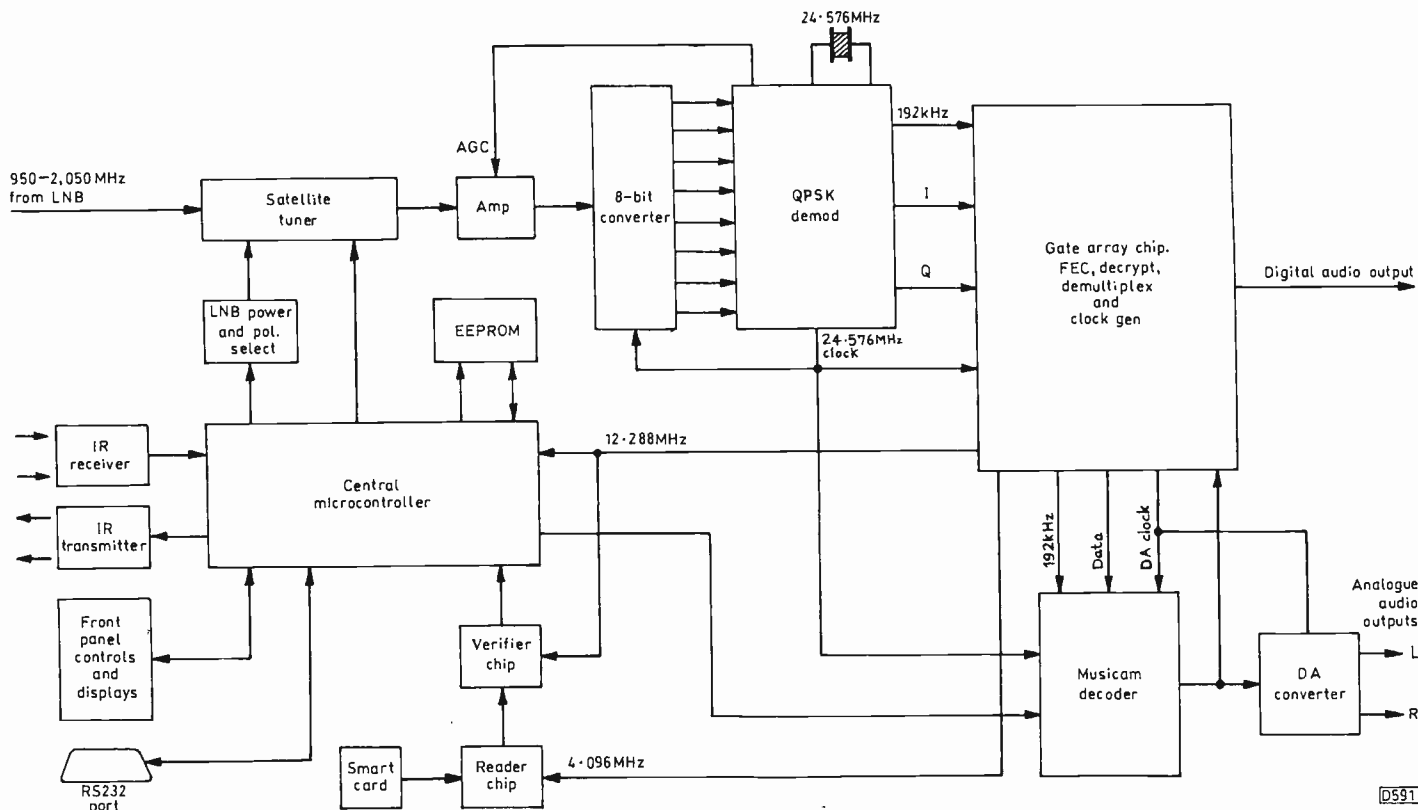


Fig. 6: Block diagram of an ADR receiver.

though there's a waiting list for receivers at the time of writing this – nearly all production is being poured into mainland Europe as fast as it can be churned out.

A typical receiver block diagram is shown in Fig. 6. It has a conventional tuner at the input to accept the 950-2,050MHz first i.f. signal from the LNB, with polarisation and band switching under the control of the central microcontroller chip. The tuner's i.f. filter has a 26MHz bandwidth, its f.m. demodulator being able to recover a standard video signal. The baseband output from the tuner is passed to the 8-bit converter via an amplifier with a.g.c., so the converter is presented with a regulated signal-level input. The following narrowband QPSK demodulator uses an application-specific chip which selects a signal subcarrier in the baseband range of the transponder, demodulating it as I (in-phase) and Q (quadrature) components for feeding, along with 192kHz bit-rate reference and 24.576MHz clock signals, to a purpose-designed gate array chip where the demultiplexing and decrypting are carried out.

This gate array chip is the heart of the receiver. It carries out data demultiplexing (RDS data decoding), first-level decoding, unscrambling of pay-radio digital audio, data transfer to the central microcontroller, audio clock PLL control and digital output data conversion. Its data, bit clock and DAC clock outputs pass to an MPEG layer II Musicam decoder chip which decodes

the audio data stream, delivering it in PCM form to a conventional DA converter chip of the type used in CD players.

To avoid distortion and dropouts under marginal signal reception conditions, the decoder chip uses the scale-factor CRC (Cyclic Redundancy Code) part of the signal to conceal errors: it can ignore erroneous scale factors or use a more advanced technique, repeating previously received correct scale factors. The DA converter delivers L and R audio outputs. It incorporates a volume control prior to its output filters.

The central microcontroller chip is an 8-bit device that's similar to those used in conventional satellite TV IRDs. It controls the demodulator and decoder chips, the smart-card interface, the decoding and display of the control and RDS data, the IR decoding and transmission (more on this shortly) and the internal signal and command routing. It works in conjunction with EEPROM programme memories and RAM for operational purposes.

Conditional access is based on an algorithm contained in the smart card. The card is interfaced and scanned by one i.c. and verified by a second which is a custom-designed chip for the system in use. The mask program it contains and the software involved are of course proprietary and confidential.

**Programme Acquisition**

When it's initially powered up the ADR receiver scans the whole satellite frequency range and the relevant sub-

carrier frequencies in both polarisation planes for each transponder, searching for ADR subcarriers. It stores all relevant i.f. and subcarrier frequencies, along with polarisation data, band and programme-related information, in a non-volatile memory, ready for interrogation and selection by the user. This scan, search and store process takes up to two minutes and is repeated at convenient intervals, typically whenever the set is switched to standby, to update on new ADR transmissions. In some cases the 'stereo pair' carried by a sub-carrier actually consists of two monaural programmes combined in a single bit stream. They are separately assigned and memorised and, when one is selected, it feeds both the L and the R outputs.

The automatic search, select and store processes relieve the user of the weary and uncertain task of tuning in the ADR receiver. Further simplification in use is provided by the electronic programme-category tag present in each audio data stream. This instructs the receiver to group programmes of the same or similar character. As a result the listener can use four basic methods of service selection, as follows:

- (1) Select category – the type of music (jazz, rock, etc.) is keyed in – after which the listener can use the up-down keys to browse.
- (2) Select the ADR function followed by a three-digit channel number and/or use of the up/down keys to select from

a channel list supplied to subscribers.

(3) Select the Astra Channel function, followed by a two-digit transponder number, then use the up/down keys to select from the ADR subcarriers available. This method is useful for finding services quickly when their presence and position is already known.

(4) Select the Favourite Channel mode followed by a two-digit number and/or use of the up/down keys to select from say up to twenty favourite channels.

In all cases the selected service can be stored as a favourite channel.

**Receiver Features**

A typical ADR receiver has a 512-channel memory for digital radio broadcasts, plus fifty storage slots for individual favourite channels, along with an eight-digit front panel LED or fluorescent display that indicates the broadcast service, channel type or operating mode.

It's also possible for the receiver to

transmit an IR signal to the remote control handset. This data can drive a twin-row, 16-digit LCD panel on the remote control unit to show details of the song title, singer, composer, album, CD number etc. If required, the information can be stored for later display at the touch of a button.

Audio line outputs are provided at standard level for linking to hi-fi equipment. There may also be audio inputs for looping through in the standby mode, a digital audio output and an RS232 interface for linking to a PC for receiver control, preprogramming and fault diagnosis.

The retail price of ADR receivers in the UK is expected to be in the region of £250.

**DMX**

Digital Music Express (DMX) is the service provider for the subscription pay-audio channels transmitted by the Astra satellite group. Its service has been up and running in Austria, Germany and Switzerland since the beginning of last September and is

scheduled for UK launch in March 1996. The subscription fee is expected to be about £6.99 a month.

The most likely marketing arrangement is that you will get a smart card validated for ten days or so with the receiver you purchase. Then, if you subscribe to DMX after this initial period, the card will be validated for as long as the subscription lasts.

At present the DMX package offers 62 music channels. This is expected to increase to 90 by the end of the year. The channels are broadly grouped under ten main categories as follows: classical, popular, oldies, rock, jazz, country, speciality, regional, news and general entertainment. The music channels have no commercials, no announcers and no news bulletins, the effect being like playing an endless CD.

The central music library is a very large one and is continuously updated. For more information, contact DMX-Europe (UK) Ltd., Europa House, Church Street, Old Isleworth, Middx TW7 6BW – telephone number 0181 569 9500.

## Digital TV

The specification for terrestrial digital TV in Europe has taken a step forward with the adoption by the DVB (Digital Video Broadcasting) group of 2,000/8,000 carrier QAM (quadrature amplitude modulation) as the transmission system. The DVB group has already agreed standards for satellite, cable and microwave (MMD) systems. In the USA, the advisory committee to the Federal Communications Commission has recommended adoption of the digital HDTV standard proposed by the 'Grand Alliance', which includes AT&T, General Instrument, NBC, the David Sarnoff Research Centre and Zenith. According to the committee the technology is "far superior" to any alternatives. Formal adoption of an HDTV standard is expected in the early part of the current year. Sets are expected to cost around \$2,000 initially.

A group of leading German and French companies, including Deutsche Telekom, Veba, Bertelsmann and Canal Plus, has agreed to a standard for set-top boxes to decode digital signals that provide interactive TV services. Initial use is expected to be in the German market, but the hope is that the standard will become a general European one.

The German public broadcasters ARD and ZDF have leased digital transmission capacity aboard Astra 1E for distribution of their main programmes in the clear. They will be leasing additional transponders on Astra 1G for further services.

Pace has received worldwide orders for over a quarter of a million digital TV decoder boxes, also incorporating NewsCrypt, for supply before July. A fire at Panasonic South Africa's Cape Town plant has led to a worldwide shortage of digital satellite TV decoders – the plant is one of only two in the world that can produce these set-top boxes.

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## DVD Specification

Agreement has at last been reached on the specification for the new generation high-density CD. It will be known as the DVD (Digital Video Disc), not the SD-CD (super-density CD) as originally proposed by the Toshiba group or the MMCD (MultiMedia CD) as proposed by Philips and Sony. The agreement between Toshiba, Matsushita, Sony, Philips, Pioneer, Time Warner, JVC, Hitachi and Mitsubishi also provides a specification for the DVD Movie Player and the DVD ROM (for computer applications).

Disc diameter will be 12cm, thickness 1.2mm (2 x 0.6mm discs bonded back-to-back), capacity 4.7Gbytes per single side and the track pitch 0.74 microns. The capacity of a double-layer, two-sided disc is likely to extend to 18Gbytes. A 635-650nm wavelength laser will be used to read the discs, the numerical aperture of the lens system being 0.6. RS-PC (Reed Solomon Product Code) error correction will

be used, with 8:16 (EFM Plus) signal modulation.

Audio/video discs will have a variable-speed data rate, the average being 4.69Mbits/sec. This includes three audio and four subtitle channels. MPEG-2 compression will be used for the video signal, with Dolby AC3 sound for NTSC signals and MPEG for PAL/Secam signals. A maximum of eight audio channels and 32 subtitle channels can be stored. Running time will be 133 minutes per side.

The first products from Philips will be ROM drives for computer applications, expected by the end of the year, with consumer discs and equipment to follow. Toshiba and Matsushita also aim to have products available this autumn, in Japan initially followed by launches in North America and Europe. Consumer DVD systems from Japanese manufacturers are expected to be priced at something above the originally hoped-for \$600.

### TV Licence Fee Increase

The TV licence fee will be increased to £90 for colour and £30 for monochrome from April 1st.

### New Generation Games Console

Nintendo's new 64-bit video games console, the Ultra 64, is to be launched in April at about £200. The console and its supporting games will take Nintendo from 16-bit to 64-bit technology, leapfrogging Sony and Sega's 32-bit games machines. According to Alan Taylor, managing director of Nintendo's UK games distributor THE Games, the new player will offer "incredibly realistic graphics, exceptional games play, performance and a multi-directional controller". It uses a Silicon

Graphics reality co-processor and a MIPS 64-bit RISC microprocessor.

Advantages include real-time anti-aliasing to smooth off jagged edges, advanced texture mapping techniques, real-time depth buffering for more realistic 3D displays, and automatic load management for smoother movements. The three-grip controllers include a 3D stick with 360° control of movement and control of speed, C buttons that change players' perspectives, a Z trigger for shooting games, and a memory pack to store game information.

### Catalogues

Willow Vale Electronics (11 Arkwright Road, Reading, Berks RG2 0LU – telephone 01734 876 444) has developed and released a first in its field, a CD ROM catalogue. The disc, with colour and sound, takes customers through the entire range of Willow Vale spares, accessories, security devices and sound and communications products. There are 280,000 stock codes, 400,000 descriptions and alternative products, 340,000 part numbers and 3,000 pictures and drawings. It can be accessed via a Windows-based PC (386 SX33 or above) with 4Mbytes of memory. The user simply keys in a part number, manufacturer's model number or a stock code to find the part required. A help file shows how to get around inside the CD ROM.

The Willow Vale CD ROM has a helpful order form facility that enables the user to pop items into a 'box' while going through the system, retrieving them all at the end of the process. If the user's machine has a built-in fax, all that's required for an order to be processed at Willow Vale is to press a button.

CPC (Component House, Faraday Drive, Fulwood, Preston PR2 4PP – telephone 01772 654 455) has launched a new product supplement to keep customers informed on the ever-increasing range of products on offer. It's issued to all account holders, providing at least four pages of latest products a month. CPC also issues a weekly offer list with up to twenty pages of reduced prices on a selected range of products.

### The EMC Directive

From January 1st all electrical goods sold should carry a CE mark to show that they comply with EC regulations on electromagnetic interference. This is referred to as EMC – electromagnetic compatibility. The aim is to ensure that electrical equipment doesn't cause excessive interference and is not affected by such interference. A "grace period" is being allowed for the clearance of non-CE stock.

There seems to be a certain amount of confusion about how the directive is to be implemented. In some cases self-certification seems to be acceptable. A number of laboratories are offering an equipment check service, at about £1,000 a time, which is obviously an onerous sum where small-scale production runs are involved.

### Cable TV

According to the ITC's most recent survey of viewing in homes connected to a broadband cable service, the cable/satellite channels have regained some of the audience share they lost during 1994. Viewing of the cable and satellite channels increased from 34.9 to 39.6 per cent between October 1994 and October 1995. The ITC also reports that during the third quarter of 1995 the number of telephone lines installed by cable operators exceeded, for the first time, the number of TV connections. US cable TV operators have called for an international cable modem standard that will work with all cable TV networks. An international specification would, according to the John Malone, chairman of US Cable Television Laboratories, the industry's R&D consortium, "take the World Wide Web a step further, bringing broadband interconnections into homes worldwide".

### Sony Service Contest

Richard Flowerday of Harborne TV, Birmingham and Steve McEvoy of The Sound Shop, Drogheda, Ireland won gold medals in the finals of the biennial Sony European Service Contest held recently in Milan. Richard's was in the TV category, Steve's in the audio category. 58 contestants from 17 countries competed in the finals. Medals could be won for TV, video and audio repairs, with Sony Service Centres and Authorised Network companies competing separately in each of the three categories.

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# EW Fault Finding

*Reports from  
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Chris Avis  
Roger F. White  
Tony Ashworth*

## Hitachi C2133TN (Stereo Plus Chassis)

No results was the complaint with this fairly new set. Only the standby light came on, nothing else. As I'd not worked on one of these sets before, I first had a good look round to see if anything obvious, such as dry-joints, might be responsible for the fault. Everything was o.k. Out came the manual, and it was a matter of starting from square one.

Power was clearly present, as the standby light was on. I assumed that the cause of the fault could lie in one of three areas, the power supply, the line timebase or the control circuitry. After a few d.c. checks I decided that the control system was to blame – the 12V was missing at pin 16 of the TEA2164 chopper circuit chip. This line goes high or low for on and standby respectively. It's controlled by a group of components on the front panel. When I finally got the board out I found that the BC858B chip transistor VE07 was short-circuit. This removed the 12V feed to the power supply chip. A replacement transistor restored normal operation. **M.L.**

## Philips 40 Chassis

Very poor colour from cold was the complaint with this set. It looked as if something was wrong in the reference oscillator circuit, though the crystal and the chip both proved to be o.k. Use of a hairdryer and freezer brought us to the culprit, which was the 2.2µF, 63V capacitor C2164 near the TDA3561 colour decoder chip. A new capacitor restored normal colour. **M.L.**

## Ferguson TX85 Chassis

This set was dead. The mains fuse had blown and the chopper transistor TR6 was short-circuit. R101 in the snubber network was dry-jointed, so this was resoldered. Resistance checks around the TEA2018A chopper control chip then showed that the earth print from the emitter of TR6 to pin 2 of the chip via pin 2 of the chopper transformer was open-circuit: the break was near

the transformer. After linking across the break we continued our tests. R98, which is in series with TR6's base, was open-circuit; D20 (1N4148) in the error feedback network was short-circuit; and the TEA2018A chip had blown its top.

After replacing these items we connected the set to the mains supply via the variac and carefully increased the input. Fortunately the set was now o.k. **P.B.**

## Philips Anubis A AC Chassis

This set worked fine with dark scenes. When the picture was bright however it would flicker and the power supply output voltages would fall. Was the line output stage taking too much current, or was the power supply unable to provide sufficient current to meet the line output stage's normal requirements?

Fortunately we were able to make some comparisons with a stock set of the same type. By loading the good set's power supply with bulbs, we found that its 95V output could provide 700mA before the supply began "chirruping" and the voltages began to fall. The faulty set could provide only 500mA.

At least we knew that the fault was in the power supply. Fitting repair kit SBC7021 (part no. 4822 310 20491) made no difference, neither did bridging the various electrolytics. I finally checked the gain of all the power supply transistors that hadn't already been replaced. Tr7554 (BC337A) was leaky. **P.B.**

## JVC AV21F1EK

This Nicam set suffered from an intermittent fault that was described as no sync. About five minutes after switching the set on from cold the picture would shake from left to right, sometimes violently. If text was selected the display was all right. If mix was selected there would be no line lock between the text and the picture. This would last for about

three minutes, after which the fault would clear. No amount of freezing or heating would then instigate the fault. Switching the set off overnight would bring the fault back however.

JVC thought that the problem might be caused by the 6MHz crystal on the text panel – the sync pulses come from the text processor chip in these sets. So I started to check around in this area and found that when the fault was present there was noise on the sync pulses in the video input waveform. This comes from the i.f. unit, where a tantalum capacitor (C02) that decouples the i.f. a.g.c. was found to be the culprit. Replacing it cleared the fault completely. **M.M.**

## Sony KV2217

This old-timer had an EW fault. Our field service engineer had replaced a number of capacitors before giving up. The first thing we noticed was that the tube was as flat as a pancake. It was an insurance job however, so we delved into the EW correction circuitry and found that coils L552 and L554 were open-circuit. After replacing these and the tube, then setting up, we had an excellent picture. **M.M.**

## Ferguson ICC5 Chassis

The tuner was cutting out occasionally. Fortunately the cause was easy to rectify: there was a dry-joint in the tuner. **M.M.**

## ITT ST35767

This set appeared to be dead. For once the line output transformer was not the cause. We found that the field output chip had blown up. Replacing it got the set working, but the picture was rather sick. Fortunately the customer had an extended warranty which paid for a new tube. **M.M.**

## Sony K VX2162

According to the flashing LEDs at the front this set was in the protection mode. The way in which I tackle this fault is to disconnect the protection



line from the main microcontroller chip and switch on. This produced a picture with a small frame. The EEPROM had become corrupted, a replacement plus setting up clearing the fault condition. **M.M.**

### Ferguson ICC5 Chassis

The picture would go in at the sides very intermittently. This was caused by cracks in the print around the line output transformer. **M.M.**

### Grundig CUC740 Chassis

This proved to be quite an elusive fault: the set would intermittently cut out, sometimes going dead and sometimes to standby. The cause of the trouble was in the 5V supply, where D671 (BY299) was going open-circuit intermittently. A new diode followed by a long soak test proved that the fault had been cured. **M.M.**

### Sony KVG2512

These sets are similar to the KVX series but incorporate a built-in satellite receiver/decoder. Card access is through a slot in the front, hidden by a flap. It was the satellite section that had failed: there was no supply to the LNB. The cause was traced to the power supply on the main board D, where CP605 was open-circuit. This item is very difficult to get at – you have to remove a heatsink clip to do so. A new CP restored the satellite reception. **M.M.**

### Saisho CM2080

This set produced only half a picture. A previous engineer had replaced the field output chip, but the culprit was C421 in the voltage boost circuit. It had dried up. **M.M.**

### Pioneer SV2803

This was a misleading fault. At the bottom of the screen there was about 15mm of picture foldover, which freezing the TDA8370 chip IC7550 seemed to cure. So we replaced the chip – and the foldover remained. The real culprit turned out to be the 680µF, 35V field scan coupling capacitor C2582. **E.T.**

### Hitachi CPT2078 (NP83CQ2 Chassis)

No sound or picture was not caused by failure of the line output transformer on this occasion. The set was stuck in the AV mode. When the AV switching link from the CITAC panel was disconnected the signals were restored. We found that the 12V zener diode ZD1438 was leaky. **G.D.**

### Sanyo CPT3104

We don't see many of these sets. This

one's picture was jumping, and an ominous arcing noise came from the line output stage. Fortunately the cause of the trouble was easy to spot. The width adjustment, a cut piece of wire, was arcing to an adjacent capacitor. Cutting it short restored a perfect picture, after which a quick clean of the customer controls made the set fit for another fifteen trouble-free years! **G.D.**

### Toshiba 255T7B

It's worth checking that these sets go into standby after a repair. This is often not mentioned until afterwards – "it wasn't like that before you fixed it". The cause of the timebases remaining active is Q803 (2SC2023) and/or Q804 (2SA1321) going short-circuit. **G.D.**

### Mitsubishi CT2555STX

Teletext could not be selected via the remote control unit at any time, but when the set was cold it would go into garbled teletext of its own accord. As the SAA5243 chip is well known for doing odd things I changed this first, to no avail. A check on the 5V feed to the teletext panel then revealed that it was slightly low. Back then to the power supply, where C922 and C923 (both 100µF) were both low in value. While in this area I checked the other electrolytics and replaced them as necessary. **G.D.**

### Finlux 3024F

There was no picture though the e.h.t. was present and the tube's heaters were alight. When the set was switched off you could see a faint line down the centre of the screen. A look around the line output panel, on the component side, soon revealed that the 470nF, 250V MKP line scan coupling capacitor C219 had a split right across the middle. **C.W.**

### Bush 2131T

We've had a good few of these sets with intermittent loss of picture or text faults. These are normally cleared by resoldering the whole of the text panel. On this occasion we discovered, while carefully moving individual components with the set in the text mode, that one lead of R13 (10kΩ) was loose in its end cap. As a result the combined line-field sync pulse waveform was losing its d.c. level. This upset the timing of the teletext processor chip. **C.W.**

### Amstrad TVR3

The cause of line disturbance on dark scenes was found by connecting the scope to the cathode of the h.t. rectifier D306. The display showed a smooth d.c. supply when the picture

was bright. When the picture was dark however there were negative-going spikes (gaps) in the supply. Replacing the diode and the associated capacitors made no difference. The cause of the trouble was the STK7348 chip IC301. **C.W.**

### ITT CT3437 (Compact B Chassis)

Although the report said that this set was dead, its power supply and line output stage were up and running. 88 was showing in the display, there was neither sound nor raster, the customer controls had no effect and the tuning didn't work. The cause of all this was the fact that the 5V supply to the memory chip on the customer control panel was missing. Regulator IC05 (TDD1605S) on this panel was open-circuit. **C.W.**

### Beon CTV14R

There was a snowy raster but no sound or channel indicator illumination. Checks in the low-voltage section showed that the standby transformer was open-circuit. It supplies the remote control section, and of course channel selection was lost. I must say that the Beon Corporation in Cumbernauld is more helpful than many other manufacturers. **C.W.**

### Matsui 2150TX

If one of these sets is stuck in standby check the h.t. feed to the line output transistor. It passes from pin 5 of the line output transformer via L603 to the transistor's collector connection. As with many of the other coils in these sets, L603 may appear to be soldered though the joint is poor. When you remove the old solder you find that the wire is black. Clean up and resolder. **C.W.**

### Loewe-Opta C8001 Chassis

The customer complained that "the telly smelt hot then just smelt then went off". It's quite common for the h.t. reservoir capacitor C652 (47µF, 250V) to leak and cause a bit of a burn up between its positive connection and the upper side of the PCB, as the upper side is clad with copper that's connected to chassis. In such a case I find that a quarter-inch drill bit put through the board will clear the carbon from the burnt area. Then fit some sort of insulator over the leg of the replacement capacitor and wire it in. This usually does the trick. **C.W.**

### ITT CVC1210 Chassis

This set was dead. You can tell from the chopper transformer's squeak whether the mains side of the supply is working. It was. So we discon-

nected the scan coil plug and checked the power supply by loading it with a bulb across the interlock pins of the socket. This proved that the cause of the fault was in the line output stage, where the output transistor was short-circuit. When this had been replaced there was some sort of waveform at its collector, and after a short time the faintest glimmer of line collapse appeared on the screen. A few further checks revealed that the EW modulator driver transistor was short-circuit and R503 (100 $\Omega$ ) open-circuit. The cause of all this was the scan coil coupling capacitor C511 (330nF, 400V). When it was removed one leg remained in the board. **C.W.**

### Sony KV2752 (RX Chassis)

The customer told me over the phone that the on/off switch was broken. It's a very common job, so an estimate was given and accepted – yes, I know, I'll never learn! When I fitted the switch and turned the set on there was nothing. Quick checks showed that although there was h.t. at the collector of the chopper transistor there were no outputs from the power supply. This called for removal of the set to the workshop – and a bit of explaining. Once the set was on the bench it didn't take us long, using the scope's component tester, to discover that the 2SC2958 chopper driver transistor Q601 was slightly leaky base-to-emitter. A replacement brought the set back to life. **J.E.**

### Philips 2A Chassis

This set was dead with a shattered mains fuse and open-circuit surge-limiter resistor (R3654). The BUT11AF chopper transistor, D6664 (BYD33J) and two of the bridge rectifier diodes were short-circuit. In addition to these items I replaced the CNX62 optocoupler and the 2.2nF, 2kV pulse capacitor C2664, just in case. A check for dry-joints then revealed a beauty at one leg of the 9.1nF flyback tuning capacitor C2609. After resoldering this I switched on and found that the set worked normally. It surprised me that the line output transistor had survived all this. **J.E.**

### ITT CVC40 Chassis

This set was dead but there was 320V at the collector of the TE1233 series chopper transistor T807. I disconnected the scan coil plug to isolate the line output stage and used a 100W bulb to load the power supply. At switch on it glowed far too brightly – there was 316V across it. T807 was short-circuit of course. As no obvious cause of its failure could be found I

fitted a replacement, using a BU326 as I was unable to find a supplier for the TE1233.

At switch on the set worked normally and continued to do so for about an hour. It then suddenly went dead again. The BU326 had failed. Fortunately years ago I'd scribbled a note on the circuit diagram naming R833 (1.5M $\Omega$ ) as the cause of intermittent chopper transistor failure. A check showed that it was open-circuit. Replacing this resistor and fitting another BU326 restored reliable operation. **J.E.**

### Philips K40 Chassis

This set came in dead. Replacing our old friend R3192 (680 $\Omega$ ) brought it back to life, but there was severe EW distortion. Although R3177 (12 $\Omega$ ) was charred and open-circuit replacing it made no difference. When resistance checks were carried out in the diode modulator circuit one of the diodes appeared to be short-circuit, but it was the parallel 0.02 $\mu$ F, 250V capacitor C2164 that was the culprit. Replacing it produced a normal raster. **J.E.**

### Contec KT8135

This set had a very bright raster with flyback lines. R474 (390k $\Omega$ ) on the tube base panel was found to be open-circuit. As a result the tube's first anode voltage was high. **J.E.**

### Philips CP90 Chassis

Field collapse was the complaint with this set. The cause was traced to R3623 (8.2 $\Omega$ ) being open-circuit. It's in the rectifier circuit that produces a 163V bias supply for the field output stage. **J.E.**

### Bush 1452T

This receiver was dead, with a blown mains fuse (F901), as the 2SD1554 chopper transistor Q404 was short-circuit. When these items had been replaced we powered the set via a variac. The power supply now produced an h.t. output, but there was no regulation and the line output stage derived 12V supply was missing. The 12V supply was missing because the 12V, 1.3W zener diode ZD402 was short-circuit. This had seen off R425 (5.6 $\Omega$ , 3W). After much checking we traced the cause of the failure to regulate to C911 (47 $\mu$ F, 50V) in the chopper transistor's base circuit. It had gone low in value. We decided to replace C909 (47 $\mu$ F, 50V) as well. **P.M.**

### Casio TV100

This set was dead: fuse FU100 (1A) had blown because the LCD backlight board inverter transistors Q901/2 had

gone short-circuit. They are surface-mounting types and are available from Casio. We replaced these items, but the only result was that Q901/2 became hot. Further checks revealed that there were short-circuit turns in the primary winding of the inverter transformer. This is easy to remove and, with a little care, can be rewound. This restored the set to normal operation. **P.M.**

### Samsung CI338GA

This set suffered from field roll because the lubricant in the field hold control had become conductive. It had reached the point where there was only a limited change in the control's resistance when the slider was moved from one end to the other. Three potentiometers of the same type on the front panel were in a similar state. We cleaned and relubricated all four, restoring normal operation. **P.M.**

### Matsui 1440/Saisho CT142R

Pressing the remote control unit's standby button would sometimes result in the set going into standby, or coming out of it, for only as long as the button was held. In addition, when the set was in the standby mode the selected channel LED would go out instead of staying on to indicate standby operation.

We checked the supply to the OEC3005 remote control decoder chip IC103 and its peripheral components. As everything seemed to be o.k. we fitted a replacement chip. This made no difference. Eventually we decided to try a universal remote control unit. The set then responded normally. Does anyone want a nearly new OEC3005 chip?! **P.M.**

### Osaki CI5013T/Samsung CI5052XT (P68SW Chassis)

The complaint with one of these sets was no sound or vision with the standby light flickering. When switched on these sets come on in the standby mode. In this state the h.t. voltage should be 125V. In our faulty set it was at approximately 70V and the set wouldn't come out of standby. The solution was to replace the SDH209B chip IC801. **D.F.**

### Bush 2002/2052T/Matsui 2074

The line output stage derived 12V supply was missing. Replacing R421 (0.68 $\Omega$ ), R419 (5.6 $\Omega$ ) and the BYX61-C12 zener diode ZD401 cured the fault (no sound/vision) for three weeks. Then ZD401 failed again.

I obtained a circuit diagram and found that the h.t. (+B) voltage was

high at 124V. When C909 and C919 (both 47 $\mu$ F, 63V) had been replaced it was possible to adjust VR901 for the correct 115V h.t. Why don't manufacturers print important voltages on the PCB? **D.F.**

### Rediffusion Mk4A Chassis with Text

We'd replaced the memory battery, stored the owner's local channels and tested the set before returning it. Soon after the owner complained that there was no teletext or clock display, just a blank screen with "0000" in the top left-hand corner when teletext was tried. It took a while before we realised that the Mk4A has a page-store facility, which requires a page number to be stored on each active channel before the teletext will function. The header page 100 was memorised for each channel and the mystery was solved. **C.A.**

### Ferguson 22B5 (TX10 Chassis)

A silly one this, but it might save someone else from wasting time. The owner had bought the set, which has teletext and stereo sound, secondhand. He then discovered that although it would produce a mixed picture and

text, if text alone was requested nothing happened – except for a slight picture shift to the left. We tried fitting a good text board from a scrap set but this made no difference. We then noticed that PL31, which plugs into the text board, has an extra grey flying lead with a connector on it. This had been pushed on to pin X on the board, though the manual labels it as "not used". Disconnecting it restored correct operation. **C.A.**

### Ferguson 14L2 (TX85 Chassis)

This set switched on but wouldn't produce a picture: it was stuck on channel 0. Neither the channel change nor the tuning worked. The cause of the fault was the 8.2V zener diode D901 in the 9V regulator circuit on the remote control board. **R.F.W.**

### GoldStar CIT2181

Intermittent loss of sync was the problem with this set. The input to the sync separator in the TDA1940 chip was being lost because C413 was leaky. **R.F.W.**

### Ferguson TX10 Chassis

This old timer was dead but apparently produced a really good picture before

it went off. We soon found that there was no chopper transistor drive. The cause of the fault was R724 (1.2k $\Omega$ ) which biases the base of the chopper driver transistor TR721. **R.F.W.**

### Tatung 165 Chassis

The problem with one of these sets was low gain. Its cause was R102 (4.7k $\Omega$ ) which was open-circuit. This resistor biases the base of the SAWF driver transistor Q101.

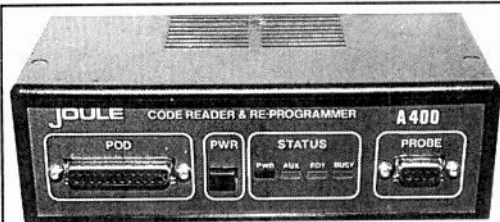
Another of these models displayed a peak white raster. The cause was the TDA3565 colour decoder chip 1501. **T.A.**

### JVC AV25S1EK (MX II Chassis)

The standby light would change colour but there was no line drive. Voltage checks showed that there was no supply to the line driver transformer because the standby switching transistor Q902 was not being switched on. Its base bias resistor R903 (2.2k $\Omega$ ) had risen slightly in value. **T.A.**

### Matsui 6092

The cause of weak, distorted sound was traced to the 2SD400 transistor Q706 on the power PCB. A BC639 proved to be a suitable replacement. **T.A.**



## JOULE A-400 ADVANCED CAR RADIO CODE READER

*The A-400 is the only system whose software and hardware is designed totally in house and factory produced.*

The A-400 currently covers the majority of models and now includes the latest Blaupunkt RDS radios. Ongoing research and development means new models are being added regularly.

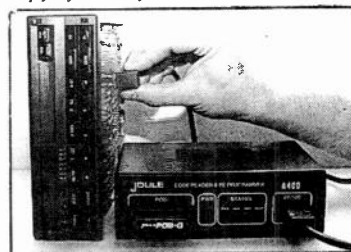
*Full technical backup via a telephone helpline is offered to all registered users. There is also a scheme in place where any radios not currently included within the system will be decoded free of charge and a free copy of that software will be supplied.*

*Decoding a radio is simple – remove the base plate, place the probe on the PCB, press a key and the code is instantly displayed. Changing the code or fully re-programming is just as easy.*

On screen help and PCB layouts showing probe location and information on how to enter the code once the set has been decoded.

*Works on any IBM or compatible PC from an Amstrad 1512 to a 486.*

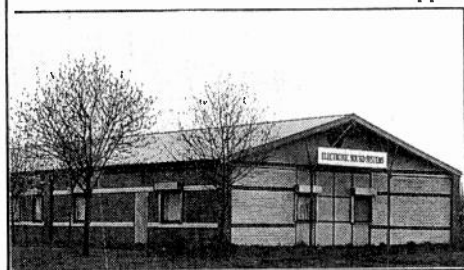
As well as its ability to decode and re-code, the advanced design of the A-400 permits total re-programming of eeproms, lending itself for use in the servicing of television receivers etc.



Place probe on the PCB and the code is instantly displayed

**Purchase the A-400 decoding system outright, price for full starter package (covers over 90 models): – £375.00 + VAT**

or, take advantage of the new INDEX system where for a £100.00 refundable deposit you will be supplied with a complete A-400 system. Decodes are supplied over the phone and are charged at £5.00 each, no rental charge.



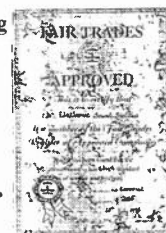
The A-400 is manufactured by a company that has been involved in the servicing of car audio and TV/video for over 20 years and is a service agency for Philips, Grundig and Blaupunkt.

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### VCR HEAD CLEANING TAPES

Ever since I confronted my first faulty VCR over twenty years ago I have been told, mainly by people in the know and fellow technicians, that video head cleaning tapes are useless. Since that first time I have seen no reason to doubt this. I was told that the early cleaning tapes were abrasive and had to be used sparingly. Presumably the tape composition has changed during the intervening years, but customers who have tried to clean their tape heads with a cleaning tape because of the dirty heads symptom regularly tell me that the tapes are ineffective. A quick wipe with the trusty chamois leather and isopropyl alcohol has always cured the problem.

I've seen cleaning cassettes jammed in machines because the top bottle compartment has struck the cassette-in switch, and cleaning tapes that have dirtied instead of cleaning the heads. Many customers seem to think that a head cleaning tape will cure any VCR fault – "it's chewing tapes, bung in the cleaner".

Yet the tapes must be good since nearly all dealers sell them! I'd welcome any comments on the subject.

*Edward Branch,  
Northallerton, N. Yorks.*

### FINANCING A RENTAL BUSINESS

The last five or six years have in some ways been the toughest period that many a TV business has experienced. Recovery from the deep recession has been slow, and has been marked by intense competition amongst white and brown goods dealers in the high street. Many small firms have been saved from going under by having a reasonable rental business, but here too competition has been fierce.

For many smaller rental businesses the problem has been to ensure that leaflet-drop competition and the big boys don't steal their customers. Good personal service and an offer to replace an ageing set – before someone else does – will often ensure that business is retained and in fact grows.

Finance can be a major problem. Banks are not always willing to lend to finance new equipment for rental, and the larger finance companies will sometimes arrange facilities only in excess of a minimum amount, which may well be too much for a small rental business.

There are specialised finance companies that don't advertise but will, subject to the usual credit checks, finance as little as £1,500 worth of equipment over periods of 12-36 months. The dealer chooses the period which will ensure that, after renting out the equipment and paying the finance company, a positive cash flow is retained.

Another alternative is block discounting, where the finance company in effect makes a cash advance against the deposit of existing rental agreements. Usually, but not always, these have to be for the rental of new equipment and to have been signed during the last three-four months.

Dealers often need finance to cover only a period of high rental demand, so that they can sign up new agreements rather than let the business go elsewhere.

*Bob Wickham, Managing Director,  
Broughframe Limited.*

### THE PHILIPS G110 CHASSIS

I'd like to add a few comments to Richard Newman's excellent article (December) on servicing the Philips G110 chassis.

My experience of this chassis has been mainly with the 8841 projection model. We've sold many of these sets, and have a number that we either rent out to pubs and clubs on a long-term basis or hire out for one-day seminars etc.

Two screws at the front, next to the dust cover that surrounds the lens, have to be taken out when removing the top section. Richard didn't mention them. They are accessible only after removing the loudspeaker grill, then removing two screws that hold the front control panel which is then swung down. As our one-day hire sets are constantly being moved around, we tend to leave these two front screws out. Removal of the top section is then as Richard describes.

In my experience the blue tube seldom fails. What does happen is that the cooling fluid turns a dark brown, resembling the colour of strong lager. In addition, when you split the tube from the optics you find that its face plate is covered with a brown substance. You also find traces of the adhesive that a plastic face-plate protector has left behind after removal in the factory prior to fitting the tube in the set. It can easily be cleaned off with isopropyl alcohol. Something else you'll find is a trapezium-shaped phosphor burn

across the tube: this seems to have little effect on the picture produced by the blue tube.

Because of leakage, I've had to replace the fluid in the red and green assemblies as well. The remaining fluid has been slightly discoloured, but the picture has been o.k. I assume that this is because the blue tube contributes on average only eleven per cent to overall brightness, the red and green tubes contributing thirty and fifty nine per cent respectively. Hence the fact that the blue output suffers most. Once the fluid has been replaced, the blue picture is restored to normal.

Finally a note on convergence, regarding the magnets on the scan coils. If you use a crosshatch pattern without a circle, you may find that the picture is displaced horizontally or vertically by one complete square without this being noticed – until you change channel to a normal picture!

Incidentally it would have been nice had Philips fitted some A1 switches (remember them?).  
*Martin Cole, Service Manager,  
Central Radio Services,  
Burnham-on-Sea, Somerset.*

### PANASONIC Z3 CHASSIS

For the benefit of other readers I would like to correct an error that occurred in the Panasonic Z3 chassis fault report on page 639 of the July 1995 issue – a set that wouldn't start up because of an X-ray (overvoltage) protection circuit fault. The offending 270kΩ resistor is R560, not R506. It's hard enough trying to find anything in this chassis! But many thanks to Mike Rathbone, without whose report I would probably never have found the cause of the trouble.

The note that came with the set I had to deal with said it went off a few seconds after being switched on, which was not surprising considering the burnt out line output transformer pin. After dealing with this I was taken aback to find that there was also an X-ray protection circuit fault. It seems to have been unconnected with the dry-joint.

*Laurie Watkinson,  
Holsworthy, Devon.*

### STUDENT'S DILEMMA

I wonder how many of your readers will find my problem familiar? Ever since I completed a degree in electrical and electronic engineering people have assumed that I can repair TVs etc. I couldn't of course, since all I knew were the basics. The inside

of even the simplest TV set was a daunting prospect.

I decided to pursue TV and video repair work: it was otherwise a question of back to school or work at McDonalds. My knowledge of the theory is o.k., but I need practical experience to pass the courses let alone get a job. Could any readers of *Television* provide any help, advice or suggestions that would assist me with the courses I'm studying? I have to find a way around or over this brick wall called 'experience'.

*Ms C. Raynor, 39 Northway, Lymm, Cheshire WA13 9AT.*

### OBTAINING SPARES

My experience of ordering spare parts over the last few years has been that very, very few companies give truly good customer service. Many of the companies that advertise regularly in this excellent magazine do not reply to faxes, even pretend they haven't received them. If they do reply, they don't answer queries carefully and are not helpful. I'm often made to feel that my queries are a disturbance! Even large, reputable consumer electronics companies will put you in a queue when you telephone. When they do finally claim to have what you want, the wrong item is often sent.

Fax communication seems to me to be by far the most efficient method. I spend a lot of time preparing my faxes and provide as much information as possible, mostly to no avail. How is it that fax enquiries to German, US and Japanese companies are usually answered within 24 hours? UK firms are fooling themselves if they think that they are providing good customer service. Come on, customer service departments: jack up your efforts or let's hear your side of the problem.

*Ritchie Langu, Zambia.*

### WHEN IS A WARRANTY NOT A WARRANTY?

The other day I was asked if I would have a look at a closed-circuit TV system at a customer's premises. It consisted of a number of CCD outdoor cameras, a digital switcher, a 20in. monitor and a time-lapse VCR, all made by Sony. The company that had installed the system, only a couple of months previously, had gone into liquidation. The problem was that one of the cameras had failed.

I explained the situation to Sony Broadcast at Basingstoke. "No problem" they said, "return the

camera and we'll see what we can do". A couple of days later I received a letter explaining that while the camera was well within its twelve months' warranty period it would have to be returned to the wholesaler from whom it was purchased. I again explained that this was not possible, because the company that had installed it had gone bust, and pointed out that as the customer had just purchased over £5,000 worth of Sony equipment, and expected to expand the system, repair of the camera free of charge would be good customer relations. All to no avail. I just had an estimate of £86.53 to repair an item less than three months old. My customer is not particularly pleased about this.

*Martin Crossman, Electrical and Electronic Services, Southend-on-Sea.*

### FAULT DATABASE

I'm currently compiling a TV and VCR fault database to assist me in my repair work, and at present have 800 TV and 50 VCR faults stored on a Psion Series 3 pocket computer. Readers could help me and themselves by sending me any number of faults on a 3.5in. 1.44Mb disc with a stamped, addressed envelope so that I can send back the full collection. The database fields should be set in the following format:

Make: Hitachi  
Model: C2519T  
Fault: No sound, OP stage OK  
Replace: D401 in i.f. can

To conserve disc space, try to be as concise as possible. I can accept files in the following formats: dBase III, dBase IV, Foxpro, Windows cardfile, HP 95LX Phone book, Psion Series 3 DBF. A covering letter stating the format sent and required would be helpful. Anyone requiring a copy to start them off is welcome to send a blank disc and a stamped, addressed envelope so that I can send as many faults as I have at the time.

*M. Stevenson, 5 Clements Court, Victoria Road, Mablethorpe, Lincs LN12 2AQ.*

### DAISY-CHAINING

The government's infuriating decision to go ahead with Ch. 5 brings up once more the subject of daisy-chaining, with most modulators confined to chs. 32-40. For single-set installations the answer is the scart system, but how many sets are provided with even as few as two

such sockets? Even four would hardly be future proof.

Designs for adding scart sockets have appeared in *Television* over the years, but none to date have remote control, either via the set's unit or an additional one. Could someone come up with a design to suit at least a fair proportion of the more common TV models? The sequential channel-hopping arrangement used with early remote control systems might provide a starting point.

U.H.F. modulators remain a necessary evil with multi-set systems, so some means of shifting the frequency of the older chs. 32-40 type outside that range would be welcome. Does anyone have any bright ideas?

Finally, a plea to manufacturers: please fit all future video/satellite/computer units with a means of depowering the u.h.f. modulator. For those who use scart connections, no good can come of having the unwanted signals produced by these modulators hanging around, however careful the EMC precautions. And please also equip your future TV models with more scart sockets.

*Philip Lane, Aberaeron, Dyfed.*

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# VCR Signal Processing

In Part 4 of his series Joe Cieszynski looks at the basic problems involved with recording and playing back the colour-under chroma part of the signal

With the luminance signal frequency modulated on to a 3.8MHz carrier, the chroma signal can no longer be at the PAL standard of 4.43MHz. If it was left there the result would be excessive luminance-chroma signal cross-modulation. A method known as colour under is therefore employed: the frequency of the chroma carrier is shifted from 4.43MHz to 627kHz, placing it beneath the luminance carrier. This frequency changing is complex, because for faithful colour reproduction the correct chroma carrier phase must be maintained at all times.

Playback signal crosstalk and chroma carrier phase/frequency errors caused by mechanical variations further complicate the chroma signal processing.

There are therefore four primary aspects to chroma signal processing in a domestic VCR: chroma carrier frequency changing; crosstalk signal cancellation; chroma carrier fre-

quency error correction; and chroma carrier phase error correction.

## Basic Chroma Record Processing Block Diagram

Fig. 1 shows in simplified form a standard VHS chroma record system. The composite video input is first fed to a bandpass filter which removes the luminance signal component and reduces the chroma signal bandwidth to 1MHz. This bandwidth limiting is necessary because the lowest luminance sideband is at 1.2MHz: there is thus only a 1.2MHz wide slot into which the chroma signal can be fitted. With a guard space left to minimise cross-modulation, the VHS chroma bandwidth becomes 1MHz (carrier frequency  $f_c \pm 500\text{kHz}$ ).

Balanced modulator one performs the frequency changing required, using the same heterodyne principle employed in a superhet radio receiver. For reasons that will be made clear later, the second input to the modulator comes from a second balanced modulator rather than a simple local oscillator.

The voltage-controlled oscillator (VXO) provides one of the two inputs to the second balanced modulator. The automatic frequency control (AFC) block provides the other input. To ensure correct luminance and chroma signal frequency interleaving, this input is locked to the off-air line sync pulses. It is also phase retarded by 90° on each line, though this is done with only the ch. 2 head signal (even fields). This phase shifting is part of the chroma crosstalk

Fig. 1: Block diagram (simplified) of the basic VHS chroma record system.

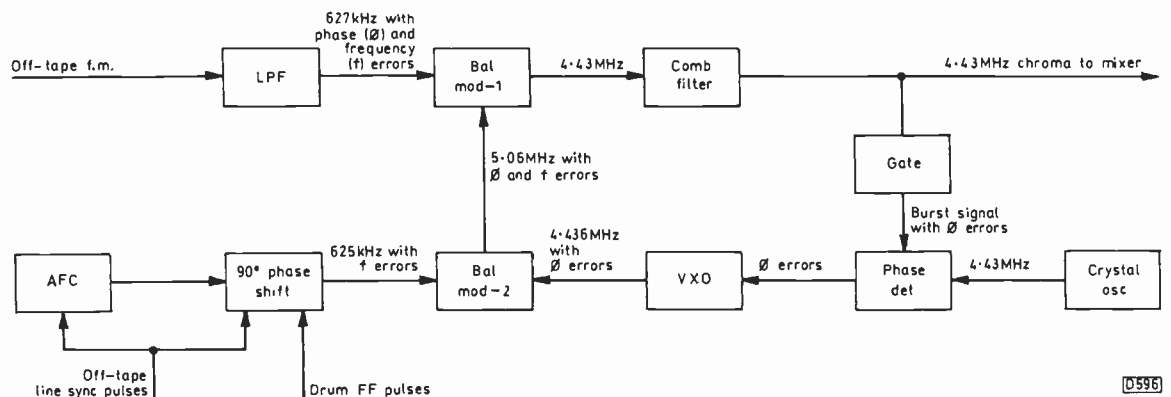
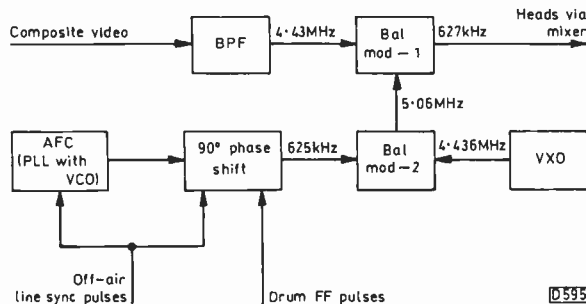


Fig. 2: Block diagram, again simplified, of the basic VHS chroma playback arrangement.

cancellation process, which we'll consider in more detail shortly.

**Basic Chroma Playback Processing Block Diagram**

Fig. 2 shows what has to be done when playing back the chroma signal. The off-tape f.m. signal is first fed to a low-pass filter, with a cut-off frequency of about 1.2MHz, to remove the luminance signal component. The two balanced modulators operate in basically the same way as in the record mode, the main difference being the reversal of the input/output frequencies at balanced modulator one.

The effect of the 90° phase-shift block is this time to phase advance the previously retarded ch. 2 head carrier on each line. We'll return to this.

The AFC circuit corrects playback chroma carrier frequency errors by detecting the amount of frequency shift and then introducing an opposite amount of shift. This shift passes through balanced modulator two, appearing at the input to balanced modulator one where the frequency correction occurs. If for example the carrier frequency rises by 1kHz, the AFC output will fall by this amount. Subtraction of the two signals in the first balanced modulator, i.e. the off-tape signal with the frequency increase and the second signal with the frequency decrease, results in an output at the correct frequency. The AFC circuit uses off-tape line sync pulses to detect frequency variations in the playback signal.

In the playback mode the voltage-controlled oscillator is controlled by an automatic phase control (APC) system which corrects chroma carrier phase errors caused by minor mechanical variations. The phase detector that controls the VXO compares the phase of the off-tape chroma burst signal with that of the output from a 4.43MHz crystal oscillator. It introduces a compensating phase shift in the VXO's output. This is passed via balanced modulator two to balanced modulator one, where error correction occurs in the same way as with frequency correction.

The comb filter uses the ch. 2 carrier phase retard/advance to cancel chroma crosstalk between adjacent video tracks.

**Crosstalk Cancellation**

Before we consider chroma signal record/playback processing in greater detail, it's necessary to look at the problem of chroma crosstalk and how this is dealt with.

All current domestic VCR formats dispense with a guard band between adjacent video tracks. This is done to increase the playing time of the tapes. When the VHS and Betamax systems were being developed, playing time was a major consideration – the 'longest' tapes then available had a playing time of only two hours. Much had been learnt from the public's reaction to the earlier Philips N1500 format. This had a guard band between each track, but the maximum playing time was only half an hour. It soon became clear that users would be quite happy to sacrifice picture quality to attain a longer playing time. The trouble is that when the guard band is removed luminance/chroma crosstalk becomes evident. If uncorrected, this crosstalk will result in colour interference and distortion.

Luminance crosstalk is largely eliminated by the use of the slant-azimuth video head technique. This has very little effect at the much lower chrominance frequencies however, see Fig. 3. The two-line offset hides the crosstalk to a large degree, but if patterning is to be avoided chroma signal crosstalk cancellation must be used.

The VHS system uses a phase rotation arrangement to cancel chroma crosstalk. This is best explained using phasor diagrams. The following description, see Fig. 4, assumes for simplicity that the VCR is recording then playing back a pure magenta raster (R - Y chroma signal). For those who are a little rusty about this sort of thing, in a phasor diagram phase

retardation is represented by a clockwise movement of the phasor.

Fig. 4 (a) shows that the ch. 1 head (odd field) records the chroma information with no alteration to the phase of the PAL signal.

Fig. 4 (b) shows that the ch. 2 head (even field) records the chroma information with the phase of the PAL subcarrier retarded by 90° on successive lines, i.e.

- Line 1 0° phase retardation
- Line 2 90° phase retardation
- Line 3 180° phase retardation
- Line 4 270° phase retardation
- Line 5 0° (= 360°) phase retardation.

Fig. 4(c) is based on the ch. 1 head playing back a video track. The large phasors represent the off-tape PAL chroma signal from the track being scanned. The smaller phasors represent crosstalk from adjacent ch. 2 tracks. Because of the phase retardation that took place during the record process, these phasors are generally out-of-phase with the main off-tape signal. At this point no cancellation has occurred.

Fig. 4(d) shows in block diagram form the comb filter system included in Fig. 2, with a two-line delay line. This usually consists of a glass delay line, the delay time being 127.88µsec (two lines). It operates on similar principles to the chroma delay line in a PAL decoder. The adder following the

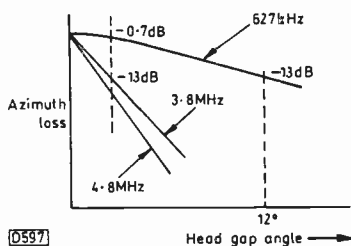


Fig. 3: Graph showing the effect of the slant-azimuth technique on f.m. (3.8-4.8MHz) and chroma (627kHz) crosstalk signals.

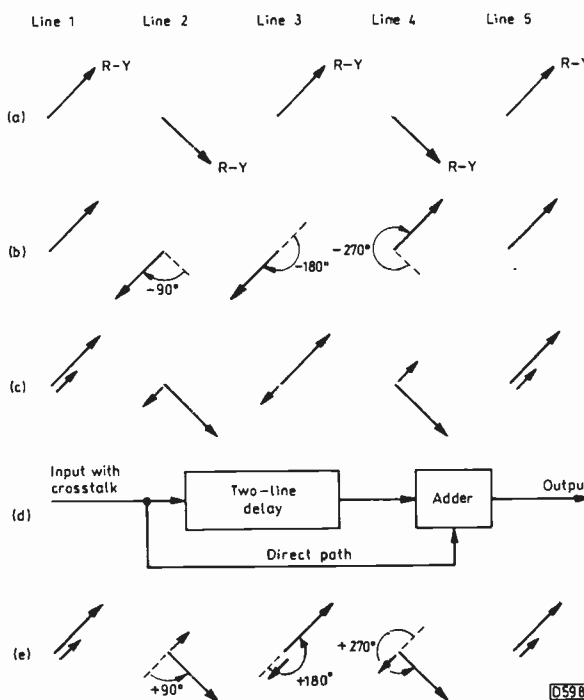
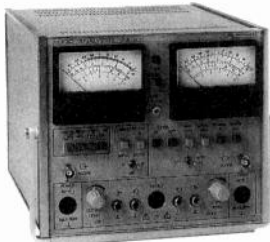


Fig. 4: How ch. 2 signal phase shifts introduced line-by-line during the record process enable chroma crosstalk to be cancelled when playing back the signal.

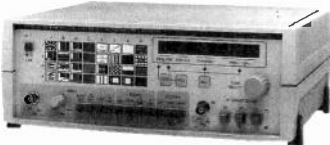
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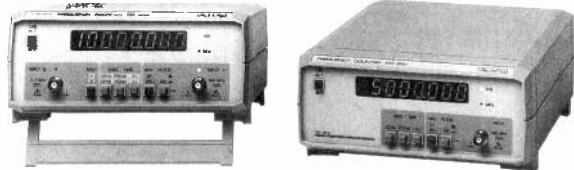


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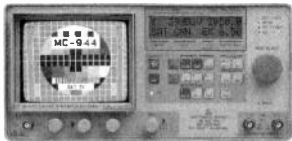


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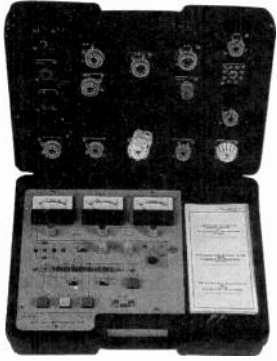


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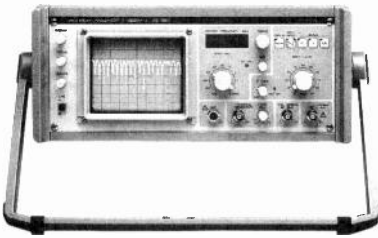
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delay line receives both a direct (undelayed) and the delayed signal. Let's assume that line 3 is being scanned by the ch. 1 video head (direct signal) and that line 1 is going to the adder from the delay line. As you can see from Fig. 4(c), the crosstalk phasors are in antiphase. They therefore cancel out in the adder (the in-phase signals add). The same thing occurs with lines 4 and 2, lines 5 and 3 etc.

Fig. 4(e) shows that cancellation also occurs when the ch. 2 head is scanning the tape. During playback the ch. 2 chroma information is phase advanced to restore it to the correct PAL phase, so in this diagram the phasors are advanced from their positions shown in Fig. 4(b). The crosstalk phasors are also phase shifted. As you can see from comparing lines 3 and 1, 4 and 2 etc. crosstalk cancellation occurs.

This crosstalk cancellation system relies on two factors. First that the content of the chroma in the pictures does not change much over two lines. In fact this is largely so. Secondly, the system can function only when the crosstalk signals are correlated vertically, i.e. when they are from the same point in the picture. Because of the two-line offset when recording, this will be the case. The offset is lost in the long-play mode however, so that the chroma crosstalk can-

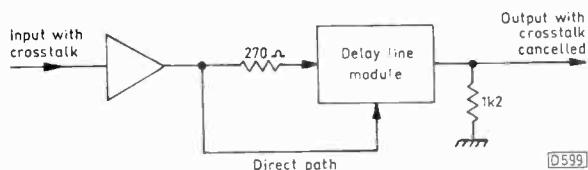


Fig. 5: Typical delay-line comb filter arrangement.

cancellation system would fail miserably unless steps were taken to compensate for this. More expensive LP machines incorporate a half-line jump circuit to overcome the problem.

Fig. 5 shows a typical comb filter arrangement. In most cases the circuitry for adding the direct and delayed signals is contained within the delay line module. Adjustments in this area were eliminated soon after the introduction of the earliest machines that used the technique, and on the whole the delay lines are very reliable. As digital techniques take over the signal processing, the delay line will become a thing of the past: digital methods will take over crosstalk cancellation.

### Next Month

Next month's instalment will look at VHS chroma signal recording in greater detail.

## Book Reviews

**Newnes Guide to TV and Video Technology, Second Edition, by Eugene Trundle. Published by Butterworth-Heinemann Ltd., Linacre House, Jordan Hill, Oxford OX2 8DP. 382 pages.**

The prodigious rate of development in our field in recent years means that this book's terms of reference are very wide. A major problem therefore is what to include and how deeply to go. The book is aimed at interested lay people, students, technicians and those in allied fields seeking an insight into current TV and video practice. I'd say it does an excellent job of meeting the needs of such an audience, and have already found it a useful reference source for a quick check on several points, thanks to its excellent index.

If you feel the need to freshen up on things like enhanced text, Pal-Plus and other enhanced TV systems, satellite and cable TV technology, you'll find useful sections on all these. The video section includes a helpful chapter on the care, operation and maintenance of VCRs.

The book can be recommended as an ideal introduction to the technology of modern TV and video equipment. It's available from Paul Richard Books, 28 Boscobel Road North, St. Leonards-on-Sea, East Sussex TN38 0NZ at £16.49 inclusive of post and packing. The credit-card order-line is 01424 434 874. The book can also be obtained from the usual retail bookseller sources. **J.A.R.**

**Birth of the Box – the story of television, by Ian Sinclair, published by Sigma Press, 1 South Oak Lane, Wilmslow, Cheshire SK9 6AR (telephone 01625 531 035) at £9.95. 200 pages.**

This book covers the subject of TV technology from the first stirrings to fairly recent developments such as Nicam and the camcorder. The emphasis however is on the pioneers and their work. It does the job thoroughly and is an excellent read. I looked hard to see whether I could find anything that was missing, and found very little. There could perhaps have been a little more on developments in the USA during the Thirties, and on the origins of the helical scan system. Otherwise, it's all there – the whole fasci-

nating story. There is of course much on the developments in electronics that made TV possible – the valve, electronic amplifiers and so on. Anyone interested in how it all came to be will find this book an authoritative guide. **J.A.R.**

**MPEG – Digital Television for All. Compiled by NTL, published by Swift Television Publications, 17 Pittsfield, Cricklade, Wilts SN6 6AN (telephone 01793 750 620). £19 plus £1.50 postage in the UK, £3 postage to other European countries or £8 postage to the rest of the world. 40 large (A4) pages.**

That this is an authoritative guide to the subject is guaranteed by its authorship, NTL, the former ITC engineering side. It contains detailed information on all relevant aspects of the subject, including the need for digital compression, methods of coding, the MPEG standards, how compression is achieved, the treatment of signals for transmission, satellite and cable requirements and the various NTL compression systems now available. The explanations are clear, though I found some of it heavy going, particularly the section about redundancy coding on different MPEG frames, with related discussion of quantised coefficients, scale matrix and DCT processing. There are however many diagrams that clarify the text, and digital compression is of course a complex subject.

NTL/Swift have in this book provided timely information for the trade, broadcasters and interested enthusiasts. As far as I know there is no other publication with so much detail on the working of digital compression. This is therefore essential reading, a topical guide to the digitally compressed transmissions about to come our way and already available elsewhere – for example Direct TV in the USA and the Australian Foxtel service.

The price may discourage some readers. This is a pity since they will be in the front line when digital TV arrives, and a grasp of the technology now should reap a good harvest later on. I suspect that the Inland Revenue would allow such essential educational material to be offset as expenses. **R.B.**

15/80H	3.83	2SC2073	0.77	2SD639	0.60	BC252B	0.07	BF470	0.33	BY399	0.11	HA13119	2.05	MJE18004	1.80	STK7358	5.81	TD41519A	2.74	TD48178FS	3.81
1N4001	0.04	2SC2078	0.86	2SD667	0.38	BC258	0.09	BF493	0.36	BYD141	0.26	HA13403	3.59	MJE2955	0.68	STR40090	6.28	TD41520B	2.48	TD48180	4.87
1N4002	0.07	2SC2100	0.23	2SD669A	0.64	BC300	0.48	BF494	0.12	BYD330	0.43	HA1377	2.62	MJE2955T	0.68	STR4211	12.63	TD41521	3.36	TD48190	2.91
1N4003	0.05	2SC2126	1.29	2SD716	1.46	BC301	0.28	BF757	0.43	BYD33J	0.27	HA1338SP3	7.69	MJE3055	0.52	STR441	28.40	TD41524A	1.88	TD48305	7.21
1N4004	0.00	2SC2229	0.28	2SD718	2.21	BC303	0.24	BF758	0.32	BYD33M	0.21	HM6232	10.46	MJE3055T	0.74	STR451	23.50	TD41553Q	4.79	TD48380	2.53
1N4005	0.07	2SC2230	1.66	2SD734	0.26	BC307	0.06	BF759	0.38	BYV10-40	2.55	HM6251	9.57	MJE340	0.50	STR50020	9.52	TD41554Q	8.12	TD49503	2.13
1N4006	0.06	2SC2235	0.36	2SD762	1.80	BC307B	0.14	BF760	0.26	BYV958	0.19	JOB	0.00	MM650	0.58	STR50103	4.10	TD41670A	2.98	TEA1014	1.87
1N4007	0.06	2SC2236	0.36	2SD820	5.06	BC307C	0.15	BF762	0.30	BYV95C	0.21	KA2206	1.32	MPS406	0.35	STR54041	4.36	TD41675A	3.85	TEA1039	2.14
1N4018	0.06	2SC2240	0.16	2SD837B	1.14	BC308	0.06	BF788	0.52	BYV96D	0.27	KA2263	0.60	MPS442	0.23	STR5412	3.68	TD41701	2.65	TEA2018	1.84
1N5061	0.00	2SC2271	0.67	2SD856	1.03	BC308A	0.09	BF869	0.25	BYW56	0.31	KA2263	0.55	MPS443	0.15	STR58041	6.41	TD41710A	3.09	TEA2029C	5.69
1N5062	0.51	2SC2274	0.35	2SD863	0.35	BC308C	0.06	BF870	0.29	BYW95C	0.65	KA8301	1.46	MPS455	0.26	STR59041	6.67	TD41872A	4.83	TEA2031A	3.40
1N5400	0.07	2SC2314	0.38	2SD869	5.18	BC309	0.04	BF871	0.41	BYW96E	0.94	KBLO8	1.42	MPS456	0.12	STR6020	5.38	TD41905	2.12	TEA2164	2.96
1N5401	0.14	2SC2335	1.12	2SD870	3.01	BC309C	0.14	BF872	0.18	BYX55600	0.23	KA6210AH	6.15	MPS492	0.15	STR6020KIT	15.08	TD41908A	2.14	TEA2165	4.27
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1N914	0.04	2SC2603	0.25	2SD965	0.67	BC337L	0.22	BFR34A	0.78	BZK6110	0.19	L200CV	2.19	NE555	0.43	T9064V	1.51	TD42005	1.63	TIC106M	0.75
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2N3053	0.38	2SC2979	2.74	2SK794	6.41	BC461	0.31	BFR96	0.55	BZK6127	0.19	LA4282	8.89	OC71	1.23	TAF222P	1.28	TD42040H	2.11	TILL11	0.64
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2N3440	0.35	2SC3153	2.40	74LS247	0.62	BC546A	0.07	BR100	0.21	BZK6156V	0.11	LA4440	1.30	PC814	1.29	TAF233P	1.97	TD42270	7.45	TIP112H	0.95
2N3442	1.00	2SC3156	6.61	7805	0.78	BC546B	0.12	BR103	0.53	BZK6162V	0.07	LA4445	2.99	PC16C57XTSD	6.61	TAF240P	4.74	TD42540	1.12	TIP121	0.42
2N3707	0.12	2SC3179	0.82	7806	0.60	BC547	0.11	BR303	1.22	BZK6175V	0.09	LA4460	2.31	RZM	0.67	TAF250P	4.07	TD42541	0.72	TIP127	0.47
2N3713	1.34	2SC3182	2.49	7808	0.72	BC547A	0.10	BR444	1.02	BZK6182V	0.19	LA4461	1.71	RA050	3.04	TAF250BP	3.74	TD42576A	5.95	TIP132	0.65
2N3819	0.55	2SC3199	0.43	7809	0.69	BC547B	0.11	BR445	0.43	BZK6191V	0.09	LA4475	2.99	RA051	4.80	TAF270P	1.59	TD42577A	2.99	TIP137	0.48
2N3904	0.32	2SC3225	0.60	7812	0.52	BC548A	0.11	BRV55	1.20	BZK7910	0.30	LA4476	2.99	RB156	2.48	TAF271P	1.13	TD42578A	4.91	TIP2955	0.31
2N3906	0.00	2SC3242	0.19	7815	0.82	BC548B	0.06	BRV56	0.96	BZK7912	0.10	LA4508	2.77	RC458	0.40	TAF273P	4.10	TD42579A	4.91	TIP29C	0.94
2N4123	0.30	2SC3310	2.12	78L05	0.35	BC548C	0.06	BR550	0.75	BZK7915	0.09	LA4700	4.27	REGBABY10	0.76	TAF274P	1.26	TD42581	4.27	TIP29E	0.47
2N5296	0.69	2SC3311	0.29	78M05	0.35	BC549B	0.11	BSS38	1.77	BZK7930	0.11	LA6358S	0.60	RGP10G	0.52	TAF280P	2.74	TD42581P	2.99	TIP3055	0.94
2SA1013	0.35	2SC3330	2.66	7905	0.35	BC550	0.15	BT139600	1.29	BZK7936	0.10	LA6510	2.94	RGP15G	0.33	TAF281P	2.98	TD42582	2.05	TIP30C	0.17
2SA1015	0.11	2SC3355	0.96	7915	0.82	BC550C	0.09	BT151500R	1.44	BZK7947V	0.07	LA7520	4.80	RGP15J	0.24	TAF288P	2.04	TD42593	0.76	TIP31A	0.33
2SA1015GR	0.11	2SC3358	0.69	AA119	0.36	BC556A	0.06	BT151800	1.15	BZK7956V	0.05	LA7800	2.41	RGP15M	0.44	TAF299P	2.65	TD42594	2.21	TIP31C	0.77
2SA1016	0.26	2SC3420	0.55	AA143	0.13	BC557	0.05	BU205	1.43	BZK7962V	0.08	LA7801	1.41	RGP30M	0.30	TAF317P	3.14	TD42595	3.19	TIP32A	0.41
2SA1020	0.44	2SC3423	0.60	AC127	0.52	BC557A	0.15	BU205	1.07	BZK7963V9	0.09	LA7820	2.71	RM11C	1.98	TAF317P	2.99	TD42600	4.86	TIP32C	0.40
2SA1029	0.26	2SC3502	0.45	AC151	0.52	BC557B	0.06	BUC208A	1.44	BZK7965V1	0.05	LA7830	1.88	S2000A	1.54	TAF680AP	4.55	TD42611A	0.64	TIP35C	1.39
2SA1048	0.19	2SC3656	0.18	AC153K	0.40	BC558B	0.08	BUC208B	1.25	BZK81CGV2	0.13	LA7835	1.80	S2000AF	1.54	TAF769P	4.55	TD42611AQ	1.32	TIP36C	1.37
2SA1286	0.60	2SC3679	4.45	AC187K	0.53	BC560C	0.06	BUC208A	1.61	BZK8110	0.11	LA7837	1.63	S2000AF	1.68	TAF788AP	4.60	TD42611AQ	0.62	TIP39C	1.39
2SA1370	0.43	2SC3788	0.77	AC188	0.40	BC5635	0.19	BUC208D	1.61	BZK8111	0.11	LC7132	4.70	S2055AF	2.02	TAF788AP	3.01	TD42653A	2.99	TIP41C	0.43
2SA1489	2.40	2SC3795	1.97	AC188K	0.82	BC6636	0.14	BUC326A	1.36	BZK8112	0.07	LED3G	0.10	SA129302	2.02	TAF788AP	2.25	TD426558	19.93	TIP42A	0.35
2SA1706	0.52	2SC3795B	2.63	AD149	0.52	BC6637	0.11	BU406	0.69	BZK8113	0.11	LED3R	0.10	SA129303	10.25	TAF8201	3.93	TD43190	1.27	TIP42C	0.35
2SA562	0.17	2SC3807	0.94	AF124	1.75	BC6639	0.09	BU406D	1.02	BZK8124	0.11	LM1203	10.47	SA5012	3.37	TAF8201	2.98	TD43301B	1.67	TIP1761A	1.59
2SA564	0.33	2SC3883	5.92	AF125	0.82	BC6640	0.06	BU407	0.53	BZK8127	0.11	LM1303N	0.88	SA5243PE	10.84	TAF8205AH	4.70	TD43330	12.29	TIP1791A	1.20
2SA608	0.24	2SC3892A	4.79	AF126	2.23	BC879	0.40	BU407D	0.98	BZK822V	0.11	LM1303N	1.29	SAB3035	1.51	TAF8207	2.54	TD43505	2.40	TIP62	0.61
2SA673	0.12	2SC3953	0.72	AF127	0.77	BCV71	0.27	BU426A	1.03	BZK833	0.11	LM324N	1.48	SG264A	11.57	TAF8210H	5.28	TD43541	0.98	TIP71	0.69
2SA684	0.43	2SC4106	2.05	AF139	0.29	BD131	0.26	BU500	1.41	BZK836V	0.11	LM393N	0.50	SGSIF344	7.28	TAF8215H	5.73	TD43560	2.96	TIP71C	0.60
2SA733	0.18	2SC4242	2.31	AN5265	1.76	BD132	0.26	BU505DF	1.35	BZK839V9	0.03	LM340T5	0.41	SL1430	1.92	TAF8216H	8.01	TD43561A	5.30	TIP72	1.03
2SA769	1.29	2SC4517	4.70	AN5435	1.46	BD135	0.33	BU506DF	2.31	BZK847V	0.06	LM358	0.60	SL1431	2.40	TAF8220H	7.69	TD43562A	3.30	TIP72C	1.03
2SA844	0.26	2SC4517A	2.52	AN5512	1.01	BD136	0.20	BU508A	0.95	BZK855V1	0.13	LM358N	0.42	SL1432	6.19	TAF8221H	6.56	TD43562ATF	3.94	TIP74	1.15
2SA872	0.35	2SC458	0.12	AN5515	1.29	BD137	0.46	BU508AF	1.08	BZK856V2	0.11	LM380N	1.03	SL471	1.70	TAF8221L	4.79	TD43565	3.40	TIP82CP	0.21
2SA872A	0.35	2SC4742	4.70	AN5521	1.66	BD139	0.18	BU508APH	1.99	BZK858V2	0.27	LM386N	0.57	SN76705AN	1.70	TAF8410K	7.19	TD43566	6.41	TMP47C432AP8188	15.19
2SA916	0.57	2SC536	0.30	AN6610	0.94	BD140	0.24	BU508D	1.32	BZK859V1	0.11	LM3914N	2.74	ST3414M	3.35	TAF8691N	7.01	TD43576B	11.31	TIP89	15.19
2SA933	1.06	2SC639	0.56	AN7161N	3.47	BD203	0.47	BU508DF	1.88	CARRB	9.95	LM3939N	1.19								

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		SS9010	SS9210	
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# Chinese Junk

## *More Adventures in CD Land*

**Les Austin on his servicing experiences with dubious Chinese audio equipment**

If you want a gondola, try Italy. Portugal is the place to look for a man-of-war, and of course China for a junk. For me, the problem is that China sends too much junk to this country. When you consider the change over the years in what comes from Japan, and more recently from some other Far East manufacturing countries, we may well get better products from China before too long. So what wound me up this time?

### The Crown CDK2300

Do you recall the Crown CDK2300 midi system I told you about a year or so ago? The one with the faulty RAM chip in the CD player section? Initially,

unco-operative. So I took the record deck off and peered inside. At switch on the disc rotated at speed and the sled was at the outermost part of its track. This suggested that there was a fault in one side of the symmetrical power supply system.

I adopted the simple course of removing the CD PCB in order to get at everything more easily – and was amazed to find that the RAM chip I'd previously fitted was hanging on to the board with just about five hands, the others having let go. Apparently they'd burnt their fingers. I next found that the CXD1130Q servo chip was split across the middle. What was going on? When I made some voltage measurements I was in for a surprise.

The PCB carried +8V and –8V supply rail markings, which a check with the service manual confirmed. The readings I obtained were +18V and –18V respectively. Now since each of these supplies is obtained individually by full-wave rectification of the output from a transformer with a centre-tapped secondary winding, not much maths is needed to calculate that the winding should be rated at about 7-0-7V a.c. I was not pleased to find that it was 17-0-17V a.c. It seems that someone in China had not done his sums correctly when the player was designed.

The +8V and –8V rails are used to drive the motors, an M5290P regulator chip producing, via series regulator transistors, +5V and –5V supplies for the general-purpose chips. Needless to say the M5290P chip was short-circuit. Thus instead of +5V and –5V we had +18V and –18V, the poor little chips having 36V across them. This was obviously far too much: one had hung itself, one had been rent asunder, yet another had been killed and probably the rest all murdered.

Out of respect, I didn't investigate further. I put them all to rest quietly, the customer had his money refunded, and

we tried to put it behind us. Repair seemed pointless: the cost of the chips would probably be far more than the unit's worth, with no great prospect of assured future reliability.

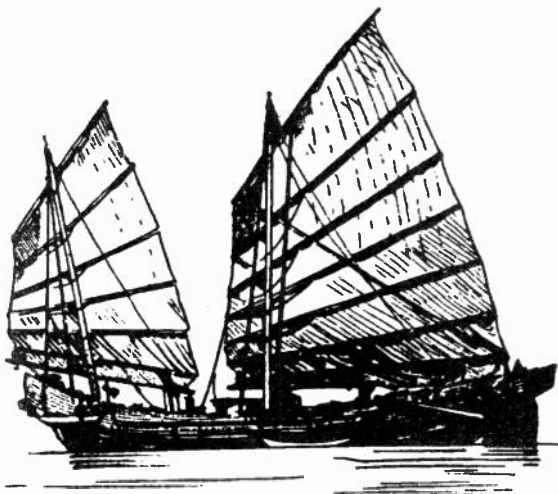
### Another One!

About a month later my eldest son asked me if I would look at a pal's midi system. Imagine my horror when he produced a Crown CDK2300! The problem was poor sound. I diagnosed a faulty volume control, and confirmed that the mains transformer was of the crazy design the inscrutable fellow in a far off land had specified. My initial response was to refuse to touch it, but I was persuaded to try to do something.

I was not prepared to repair it with that transformer still fitted. But, if I fitted a transformer from some other manufacturer's midi system, would I be on dodgy ground if anything went wrong? What to do? I knew that there was a new Crown importer. Perhaps they could help? It took many phone calls before I located the correct people. They were very helpful but had not been the importers for long and had yet to get their spares sorted out. A current model (CDK193R) seemed to correspond with the midi system in my workshop, and in due course the service manager rang to tell me that this had a transformer that provided the correct output voltages (thanks Wilf). They were eventually able to send me one. The original transformer, marked CDK23B, is still stocked by HRS. The one I bought from Independent Services Ltd of Ellesmere Port, for Model CDK193R, is part no. EP50-101-570068-4C. After fitting this transformer and a volume control from HRS a satisfactory repair was achieved.

### An Alba CDI1010

An Alba CD1010, also made in China, was brought in a few days later. "I don't know what's the problem with



*And there's more on the way...*

I sold it to a happy customer. After about three months he brought it back, complaining that the sound was rough. A dirty volume control was diagnosed, and a call was made to HRS for a replacement (part no. 9500702). After fitting this the customer returned to his state of happiness. But not for very long.

His next complaint was that the CD section had packed it in, stealing his favourite disc and becoming noisily

this one" said John, "but the drawer flies open, the sled moves to the outside of the disc and makes a noise like a machine gun, and the laser's lens leans over to one side as if it's drunk. I'll leave it with you and give you a call later." I suggested calling him, to put off the moment of truth.

It seemed obvious that this was going to be another power supply problem. So I connected my meter's black lead to a main PCB test point marked 0V, then checked the d.c. voltages at the power supply connector. Instead of +12V and -12V supplies there were excessive negative voltages. When I pulled the connector off I found that both voltages were still present! Strange, I thought. I decided to remove and examine the main PCB.

More problems. No chips hanging on in their death throes this time, but a series of lengths of burnt-off print. This was earth line print from the centre pin of the power supply connector. It follows a tortuous path around the board. I checked along it until I came to a diode where the damage ceased. I sat back and mused. We get these little safety resistors that go open-circuit for no apparent reason all over the place. But when there's a real need for one the

inscrutable designer in China doesn't bother to fit it.

Time for a quick bodge with some jumper wires and a search for the obviously short-circuited cause of the trouble. I won't bore you with a tedious account of the search, just provide a list of the initial toll of damaged parts: D104 (7.5V zener diode), D114 (1N4148), IC110 (7805), IC112 (79L06), Q115 (2SA608), Q101 (2SC2458), Q107 (a DTC124 digital transistor), the LA6520 sled driver chip and R243 (22Ω). These items are all on the main panel. Q06 (2SD1384) and both 500mA fuses on the power supply subpanel were also faulty.

After replacing these items the voltage on the negative side of the supply was correct, but there was only about 2V on the positive side. Checks along the positive rail were obviously called for. I arrived at pin 23 (Vcc+) of the LA9200 chip and disconnected it from the board. This reinstated the full supply voltage. The next move was to replace this chip with a known good one from my junk box. I used the celebrated leg lifter (see earlier article), some Philips desoldering braid and the big Weller gun to carry out the repair.

Time to try the player again. No luck.

The laser lit (continuously) but there was no sled motion or focus search, and the display remained unilluminated. Definitely give in time now, as there was no chance of the job making a profit. Ring John and suggest he tells his customer that I wish to file it in the bin, where much of this Chinese junk belongs. . .

### A Couple More

Shortly after the above episode a chap arrived in a BMW, clutching two CD players. The first was a Sony CDP29, which required a new drawer drive belt and the cheaper KSS210 laser unit from CPC. The second was an Alba CD1010.

I opened the latter up and looked, fearfully, at the underside of the main PCB. To my surprise all was well. After replacing the two fuses on the power supply subpanel the machine worked satisfactorily. I noticed that the fuses, though both of the correct type, were clearly from different sources. So there'd been a previous failure. What had it been, and how long would my replacements last? I can report that the machine hasn't bounced yet, but to be fair I should add that it was collected only about two hours ago. . .

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# Converting the Amstrad SRD510 for Astra 1D Reception

P. Haylor, G6DRN

This little modification was discovered one afternoon while there was a lull in the workload and an old workshop SRD510 was found lurking on a shelf, looking sorry for itself.

Since Sky Gold was moved to ch. 60, many people have discovered to their cost that their equipment will not receive this and many other programmes. The first phone call usually begins with "why can't I get this programme now? I've spent the whole b\*\*\*\*y morning and I still can't f\*\*\*\*ing find it!!" – why customers must swear to you on the phone is still a mystery to me. So you start to explain about 1D, which only makes them more irate. They've usually missed the special offer from Sky for a low-price ADX, and when you tell them the cost they moan like mad.

As I specialise in repairs, spares and replacement receivers, it would be to my advantage if the receivers I sold were all able to receive the 1D channels. So this is the result of my experiments.

## Procedure

Make sure that the receiver is working fully before making the following alterations. On checking with the service manual for the SRD510 I found that there's a link, marked LK1, which is not fitted. It's right next to the main chip IC5, just in front of pin 40 and before C87 (see Fig. 1). Remove the PCB carefully, then add this link. When you reassemble and test the receiver, on going into the menu mode you will notice a few additions. The SIS now works, and there's the addition that you require, the dish A/B setting. When this setting is changed the voltage at pin 14 of the decoder scart connector is switched on or off. With this information, you can carry out the rest of the conversion.

Obtain a Global ADX Plus converter and remove the plastic case. Turn the receiver around so that its back is facing you (see Fig. 2). From the top left-hand corner measure 75mm across and mark. Then from the top measure 15mm down. Mark the case so that a hole can be drilled at this point. Draw another line 20mm to the right of the first one, again 15mm down from the top, for a second hole. Drill these two holes – both 3/8th inch. If you have measured them

out correctly, the ADX converter can be fitted from the inside with the lead at the left of the converter (viewed from the rear of the receiver). Cut away any plastic lugs so that the converter sits straight. Fix the converter to the case with two nuts and washers (I obtain these from F connectors).

The converter should now be installed just below the receiver's lid line, with the small switch and the LED facing the front of the cabinet. If all's well, the lead can be soldered to pin 14 of the decoder socket, on the inside; alternatively pass it through the case and push it into the socket. This assumes that the socket is not being used for an external decoder.

Make up a 15cm long satellite coaxial cable lead with F connectors at each end. Connect one end to the receiver's F connector and the other end to the converter's left-hand F connector (viewed from the rear of the receiver). Connect the feed from the dish, then switch on. The converter's switch should be in the left-hand position when viewed from the front of the receiver. The original programmes should still be there. If so proceed, if not recheck!

## Tuning

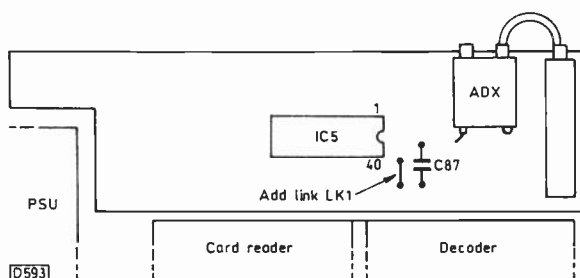
If you are still using a 10GHz LNB, try it – it may work, saving the need to spend out on a 9-75GHz one.

Tune in Sky News (11.376GHz vertical). Go to dish selection on the menu and change to B. The converter's light should come on and Sky Gold should be present. If so, and there's a good picture, the only thing still to be done is to replace the case. You may then like to try the other 1D channels.

If you cannot get a good picture with the existing LNB, a 9-75GHz one will have to be obtained and fitted. You will also have to operate the small hidden switch in the converter and retune the programmes 250MHz higher, except for the following:

UK Gold	11-303 H
Movie ch	11-229 V
Disney	11-347 V
Sky Sport	11-259 V
VH-1	11-288 V
CMT	11-318 V
CNN	11-377 V
TV3	11-362 H
TV3	11-421 H
1 Plus	11-244 H
DSF	11-273 H
N3	11-332 H
NTV	11-391 H
Premiere	11-241 H
Cinemanía	11-406 V
Documanía	11-436 V

Fig. 1: Position of link LK1, which has to be added, and the ADX converter when installed at the rear of the receiver.



These channels are programmed to the frequencies above, and the 'chan' setting on the menu is set to B.

## In Conclusion

This has made the SRD510 1D compatible – if you don't mind the tuning!

If you are not one hundred per cent sure what you are doing, don't try any of this – there are mains voltages in the power supply, and these need to be treated with respect.

To ensure reliability I would advise upgrading the SRD510's power supply. This has been described in the magazine before (see page 346, March 1995 for example). Also earth the ADX converter to the main chassis with a wire.

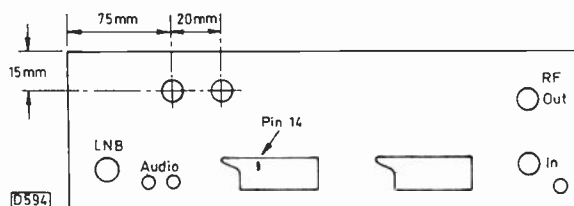


Fig. 2: Positions of the holes that have to be drilled in the back panel to mount the converter inside the receiver's case.

This modification may work with the SRD520 as well, but I've not tried it.

# HELP WANTED

**Wanted:** Teletext panel for the Sony Model KV2256UB. Also i.c. type TDA2800. R.M. Webb, 78 Station Road, Rolleston, Burton-on-Trent DE13 9AB. 01283 814 582.

**Wanted:** Relay type TV5 and zener diode type ZTE2V4 (D17) for the Ferguson Model 22D2 (TX100 chassis). V. Jeremy, 7 Tai Penyard, Penyard, Methyr Tydfil CF47 0LP.

**Wanted:** Circuit diagram (photocopy would do) for the Hinari HT-5T1 CTV. J. Naughton, c/o Domestic Electronic Repair Services, 40 Gala Crescent, Wishaw ML2 7JR.

**Wanted:** For the Philips VR6462 VCR, left and right gear wheels (item 294), part no. 4822-522-31833, or a complete deck in working order. J. Whittle, 51 Amberley Drive, Bognor Regis, Sussex PO21 5NP. 01243 828 765.

**Wanted:** LOPT (numbers 4206MSH1FAP32 or MHF028-17-4101-4-100 on the case) and circuit diagram for the Videoport Model VCP36 video player/TV with Ferguson type top-loading video that ejects at the right-hand side of the unit. Contact Mike on 01244 537 198 or 01244 815 718.

**Wanted/for disposal:** LOPT wanted for the NEC Model 14T412SB. Have for disposal *Television* magazines 1980-1990 and some earlier ones. Offers please. B. Weston, 8 Llainwen, Tynyngogl, Anglesey, Gwynedd LL74 8SD. 01248 852 950.

**Wanted:** Liquid crystal display for the Altai DD6010 digital multimeter. S.J. Riley, 201 Piperknowle Road, Hardwick, Stockton on Tees, Cleveland TS19 8JG. 01642 606 091.

**Wanted/for disposal:** Operating instructions (photocopy would do) wanted for the Xerox 7010 fax machine/telecopier; also parts for or a

scrap Xerox 1020 photocopier. Have for disposal, boxed and unused, a Leader LCG396 pattern generator (NTSC system). Any offers? Ian Harrison, 321 Old London Road, Hastings, East Sussex TN35 5BD. 01424 435 462.

**Wanted:** Circuit diagram for the Technics stereo amplifier Model SU8080. G. Cannon, 16 St Cuthbert's Road, Holy Cross, Wallsend, Tyne and Wear NE28 7JF. 01912 620 712.

**Wanted:** Complete drum motor assembly for the Fisher FVH-P716 VCR. Also a Sony power supply module, CD-09-520305 (part no. 1-464-217-11) as used in the SLC9UB. I. Mackintosh, 7 Wellington Court, Treardour Bay, Holyhead LL65 2LJ. 01407 860 864.

**Wanted:** Information on a 'Duke box', make NSM, Model CITY ES 160 ST. R.H. Lees, 58 Coxithill Road, St. Ninians, Stirling FK7 9HY. 01786 479 931.

**Wanted:** Manual or circuit diagram (photocopy will do) for the Osaki Explorer Model P10R. Also IC402 for this set – there is no type or part no stamped on it. Don Aird, 29 Leachkin Avenue, Inverness IV3 6LH. 01463 233 441 or fax 01463 243 224. I can provide copies of almost any *Trader* service sheet from the mid-Thirties to the early Seventies.

**Wanted:** HA11741 (7F3) servo motor controller or PCB for the Osaki VCR31. Also service data for the Ferguson 3V29 and Saisho CT142R. Could stat and return. Dennis Bowman, 52 Tomlin Avenue, Mirehouse, Whitehaven, Cumbria CA28 8BS. 01946 590 940.

**Wanted:** Help with a Matsui 1455. It's o.k. with an input of 100V: anything higher and the 125V h.t. leaps to 300V. Has anyone any information on the Philips Viewtext (viewdata) system? Jack McDonald, Mews Cottage, Pond

Lane, Clanfield, Waterlooville, Hants PO8 0RG. 01705 596 058.

**Wanted:** Circuit diagram (photocopy would do) for the Toshiba Model 145E7B. R.S. Emmett, 124 Heol Dulais, Birch Grove, Swansea, Glamorgan SA7 9LW. 01792 323 090.

**For disposal:** Early Murphy colour set with four tuning buttons on top and a blue cabinet, also various TV/video boards/chassis. Peter Shoreland, 5 Russell Way, Winnersh, Reading, Berks RG41 5SN. 01734 789 579.

**Wanted:** Circuit diagram for the Combi-99 decoder. Ron Bromley, 208 Canterbury Road, Leyton, London E10 6EH. 0181 556 4627.

**Wanted:** Set of field driver and output transistors for the Philips K12 chassis – BD291, BD292, BD327, BC337. A.S. Tagone, 210 Rochester Road, Chalk, Gravesend, Kent DA12 4TY. 0141 355 357.

**Wanted:** Back copies of *Television*, 1980-1992. Justin Smith, ATV, 4 Shenstone Road, Hillsborough, Sheffield S6 1SQ. 01142 854 254.

**Wanted:** Manual/circuit for the Samsung BT309K mono portable and the Philips CTX-E chassis (20in.). Also a suitable rotary tuner for the BT309K. Michael J. Levy, 19 Totternhoe Close, Kenton, Harrow, Middx HA3 0HS. 0181 907 3620.

**Wanted:** Encapsulated transformer or complete PSU panel for the Infotec 6155 fax machine. The transformer is marked HIT8702, N6016562, Lot no. F880802, Ricoh, Japan. Also any information of the Sony KTX9100UB Viewdata terminal with a view to conversion to RGB/composite video inputs. Andie Wilkes, 34 Tideswell Road, Great Barr, Birmingham B42 2DT. 01926 404 935 (day), 01216 050 720 (evenings).

**The Help Wanted column is intended 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.**

**SURVEILLANCE TELESCOPE** Superb Russian zoom telescope adjustable from 15x to 60x complete with metal tripod (impossible to use without this on the higher settings) 66mm lens, leather carrying case £149 ref BAR69

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# What *a Life!*

Donald Bullock recalls some of the troubles that beset him during the month

There had been thunder storms all day and the workshop was cold and damp. I'd just put my feet up and poured myself a smallish whisky when there was a frantic banging at the door. I went to answer it. My first mistake. It was Mr Snide.

"Hello Don. Got a bit of trouble with the old Philips telly. Can you open up the workshop?"

I nodded. My second mistake. Then we paddled off towards his car. As I did so he started to rub his back. "Got a bit of back trouble" he wheezed, "can you get it from the car?"

I struggled through a car full of old lumber, yanked the set out and took it back to the bench. Then he came out with his punch line.

"Do it if it comes to a tener or less."

For once I was too tired to straighten him out. Not that it mattered. I've been straightening out customers for over forty years. They're worse than ever now.

As he departed Greeneyes came in then started her vacuum cleaner up. That was all I needed. It crackled then emitted a cloud of dust and a nasty burning smell.

"Must have it" she said, yanking out the plug. I hate having to mess about with vacuum cleaners.

The mains lead was cooking where it had worn, as it enters the body of the cleaner. I had it done it no time. Then back to Mr Snide's set.

## **The Philips 2A, Part 1**

When I opened it up there was a 2A chassis inside. I plugged it in and got a pattern of sparklers at the front right. On closer examination I saw that it was damp – and smelt of gin. Several chopper circuit components had been the sparklers I'd seen. "Up to ten quid, eh?" I mused.

When Mr Snide called first thing next morning I pushed the set back to him. "Try Snoddies" I said. "They like to do these. I can't manage it at the moment." Well, it was one way of dealing with the situation.

## **The Mighty Grundig**

Then I looked about me and saw a huge white cabinet with a massive

tube. I struggled to get it on to the bench. Another mistake.

It was a Grundig set fitted with the CUC4620 chassis. This has seven large subpanels connected to it and two more panels slotted into the front. With no circuit diagram, and realising that I'd be little better off if I did, I peered through its spaghetti junction of pretty wiring and wondered whether I had any whisky left. "Be a man" urged a little voice in my mind. "Who, me?" I answered as I looked at the card.

"Was plugged in and on standby in a thunder storm" it said. "The mains supply flicked off then back on and the set died. Only the green 'on' LED lights."

There was voltage across the mains rectifier's reservoir capacitor, but there were no chopper circuit output voltages. Maybe there was a short-circuit across one of the outputs. I checked the line output stage, to no avail. Then I noticed a wad of ceramic resistors and decided that it would be easier to check these than try to think. They were all o.k. Oh dear. I wished I had stayed at that local newspaper job all those years ago. But I didn't. Time to face up to the chopper circuit.

I checked the chopper transistor, which was o.k. Then I went on to check the rest of the components. Some time later I'd cleared everything except the TDA4601 chopper control chip IC631. I replaced it, counted the remaining stock, then reached for the variac and the waste bin.

I switched on gingerly and wound up the variac's output by degrees. Suddenly four thumps shook the room and a raster came up before I could dive for cover. I plugged in an aerial feed and breathed a sigh of relief. "That wasn't too bad, was it?" coaxed a fat, cross-eyed lady on the screen.

## **Richard's Colour Portable**

As I boxed the Grundig set up I noticed that Richard Renton had sidled in. He was standing at the counter looking down.

"It's gone all red" he protested about the Toshiba 143R4BR portable he'd

brought in. I looked at the door and off he went.

I plugged in the set which wasn't red, it was dead. But I don't mind working on this model. It's a tidy, well planned set. I went straight for R801, the 6-2Ω ceramic resistor in the power supply. It was open-circuit. When I replaced it the set, to my surprise, came on fully: it should have come on in standby. Then I noticed that my nice new 6-2Ω resistor was glowing like a hot poker.

The thing to check was the over-voltage protection diode D808, which was short-circuit. So I replaced it then turned to C813, a 47μF, 50V electrolytic capacitor that's connected to pin 2 of the STR50020 chopper regulator chip. You sometimes find that it has gone low in value, triggering such troubles. But it was all right this time.

I connected the set to the mains via the variac and wound up the input. At 100V the ammeter needle shot over and the over-voltage diode said goodbye. As I was fitting a replacement Richard Renton returned.

"Oh, Mr Butcher. . ." he began. "Hang about" I replied.

I took out the STR50020 chip and found that it was short-circuit. After fitting a replacement I gingerly wound the set up again. This time it came on in standby. When I switched on there was a picture, but it was red. I noticed that the tube base was slightly askew.

"That's the fault" he volunteered as I pushed the base on properly. "Oh, you've cured it. Wasn't much, was it?"

Incidentally Toshiba is the only major manufacturer I know of that still gives technical help to non-dealers. What's more, the engineers are cheerful, polite and eager to help. They usually can, knowing their sets well. We don't sell new TVs now, but if we did we'd be after a Toshiba agency. We recommend the company's sets whenever a customer decides it's time to buy a new one.

## **An Amstrad CTV2210**

Our next customer was Timothy Tapworth. He had an Amstrad

CTV2210 in his arms. "Oh no!" I cried. But I like Tim, so I decided to look at his set while he waited.

It was dead. Fuse F502, which lives – and dies – in the centre back of the chassis, was blackened. I took out the 2SC3156 chopper transistor for test, without much hope. But it was faulty, a new one restoring the set to life. The picture was excellent.

"Wonderful" shouted Tim, pulling out his wallet. "'S nothing" I said, "fifteen". He dropped a couple of coins on to his fivers. "Have a drink" he said.

He went off, leaving me happy. Then a dark cloud came along. It was Mr Snide, clutching his Philips telly, the one with the 2A chassis. I was unhappy again.

### **The Philips 2A, Part 2**

"Did what you said Don. Took it to Snoddies. They've got a new engineer, a Mr Bathwater. He tried, but couldn't fix it. They said they'd put a lot of stuff in but it still blows the fuse at switch on. Charged me thirty five quid. When I complained the tall chap with the rotten teeth got nasty, so I paid. Will you have a go? Forget the ten quid bit."

I felt sorry for Snide this time, and curious about his set. So I offered to have a look at it. Sure enough Snoddies had dried out the chassis and replaced several components – the mains fuse, the line output transistor and a number of items on the primary side of the power supply, including the BUT11 chopper transistor, C2664 (1.5nF, 1kV) which often splits, transistors 7685 and 7686, the CNX62 optocoupler, all the diodes and a lot of resistors. Every other component had been unsoldered and tested, and the chopper transformer had been taken out. They'd then moved to the secondary side of the circuit, where the tale was similar.

I studied the chassis, looking for unintentional shorts or cracks, but couldn't find any. The soldering was awful and lumpy, and the print covered with old flux. So I got to work with solder braid, tidied up the soldering and cleaned off the flux. Then I studied the bench, swept the floor and thought about coffee. But I couldn't put it off any longer.

After fitting a new 2A fuse I started the set up gradually via the variac. The fuse blew almost immediately. I disconnected the load from the mains bridge rectifiers, leaving the reservoir capacitor C2659 connected. When I tried again the fuse remained intact and there was 300V across C2659. This cleared the input circuitry. I next set out to clear the line timebase by disconnecting the supply to it and

loading the h.t. line with a 100W bulb. On my next try the lamp lit brightly for a split second then the fuse blew violently. I replaced the chopper transformer, but this made no difference. At any rate I'd established that the cause of the trouble was on the primary side of the circuit.

I decided to check the transistors first. They were all of the right type and good. Then I checked the diodes similarly. I turned to the capacitors, checking each one for leakage and capacitance value. I still couldn't find anything wrong.

Short of something really odd, this left only the resistors. Most were new, and none looked discoloured. But there was nothing for it but to check each one. I found the cause of the trouble when I got to R3666. It should have been 1.5Ω but was actually 15Ω! I studied it and realised what had happened. The replacement that had been fitted was colour coded brown, green, black, plus the tolerance band. It should have been brown and green plus the tolerance band. Fitting the correct value restored the set to perfect operation. An easy mistake to make, especially as a chap becomes increasingly disorientated by a tricky repair. For once I almost felt sorry for Snoddies. I also wondered how poor Mr Bathwater would fare in his new job.

Then I thought of the time I'd spent on Mr Snide's set, and wondered how much to charge him in the circumstances. Then I thought of me, and wondered how on earth I'd managed to become a TV repairman.

### **Variac Tip**

Incidentally when I made up my variac I took a tip or two from Richard Pollock. I've mentioned him before – he's retired now and lives close by. He housed his in a wooden case, and included in series with it an old Ferguson 2A mechanical cutout (as used in the 3000 series chassis). This trips in the event of an overload. He also fitted amp and volt meters, so that he can monitor the voltage applied and the current consumption as the variac's setting is advanced. I wired mine up similarly.

The trouble with a chopper power supply is that it won't normally come to life until the variac's output has reached about 100V. The primary side of the circuit then starts up and, if there's a short-circuit on the secondary side, current is drawn suddenly and heavily. This is where the 2A cutout comes in. Often the cause of the trouble is in the primary side of the circuit however: in this case the variac can be very helpful.

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# VCR CLINIC

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## Ferguson FV72

If the machine takes in a tape but the threading poles move only slightly then stop, suspect that the main cam has lost a tooth. The Ferguson part number is 20086520. **P.B.**

## Grundig VS340

For intermittent or complete loss of the control track signals, check for dry-joints where the cables connect to the audio/control/erase head. **P.B.**

## Mitsubishi HSB12

There was no play, and no counting in the fast-wind modes. A look at the deck showed that the tape wasn't being loaded correctly: the half-loading arm was jammed by the soft-brake arm on the take-up side, and as a result didn't take the tape around the audio/control head – hence no counter. The pad on the end of the soft-brake arm had fallen off, leaving the arm in the wrong place all the time. As the arm was o.k. and the pad was lying by the take-up reel disc we decided to stick it back on. The machine then worked perfectly. **C.W.**

## Amstrad TVR3

The strange report with this VCR/TV set combination read "plays films in green though the TV pictures are all right". Sure enough, this was so. After some contemplation we decided to replace HIC101 (1812421), which restored normal colour in all modes. The CPC part code is AM152030. **C.W.**

## Ferguson FV31

This machine carried out all functions except stop. Playback and record were fine, but when stop was selected the machine might carry out any function. It would sometimes switch off, and at other times perhaps go into reverse picture search. If a cassette was loaded and the machine was left in the stop mode, it might set off by itself after a while. A replacement HD614081S microcontroller chip cured the fault. We later learnt that

the fault had started after a storm during which the power supply to the house had been struck. **C.W.**

## Samsung SI1260

There were no deck functions. The usual cause of this is loss of the power supply to the motor and servo sections because D112 (1N4001) has failed. Experience has shown that to ensure reliability it's wise to replace D108, D109, D110 and D123 as well. They are all type 1N4001 and are on the main, not the power supply, panel. **C.W.**

## General VGX520

This machine worked well in the E-E mode, but when playback was tried the colour was present for only about five seconds after which the picture became black-and-white. Call it intuition if you will, but I suspected the power supply and was rewarded when the colour returned for a few seconds after a shot of freezer on capacitors C1002 and C1003. Replacing these two 47µF capacitors restored good pictures in all modes, but as I was in the mood I decided to replace all the electrolytics on the board. Perhaps the machine will still be going in the next century! **C.W.**

## Matsui VX2000Y

As these machines have no fast wind buttons you need the handset for servicing. This one came in without the handset. The faults were noisy fast winding and an intermittently wobbly playback picture. The fast wind groaning was caused by a noisy capstan motor. Dismantling it then cleaning and lubricating the bearing cured that – there was a huge amount of sticky mess in there. Back-tension arm oscillation was the cause of the wobbly playback. This was in turn caused by dirt on the tension band pad. Cleaning sufficed. **N.B.**

## Sanyo VHR3100

This machine had been elsewhere. Its power and eject buttons didn't work.

Everything else did – there's a power button on the remote control handset. But there was no remote eject.

The two buttons are on a separate PCB from the timer and all the other buttons. They share it with the tracking control, which worked. The cause of the problem was lack of an earth connection to the two switches: the print was intact, but the lead that should have earthed the area to the mechanism was loose inside the unit. It should have been screwed to the top of the cassette carriage. **N.B.**

## Panasonic NVJ40/2/5/7/F55

No output is a very common problem with the handsets that come with these machines. The display lights up, the bar scanner works but there are no IR commands. The cause is simple: the IR output LED goes open-circuit or high resistance (causing poor range). Spares for the units are available, despite the absence of a list in most of the service manuals. The part number for the LED is SE303ACY: it costs about a pound. Being complex, replacement handsets are extremely expensive. So repair is by far the best idea. **N.B.**

## Ferguson 3V57

This machine was completely dead: no functions, no clock, no nothing! When we measured the power supply outputs at CN3 we found that the unswitched 12V and 17V outputs were o.k. at pins 7 and 8. But there were no switched output voltages – pins 1 and 2 should be at 5V and 12V respectively. As a check, take pin 9 (labelled P CTL IN) of CN3 low: the switched voltages should then appear.

In this case they did. So over to the microcontroller board, where the 5V supply was missing at pin 32 of the chip. This is derived from the unswitched 12V rail via TR201 (BC337), which was open-circuit.

After replacing it the clock worked but the machine still wouldn't power

up when asked. Over next to the servo/MDA section, where IC607 (M50730-610SP) had no 5V supply at pin 52. This time Q602 (2SD638 – use a BC639) was open-circuit. The machine worked normally when this had been replaced.

The common denominator was the unswitched 12V supply, but a check on the components here proved fruitless. No further problems arose during the soak test. **S.L.**

### Amstrad VCR9140

Intermittent mains fuse failure was the complaint with this recent machine. We failed to find any contributory cause. As its F200mA value seemed to be very low, we checked with Amstrad technical who told us that it has been upgraded to T500mA. **S.L.**

### Hitachi VTF770

A defective capstan motor is usually the cause of failure of the 1.6A delay fuse in the power supply at intervals varying from days to weeks. There may be other symptoms, perhaps a screech or roar during loading, eject or fast tape transport. **E.T.**

### Goodmans GVR4500

Although these machines are relative strangers to us, we've recently had two with the same puzzling symptom: intermittent failure to load a tape, followed by reversion to the standby mode. In both cases we found that the loading motor spindle was turning inside the hollow worm shaft, which had cracked and thus loosened its grip on the spindle. **E.T.**

### Akura VX140

This machine wouldn't accept tapes fully: they would go in partially then come back out again. The cassette flap releaser was missing. The cure was to replace the 'lift slide holder assembly'. **G.S.**

### Nokia VR3615

The picture was intermittently too bright. On checking the video waveform at the input to the modulator I found that it was producing over-modulation. The cause of the fault was traced to a damaged solder pad at the bias feed resistor R189, which is connected to the video buffer transistor Q181. Normal operation was restored by repairing a small piece of print. **G.S.**

### Samsung VIK326

This machine wouldn't tune in any channels: it searched for stations but wouldn't find any. When I checked the i.f. output from the tuner during

search I found a reasonable signal as the tuner passed through the station, but there was no output from pin 13 of IC401. Replacing this chip cured the fault. **G.S.**

### Panasonic NVG21

This machine was dead with no functions. When I checked the power supply outputs I found that the regulated 5V and 6V supplies were far too low. Replacing the STR5338 regulator chip restored normal operation. **G.S.**

### Nokia VR3615

This machine wouldn't come out of standby and wouldn't accept tapes. At switch on the drum and capstan started but the loading motor didn't shuffle. The power supply outputs were all present and correct, but when a check was made at pin 8 (V ref) of the loading motor drive chip IC602 the reading was very low. It should be around 8V. Zener diode D607 was found to be virtually short-circuit, a replacement restoring normal operation. **G.S.**

### Samsung VI375

This machine was dead with no clock and no functions. Checks in the power supply showed that IC101 (STR11006) was short-circuit, R101 open-circuit and ZD101 short-circuit. As ZD101 provides over-voltage protection, it seemed that the power supply outputs had gone high before these various items failed. The culprit was C110 (100µF) which had fallen in value to around 10µF. **G.S.**

### Nokia VR3615

This machine wouldn't tune in any channels. When the tuner's VT input was checked during search a ripple was seen to be present – and the search wouldn't go below 12V. A check on the PWM output from the microcontroller chip showed that this was noisy, irregular and erratic. I then noticed the presence of discoloured manufacturer's flux in this area. After treating the area with PCB cleaner the machine worked normally. **G.S.**

### Samsung VIK326

There were no functions with this machine, which wouldn't come out of standby. A check in the power supply showed that the ALL 5.8V supply wasn't being smoothed. Replacing C35 and C36 cured this smoothing problem, after which the machine worked normally. **G.S.**

### Samsung SI3240

When the power button was pressed the channel number failed to light up and the machine wouldn't accept a

tape. The cure is to replace the lift right-hand side and align the mechanism. **R.B.**

### Sanyo VHR7250

At switch on this machine wouldn't accept a tape and the drum failed to turn. Checks in the power supply showed that the always 13V output was low. The cause was a dry-joint at D5107. **R.B.**

### Nokia VR3761

This machine wouldn't come out of standby. When the switched power supplies were checked we found that there was no switched 5V output. Q5402 (2SC4484S) was found to be short-circuit base-to-emitter, a replacement restoring normal operation. **R.B.**

### Panasonic NVFS100

There were snowy E-E and r.f.-r.f. outputs and no reel counter operation. Voltage checks at plug P1101 in the power supply showed that the non-switched 12V output at pin 1 was missing. Q1102 was found to be open-circuit base-to-emitter. **R.B.**

### Nokia VR3783

There was a loud tone during playback and an intermittent tone was recorded. The cure was to refit the full erase head to the audio/control head PCB. **R.B.**

### Sanyo VHR244

There was no record colour with this machine. A check on oscillator X1001 showed that it wasn't running. Replacing the crystal cured the fault. **R.B.**

### Philips VR7225 Turbo

This machine's lift didn't work. Tests showed that the gear which operates the lift was slipping on its shaft. The assembly forms part of the worm gear on top of the deck, and is driven from the main cam. Order kit A and you get a worm gear plus cassette drive gear and main cam. Fitting these parts and retiming the lift in accordance with the instructions in the manual produced perfect results. **R.N.**

### Philips VR6185

The customer had got a tape stuck in this machine. Instead of calling me first, he took the top off and used a knife to get the cassette out. When I looked at the machine the lift was lying loose inside together with the remains of lever arm 238. According to the customer there had been intermittent picture rolling for some time, then the machine had continuously ejected tapes. The problem tape got

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stuck when he had physically blocked the cassette opening by holding the cassette down while the machine was trying to eject it. In spite of all this mistreatment, the rest of the mechanism seemed to be in reasonable order.

The cause of the rolling picture was a disintegrated pinch roller. After splitting the deck and fitting a replacement and a new lever arm, then reassembling everything, I found that the deck seemed to work when run with a d.c. supply to the loading motor. But when a tape was tried it was immediately ejected. The service mode indicated that there were no capstan pulses. As the capstan was turning, I decided to check the sensor. Once again the deck was split, and when the sensor panel was removed one of the sensor's leads was seen to be adrift. On putting this right and reassembling the deck I found that the machine now worked mechanically.

My problems were not over however, as the customer had fiddled with the sync head. In fact he'd tightened the screws to the extent that the base of the head was bent. I had to fit a new head and set it up.

So the original faults had been a worn pinch roller and a lead off the capstan sensor. What should have been a half-hour job had taken almost three hours. **R.N.**

### Philips VR6462

The 330µF, 16V capacitors used extensively in this and other Philips VCRs seem to fail quite often, usually going short-circuit. The complaint I had with one machine that came in recently was no sound. C2007 on the audio panel had gone short-circuit. **R.N.**

### Hitachi VT19

During playback the capstan would, after a while, gradually slow down, with slurred sound and cyclic tracking bars. The symptoms were similar to those produced by lack of control pulses because of a worn or dirty ACE head. Eventually the capstan would stop, followed by the tape unloading into the stop mode. In the fault condition there was a healthy 12V at one side of the posistor (PH1151 - 4R7) that supplies the capstan drive chip, but the voltage at the output side dropped rapidly. When it reached 4V the capstan stopped. The PTC was very hot to touch. Fortunately a replacement cured the fault. **J.E.**

### Matsui VCP550

This machine is actually made by GoldStar, the same mechanism being

used in that company's models, in particular the RC703L. The half-load arm can cause several faults. This particular machine failed to load the tape to the audio/control head and the capstan shaft. A previous engineer had thought that the capstan motor was faulty and had replaced it. The cause of the fault was much simpler: the half-load arm had gone out of mesh with the lever gear. Realignment put matters right. **M.M.**

### Toshiba V213

The power and rewind buttons on the front of this machine didn't work, though these functions could be controlled by the remote control handset. I found that pins 1 and 3 of BK05 on the front panel PCB were bridged. Resoldering them cured the fault. **M.M.**

### Logic VR955/Samsung V1710

This machine wouldn't record. Checks showed that there was no record 9V supply because Q110 was open-circuit. This was in turn caused by bias coil L504 having gone short-circuit. Replacing these items, also an idler and the pinch roller, restored correct operation of the machine. **M.M.**

### JVC HRD830

The mechanism would jam when loading. On investigation we found that the brass shaft on which the control cam rotates had risen slightly. As a result the cam rose and jammed on the half-load gear. The solution is to push the shaft back down, using the back of a screwdriver. A click will often be heard as the shaft goes back into place. **M.M.**

### Sharp VC750

This machine's mechanism kept jamming. The cause was the loading gears which were worn. They would jump a tooth, particularly when unlacing. As a result the back-tension arm fouled the movement of the supply guides. Fitting replacement gears cured the trouble. **M.M.**

### Philips VR522

This machine was jammed. A field engineer had removed the tape, only to find that the entry guide had parted company with the load arm. Refitting was all that was necessary - a quick and easy repair for a change. **M.M.**

### Sanyo VHR190E

A common fault with this Sanyo model and its clones is mechanism lock-up, i.e. intermittent failure to

accept a tape. The cause is usually the mode switch, Sanyo part number 613 1100 374. Note that carriage replacement should be done in the down position. **M.M.**

### Ferguson FV74L

A buzz on sound was the complaint with this machine - but only during playback of its own recordings. E-E and prerecorded tape playback were fine. The cause of the fault was that the recorded video level was too high: slight adjustment of the deviation control PV04 cured the buzz. **M.M.**

### Matsui VX990

This old timer had two faults that initially appeared to be unrelated: there was loss of playback colour and wow and flutter on the sound. Investigation revealed that there was excessive ripple across C08 in the power supply. A replacement cured both symptoms. **M.M.**

### B and O VHS63\*

Playback with this Philips clone was marred by the fact that all vertical lines were affected by what appeared to be a hum bar. But it wasn't a hum bar: there were approximately six cycles per frame! Neither the f.m. envelope nor the video signal provided a clue, but a check on the drum motor's connection revealed massive spikes. The fault was cured by replacing the lower drum. **M.M.**

### Ferguson FV32L

The reported fault was incorrect tracking. When we tested the machine we found that playback of its own recordings was poor. Replacement of the upper drum produced little improvement, but replacing the lower drum cured the fault. **M.M.**

### Sanyo VHR350E

This machine had an intermittently low gain tuner. Fortunately all that was wrong was some dry-joints in the tuner can. We dealt with these then gave the machine a long soak test. This proved that the fault had been cured. **M.M.**

### Panasonic NVL28

Intermittent failure to record or play and tape chewing were the complaints with this machine. On inspection I found that arm P5 was sticking on its post. It would sometimes fail to go into the fully eject position, thereby catching the tape. At other times it wouldn't pick up the tape and take it past the capstan shaft. Lubricating the shaft and arm cured the trouble. **M.M.**

\* = Philips  
VR6462



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\*System specification as detailed above

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# Satellite Notebook

**Satellite  
equipment  
servicing  
experiences  
related by  
Hugh Cocks**

## Lightning Damage

The winter storms have been causing us the usual problems. Here in Portugal the rain comes as either a full tropical downpour or nothing at all. Such downpours don't enhance satellite TV signals, and the mains supply starts to fluctuate. We try to encourage our customers to disconnect their equipment from the mains whenever this happens.

We had a call for help with a Pace SS9000 receiver one morning after a storm, the complaint being that the red light failed to appear. When we opened the receiver up we found that, as usual, the mains fuse was blackened. Checks showed that the chopper transistor and transformer were o.k. The culprit turned out to be the mains bridge rectifier's 47µF, 400V reservoir capacitor C7. It was dead short-circuit, though the diodes were all right. A replacement restored normal operation: nothing else in the house seemed to have been affected, though the storm was apparently very close by.

The man who brought in a damaged SS9200 one morning commented that "it smells of burning". Very true! R324 (4.7Ω) had totally disintegrated, leaving a black scar on the PCB. It lives behind Q2, on the front right-hand top side of the board and is part of the LNB supply. Replacement restored normal results, which was lucky. The rest of the equipment was not so fortunate however. Outside, a 2m fixed metal dish lives on an exposed hillside. It feeds two houses via around 50m of coaxial cable and two line amplifiers. The LNB and the line amplifiers had died, but the second receiver, which is a Connexions IRD, had survived.

As the owner wasn't keen on the idea of moving the dish we suggested a good earth from the mount to ground (it's fixed in concrete) and possibly fitting a well earthed metal pole higher than the dish and a little distance off to attract any strike away from the dish.

Both receivers had 2GHz tuners. So an Astra 1D LNB and a couple of 2GHz line amplifiers were fitted as replacements. All channels had to be retuned by 250MHz of course, which the owner was keen to do himself. In this situation we give customers a channel printout with the old and new frequencies – it

saves on mental arithmetic if nothing else!

## An Echostar SRI500

The owner of this receiver was a Swiss gentleman who had lost his Swiss radio international feed on the Kabel 1 channel (11.332GHz horizontal) since this had transferred back from Astra 1C to 1A – we don't receive the 1A horizontal channels here. Fortunately the feed is doubled on the Teleclub transponder via 1D (10.803GHz horizontal) and a 1D converter worked well.

This receiver has independent 13/17V polarisation switching and a magnetic polarotor output, the latter not being used here. Adding a 390Ω resistor across the polarotor output produced a smoothly varying voltage when the skew buttons were pressed. We connected the 1D converter's switching lead to the power polarotor terminal – the voltage swing was better here than at the upper one. The converter could then be switched in and out automatically, depending on the 'skew'. The latter is memorised on a per-channel basis.

While we were working on the receiver the picture started to come and go. It transpired that one terminal of the video gain preset VR101 had never been soldered properly.

## Amstrad SRD600

A Norwegian customer rang us. He'd bought this receiver secondhand in Norway and wanted it to be installed with suitable dishes for Astra and Intelsat at 1°W (for the Norwegian channels). The receiver has Eurocrypt and VideoCrypt decoders and two card slots. A vaguely annoying feature is that if you tune in a VideoCrypt channel with Eurocrypt MAC cards in both slots "Your Card is Invalid" is displayed on the screen: the decoders look for their own type of card in the relevant slots.

After installing separate dishes I received good signals from both satellites (the receiver has two inputs, but requires a converter to cope with Astra 1D). But hard though I tried NRK in DMAC couldn't be decoded, though the Norwegian TV2 and TV3 were o.k. with their respective cards. A manual would have helped!

After a lot of fruitless effort I suddenly found that NRK would appear if it was tuned in on any of the receiver's last few channels (99 and down). These are easily reached by going below one on the remote control unit. In due course I obtained the instructions (in English, fortunately) but there was no reference to this.

## The Pace MSS100

This model seems to have poorer sound sensitivity than previous Pace receivers: if the picture is at all weak, the sound quality deteriorates rapidly. Since most of the BBC radio channels are carried on UK Gold, this is a problem for us here in Portugal – from about 10 p.m. the UK Gold signal rapidly drops in strength, coming back by the morning. Astra 1B always seems to have had a bit of a 'wobble' – other 1B channels are similarly affected.

I noticed that in mono the 7.02 and 7.92MHz subcarriers are much better than those in between (7.38, 7.56 and 7.74MHz), which must mean that these are being degraded by the adjacent signals, the 7.02 and 7.92 carriers having a neighbour on only one side. So the bandwidth could be a little too wide. An inspection of the block diagram showed that the signal enters at pin 23 of U500 for audio demodulation using a phase-locked loop system. It occurred to me that the loop bandwidth might be a little wide, and that reducing the signal input at pin 23 might help.

Some experimentation showed that an 82pF capacitor to chassis (the best chassis connection is at pin 19) gives improved results, also good wider bandwidth Eutelsat audio with the other audio bandwidth settings. You start to get scratchy audio quality when the value is increased to 120pF or above.

Whilst on the subject of the MSS100, don't drop one! A customer managed to do this recently. The case and the PCB survived all right but the core of the chopper transformer cracked. In this state the receiver worked for about ten minutes then shut down. Cooling it down would give you another ten minutes' operation – together with a pattern on the picture and overheating rectifier diodes.



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IT3548	16.99	KV2752	16.99	LA7522	4.99	STK5466	8.50	TEA2018A	2.00	UCP1310	8.00
IT2613	16.99	KV2756	16.99	LA7800	1.80	STK5471	4.99	TEA2028C	4.00	UCP1355	4.00
IT3306	16.99	KV2756	16.99	LA7801	1.95	STK5476	6.99	TEA2164	3.00	UCP1318	4.00
IT3325	16.99	KV2756	16.99	LA7802	1.80	STK5476	6.99	TEA2165	4.00	UCP1363	3.00
IT3835	16.99	KV2756	16.99	LA7820	3.50	STK5482	4.99	TD1044	2.50	UCP1364	4.00
IT3487	16.99	KV2756	16.99	LA7830	1.99	STK5490	5.50	TD1082	5.50	UCP136	

# Long-distance Television

**A review of DX-TV conditions and reception, with satellite news and sightings. Meteor scatter reception and main shower dates for 1996. Will Remoteless Key Entry be another source of unwanted interference? Roger Bunney reports**

November into early December 1995 was again a very quiet period for long-distance signal propagation. The Leonids meteor shower in mid-November failed to produce any reports of signal loggings. It's quite common however for conditions to be quiet at this time of the year.

Something that will bring a chill to TV-DXers is the fact that two blocks of Band I spectrum have been released for mobile radio use, 62.7-63.4MHz for base stations and 55.7-56.4MHz for mobile units. These frequencies coincide with ch. E4 and E3 respectively. Diplomat Communications Systems Ltd., a UK manufacturer, has already produced a full-function 25W radio for use at these frequencies.

A check on the letters I received during the month shows that there were reports of Sporadic E reception on only two days, November 5th

when Canal Plus ch. L2 was received mid-morning and the following day when TVE (Spain) chs. E2-4 were received at lunchtime.

A long letter from Stathis Panagiotidis (Thessaloniki, Greece) provides details of Band I activity in his area. His local signals are now all delivered in Band III or at u.h.f., though he can receive weak signals from a ch. E4 transmitter in Macedonia. A private Greek channel, Sky TV, uses ch. E3 in Athens while ET-1 is transmitted on ch. E3 from atop the Akarnanika mountain in the Patrai region. Seven Band III channels are in use in Thessaloniki, where at u.h.f. only chs. E36 and 61 are not in use – all the other channels carry programmes from private operators, satellite channel relays or religious offerings. With the exception of Filmnet on ch. E21 these are all in the clear.

## Satellite Sightings

Nicholas Earley reports that Ku band signals from the recently launched Japanese JcSAT-3 craft at 128°E have been received in New South Wales using a 3m dish and a low-threshold Palcom receiver. It seems that a 3.7m dish at least will be required for Ku band reception in eastern Australia. Launch of the AsiaSat-2 craft into orbit at 105.5°E is imminent: it should provide C band signals at 33dBW in New Zealand and at 37dBW in the eastern Mediterranean area. The satellite's Ku band coverage is much more restricted, being aimed at China and Mongolia.

Julian Redwood (Christchurch) watched excellent feeds of the Shuttle

landing from satellites "all over the place" on November 20th. He has been busy with modifications to the inductors inside his satellite receiver's tuner to achieve improved C band reception. As a result he now receives signals from Arabsat 1D at 20°E just above the noise, using a 1.8m dish. He says he is unable to pass on his modifications since there is "a fine line between improvement and total disaster"!

The UKI-34 Sky TV team parked outside 25 Cromwell Street, Gloucester at the end of the Rose West case, on November 23rd, its report being sent back via Eutelsat II F3 at 16°E. This satellite has produced other interesting signals. From 1700 onwards on November 18th there was an Algerian offering at 11.634GHz (horizontal) in addition to the usual 11.678GHz network programme. It consisted of a PM5544 test card with the identifications 'ALGERIA' at the top and 'CIP ENTV' at the bottom. There was no programme material. Romanian International was present for several days at 11.575GHz (horizontal) with 'probe tehnic' – I assume that this means a technical probe or test. The signal, transmitted during the evening, was very strong. Nag and pony-trap racing continue at 12.560GHz (horizontal) during the daytime and early evening – some of the events are scrambled.

Alan Smith has recently returned to Thailand, where he found that band C signals are now available from PAS-4 at 68.5°E. He's seen no Ku band signals, though these are received in Europe from the satellite's western

*The opening caption for cattle market auctions often seen in the early morning via Eutelsat II F3 at 16°E.*



spot beam. Presumably the beam is too well defined, with few sidelobes.

The 11.131, 11.170 and 11.470GHz (horizontal) transponders aboard Eutelsat 1 F4 at 25.5°E were used for the remote-studio links during the live Police Action programme on November 18th.

John Locker (Wirral) was perhaps the first person to have received signals from Astra 1E, while it was parked at 14.5°E on test. He received the 60dBW DBS output at 11.750 and 12GHz on November 4th. John has also been monitoring Ku band signals from the PAS-4 satellite at 68.5°E. PAS-4 is only about two degrees above the horizon at his location and is between trees – signal levels have improved since the leaves fell.

Intelsat 601 at 27.5°W often carries French horse racing on Saturdays, continuing well into the evening. Check at 11.053GHz (horizontal), the French commentary being at 6.6MHz.

### News Items

**UK:** Residents of the Isle of Dogs, London have lost their case at the court of appeal against the developers of Canary Wharf. They were claiming compensation for loss of quality TV reception as a result of the construction of the building. The matter may be taken to the House of Lords.

**Hungary:** A new broadcasting bill will release all channels previously used by the Russian army. They will be used for a third independent commercial network. The MTV-2 network is to be leased for independent operation for a franchise

period of ten years.

**USA:** A high-definition TV station, location at present unknown, is expected to open later this year, providing picture quality similar to 35mm cinema film. The consortium backing it includes NAB and other broadcasting organisations, also equipment manufacturers.

**France:** ARTE is now transmitting Nicam stereo sound in the Paris and Strasbourg areas, with French and German audio subcarriers. The service is being extended to other areas.

### RKE Interference

The December 1995 issue of the RSGB magazine *Radcom* contained interesting information on interference from the Remote Keyless Entry (RKE) systems used to control vehicle central locking/alarms. These systems use either infra red or u.h.f. for transmission. Units that use u.h.f. transmit at 433.92MHz, with no more than 2nW, though in practice three times this level has been measured. This is sufficient to swamp amateur radio equipment operating at 70cm, while the transmitters can saturate, immobilising the RKE function. RKE receiver input selectivity is often minimal, the bandwidth approaching several MHz. This presents a problem where amateur repeaters operate across the RKE channel. There are many diverse and subtle sources of interference these days!

### MS Reception

Random meteor activity is experienced throughout each day,

## 1996 Meteor Showers

Our thanks to Neil Bone, director of the Meteor Section of the British Astronomical Association, for the following meteor shower list for the year:

Lyrids	April 15-25th, peaking on the 21-22nd.
May Aquarids	April 24th-May 20th, peaking on May 4th.
Cetids	May 7th-June 9th, peaking on May 14-25th.
Delta Aquarids	July 15th-August 20th, peaking on July 28-29th and August 6-7th.
Perseids	July 23rd-August 20th, peaking on August 11-13th.
Orionids	October 16-27th, peaking on the 20-22nd.
Taurids	October 20th-November 30th, peaking on October 31st-November 5th.
Leonids	November 15-20th, peaking on the 17-18th.
Geminids	December 7-16th, peaking on the 13-14th.

Those with long memories may recall the very intense Leonids meteor shower back in 1966. I experienced part of this event late one November morning, when the signals present across Band I resembled the conditions during a summertime SpE opening! Another major storm is expected in either 1998 or 1999. Leonids activity could increase considerably over the next two years: it might be worthwhile checking on November 17th this year at 1000 hours give or take a few hours.

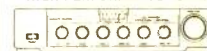


when small particles of space debris burn up in the E layer. The burn up produces an ionised trail that can reflect Band I signals for a brief period – seldom more than a few seconds. If you are lucky enough to be tuned to a Band I channel exactly you may see a TV picture flash. When test cards were transmitted for most of the day identification of the signal source was relatively simple. Now, with 24-hour programming in so many countries, identification of the

**A test pattern transmitted via Orion Atlantic at 37.5°W prior to a news feed.**

## NEW PRODUCTS

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**A Romanian International TV service test transmission seen via Eutelsat II F3 at 16°E.**

signal source can be extremely difficult – if not impossible. The ionisation can last for up to thirty seconds with an intense trail, sufficient to produce signal reflection as high as Band III.

At predicted times – see box on previous page – clouds of space debris are encountered by the earth. These meteor showers can produce quite dramatic reception across the

Band I channels. Single-hop signal reflection distances are similar to those with SpE propagation in mid-summer, i.e. 500-1,200 miles. Double-hop reflection via MS has never been reported.

Advances in low-noise tuner front-end design make Band III MS reception possible, given an efficient aerial, a low-noise head amplifier and a receiver with a narrow i.f. bandwidth, tuned in accurately and with quick-synchronising timebases. MS DXing requires time and great patience however!

#### Satellite TV News

Good news for UK satellite enthusiasts: the Orion Satellite Corporation has been given permission to position Orion 2 at 12°W. It will provide transatlantic communications between the US mid-West and Europe as far as Moscow and beyond, also Africa. Thirty two Ku band transponders will be available during the satellite's prospective thirteen-year life. One user of Orion 2 could be Associated Newspapers, for its Channel One and Performance cable TV channels – negotiations are currently being held with both Orion and Eutelsat.

Italian Pay-TV operator Telepiu is now transmitting MPEG-2 digital TV via Eutelsat II F1 at 12.542GHz (vertical) for demonstration purposes. It has reserved four transponders aboard Hot Bird 2, which is due for launch in August.

France Telecom is to adopt Wegener audio for the TF1 and France 2 services via Telecom 2B at 5°W (7.02/7.20MHz), dropping the J17 standard.

The Indian Insat 2C satellite should now be operational, following its end-November launch, with twelve C band transponders giving coverage across SE Asia and the Middle East.

The South African Broadcasting Corporation (SABC) plans to launch fourteen digital satellite TV channels via four transponders aboard the PAS-4 satellite. Services could start this summer.

There have been receiving equipment problems with the Australian Galaxy direct-to-home pay-TV service. Although many people have installed dishes and other hardware over the last ten months, there has been a lack of MPEG decoders. According to a newspaper report most of the decoders in the first consignment were returned, one problem being a very long lock-up time – in excess of ten seconds. This would be no good for channel hopping!

European hackers claim to have cracked the AFRTS B-MAC encryption system after gaining access to ex-Gulf war surplus decoders. Strange to relate, while I was reading through a surplus broadcast equipment sales list from a London company last August I noticed a Scientific Atlanta B-MAC decoder at £50 plus VAT! ■

#### THE SATELLITE NEWSLINE (VOICE)

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Updated at least once a day this Newsline is available 24 hours a day, 7 days a week with all the very latest news in the satellite world including: New Channel Launches; The latest Scams and Cons; New Products and Services; The Latest Rumours and Issues; Adult Viewing – What's Going On. Simply call the number and listen to today's News.

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## Answer to Test Case 398

– see page 259 –

The serviceman's lot is not a happy one! By the time that Ray, with a little help from his friends, had got to the bottom of the trouble with the Sharp VC787 it had been on his bench for nearly three unpaid hours. But such is life at the bench.

The culprit was found on the opposite side of the deck from where all the testing and investigation had taken place. Close inspection of the tape motion in the LP mode revealed that it juddered somewhat during its passage between the drum exit guide and the audio head. These fluctuations corresponded with that of the sound. The LP playback picture also had a slight wobble/judder effect at the same rate and – this was the vital clue – the back-tension regulator arm and lever were juddering in the same way. A back-tension gauge then produced a high and fluctuating reading of about 60g/cm.

This was obviously the source of the trouble, with repercussions all the way round the tape path. While still high, the excessive back tension settled down at the faster SP-mode rotation rate, with no tension regulator lever oscillation. The cure was quite easy. The supply spool's centre-bearing hole and shaft were cleaned and lubricated and a new tension-regulator band was fitted. This, with the back-tension setting adjusted correctly, cured the fault – leaving Cathode Ray to battle with the repair jobs that had come in meanwhile. . .

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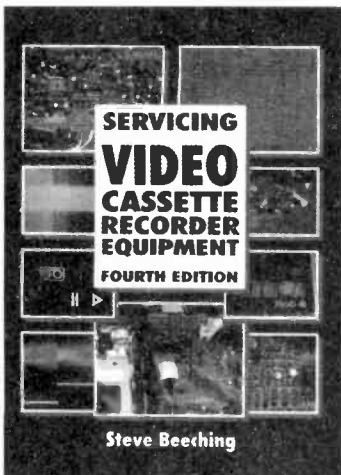
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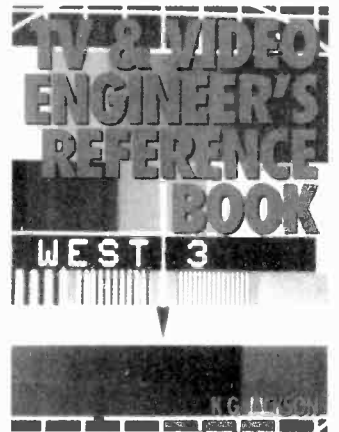
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TV1

# Servicing *the Tatung 190 Chassis*

John Coombes

**T**he Tatung 190/195 series chassis is designed to drive 90° standard- or min-neck tubes with screen sizes from 14 to 21 inches. Production started in early 1989. Models that use it have 9 as the second digit in the model number, e.g. TT8906. The various versions of the chassis are as follows: 190 14in. without remote control; 191 20in. without remote control; 195 14in. with remote control; 196 20in. with remote control; 197 21in. with remote control.

Fig. 1 shows the power supply circuit, which features an FET chopper transistor (TR801). In most versions the h.t. is 115V. In the 197 however it's 109.5V. This version also uses a different line output transformer.

## Power Supply Faults

If the set is dead with a blown mains fuse (F801, 1.25AT), check the mains filter capacitor C801, the BY133 mains bridge rectifier diodes D801-4 the the BUK454-800 chopper transistor TR801 for shorts. The TDA4605 chopper control chip IC801 is another possibility. It's best to replace TR801 and IC801 as a pair. Whenever you find TR801 short-circuit, check the value of R811 (470k $\Omega$ ) – it can go high. It may be worth checking TR801's heatsink insulation. You may find that the surge limiter resistor R801 has gone open-circuit as well as F801.

If the set is dead and F801 is intact it's likely that the fault is with the start-up resistors R802 and R803 (15k $\Omega$ , 0.5W). Check them both for being high in value or open-circuit. In later production sets 16k $\Omega$ , 0.6W metal-film resistors were used in these positions. Other possibilities are TR801 going short-circuit gate-to-source, C803 being low in value or open-circuit and IC801. If there's no h.t. on the primary side of the chopper transformer T801, check for dry-jointed connections. The connections can also go high-resistance, the result being intermittent loss of the sound and picture.

If there's no h.t., disconnect L403 and connect a 60W bulb as a dummy load across C814 to ascertain whether the fault is in the power supply or the line timebase. If the bulb lights, the fault is in the line timebase. If it doesn't, check whether the BA159 h.t. rectifier diode D809 is open- or short-circuit. Alternatively its reservoir capacitor C814 (47 $\mu$ F) could be short-circuit.

Tripping is likely to mean a short across one of the power supply's outputs.

No results can also be caused by failure of the components in the 10V rectifier circuit, D810 and C812. The 10V output supplies the 78M05CV 5V regulator IC804. This provides the 5V supply for the HD401220 microcontroller chip.

If necessary check the components in the 17V rectifier circuit, D811 and C813. The output from this circuit is used by the audio output chip and the line driver stage, and also goes

to the LM317T 12V regulator IC803 which in turn feeds the TDA4505 multi-function chip IC101.

## Line Timebase Faults

The first check to make in the line output stage is for h.t. at the collector of the S2000AF line output transistor TR403. This transistor, the BY133 efficiency diode D401 or C407 (47 $\mu$ F, 250V) could be short-circuit. The cause of line output stage failure could be shorted turns in the line output transformer T402. Also check for open-circuit or dry joints at pins 3 and 5 of the scan coil connector PL401

If there's no line drive, check for 17V at the collector of the BC337 line driver transistor TR402. If this voltage is missing, check whether R413 (18 $\Omega$  metal film) is open-circuit and the driver transformer T401 for open-circuit or more likely dry joints. Alternatively TR402 could be short-circuit or leaky.

If R413 is open-circuit, check whether its associated smoothing capacitor C412 (470 $\mu$ F) is short-circuit. R413 can also go high in value. This can result in loss of line drive, lack of width or ragged verticals.

Returning to loss of line drive, if TR402 and its associated components are o.k. check for the presence of line drive pulses at the base of the preceding BC547 emitter-follower transistor TR401. If these are present, check TR401 by replacement. If they are missing, check back to pin 26 of the TDA4505 multi-function chip IC101. Before replacing this chip, make sure that its 12V supply is present at pin 7 and that R114, R115 (both 2.7k $\Omega$ ), C116 (22nF) and C111 (2.7nF, 1 per cent) are o.k.

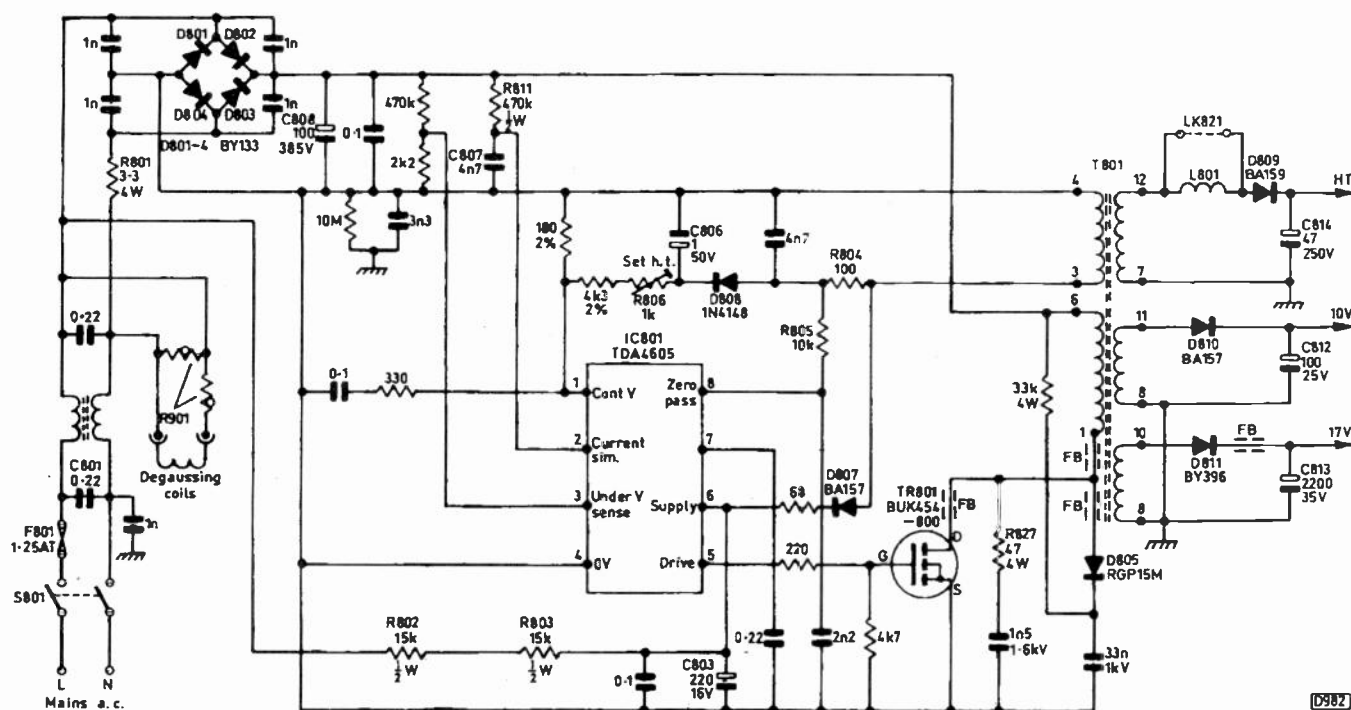
## Field Timebase Faults

Field collapse is the most common field timebase fault. The usual cause is failure of the TDA3653B field output chip IC301. If it has gone short-circuit, R411 (10 $\Omega$ ) will be open-circuit. If IC301 is dry-jointed the result may be intermittent field collapse.

If IC301 is o.k., check whether D403 (BA157), R411 (10 $\Omega$ ) or R119 (3.9k $\Omega$ ) is open-circuit. Check for open-circuit or dry joints at pins 1 and 2 of the scan coil connector L401. Then check for a field drive output at pin 3 of the TDA4505 multi-function chip IC101. If this is missing, check IC101 by replacement.

C306 (100 $\mu$ F, 50V) in the flyback boost network can go open-circuit to cause field collapse. In this case there will probably be intermittent failure of the field output chip. It may be necessary to replace IC301, IC101 and C306 to restore normal operation.

IC101 can also be responsible for top foldover with exces-



sive height. Before condemning it, make sure that its 12V supply is correct at pin 7. If this voltage has risen the 12V regulator chip IC803 is probably faulty. If the supply is low there will be reduced height.

Top foldover can also be caused by C409 (1,000 $\mu$ F, 35V). This is the reservoir capacitor in IC301's supply circuit.

## No Sound

The first check when there is no sound should be for 17V at pin 14 of the LM380M audio output chip IC601. If this supply is missing, check whether L602 (if fitted) is open-circuit or dry-jointed, or C606 (470 $\mu$ F, 25V) is short-circuit. The loudspeaker LS601 or the audio output coupling capacitor C610 (220 $\mu$ F, 25V) could be open-circuit. If these things are all o.k., check IC601 by replacement.

IC601's input comes from pin 12 of IC101 via C603 (0.1 $\mu$ F). Either of these items can cause loss of the sound.

## No Colour

For no colour, first check that the TDA3565 colour decoder chip IC501 is receiving its 12V supply at pin 1. If this voltage is missing, check whether L501 is open-circuit. If not, check IC501 by replacement.

Other possible causes of no colour are the 8.8MHz crystal XL501 being faulty or dry-jointed, or the reference oscillator preset R521 (10k $\Omega$ ) faulty or misadjusted.

## Grey Scale and Brightness Faults

Grey-scale faults are likely to be caused by the load resistors in the RGB output stages. Each transistor has three 47k $\Omega$  load resistors which are connected in parallel. They can change value or go open-circuit, and the outcome can look like a poor tube.

For uncontrollable brightness check whether R201 (8.2 $\Omega$ ) in the h.t. feed to the RGB output stages is open-circuit. Alternatively the sandcastle pulses at pin 7 of IC501 could be incorrect. They come from pin 27 of IC101, which also receives a pulse feed from the line output transformer.

## The Tuner and IF Strip

If there are no signals, check that the tuner is receiving its 12V supply at pin 2.

The TAA550 33V regulator chip IC001 can be responsible for a snowy display, no vision or drifting. Check it by replacement.

If there is no picture, just a snow storm, check whether IC001 is short-circuit or R009, R010 (both 6.8k $\Omega$ , 0.5W), R004 or R771 (both 18k $\Omega$ ) is open-circuit.

If there is a halo effect on the picture, check the SAWF (FL101) for dry-joints.

IC101 can also be responsible for signal faults.

## Remote Control Faults

If there is no remote control operation, check first whether the handset's batteries are low or the connections are corroded or broken. Then check for dry-joints at the LED (D790) or a faulty or dry-jointed crystal (XL790, 455kHz). If necessary check the SAA3008 remote control transmitter chip IC790 by replacement.

If only one handset function operates incorrectly it may be necessary to replace the unit.

If the remote control handset is operating correctly but there is no remote control, the TFMP2380 IR receiver chip IC703 (labelled C1703 on the circuit diagram) is suspect. Check it by replacement. Before doing so, ensure that there is 5V at the junction of R767 and R768 and that neither R767 (3.3k $\Omega$ ) nor R768 (220 $\Omega$ ) is open-circuit, also that C715 (22 $\mu$ F, 25V) is not short-circuit.

**Fig. 1: The chopper power supply circuit used in the Tatung 190 series chassis. In remote control versions the on/off switch S801 has an extra, momentary-make contact. The h.t. is 115V with most versions of the chassis: the exception is the 197, where the h.t. is 109.5V.**

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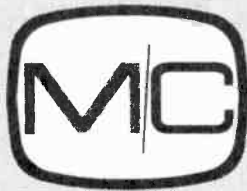
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Hewlett Packard Plug-in Type 8694, £95.  
Telequipment Oscilloscope Type D83, £235.  
Plessey H.F. Receiver Type PRS2280, Memory, CW, AM, SSB, LED Readout, £1,700.  
Racal Universal Counter Type 9837H, £75.  
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Stepper Motors, 12 volt, 1.8Deg, £3 each.  
Racal-Dana Frequency Counter Type 1998, £900.  
Hitachi Video Tuner Type VT-TU70E, £45.  
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Avo Multimeter Model 8 MK5, £100.  
Pye Controller Type UE06, £50.  
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Tektronix Oscilloscope Type 7603 Mainframe, £200.  
Smiths Tachometers, 0-2500 RPM, 4 1/2" Round, £5 each.  
Nicolet Digital Storage Oscilloscope Type 3091, £900.  
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Taylor Digital Volt-Ohm Meter Type TD20, £45.  
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Schlumberger Radio Communications Test Set Type 4010, £750.  
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2SA642	.50	2SC900	.52	AN5750	1.00	KIA7640AP	1.45	TA7614AP	2.00
2SA643	.40	2SC929	.30	AN5760	2.80	LA1140	1.40	TA7628P	1.50
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2SB324	.40	2SD261	.50	AN72130	1.80	LA4100	2.00	TBA8198.H	0.70
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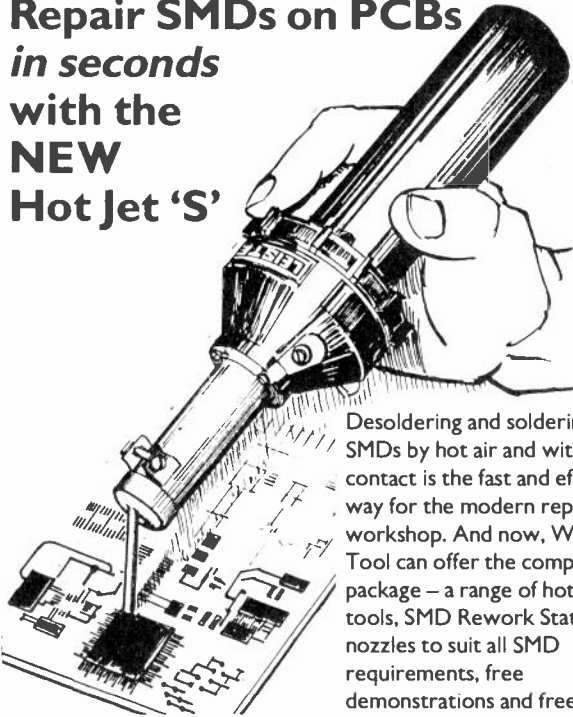
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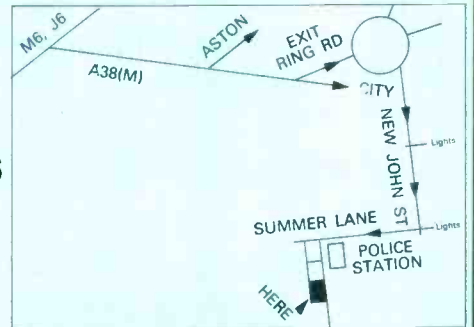
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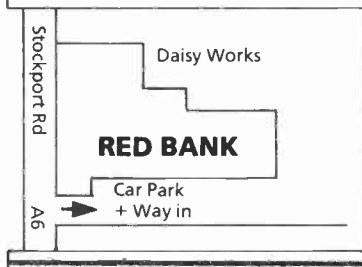
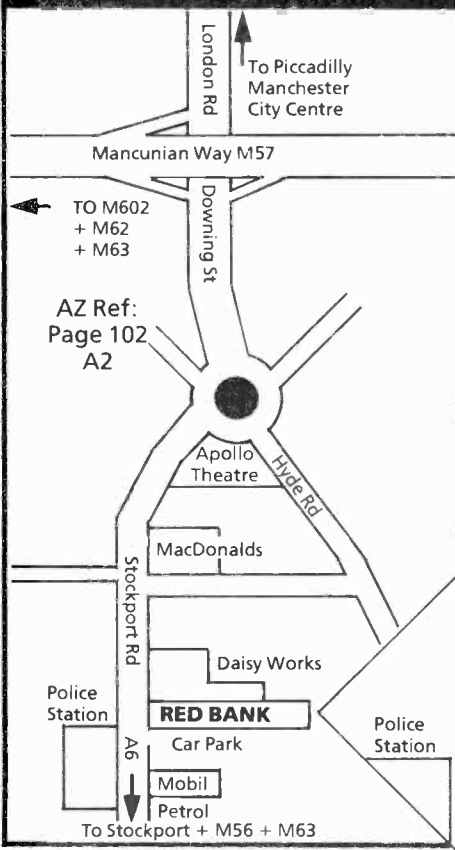
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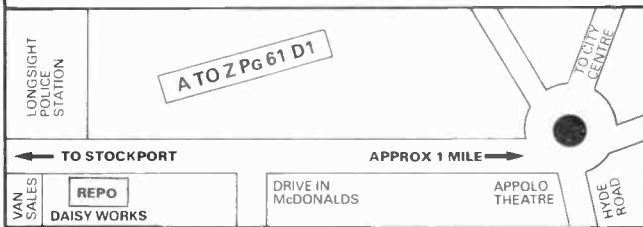
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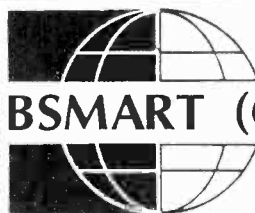
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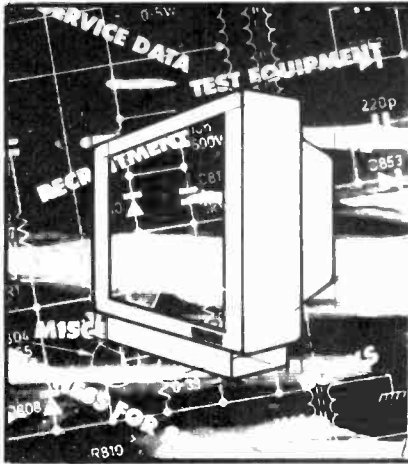
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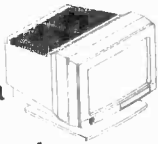
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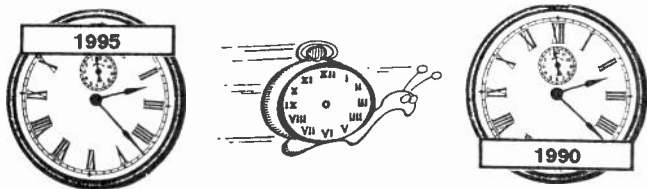
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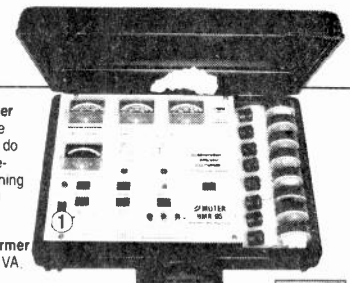
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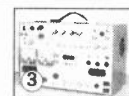


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LOPT - TFB4032BD - TOSHIBA	£10.00
LOPT - TFB4038AD	£10.00
LOPT - TFB4088AD - TOSHIBA	£8.00
LOPT - TFB4110AD - TOSHIBA	£10.00
LOPT - TLF1456B - NATIONAL PANASONIC	£15.00
LOPT - TLF1457B - NATIONAL PANASONIC	£15.00
LOPT - TLF7016 - NATIONAL PANASONIC	£15.00
LOPT - TX89	£12.00
LOPT - TX98	£12.00
LOPT - TX99	£12.00
LOPT - Y260781 - FERGUSON	£8.00
MOTOR - CASSETTE TYPE - 12V WITH SPEED CONTROL	£0.50
PANEL - CMC115 - TTT FRONT PANEL - ITT	£6.00
PANEL - CVC80 POWER PANEL	£5.00
PANEL - ICC5 CHROME BOARD - IC No. ON BOARD	
U4647 TKF OR HA11498	£6.00
PANEL - ICC5 - TUBE BASE PANEL	£5.00
PANEL - IK2 - FM2211 STEREO	£5.00
PANEL - SEL 69112407 - TTT FRONT PANEL - SAME AS CMC303	£6.00
PANEL - SEL 1FB194P - TTT FRONT PANEL - ITT	£6.00
PANEL - SEL 1FB150 U/K - TTT FRONT PANEL - ITT	£10.00
PANEL - SEL 1FB300 - TTT FRONT PANEL - ITT	£10.00
PANEL - TX9, TX10 - TUNING PANEL 1599G	£5.00
PANEL - TX10 - REMOTE PANEL 540101	£5.00
PANEL - TX89	£10.00
PANEL - TX90 - THORN FRONT PANEL - 8 PUSH BUTTONS 01M4-515-002	£10.00
PANEL - TX98 - T1353E FRONT PANEL W/INFRA-RED RECEIVER	£5.00
PANEL - TX98 - TUBE BASE PANEL	£5.00
PANEL - TX98, TX99, TX100 - REMOTE - M494B1 - 01V6-223104	£10.00
PANEL - TX98, TX99, TX100 - REMOTE - M494B1 - 01V6/682.003	£10.00
PANEL - TX99	£5.00
Tripod shoulder pod for camcorder	£5
Ferguson VA super 218 cardioid camera microphone telescopic boom and stand	£12.50
Ferguson camcorder battery V.A.366 6v-1400 M/A	£5
Mitsubishi video hand set r.m.m. 45	£7
Ferguson lens for camcorder 2 off tele conversion lens x 1.4 and x 0.7	
Ferguson TX98, TX99 Text Panel T1228B	£15
RC Matsui hand set £5. Equivalent models Pace 900, hand set Ferguson, Sony, Grundig	£8
6 VA RS Encapsulated main transformer 0-120v-0-120v Pri 0-9v-0-9v Sec	
Burglar alarm kit main control panel. Send for data	£12.50

Bullet Type L.N.B.S. New	£3
Not Tested 10.7 to 11.7 GHz	
P.S.U. AC 12v 500MA	£1.00
P.S.U. AC 9v 1A	£1.50
ITT CMC201 Panel	£10

