DECEMBER 1994

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TELEVISION

SERVICING·VIDEO·SATELLITE·DEVELOPMENTS

A REED BUSINESS PUBLICATION

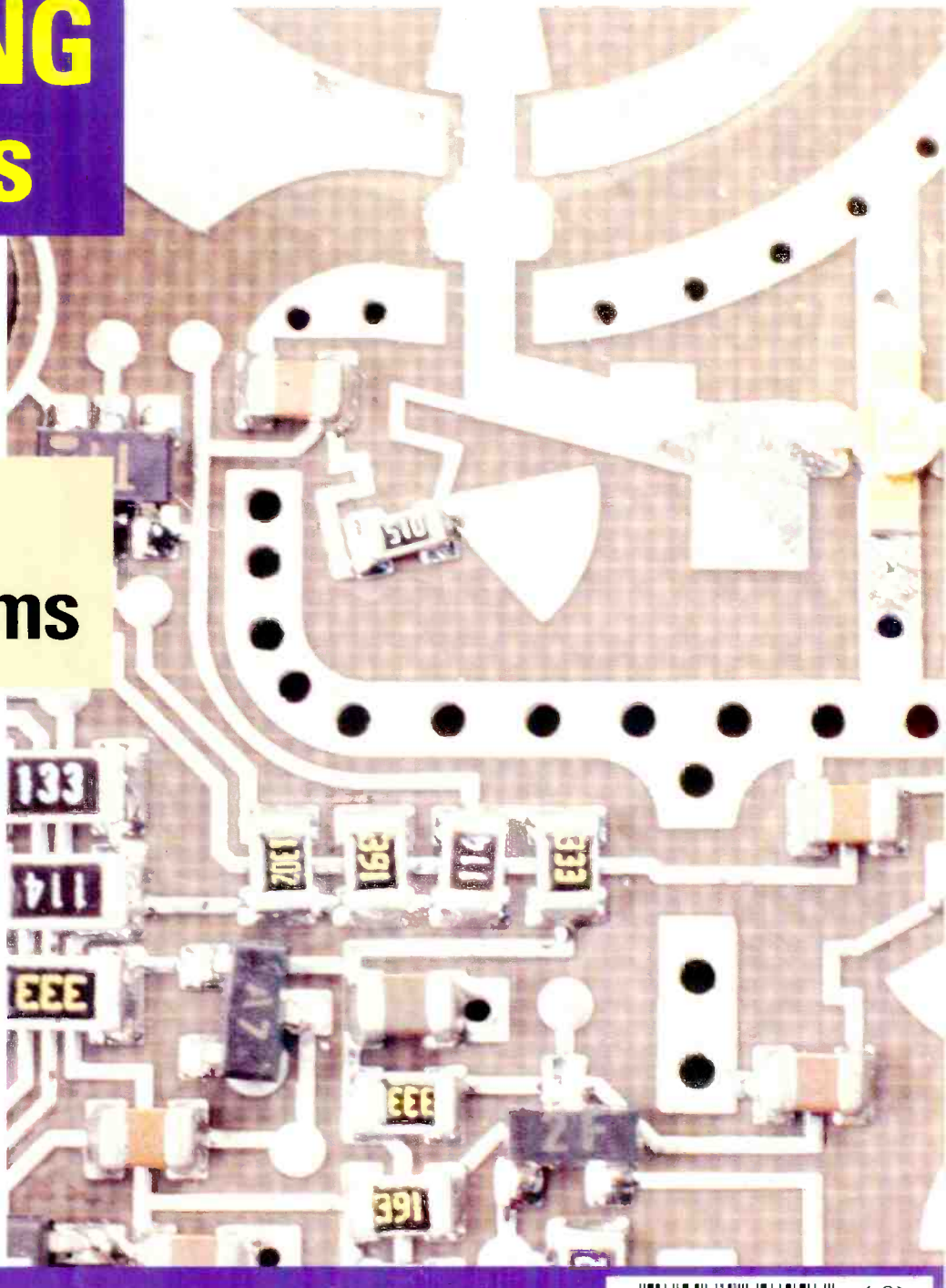
REPAIRING SAT LNBs

Camcorder Fault Notes

PC Monitor Test Programs

Audetel and Closed Captions

The Organic Semiconductor Electrolytic



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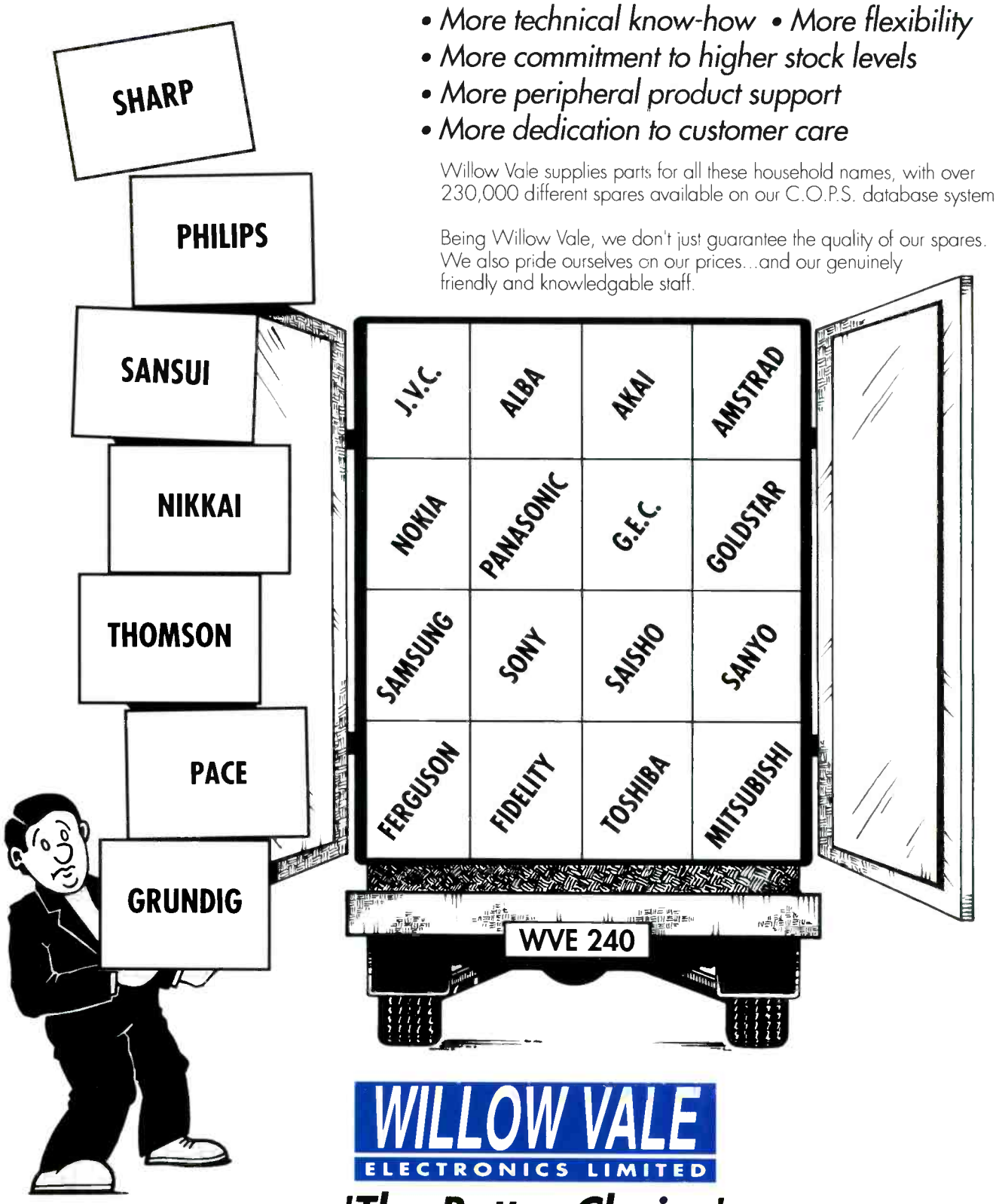

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TELEVISION

DECEMBER 1994
On Sale
November 16th

Vol. 45, No. 2

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

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AC141K	45p	BD314	100p	BSS74	33p	MJE30A	30p	2N2221	23p	14.756	200p	BR32	43p	36808	500p	AN7310	60p	KA2102	150p
AC176	22p	BD315	150p	BSX20	15p	MJE340	25p	2N2222	23p	15.0	160p	2A/200V		6809	500p	AN7311	90p	KA2130	150p
ACY18	48p	BD317	150p	BT100A	70p	MJE350	80p	2N2369	15p	24.0	250p	BR34	43p	6810	150p	AN7410	150p	KA2206	150p
ACY19	48p	BD331	40p	BT106	180p	MJE520	30p	2N2484	15p			2A/400V		6818	380p	AY3-1015	290p	KA2209	125p
AD149	60p	BD332	40p	BT109	90p	MP8112	45p	2N2646	40p	*VOLTAGE REGULATORS*		BR36	44p	6821	130p	AY3-1270	800p	KA2210	230p
AF125	50p	BD361	60p	BT119	100p	MPSA05	15p	2N2904	20p			2A/600V		6840	290p	AY3-1350	450p	KA2212	80p
AF139	30p	BD362	60p	BT146	99p	MPSA06	15p	2N2905	20p	7805	25p	BR62	80p	6845	200p	AY3-8910	360p	KA2213	130p
AF239	30p	BD370	30p	BTY79	140p	MPSA13	15p	2N2906	18p	7806	25p	6A/200V		6850	90p	AY3-8912	400p	KA2214	150p
BB105B	18p	BD371	30p	BU105	80p	MPSA20	15p	2N2907	18p	7808	25p	BR64	72p	8085A	300p	BA301	55p	KA2261	100p
BB205B	24p	BD410	50p	BU108	100p	MPSA42	15p	2N3019	28p	7812	25p	6A/400V		8086	500p	BA311	80p	KA2263	100p
BC107	8p	BD433	28p	BU109	80p	MPSA43	15p	2N3053	18p	7815	25p	BR251	150p	8088	480p	BA313	60p	KA2264	100p
BC108	8p	BD434	30p	BU110	90p	MPSA70	15p	2N3054	40p	7818	25p	25A/100V		B156	300p	BA333	80p	KA2284	100p
BC109	8p	BD435	31p	BU111	100p	MPSA92	20p	2N3055	38p	7824	25p	BR252	165p	8224	240p	BA401	60p	KA2401	150p
BC109C	10p	BD436	30p	BU124	60p	MPSA93	20p	2N3055H	50p	7905	25p	25A/200V		8226	240p	BA402	50p	KA2412	350p
BC140	20p	BD437	28p	BU126	65p	MR510	35p	2N3442	85p	7906	30p	BR254	185p	8250	750p	BA511	145p	KA2912	125p
BC141	20p	BD438	36p	BU180	100p	MR856	36p	2N3702	9p	7908	30p	25A/400V		8251	200p	BA514	160p	KA2914A	300p
BC142	20p	BD439	40p	BU184	100p	OC28	350p	2N3703	9p	7912	30p	BR256	200p	8253	160p	BA516	150p	LA1130	240p
BC143	20p	BD440	40p	BU204	65p	OC29	250p	2N3704	9p	7915	30p	25A/600V		8257	220p	BA521	100p	LA1150	150p
BC147	8p	BD441	40p	BU205	70p	OC35	350p	2N3705	9p	7918	30p	BR258	240p	8271	3400p	BA524	240p	LA1185	150p
BC149	8p	BD533	50p	BU206	100p	OC36	250p	2N3706	9p	7924	30p	25A/800V		8279	270p	BA526	180p	LA1201	75p
BC159	8p	BD534	38p	BU208	70p	OC45	50p	2N3707	9p	78L05	24p	BR351	185p	8283	400p	BA527	95p	LA1210	140p
BC160	30p	BD535	38p	BU208A	75p	OC200	180p	2N3710	12p	78L08	24p	35V/100V		8284	440p	BA532	100p	LA1222	80p
BC171	10p	BD536	38p	BU208AT	200p	R2008B	100p	2N3711	12p	78L12	24p	BR352	200p	8287	260p	BA534	220p	LA1230	130p
BC172	10p	BD537	40p	BU208D	130p	R2010B	100p	2N3771	85p	78L15	24p	35V/200V		8288	650p	BA536	150p	LA1364	200p
BC177	14p	BD538	40p	BU209	90p	S2000A3	175p	2N3772	90p	78L18	24p	BR354	220p	8748	700p	BA546	160p	LA1365	120p
BC178	14p	BD643	50p	BU225	120p	S2000AF	175p	2N3773	100p	78L24	24p	35V/400V		8755	800p	BA612	120p	LA1368	220p
BC179	14p	BD645	50p	BU226	120p	S2055A	175p	2N3799	18p	79L05	35p	BR356	230p	8T26	95p	BA656	110p	LA1385	170p
BC182	7p	BD647	50p	BU312	90p	S2055AF	200p	2N3819	29p	79L08	35p	35V/600V		8T28	110p	BA658	350p	LA2000	150p
BC182L	7p	BD649	50p	BU325	55p	S2530A	100p	2N3903	11p	79L12	35p	BR358	260p			BA684	400p	LA2101	270p
BC183	7p	BD675	40p	BU326A	75p	S2800M	72p	2N3906	11p	79L15	35p	35V/800V				BA685	400p	LA2200	190p
BC183L	7p	BD676	40p	BU406	60p	TIP29	15p	2N4031	25p	LM309K	100p	BY164 1.5A/		*LINEAR ICs*		BA1310	160p	LA3160	120p
BC184	7p	BD677	38p	BU406D	85p	TIP29A	22p	2N4401	12p	LM317T	100p	100V	40p	AN203	210p	BA1320	75p	LA3210	65p
BC184L	7p	BD678	40p	BU407	55p	TIP29C	25p	2N4403	12p	LM323K	350p	BY176 1.5A/		AN210	165p	BA1330	120p	LA3300	140p
BC212	7p	BD679	40p	BU407D	75p	TIP29E	40p	2N5061	20p	78H08KC	800p	800V	40p	AN214Q	170p	BA1360	160p	LA3301	110p
BC212L	7p	BD680	40p	BU408	60p	TIP30	25p	2N5088	20p	79H12KC	700p			AN228	280p	BA4403	220p	LA3361	100p
BC213	7p	BD681	45p	BU408D	75p	TIP30C	25p	2N5192	50p	79HGKC	800p			AN252	150p	BA5101	350p	LA3375	300p
BC213L	7p	BD682	45p	BU409	85p	TIP31A	22p	2N5241	500p			*TRIACS*		AN259	250p	BA5102	140p	LA4030	180p
BC214	7p	BD705	50p	BU426A	70p	TIP31C	27p	2N5245	45p	*VALVES*				AN262	140p	BA5204	200p	LA4031	140p
BC214L	7p	BD707	50p	BU500	100p	TIP32	24p	2N5294	30p			TIC206D	60p	AN271	230p	BA5402	180p	LA4032	140p
BC237	7p	BD709	50p	BU505	90p	TIP32A	21p	2N5296	30p	DAF96	100p	4A/400V		AN274	250p	BA5406	180p	LA4051	160p
BC238	7p	BD711	50p	BU505D	90p	TIP32C	28p	2N5448	12p	DY87	80p	TIC225D	69p	AN301	330p	BA5408	180p	LA4100	85p
BC239	7p	BD736	50p	BU505DF	90p	TIP33	50p	2N6107	40p	EBF80	60p	6A/400V		AN303	250p	BA6104	250p	LA4101	80p
BC300	20p	BD826	50p	BU506	100p	TIP33C	60p	2N6292	40p	ECC84	80p	TIC226D	68p	AN304	360p	BA6208	175p	LA4102	100p
BC301	20p	BD828	50p	BU506D	70p	TIP34	50p	2N6385	120p	ECH84	90p	8A/400V		AN315	210p	BA6209	85p	LA4110	120p
BC302	20p	BD839	55p	BU506DF	120p	TIP34C	60p	2N6403	160p	ECL84	100p	TIC236D	85p	AN316	350p	BA6304	120p	LA4120	270p
BC303	20p	BD897	50p	BU508A	70p	TIP35C	65p			EF183	75p	12A/400V		AN360	100p	BA6305	140p	LA4140	60p
BC304	25p	BD899	50p	BU508AF	95p	TIP36C	65p			EF184	85p	TIC246D	105p	AN362	140p	BA6410	220p	LA4160	100p
BC327	7p	BD977	50p	BU508D	75p	TIP41A	20p	*RECTIFIER DIODES*		EL500	100p	16A/400V		AN366	150p	BA6411	250p	LA4182	180p
BC328	7p	BDX33	60p	BU508DF	115p	TIP41C	22p			EY86	70p	TIC253D	190p	AN610	160p	BA6993	150p	LA4190	300p
BC337	7p	BDX65	80p	BU508V	110p	TIP42A	20p	BY127	8p	EY87	70p	20A/400V		AN3312	350p	BA7001	150p	LA4192	140p
BC338	7p	BDW24	55p	BU508VF	100p	TIP42C	22p	BY133	8p	EY88	80p	TIC263D	205p	AN3821K	600p	BA7004	200p	LA4200	130p
BC441	28p	BDW93	50p	BU526	75p	TIP47	40p	BY164	40p	PC97	100p	25A/400V		AN3822K	600p	BA7007	200p	LA4201	120p
BC446	8p	BDW94	50p	BU536	100p	TIP48	40p	BY179	35p	PCC85	60p			AN3990K	300p	BA7021	180p	LA4260	230p
BC477	18p	BDY92	100p	BU546	125p	TIP50	60p	BY184	32p	PCF80	100p			AN3991K	400p	BA7022	350p	LA4261	300p
BC516	22p	BF137	35p	BU608	120p	TIP51	80p	BY206	11p	PCF801	110p	*THYRISTORS*		AN5025	250p	BA7751LS	150p	LA4270	300p
BC537	25p	BF167	30p	BU626	120p	TIP52	80p	BY207	9p	PCF806	115p	2N5061	20p	AN5033	400p	BA7752	250p	LA4420	140p
BC546	8p	BF181	18p	BU705	130p	TIP54	85p	BY227	19p	PCH200	100p	0.8A/60V		AN5132	250p	BA7755	150p	LA4422	130p
BC547	8p	BF183	20p	BU706DF	175p	TIP105	65p	BY228	28p	PCL81	65p	TIC116C	59p	AN5150	400p	BA7767AS	155p	LA4430	130p
BC548	8p	BF195	7p	BU706F	150p	TIP106	65p	BY298	15p	PCL82	80p	8A/300V		AN5151	600p	CA3011	110p	LA4440	150p
BC549	8p	BF199	8p	BU801	70p	TIP107	65p	BY299	18p	PCL84	80p	TIC116D	70p	AN5215	100p	CA3048	190p	LA4445	150p
BC550	8p	BF200	16p	BU806	70p	TIP110	40p	BY448	20p	PFL200	110p	8A/400V		AN5256	150p	CA3052	190p	LA4460	120p
BC556	8p	BF225	30p	BU807	60p	TIP111	40p	BYX10	15p	PL36	120p	TIC126D	75p	AN5262	175p	CA3054	95p	LA4461	120p
BC557	7p	BF240	16p	BU902	110p	TIP112	35p	BYX55/600	25p	PL83	60p	12A/400V		AN5265	80p	CA3085	135p	LA4500	200p
BC558	8p	BF245	25p	BU903	110p	TIP112H	50p	BYX70/500	32p	PL84	80p	TIC126M	90p	AN5352	600p	CA3088E	200p	LA4505	220p
BC559	8p	BF254	15p	BU920	100p	TIP115	30p	OA47	10p	PL95	180p	12A/600V		AN5411	450p	CA3089E	150p	LA4508	200p
BC560	8p	BF255	12p	BU922	110p	TIP116	30p	OA91	10p	PY81	100p	C106D	28p	AN5421	150p	CA3090Q	250p	LA4510	100p
BC637	20p	BF256	18p	BU930	130p	TIP117	30p	OA202	10p	PY500A	190p	4A/400V		AN5429	420p	CA3130S	100p	LA4520	170p
BC639	20p	BF257	18p	BU2508A	130p	TIP120	37p	IN4001	3p			BR103	37p	AN5512	100p	CA3134E	280p	LA4550	200p
BC640	20p	BF259	18p	BU2508AF	130p	TIP121	35p	IN4002	3p			BR303	85p	AN5515	160p	CA3140E	38p	LA4555	120p
BCY33	200p	BF262	25p	BU2508D	130p	TIP122	30p	IN4003	3p	*LEDs*		BT106	180p	AN5520	550p	CA3160	85p	LA4570	130p
BCY34	200p	BF270	18p	BU2508DF	150p	TIP125	30p	IN4004	3p			BT119	100p	AN5521	100p	CA3189E	230p	LA5112	200p
BCY70	16p	BF273	15p	BU2520AF	225p	TIP126	40p	IN4005	3p	3mm		17088	200p	AN5612	200p	CA3193E	230p	LA5523	150p
BCY71	16p	BF311	21p	BU2520DF	225p	TIP127	35p	IN4006	3p	RED	5p	17089	200p	AN5613	200p	CA3260E	170p	LA5527	150p
BCY72	16p	BF336	20p	BU2525AF	325p	TIP130	30p	IN4007	4p	YELLOW	8p	17127	200p	AN5615	300p	CA3290E	150p	LA5700	300p
BD115	30p	BF337	20p	BUH515	200p	TIP131	30p	IN4148	2p	GREEN	8p	15/80H	230p	AN5620	250p	CX108	950p	LA7011	220p
BD124P	50p	BF338	20p	BUT11AF	55p	TIP132	30p	IN5400	9p	5mm		15/85R	230p	AN5622	275p	CX136	600p	LA7033	400p
BD131	25p	BF362	30p	BUT12	80p	TIP141	65p	IN5401	8p	RED	5p	SG264	800p	AN5625	400p	CX139A	750p	LA7042	280p
BD132	25p	BF367	13p	BUT56A	75p	TIP142	75p	IN5402	8p	YELLOW	8p	SG613	1600p	AN5712	180p	CX141	750p	LA7046	300p
BD133	50p	BF371	17p	BU18	80p	TIP145	50p	IN5403	8p	GREEN	8p			AN5722	140p	CX145	725p	LA7224	150p
BD135	20p	BF421	18p	BU18AF	80p	TIP146	70p	IN5404	8p			*COMPUTER ICs*		AN5730	160p	CX150B	325p	LA7505	250p
BD136	20p	BF422	21p	BUX10	150p	TIP147	80p	IN5405	11p	*RECTANGULAR LEDs*				AN5732	120p	CX175	325p	LA7507	250p
BD137	20p	BF423	25p	BUX11	200p	TIP150	90p	IN5406	12p			Z80ACPU	100p	AN5753	130p	CX187	825p	LA7520	200p
BD138	20p	BF455	12p	BUX12	150p	TIP151	60p	IN5407	12p	5mm × 2.5mm		Z80ADMA	200p	AN5763	450p	CX804A	775p	LA7620	500p
BD139	20p	BF458	19p	BUX20	350p	TIP2955	42p	IN5408	12p	RED	5p	Z80ACTC	140p	AN5790	240p	CX867	575p	LA7800	90p
BD140	20p	BF462	50p	BUX21	450p	TIP3055	42p	RGP15	25p	YELLOW	8p	Z80ASIO-1	210p	AN5791	225p	CX868	525p	LA7801	100p
BD144	90p	BF471	28p	BUX22	450p	TIPL763A	200p	RGP30	18p	GREEN	8p	Z80ASIO-2	210p	AN5836	450p	CX877	300p	LA7802	300p
BD157	38p	BF472	28p	BUX37	220p	TIPL791A	80p	SKE4F2/06	60p			75107	65p	AN5900	130p	HA1125	120p	LA7806	260p
BD166	30p	BF479	30p	BUX40	210p	TIS61	15p	SKE4F2/08	80p	*OPTO COUPLERS*		75110	75p	AN6135	120p	HA1197	130p	LA7808	250p
BD175	30p	BF494	16p	BUX41	200p	TIS90	15p	SKE4F2/10	100p			75113	100p	AN6247	200p	HA1199	130p	LA7820	100p
BD177	30p	BF495	16p	BUX42	200p	TIS93	20p	SR2M	60p			75122	110p	AN6270	400p	HA1319	200p	LA7823	200p
BD179	32p	BF595	16p	BUX47A	220p	VK1010	88p			4N37	48p	75154	100p	AN6300	600p	HA1338	300p	LA7910	150p
BD181	45p	BF596	16p	BUX48A	150p	VN10KM	60p	*LC. SOCKETS*		4N38	68p	75162	700p	AN6306	380p	HA1339A	350p	LA7940	200p
BD182	60p	BF615	30p	BUX80	180p	ZTX107	11p			AN203	210p	75182	95p	AN6320	180p	HA1377	120p	LC7131	260p
BD184	60p	BF617	30p	BUX84	50p	ZTX108	11p	8 PIN	5p			75183	95p	AN6332	320p	HA1388	320p	LC7132	400p
BD187	30p	BF760	40p	BUX85	50p	ZTX109	12p	14PIN	6p	*BRIDGE RECTIFIERS*		75195	185p	AN6341	200p	HA1389	210p	LC7137	450p
BD201	33p	BF763	40p	BUX86	30p	ZTX212	20p	16PIN	7p			2114	150p	AN6344	440p	HA1392	120p	LF347	110p
BD202	38p	BF870	22p	BUX87	50p	ZTX300	10p	18PIN	10p	W005	16p	2532	200p	AN6350	610p	HA1394	170p	LF353	48p
BD203	42p	BF871	22p	BUX98A	350p	ZTX301	16p	20PIN	12p	1A/50V		2716	100p	AN6359	500p	HA1397	200p	LF355	60p
BD204	42p	BF960	38p	BU69A	200p	ZTX302	10p	22PIN	13p	W01	18p	2732	200p	AN6360	320p	HA1398	240p	LF357	70p
BD222	31p	BF961	35p	BUY71	250p	ZTX303	20p	24PIN	14p	1A/100V		2732A	220p	AN6362	400p	HA11219	280p	LF398	300p
BD225	31p	BF964	38p	BUZ11	200p	ZTX304	10p	28PIN	16p	W02	19p	2764	150p	AN6371	350p	HA11221	180p	LM301	26p
BD232	31p	BFR90	85p	BUZ71	75p	ZTX320	20p	40PIN	18p	1A/200V		27C64	200p	AN6387	480p	HA11225	130p	LM311	35p
BD233	30p	BFR91	99p	BUZ80	200p	ZTX501	13p			W04	21p	27128	150p	AN6884	200p	HA11235	120p	LM319	165p
BD234	32p	BFT43	30p	BY448	20p	ZTX502	10p	*ZENERS*		1A/400V		27256-25	150p	AN7105	170p	HA11251	190p	LM324	30p
BD235	28p	BFX29	20p	BYT11	25p	ZTX503	18p			4116	40p	27512	300p	AN7110	75p	HA11423	140p	LM335Z	120p
BD236	30p	BFX84	20p	C106D	28p	ZTX504	25p	400 mWatts		4164-15	80p	4116	40p	AN7114	120p	HA11724	650p	LM339	35p
BD237	21p	BFX85	20p	IRF630	150p	2N696	26p	2V7 to 39V	5p	4164-12	90p	4164-15	80p	AN7115	110p	HA12002	220p	LM348	50p
BD238	24p	BFX87	15p	J174	38p	2N697	22p	1.3 Watts		41256-15	80p	4164-12	90p	AN7116	90p	HA12003	250p	LM358	45p
BD239	30p	BFX88	15p	J300	50p	2N698	40p	2V7 to 39V	9p	41256-12	100p	41256-12	100p	AN7120	100p	HA12005	180p	LM380	80p
BD240	40p	BFX89	60p	MJ900	200p	2N78	22p			41256-10	110p	41256-10	110p	AN7130	75p	HA12017	100p	LM381	150p
BD241A	40p	BFY50	14p	MJ1000	200p	2N914	28p	*CRYSTALS*		BR81D	33p	41464-12	150p	AN7140	170p	HA13001	110p	LM382	130p
BD243A	50p	BFY51	14p	MJ1001	200p	2N930	18p			2A/100V		6116	80p	AN7145	195p	HA13002	200p	LM386	60p
BD244	50p	BFY52	14p	MJ10012	300p	2N1131	28p	Freq in MHz		BR82D	33p	6264-10	210p	AN7146	210p	HA13006	400p	LM387	100p
BD245	50p	BFY56	25p	MJ15003	250p	2N1132	28p	2.4576	180p	2A/200V		62256-12	300p	AN7154	180p	HA13007	400p	LM393	45p

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Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
LM431	50p	STK441	880p	STK5422	375p	STR30115	275p	TA7784	250p	TDA1574	125p	TDA3586	750p	TDA8170	170p	UPC1158H	70p	2SA937	20p
LM710	45p	STK443	700p	STK5431	550p	STR30120	400p	TA8132AN	200p	TDA1576	170p	TDA3590	300p	TDA8172	250p	UPC1178H	250p	2SA939	140p
LM723	40p	STK457	470p	STK5434	570p	STR30123	450p	TA8205	250p	TDA1578A	210p	TDA3591	360p	TDA8173	280p	UPC1180C	200p	2SA940	50p
LM741DIL	18p	STK459	560p	STK5436	500p	STR30125	550p	TA8210	300p	TDA1579	200p	TDA3592A	350p	TDA8174	300p	UPC1185H2	400p	2SA942	60p
LM741MET	45p	STK460	660p	STK5441	400p	STR30130	250p	TA8215	300p	TDA1596	200p	TDA3640	350p	TDA8175	300p	UPC1186	80p	2SA949	70p
LM747	55p	STK461	620p	STK5451	390p	STR40090	350p	TA8216H	375p	TDA1598	250p	TDA3651	200p	TDA8178	400p	UPC1187	150p	2SA950	18p
LM1889	300p	STK463	950p	STK5461	500p	STR41090	400p	TA8227	250p	TDA1600	275p	TDA3652	500p	TDA8185	300p	UPC1188H	350p	2SA952	50p
LM1894N	200p	STK465	720p	STK5462	500p	STR44115	550p	TA8691N	550p	TDA1670A	230p	TDA3652TX10	800p	TDA8190	200p	UPC1197	140p	2SA953	60p
LM3900	40p	STK501	550p	STK5464	300p	STR45111	550p	TA8718N	550p	TDA1675	250p	TDA3653	150p	TDA8191	425p	UPC1198H	200p	2SA954	75p
LM3909	100p	STK561	450p	STK5466	500p	STR50020	450p	TAA550	25p	TDA1701	300p	TDA3654	90p	TDA8192	275p	UPC1222	130p	2SA958	60p
LM3914	160p	STK563	415p	STK5467	400p	STR50092	550p	TBA120S	40p	TDA1771	250p	TDA3710	300p	TDA8196	150p	UPC1225H	220p	2SA963	120p
LM3915	160p	STK583	500p	STK5468	300p	STR50103A	260p	TBA396	70p	TDA1870A	200p	TDA3720	175p	TDA82148	225p	UPC1230	150p	2SA965	40p
LM3916	270p	STK760	600p	STK5471	330p	STR50113	500p	TBA520	120p	TDA1872A	275p	TDA3724	500p	TDA82153	300p	UPC1238	120p	2SA966	35p
L200	200p	STK770	400p	STK5473	480p	STR50115	500p	TBA530	100p	TDA1904	80p	TDA3725	500p	TDA8303	350p	UPC1270H	250p	2SA968	55p
M491BB1	500p	STK772B	480p	STK5476	350p	STR51041	500p	TBA540	90p	TDA1905	80p	TDA3730	400p	TDA8304	600p	UPC1274V	250p	2SA970	25p
M494B1	700p	STK780	575p	STK5478	380p	STR50213	500p	TBA560	90p	TDA1908A	90p	TDA3740	480p	TDA8305	500p	UPC1277	240p	2SA979	35p
M50115P	320p	STK1039	460p	STK5479	300p	STR53041	500p	TBA800	40p	TDA1910	225p	TDA3750	400p	TDA8340	200p	UPC1278	240p	2SA984	25p
M50117P	500p	STK1040	640p	STK5481	520p	STR54041	350p	TBA810AS	40p	TDA1940	180p	TDA3760	350p	TDA8341	250p	UPC1288V	230p	2SA985	60p
M50119P	525p	STK1049	700p	STK5482	285p	STR55041	500p	TBA820	55p	TDA1941	300p	TDA3771	460p	TDA8380	200p	UPC1298V	320p	2SA988	25p
M50784	300p	STK1050	650p	STK5483	440p	STR56041	550p	TBA820M	35p	TDA1950	175p	TDA3791	300p	TDA8390A	650p	UPC1318	300p	2SA992	30p
M50786	500p	STK1060	700p	STK5486	450p	STR58041	325p	TBA920	100p	TDA2002	50p	TDA3800	350p	TDA8405	550p	UPC1335V	320p	2SA993	50p
M50790	600p	STK1070	850p	STK5488	480p	STR59041	475p	TBA950	100p	TDA2003	65p	TDA3803A	500p	TDA8415	650p	UPC1350	115p	2SA999	30p
M51161	300p	STK1080	940p	STK5490	450p	STR60001	525p	TBA990	60p	TDA2004	150p	TDA3810	200p	TDA8417	550p	UPC1363	190p	2SA1006	90p
M51381P	200p	STK2025	620p	STK5632	450p	STR61001	550p	TC5020	200p	TDA2005	150p	TDA3825	225p	TDA8421	500p	UPC1363C	300p	2SA1008	125p
M51387P	800p	STK2028	500p	STK5725	450p	STR80145	550p	TC5081AP	80p	TDA2006	70p	TDA3840	300p	TDA8245	500p	UPC1364C	350p	2SA1009	200p
M51544	150p	STK2029	480p	STK5730	450p	STR81145	600p	TC9106	500p	TDA2007	120p	TDA3843	200p	TDA8432	550p	UPC1365	250p	2SA1010	225p
M51848	150p	STK2038	700p	STK6316	300p	STRD1206	600p	TC9125BP	410p	TDA2008	100p	TDA3845	325p	TDA8433	600p	UPC1370C	300p	2SA1011	80p
M54523P	200p	STK2048	950p	STK6324B	500p	STRD1406	600p	TC9134	750p	TDA2009	160p	TDA3856	400p	TDA8440	300p	UPC1373	85p	2SA1012	85p
M54563P	200p	STK2110	550p	STK6431	850p	STRD1706	450p	TC9142	320p	TDA2010	150p	TDA3857	350p	TDA8442	200p	UPC1377C	200p	2SA1013	100p
M58484	500p	STK2125	580p	STK6722	725p	STRD1806	400p	TC9143	300p	TDA2020	120p	TDA3950	225p	TDA8443	350p	UPC1378	180p	2SA1015	15p
M51516	260p	STK2129	610p	STK6732	1000p	STRD1816	400p	TC9145	150p	TDA2030	80p	TDA4050	150p	TDA8451	400p	UPC1382	110p	2SA1016	30p
M51518	200p	STK2139	675p	STK6822	900p	STRD3035	300p	TC9148	200p	TDA2040	140p	TDA4092	350p	TDA8452	200p	UPC1384	425p	2SA1018	100p
MB3712	140p	STK2155	900p	STK6922	500p	STRD4412	500p	TC149	225p	TDA2048	600p	TDA4100	225p	TDA8453	350p	UPC1387C	250p	2SA1020	30p
MB3713	130p	STK2230	470p	STK6932	525p	STRD4512	400p	TC9150	425p	TDA2054M	110p	TDA4180	145p	TDA8490	350p	UPC1394	120p	2SA1021	35p
MB3714	270p	STK2240	740p	STK6962	275p	TA7054	190p	TC9152	425p	TDA2107	250p	TDA4190	180p	TDA8702	275p	UPC1397	350p	2SA1023	60p
MB3715	250p	STK2250	650p	STK6972	490p	TA7061	115p	TC9153	300p	TDA2148	350p	TDA4200	360p	TDA8703	500p	UPC1403CA	650p	2SA1026	90p
MB3722	280p	STK3041	370p	STK6981B	600p	TA7066	120p	TC9156	300p	TDA2151	375p	TDA4280	320p	TDA8708	900p	UPC1420CA	450p	2SA1029	60p
MB3730	160p	STK3042	375p	STK6982	600p	TA7089	300p	TC9163	375p	TDA2170	260p	TDA4282	360p	TDA8732	400p	UPC1421CA	650p	2SA1036	60p
MB3731	220p	STK3044	500p	STK7216	420p	TA7119	150p	TC9164	400p	TDA2220	200p	TDA4290	200p	TDA9045	400p	UPC1423CA	550p	2SA1037	50p
MB3756	160p	STK3062	500p	STK7217	400p	TA7120	55p	TC9172P	300p	TDA2270	250p	TDA4400	175p	TDA9080	550p	UPC1470	200p	2SA1038	40p
MB3759	200p	STK3082	550p	STK7225	500p	TA7137	60p	TCA9940	100p	TDA2320	80p	TDA4420	120p	TDA9403	180p	UPC1488H	150p	2SA1048	25p
MB8719	360p	STK3102II	530p	STK7226	600p	TA7140	100p	TCEP100	100p	TDA2501	400p	TDA4421	300p	TDA9503	150p	UPC1505C	400p	2SA1051	300p
MC1455	45p	STK3162II	900p	STK7251	500p	TA7157	100p	TD62308AP	200p	TDA2503	200p	TDA4426	170p	TDA9513	300p	UPC1514CA	200p	2SA1060	120p
MC1496	65p	STK3156	500p	STK7308	350p	TA7193	320p	TD62382	200p	TDA2504	200p	TDA4427	200p	TEA1002	650p	UPC1515CA	250p	2SA1069	150p
MC3401	45p	STK4017	400p	STK7309	400p	TA7200	200p	TD62506	200p	TDA2505	300p	TDA4431	150p	TEA1007	120p	UPC1520CA	250p	2SA1076	230p
NE555	20p	STK4019	480p	STK7310	470p	TA7205	110p	TD62705	250p	TDA2506	500p	TDA4437	300p	TEA1009	100p	UPC1536C	550p	2SA1077	300p
NE556	40p	STK4021	380p	STK7348	400p	TA7207	150p	TD6304AP	300p	TDA2510	450p	TDA4439	220p	TEA1017	280p	ZN423	100p	2SA1081	80p
NE558	80p	STK4024II	550p	STK7356	425p	TA7208	125p	TD6306P	350p	TDA2514A	500p	TDA4440	180p	TEA1019	130p	ZN424	100p	2SA1082	80p
NE565	110p	STK4025	530p	STK7358	440p	TA7214	220p	TD6350P	200p	TDA2515	450p	TDA4442	240p	TEA1024	150p	ZN425	320p	2SA1084	100p
NE567	115p	STK4026	480p	STK7402	560p	TA7217	145p	TD6359P	300p	TDA2530	450p	TDA4443	250p	TEA1045	300p	ZN426	260p	2SA1085	75p
NE571	290p	STK4028	550p	STK7404	400p	TA7220	220p	TDA1001	200p	TDA2532	120p	TDA4445	220p	TEA1060	225p	ZN427	560p	2SA1091	100p
NE592	85p	STK4032II	510p	STK7406	650p	TA7222	90p	TDA1002	200p	TDA2540	85p	TDA4450	225p	TEA1067	150p	ZN429	215p	2SA1094	190p
NE5532P	140p	STK4036	470p	STK7408	675p	TA7223	210p	TDA1003	150p	TDA2541	120p	TDA4452	250p	TEA1080F	170p	ZN459	190p	2SA1095	300p
SAA1006	300p	STK4038	680p	STK7410	900p	TA7225	300p	TDA1005A	175p	TDA2542	110p	TDA4453	275p	TEA1087	40p	ZN1040	640p	2SA1096	80p
SAA1008	450p	STK4040II	650p	STK7554	600p	TA7226	290p	TDA1010A	80p	TDA2543	210p	TDA4480	280p	TEA1101	425p	ZNA134H	2150p	2SA1102	130p
SAA1010	400p	STK4042II	800p	STK7561	650p	TA7227	170p	TDA1011	75p	TDA2545	120p	TDA4482	350p	TEA1330	65p			2SA1103	130p
SAA1024	250p	STK4044	800p	STK7562	1000p	TA7230	100p	TDA1012	120p	TDA2546A	200p	TDA4500	300p	TEA1511	150p			2SA1104	140p
SAA1025	250p	STK4046	950p	STK7563	800p	TA7232	95p	TDA1013A	110p	TDA2549	300p	TDA4501	400p	TEA2000	275p			2SA1105	250p
SAA1075	350p	STK4048	1280p	STK8050	750p	TA7233	120p	TDA1015	85p	TDA2555	175p	TDA4502	550p	TEA2014A	80p			2SA1106	160p
SAA1124	200p	STK4060	510p	STK8250	500p	TA7237	300p	TDA1016	140p	TDA2556	230p	TDA4503	300p	TEA2018A	200p			2SA1111	90p
SAA1250	280p	STK4065	650p	STK8260	1200p	TA7238	400p	TDA1020	110p	TDA2557	225p	TDA4505	300p	TEA2114	200p			2SA1112	150p
SAA1251	380p	STK4101	500p	STK8280	1850p	TA7240	160p	TDA1022	330p	TDA2558	500p	TDA4510	270p	TEA2117	450p			2SA1123	40p
SAA1274	280p	STK4111	500p	STK73410	350p	TA7241	165p	TDA1023	130p	TDA2575A	100p	TDA4555	400p	TEA5114A	200p			2SA1124	60p
SAA1293	550p	STK4112	500p	STK73410II	500p	TA7242	190p	TDA1024	150p	TDA2577A	200p	TDA4556	370p	TL431	45p			2SA1127	50p
SAA3004	400p	STK4121	480p	STK73605	375p	TA7243	320p	TDA1025	120p	TDA2578A	200p	TDA4557	450p	TL061	40p			2SA1133	120p
SAA5000	220p	STK4122	560p	STR370	300p	TA7245	225p	TDA1028	175p	TDA2579A	250p	TDA4560	270p	TL064	80p			2SA1141	200p
SAA5010	220p	STK4131	600p	STR371	400p	TA7267	220p	TDA1029	200p	TDA2582	130p	TDA4600	140p	TL071	38p			2SA1142	100p
SAA5012	400p	STK4132II	600p	STR380	350p	TA7269	260p	TDA1035	160p	TDA2590	170p	TDA4600II	160p	TL074	80p			2SA1145	40p
SAA5020	350p	STK4141II	420p	STR381	390p	TA7270	170p	TDA1041E	250p	TDA2593	110p	TDA4601	120p	TL083	55p			2SA1152	150p
SAA5030	440p	STK4142	530p	STR383	410p	TA7271	220p	TDA1041P	180p	TDA2594	300p	TDA4605	220p	TL084	70p			2SA1156	90p
SAA5040A	280p	STK4151	680p	STR384	350p	TA7272	260p	TDA1044	110p	TDA2595	200p	TDA4610	370p	TMS1000-341	400p			2SA1162	30p
SAA5040B	400p	STK4152	650p	STR440	700p	TA7273	300p	TDA1047	200p	TDA2600	250p	TDA4660	370p	TMS1000NLPM	200p			2SA1169	500p
SAA5050	650p	STK4161	650p	STR450	520p	TA7274	210p	TDA1048	200p	TDA2611A	100p	TDA4800	350p	TMS100-233	400p			2SA1170	500p
SAA5231	300p	STK4162	550p	STR541	600p	TA7280	190p	TDA1053	300p	TDA2630	300p	TDA4935	300p	TMS1024	300p			2SA1175	30p
SAA5243PE	800p	STK4171	750p	STR452	600p	TA7281	200p	TDA1054	180p	TDA2640	220p	TDA4940	325p	TMS1025	350p			2SA1184	120p
SAB3013	200p	STK4172II	680p	STR453	500p	TA7282	160p	TDA1059B	40p	TDA2653A	225p	TDA4950	120p	TMS3617NS	350p			2SA1186	500p
SAB3035	600p	STK4181	680p	STR454	400p	TA7283	200p	TDA1060	140p	TDA2654	200p	TDA5330T	300p	TMS3701BN	300p			2SA1198	40p
STA301A	200p	STK4182II	750p	STR455	500p	TA7288	220p	TDA1062	140p	TDA2670	150p	TDA5600	450p	TMS3712	350p			2SA1206	60p
STA401A	220p	STK4191	700p	STR456	470p	TA7299	200p	TDA1072	150p	TDA2690	100p	TDA5660P	250p	TMS3891	550p			2SA1208	70p
STA403A	270p	STK4192	700p	STR457	600p	TA7310	100p	TDA1074	280p	TDA2730	200p	TDA5700	200p	TPU2732	1200p			2SA1209	180p
STA405A	280p	STK4231II	700p	STR470	400p	TA7312	120p	TDA1077	250p	TDA2760	400p	TDA5708	400p	TPU2735	900p			2SA1210	120p
STA431A	250p	STK4241	1050p	STR1096	275p	TA7313	70p	TDA1082	275p	TDA2780	600p	TDA5709	450p	U1118	250p			2SA1215	600p
STA432A	220p	STK4241V	1250p	STR11195	350p	TA7314	175p	TDA1083	95p	TDA2791	275p	TDA5810	600p	U1118	300p			2SA1216	550p
STA434A	270p	STK4272	500p	STR1229	325p	TA7315	200p	TDA1085	170p	TDA2795	200p	TDA5820	370p	U254B	150p			2SA1217	100p
STA435A	270p	STK4273	550p	STR2005	400p	TA7317P	120p	TDA1087	60p	TDA2822M	90p	TDA5850	175p	U318M	350p			2SA1220	75p
STA441C	220p	STK4301	500p	STR2012	400p	TA7324	75p	TDA1092	100p	TDA2840	200p	TDA6200	750p	U321M	450p			2SA1232	180p
STA456C	240p	STK4311	650p	STR2013	300p	TA7325	90p	TDA1097	475p	TDA3047	100p	TDA7000	170p	U329M	350p			2SA1242	80p
STA471	210p	STK4332	365p	STR2015	550p	TA7328	110p	TDA1151	40p	TDA3048	130p	TDA7010T	120p	U338M	300p			2SA1244	120p
STA901M	280p	STK4352	500p	STR2105	600p	TA7335	85p	TDA1154	50p	TDA3082	200p	TDA7050	200p	U420B	70p			2SA1246	80p
STK0025	420p	STK4362	450p	STR3113	225p	TA7336	180p	TDA1170	85p	TDA3083	200p	TDA7052	120p	U427B	70p			2SA1249	100p
STK0029	360p	STK4372	490p	STR3115	400p	TA7341	250p	TDA1180	120p	TDA3190	100p	TDA7053	200p	U664B	175p			2SA1261	150p
STK0039	600p	STK4392	500p	STR3123	400p	TA7343	120p	TDA1180A	190p	TDA3300B	480p	TDA7056	200p	U2401B	125p			2SA1262	110p
STK0040	520p	STK4432	600p	STR3125	480p	TA7357	340p	TDA1190	80p	TDA3301B	280p	TDA7072	175p	U2829B	130p			2SA1263	280p
STK0049	510p	STK4773	820p	STR3135	250p	TA7358	85p	TDA1200B	80p	TDA3310	120p	TDA7077	175p	U4606B	600p			2SA1264	280p
STK0050	440p	STK4793	800p	STR3212	275p	TA7401	250p	TDA1220	75p	TDA3330	500p	TDA7211	150p	UC3842N	125p			2SA1265	200p
STK0059	620p	STK4803	640p	STR3214	275p	TA7607	200p	TDA1235	300p	TDA3410	150p	TDA7220	100p	UC3844	100p			2SA1283	50p
STK0060	820p	STK4813	800p	STR3215	275p	TA7608	360p	TDA1236	240p	TDA3420	200p	TDA7222	200p	ULN2002	70p			2SA1284	60p
STK0070	1100p	STK4833	700p	STR3315	275p	TA7609	170p	TDA1251	150p	TDA3501	340p	TDA7230A	225p	ULN2003	69p			2SA1286	60p
STK0080	580p	STK4843	720p	STR4090A	650p	TA7611	210p	TDA1270	150p	TDA3502	450p	TDA7233	150p	ULN2068	270p			2SA1290	150p
STK011	330p	STK4853	730p	STR4142	450p	TA7612	300p	TDA1327	200p	TDA3504	300p	TDA7240	175p	ULN2804	170p			2SA1294	450p
STK015	440p	STK4863	700p	STR4211	370p	TA7614	170p	TDA1410	220p	TDA3505	275p	TDA7241	250p	UPC20C	220p			2SA1295	500p
STK016	760p	STK4873	850p	STR4512	400p	TA7616	300p	TDA1412	35p	TDA3506	260p	TDA7250	500p	UPC554	130p			2SA1301	260p
STK025	650p	STK4893	1000p	STR5015	500p	TA7621	300p	TDA1510	170p	TDA3507	450p	TDA7255	500p	UPC556	60p			2SA1302	300p
STK050	1600p	STK4913	900p	STR5100	550p	TA7622	420p	TDA1512	180p	TDA3510	350p	TDA7256	600p	UPC556H	80p			2SA1303	400p
STK077	520p	STK5314	475p	STR5214	475p	TA7628	110p	TDA1514A	450p	TDA3520	650p	TDA7272	170p	UPC571	220p			2SA1304	110p
STK078	580p	STK5315	500p	STR5315	575p	TA7629	220p	TDA1515A	200p	TDA3530	350p	TDA7273	80p	UPC574	60p			2SA1306	110p
STK080	550p	STK5322	500p	STR5412	350p	TA7630	200p	TDA1516Q	350p	TDA3540	200p	TDA7274	60p	UPC575C2	90p			2SA1307	100p
STK082	540p	STK5324	450p	STR6020	325p	TA7632	400p	TDA1517	250p	TDA3541	175p	TDA7275	75p	UPC577	64p			2SA1309	50p
STK084	600p	STK5325	370p	STR9005	400p	TA7640	90p	TDA1519	200p	TDA3560	260p	TDA7284	100p	UPC592	95p			2SA1315	100p
STK085	900p	STK5331	300p	STR9012	450p	TA7641	140p	TDA1519A	200p	TDA3561	300p	TDA7350	650p	UPC595	190p			2SA1317	30p
STK086	800p	STK5332	180p	STR10006	450p	TA7658	100p	TDA1520	275p	TDA3561A	300p	TDA7359	300p	UPC596	190p			2SA1318	20p
STK0100	900p	STK5333	500p	STR11006	400p	TA7668	100p	TDA1521	250p	TDA3562	260p	TDA7360	700p	UPC1001	220p			2SA1321	80p
STK0100II	1200p	STK5335	350p	STR12006	450p	TA7680AP	225p	TDA1522	110p	TDA3562TFK	300p	TDA7770	225p	UPC1018	170p			2SA1329	200p
STK420	400p	STK5337	500p	STR13006	500p	TA7688	150p	TDA1524	200p	TDA3563	350p	TDA8114	225p	UPC1020	200p			2SA1346	20p
STK430	500p	STK5338	295p	STR15006	500p	TA7698	450p	TDA1540	420p	TDA3564	325p	TDA8115	200p	UPC1023	60p			2SA1352	100p
STK433	400p	STK5339	400p	STR16006	500p	TA7699	600p	TDA1541	750p	TDA3565	275p	TDA8140	200p	UPC1025	230p			2SA1353	100p
STK435	375p	STK5342	245p	STR20005	450p	TA7705	300p	TDA1542	250p	TDA3566	280p	TDA8143	160p	UPC1026	95p			2SA1358	130p
STK436	430p	STK5361	375p	STR20012	450p	TA7750	200p	TDA1543	300p	TDA3567	350p	TDA8145	120p	UPC1028	90p			2SA1370	100p
STK437	460p	STK5372	260p	STR20015	450p	TA7757	200p	TDA1571	300p	TDA3570	375p	TDA8153	250p	UPC1031H	150p				
STK439	500p	STK5421	450p	STR30110	400p	TA7769	130p	TDA1572	175p	TDA3580	400p	TDA8160	125p	UPC1032	60p				

JAPANESE TRANSISTORS

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
2SA1371	100p	2SC1008	20p	2SC1730	10p	2SC2270	60p	2SC2750	300p	2SC3277	280p	2SC3893	225p	2SD836A	60p	2SD1279	600p	2SD1815	100p
2SA1380	75p	2SC1010	225p	2SC1735	70p	2SC2271	30p	2SC2751	270p	2SC3280	200p	2SC3895	400p	2SD837	55p	2SD1288	175p	2SD1825	60p
2SA1381	100p	2SC1012	75p	2SC1739	800p	2SC2274	15p	2SC2752	140p	2SC3281	200p	2SC3897	650p	2SD838	300p	2SD1289	250p	2SD1843	100p
2SA1382	120p	2SC1013	170p	2SC1740	10p	2SC2275	50p	2SC2767	300p	2SC3284	600p	2SC3907	250p	2SD841	110p	2SD1291	400p	2SD1846	350p
2SA1385	180p	2SC1014	140p	2SC1741	35p	2SC2278	70p	2SC2769	400p	2SC3293	85p	2SC3927	250p	2SD844	200p	2SD1292	60p	2SD1849	325p
2SA1386	400p	2SC1030	150p	2SC1755	90p	2SC2290	1800p	2SC2773	700p	2SC3298	50p	2SC3950	120p	2SD845	250p	2SD1297	300p	2SD1850	325p
2SA1423	30p	2SC1047	20p	2SC1756	35p	2SC2291	40p	2SC2774	500p	2SC3299	120p	2SC3953	60p	2SD850	170p	2SD1302	20p	2SD1858	40p
2SA1489	300p	2SC1050	280p	2SC1758	30p	2SC2295	60p	2SC2785	60p	2SC3300	400p	2SC3973	210p	2SD856	48p	2SD1308	80p	2SD1877	250p
2SA1491	300p	2SC1060	70p	2SC1775	10p	2SC2298	35p	2SC2786	20p	2SC3303	100p	2SC3987	220p	2SD858	250p	2SD1309	140p	2SD1878	230p
2SA1493	500p	2SC1061	85p	2SC1781	20p	2SC2307	500p	2SC2787	10p	2SC3306	130p	2SC3996	1200p	2SD863	23p	2SD1310	140p	2SD1879	275p
2SA1516	280p	2SC1070	65p	2SC1789	100p	2SC2308	10p	2SC2791	500p	2SC3307	600p	2SC4006	100p	2SD864	200p	2SD1313	1000p	2SD1884	300p
2SA1535	175p	2SC1096	40p	2SC1809	40p	2SC2312	300p	2SC2792	220p	2SC3309	150p	2SC4020	280p	2SD866	120p	2SD1326	200p	2SD1886	450p
2SB324	40p	2SC1098	120p	2SC1810	250p	2SC2314	70p	2SC2793	700p	2SC3316	280p	2SC4023	325p	2SD866A	140p	2SD1328	60p	2SD1887	450p
2SB546	45p	2SC1106	180p	2SC1815	10p	2SC2316	150p	2SC2808	40p	2SC3317	350p	2SC4056	350p	2SD868	260p	2SD1347	70p	2SD1910	280p
2SB560	25p	2SC1114	415p	2SC1819	70p	2SC2320	10p	2SC2810	360p	2SC3323	480p	2SC4106	200p	2SD870	190p	2SD1348	65p	2SD1911	300p
2SB561	50p	2SC1115	280p	2SC1826	60p	2SC2324	120p	2SC2812	40p	2SC3327	60p	2SC4123	450p	2SD871	300p	2SD1350	150p	2SD1913	50p
2SB562	25p	2SC1116	290p	2SC1827	60p	2SC2329	480p	2SC2814	40p	2SC3331	25p	2SC4124	250p	2SD879	60p	2SD1376	125p	2SD1929	60p
2SB566	90p	2SC1124	270p	2SC1829	500p	2SC2331	50p	2SC2824	75p	2SC3333	120p	2SC4169	60p	2SD880	40p	2SD1379	100p	2SD1939	75p
2SB595	55p	2SC1161	110p	2SC1833	40p	2SC2333	200p	2SC2825	900p	2SC3345	100p	2SC4236	550p	2SD882	25p	2SD1380	100p	2SD1941	500p
2SB596	50p	2SC1162	30p	2SC1834	50p	2SC2334	80p	2SC2826	200p	2SC3352	200p	2SC4237	650p	2SD892A	100p	2SD1384	50p	2SD1959	280p
2SB598	30p	2SC1164	600p	2SC1844	50p	2SC2335	75p	2SC2827	200p	2SC3353	280p	2SC4242	170p	2SD894	35p	2SD1390	350p	2SD1961	50p
2SB600	500p	2SC1165	750p	2SC1845	15p	2SC2344	150p	2SC2832	300p	2SC3355	50p	2SC4301	550p	2SD895	200p	2SD1391	250p	2SD1978	50p
2SB646	40p	2SC1166	100p	2SC1846	35p	2SC2347	60p	2SC2834	400p	2SC3356	120p	2SC4742	275p	2SD896	200p	2SD1392	150p	2SD1984	450p
2SB647	20p	2SC1170	180p	2SC1847	45p	2SC2353	120p	2SC2837	250p	2SC3358	50p	2SC4769	300p	2SD900	400p	2SD1395	150p	2SD2012	50p
2SB648	45p	2SC1172	150p	2SC1855	85p	2SC2360	120p	2SC2839	40p	2SC3361	50p	2SD198	140p	2SD905	450p	2SD1396	120p	2SD2125	225p
2SB649	35p	2SC1173	40p	2SC1856	25p	2SC2361	150p	2SC2853	70p	2SC3376	300p	2SD199	195p	2SD916	130p	2SD1397	120p	2SD2333	300p
2SB688	90p	2SC1195	210p	2SC1865	700p	2SC2362	50p	2SC2877	120p	2SC3377	50p	2SD200	180p	2SD917	300p	2SD1398	120p	2SJ48	425p
2SB703	90p	2SC1212	35p	2SC1870	700p	2SC2365	280p	2SC2878	20p	2SC3378	120p	2SD201	260p	2SD921	320p	2SD1399	300p	2SJ49	425p
2SB705	200p	2SC1213	15p	2SC1875	220p	2SC2369	100p	2SC2879	3200p	2SC3383	80p	2SD257	195p	2SD923	360p	2SD1400	280p	2SJ50	425p
2SB707	200p	2SC1214	15p	2SC1881	70p	2SC2371	25p	2SC2883	60p	2SC3387	550p	2SD313	25p	2SD946	120p	2SD1402	150p	2SJ56	700p
2SB716	20p	2SC1215	25p	2SC1890	15p	2SC2373	210p	2SC2898	200p	2SC3393	80p	2SD315	75p	2SD947	100p	2SD1406	60p	2SJ74	60p
2SB718	60p	2SC1216	200p	2SC1904	125p	2SC2383	50p	2SC2899	50p	2SC3399	50p	2SD325	30p	2SD950	300p	2SD1407	60p	2SJ75	280p
2SB727	200p	2SC1222	15p	2SC1906	15p	2SC2389	45p	2SC2909	60p	2SC3400	35p	2SD330	65p	2SD951	290p	2SD1408	125p	2SJ76	220p
2SB754	80p	2SC1226	75p	2SC1907	20p	2SC2407	110p	2SC2911	80p	2SC3401	50p	2SD348	300p	2SD957A	520p	2SD1409	170p	2SJ77	350p
2SB755	310p	2SC1252	850p	2SC1909	250p	2SC2408	120p	2SC2912	120p	2SC3402	40p	2SD357	40p	2SD958	60p	2SD1412	75p	2SJ79	225p
2SB772	25p	2SC1278	110p	2SC1913	90p	2SC2412K	50p	2SC2921	650p	2SC3409	400p	2SD358	40p	2SD965	35p	2SD1413	60p	2SJ103	75p
2SB774	50p	2SC1279	30p	2SC1921	15p	2SC2440	200p	2SC2922	480p	2SC3412	800p	2SD371	240p	2SD970	170p	2SD1415	190p	2SJ108	60p
2SB775	100p	2SC1306	90p	2SC1923	10p	2SC2458	10p	2SC2928	550p	2SC3416	30p	2SD380	650p	2SD973	60p	2SD1417	125p	2SJ115	525p
2SB791	280p	2SC1308K	350p	2SC1929	180p	2SC2459	50p	2SC2929	280p	2SC3417	90p	2SD381	50p	2SD973A	70p	2SD1425	260p	2SJ117	550p
2SB795	60p	2SC1312	40p	2SC1940	110p	2SC2470	65p	2SC2934	75p	2SC3419	120p	2SD388	150p	2SD985	120p	2SD1426	160p	2SJ119	700p
2SB825	135p	2SC1317	15p	2SC1941	27p	2SC2481	120p	2SC2937	250p	2SC3420	80p	2SD389	60p	2SD986	120p	2SD1427	180p	2SJ161	650p
2SB861	110p	2SC1318	10p	2SC1942	350p	2SC2482	20p	2SC2938	235p	2SC3422	75p	2SD400	14p	2SD1012	40p	2SD1428	220p	2SJ162	680p
2SB882	180p	2SC1325	400p	2SC1944	350p	2SC2483	120p	2SC2939	400p	2SC3423	60p	2SD401	50p	2SD1020	40p	2SD1429	410p	2SK19	45p
2SB886	90p	2SC1327	20p	2SC1945	350p	2SC2484	185p	2SC2944	300p	2SC3446	150p	2SD402	120p	2SD1021	120p	2SD1430	280p	2SK40	50p
2SB950	180p	2SC1328	15p	2SC1946	1500p	2SC2491	200p	2SC2958	50p	2SC3447	200p	2SD415	55p	2SD1022	400p	2SD1431	400p	2SK49	50p
2SB951	190p	2SC1342	15p	2SC1947	450p	2SC2495	1900p	2SC2962	800p	2SC3456	200p	2SD424	350p	2SD1024	130p	2SD1432	400p	2SK55	100p
2SB1009	110p	2SC1345	15p	2SC1957	70p	2SC2498	50p	2SC2979	160p	2SC3457	125p	2SD426	150p	2SD1030	75p	2SD1433	750p	2SK68	100p
2SB1077	180p	2SC1346	100p	2SC1959	10p	2SC2500	25p	2SC2987	250p	2SC3459	180p	2SD427	350p	2SD1031	70p	2SD1438	140p	2SK73	75p
2SB1109	100p	2SC1358	270p	2SC1967	1300p	2SC2502	200p	2SC2988	150p	2SC3460	180p	2SD438	35p	2SD1046	200p	2SD1439	165p	2SK106	40p
2SC182	75p	2SC1359	15p	2SC1969	160p	2SC2519	60p	2SC2995	60p	2SC3461	350p	2SD467	15p	2SD1047	180p	2SD1441	280p	2SK107	40p
2SC372	25p	2SC1360	70p	2SC1970	100p	2SC2527	300p	2SC2999	50p	2SC3466	225p	2SD468	15p	2SD1051	130p	2SD1445	200p	2SK118	50p
2SC380	10p	2SC1364	25p	2SC1971	400p	2SC2534	150p	2SC3001	1400p	2SC3468	70p	2SD471	20p	2SD1060	130p	2SD1450	60p	2SK125	100p
2SC382	50p	2SC1383	25p	2SC1972	600p	2SC2535	300p	2SC3012	300p	2SC3481	300p	2SD525	50p	2SD1062	150p	2SD1451	260p	2SK133	650p
2SC388A	60p	2SC1384	20p	2SC1973	150p	2SC2538	100p	2SC3019	320p	2SC3482	275p	2SD526	70p	2SD1063	200p	2SD1452	350p	2SK134	415p
2SC394	60p	2SC1393	20p	2SC1983	75p	2SC2540	1900p	2SC3025	500p	2SC3486	275p	2SD545	18p	2SD1064	250p	2SD1453	140p	2SK135	415p
2SC403	25p	2SC1394	15p	2SC1984	150p	2SC2542	300p	2SC3026	550p	2SC3502	100p	2SD549	120p	2SD1065	160p	2SD1455	250p	2SK147	160p
2SC454	15p	2SC1398	55p	2SC1985	100p	2SC2545	55p	2SC3030	300p	2SC3503	50p	2SD551	300p	2SD1069	150p	2SD1457	165p	2SK150	150p
2SC458	10p	2SC1400	50p	2SC1986	100p	2SC2546	25p	2SC3037	125p	2SC3504	120p	2SD555	500p	2SD1071	450p	2SD1459	120p	2SK163	40p
2SC460	10p	2SC1403	500p	2SC2001	15p	2SC2547	65p	2SC3038	125p	2SC3505	240p	2SD560	50p	2SD1073	350p	2SD1468	60p	2SK168	40p
2SC461	15p	2SC1407	550p	2SC2002	15p	2SC2550	50p	2SC3039	80p	2SC3506	250p	2SD571	20p	2SD1088	150p	2SD1479	200p	2SK176	800p
2SC495	45p	2SC1413	150p	2SC2003	20p	2SC2551	70p	2SC3040	260p	2SC3507	650p	2SD575	530p	2SD1094	520p	2SD1487	225p	2SK192	45p
2SC496	25p	2SC1419	50p	2SC2004	20p	2SC2552	60p	2SC3042	300p	2SC3509	750p	2SD600	30p	2SD1110	225p	2SD1491	100p	2SK195	150p
2SC497	85p	2SC1429	50p	2SC2021	10p	2SC2553	200p	2SC3057	150p	2SC3518	120p	2SD601	40p	2SD1111	20p	2SD1494	300p	2SK197	140p
2SC515	100p	2SC1444	275p	2SC2022	110p	2SC2555	120p	2SC3058	2500p	2SC3519	250p	2SD602	60p	2SD1113	225p	2SD1496	350p	2SK214	170p
2SC535	30p	2SC1446	55p	2SC2023	180p	2SC2562	90p	2SC3068	60p	2SC3531	225p	2SD612	50p	2SD1128	200p	2SD1497	230p	2SK216	200p
2SC536	20p	2SC1447	70p	2SC2026	30p	2SC2563	200p	2SC3070	35p	2SC3549	200p	2SD613	70p	2SD1133	100p	2SD1497-02	350p	2SK218	400p
2SC558	275p	2SC1448	100p	2SC2027	200p	2SC2564	230p	2SC3074	200p	2SC3552	300p	2SD636	10p	2SD1135	75p	2SD1505	120p	2SK240	140p
2SC563	120p	2SC1449	120p	2SC2028	75p	2SC2565	260p	2SC3075	150p	2SC3568	200p	2SD637	15p	2SD1138	50p	2SD1507	60p	2SK312	750p
2SC605	100p	2SC1450	200p	2SC2029	120p	2SC2568	120p	2SC3077	120p	2SC3584	200p	2SD638	15p	2SD1140	40p	2SD1509	100p	2SK315	70p
2SC619	100p	2SC1454	250p	2SC2037	50p	2SC2570	30p	2SC3086	150p	2SC3595	220p	2SD639	20p	2SD1142	350p	2SD1511	100p	2SK320	120p
2SC641	80p	2SC1470	120p	2SC2053	120p	2SC2571	350p	2SC3089	130p	2SC3605	60p	2SD640	350p	2SD1148	175p	2SD1519	250p	2SK323	130p
2SC644	10p	2SC1472	40p	2SC2055	150p	2SC2577	110p	2SC3101	750p	2SC3606	100p	2SD655	18p	2SD1159	90p	2SD1521	70p	2SK386	600p
2SC647	300p	2SC1473	15p	2SC2058	20p	2SC2578	170p	2SC3112	35p	2SC3607	150p	2SD661	60p	2SD1160	150p	2SD1541	350p	2SK405	450p
2SC681	250p	2SC1474	45p	2SC2060	60p	2SC2579	110p	2SC3114	40p	2SC3636	280p	2SD666	25p	2SD1163A	220p	2SD1548	450p	2SK413	500p
2SC683	35p	2SC1475	60p	2SC2061	75p	2SC2580	175p	2SC3116	75p	2SC3657	400p	2SD667	20p	2SD1164	75p	2SD1554	170p	2SK415	500p
2SC708	100p	2SC1505	80p	2SC2068	60p	2SC2581	225p	2SC3117	120p	2SC3659	600p	2SD668	120p	2SD1168	270p	2SD1555	170p	2SK429	180p
2SC710	15p	2SC1507	45p	2SC2071	140p	2SC2588	600p	2SC3122	50p	2SC3668	120p	2SD669	35p	2SD1169	280p	2SD1556	400p	2SK511	450p
2SC711	15p	2SC1509	35p	2SC2073	40p	2SC2590	40p	2SC3148	185p	2SC3675	100p	2SD673	350p	2SD1173	350p	2SD1564	100p	2SK513	325p
2SC730	350p	2SC1514	35p	2SC2075	60p	2SC2591	50p	2SC3149	180p	2SC3678	280p	2SD676	250p	2SD1185	400p	2SD1565	75p	2SK531	350p
2SC732	40p	2SC1515	60p	2SC2078	95p	2SC2592	200p	2SC3150	125p	2SC3679	180p	2SD716	80p	2SD1186	400p	2SD1571	170p	2SK534	700p
2SC733	15p	2SC1520	45p	2SC2085	100p	2SC2603	10p	2SC3151	230p	2SC3680	380p	2SD717	180p	2SD1187	250p	2SD1572	100p	2SK537	900p
2SC735	40p	2SC1541	110p	2SC2086	60p	2SC2610	60p	2SC3152	130p	2SC3685	450p	2SD718	85p	2SD1189	55p	2SD1576	250p	2SK538	450p
2SC738	15p	2SC1545	120p	2SC2092	100p	2SC2611	30p	2SC3153	230p	2SC3687	600p	2SD722	240p	2SD1190	150p	2SD1577	250p	2SK539	1100p
2SC739	150p	2SC1567	40p	2SC2094	1200p	2SC2621	70p	2SC3156	350p	2SC3688	550p	2SD725	270p	2SD1191	120p	2SD1579	120p	2SK555	400p
2SC761	110p	2SC1568	35p	2SC2097	2300p	2SC2625	190p	2SC3157	200p	2SC3692	150p	2SD734	15p	2SD1192	90p	2SD1589	60p	2SK556	500p
2SC762	150p	2SC1569	55p	2SC2099	2500p	2SC2626	600p	2SC3158	260p	2SC3715	480p	2SD741	120p	2SD1196	150p	2SD1590	100p	2SK557	400p
2SC783	85p	2SC1570	40p	2SC2118	1100p	2SC2631	20p	2SC3159	200p	2SC3717	120p	2SD743	130p	2SD1197	150p	2SD1591	310p	2SK566	475p
2SC790	50p	2SC1571	50p	2SC2120	10p	2SC2634	10p	2SC3164	350p	2SC3729	450p	2SD756	100p	2SD1207	40p	2SD1593	125p	2SK695	550p
2SC792	380p	2SC1573	25p	2SC2131	550p	2SC2636	40p	2SC3169	150p	2SC3746	100p	2SD757	120p	2SD1210	280p	2SD1595	160p	2SK719	300p
2SC805	225p	2SC1580	600p	2SC2141	60p	2SC2637	120p	2SC3170	300p	2SC3747	120p	2SD758	140p	2SD1211	120p	2SD1608	210p	2SK724	600p
2SC828	20p	2SC1583	25p	2SC2153	40p	2SC2640	1800p	2SC3173	180p	2SC3752	250p	2SD762	100p	2SD1218	75p	2SD1609	70p	2SK725	600p
2SC829	15p	2SC1586	540p	2SC2166	80p	2SC2653	100p	2SC3175	150p	2SC3781	150p	2SD763	140p	2SD1223	75p	2SD1632	500p	2SK727	1200p
2SC839	20p	2SC1617	340p	2SC2168	120p	2SC2654	180p	2SC3178	175p	2SC3783	600p	2SD768	180p	2SD1225	120p	2SD1637	50p	2SK735	600p
2SC870	100p	2SC1623	50p	2SC2188	70p	2SC2655	75p	2SC3179	70p	2SC3787	100p	2SD772	200p	2SD1227	40p	2SD1647	40p	2SK758	300p
2SC898	275p	2SC1624	60p	2SC2200	250p	2SC2656	550p	2SC3181	200p	2SC3789	75p	2SD773	20p	2SD1229	250p	2SD1649	260p	2SK787	1100p
2SC930	15p	2SC1626	55p	2SC2221	650p	2SC2660	100p	2SC3182	120p	2SC3790	120p	2SD774	30p	2SD1237	300p	2SD1650	180p	2SK794	500p
2SC941	15p	2SC1627	15p	2SC2228A	60p	2SC2665	200p	2SC3199	40p	2SC3795	175p	2SD777	400p	2SD1246	20p	2SD1651	150p	2SK872	650p
2SC943	160p	2SC1628	75p	2SC2229	15p	2SC2668	10p	2SC3209	120p	2SC3798	220p	2SD784	650p	2SD1247	40p	2SD1663	450p	2SK903	500p
2SC944	140p	2SC1634	50p	2SC2230	80p	2SC2671	100p	2SC3210	550p	2SC3807	120p	2SD786	100p	2SD1248	270p	2SD1666	90p	2SK1057	600p
2SC945	10p	2SC1669	100p	2SC2233	100p	2SC2681	170p	2SC3211	220p	2SC3811	80p	2SD787	20p	2SD1251	180p	2SD1667	120p	2SK1058	800p
2SC950	40p	2SC1674	15p	2SC2235	60p	2SC2682	70p	2SC3212	260p	2SC3832	200p	2SD788	30p	2SD1263	90p	2SD1668	120p	2SK1117	250p
2SC959	225p	2SC1675	90p	2SC2236	20p	2SC2688	27p	2SC3225	50p	2SC3833	250p	2SD789	20p	2SD1264	55p	2SD1677	300p	2SK1118	225p
2SC980	40p	2SC1678	80p	2SC2237	540p	2SC2690	75p	2SC3244	45p	2SC3853	220p	2SD792	400p	2SD1265	75p	2SD1730	350p	3SK45	100p
2SC982	20p	2SC1683	100p	2SC2238	45p	2SC2705	50p	2SC3246	50p	2SC3854	250p	2SD794	33p	2SD1266	180p	2SD1732	400p	3SK51	100p
2SC983	120p	2SC1684	30p	2SC2240	15p	2SC2710	50p	2SC3259	350p	2SC3855	220p	2SD795A	140p	2SD1267	55p	2SD1739	275p	3SK59	100p
2SC1000	20p	2SC1685	30p	2SC2258	30p	2SC2712	20p	2SC3260	220p	2SC3857	500p	2SD811	450p	2SD1271	55p	2SD1740	125p	3SK74	50p
2SC1001	950p	2SC1729	900p	2SC2259	60p	2SC2716	50p	2SC3261	230p	2SC3858	550p	2SD819	200p	2SD1271A	225p	2SD1748	90p	3SK77	50p
						2SC2719	25p	2SC3262	280p	2SC3870	200p	2SD820	250p	2SD1272	200p	2SD1760	80p	3SK81	50p
						2SC2721	120p	2SC3263	280p	2SC3883	280p	2SD821	550p	2SD1273	50p	2SD1762	50p	3SK85	160p
						2SC2738	200p	2SC3264	390p	2SC3884A	300p	2SD822	290p	2SD1275	50p	2SD1773	160p	3SK88	70p
						2SC2740	450p	2SC3269	50p	2SC3886A	400p	2SD826	30p	2SD1276	60p	2SD1783	100p	3SK121	150p
						2SC2749	350p	2SC3270	50p	2SC3890	150p	2SD836	60p	2SD1277	190p	2SD1796	180p		

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REPLACEMENT VIDEO HEADS

Model	Price
AIWA	
AV66/AV77	1200p
G700	1100p
G900	1500p
AKAI	
VS105, 112, 115, 116, 125, 126, 201, 202, 205, 220, 240, 244, 245, 247, 248, 250, 301, 303, 304, VSP8, VSP82	1350p
VP7100, VS9300, VS9500, VS9800	650p
VP77, VP88, VP7100, VP7200, VS9700, VS9800	1400p
VS1, VS2, VS3, VS4, VS5, VS10, VSP1	1350p
VS33, VS35, VS37, VS38, VS53, VS55, VS66, VS765, VS767, VS768	2400p
VS512, VS515, VS516	2800p
VS465	2600p
VS11, VS12	1400p
VS6, VS8, VS9	2400p
VSX9	2500p
VSF600, VSF650	3600p
VS155, VS165	2500p
VS20, 22, 24, 25, 26, 27, 422, 426, 427, VSF10, VSP9	1400p
VSR9	1500p
VS109, VS603, VS606, VS607	2500p
VS75	2500p
ALBA	
VCR4000, VCR5000, VCR6000	1650p
AMSTRAD	
VCR4500, VCR5200, VCR9000, TVR1	1100p
VCR7000	1100p
VCR6000, 6100, 6200, 8600, 8602, 8700, DD8900, 8904, TVR4	1200p
TVR2, TVR3, VCR4600, VCR4600 MKII, VCR4700	1150p
AUTHENTIC	
N850	800p
AWA	
ATVI	800p
BAIRD	
8900, 8901, 8902, 8903, 8906, 8922, 8928	650p
8904, 8923, 8924, 8925, 8929, 8935, 8943, 8944	650p
8909, 8912	800p
8930, 8931, 8933, 8940	800p
8942	2300p
8945	2000p
8947, 8948	1600p
8950	1700p
VC141L	3000p
VH582	7000p
BLAUPUNKT	
RTV100, 200, 202, 211, 214, 222, 224, RTX100, 200	800p
RTV301, RTX250, RTV333	800p
RTV306, 307, 309, 311, 315, 316, 520, 707	1650p
RTV310, 311A, 312, 317, 319, 320	1100p
RTV324, RTV325	1550p
RTV328	1850p
RTV424	3500p
RTV434, RTV444	3900p
RTX260, RTX720, RTV330	2300p
RTV454, RTV740	5000p
RTV478	3700p
RTV520, RTV530	1800p
RTV535, RTV560, RTV570	2000p
RTV635, RTV660, RTV670, RTV730	3000p
CR1000, CR1200, CR1500	4650p
CR1800	4100p
RTV321, RTV322	1700p
RTV338	2800p
RTV348	2700p
RTV404, RTV414	3000p
RTV640	3000p
RTV750, RTV800, RTV900	3500p
RTV810	4400p
RTV910	4500p
BOSCH BAUER	
VRH50	1000p
VRP20	1000p
VRP25	1000p
VRP30	3350p
CANON	
VR10	1000p
VR30A, VR30B, VR30E, VR40A	3350p
DAEWOOD	
912, VCR12, VCR30, VCR32, VCR50, VCR52	1800p
VCP11 RAF	1800p
DECCA	
8300	1000p
8400, 8500	650p
DUAL	
EVR101	2300p
VR70, VR71, VR74, VR81, VR90, VR91	650p
VR85, VR96	2300p
VR97	3300p
VR80, VR92	650p
VR93	2450p
EDISON	
VC2130, 2133, 2135, 2140, 2830, 2930, 2932, 2934, 3122	650p
VK2132, VK2512	2300p
VK2436, VK2340	650p
VK2530, VK2532, VK2631, VK2541	1600p
VK2632	1700p
VK2637	3050p
VKH2545	2450p
VKH2639, VKH2439	3300p
FUNAI	
E11, 1100, VIP1000, 1400, 3000, 5000, VCR4000, 4500, 4800, 5200, VCR5600, 6400, 6600, V1, V25	1100p
VCR4600, VCR5400, VCR5800	1200p
VCR5480, 5843, 8007, VIP2500A, 3000A, 6000, 150	2000p
VCR4530, VCR6000, VCR6100, VCR6800, VCR6803	1300p

Model	Price
VCR8103, VCR8107	2200p
VIP300A MKII	1900p
FISHER	
FVHP420, 510, 520, 530, 615, 618, 620, 622, 710, 711, 715, 720, 721, 722, 730, 830, 905, 906, 908, 910, 911, 915, 916, 918, 5000, 5001, 5005, 5050, 5075	1150p
VBS3500, 7100, 7500, 7600, 9900, VBR330	2000p
V8S7000, VBS7100, VBS9000	2000p
FVHP500, 711, 715, 721, 722, 730, 830, 5100, FVHD720	1100p
FVHP725, 830, 980	2500p
FVHP990	2700p
FVHP975	2400p
FVHD40, FVHD140, FVHP1, FVHP10, FVHP20	1150p
FIDELITY	
HQS200, VCR600, VCR6100, VR900, VR9100	1500p
VCR100	1100p
VTR1000	1100p
GOLDSTAR	
8000 3HSSDB	1900p
GVH51, GVH122, VCP4000, VCP4100, VCP4200	1300p
GHV1232, 1233, 1241, 1242, 1243, 1244 1245, 1246, 1290, 1291, 1295, 1296, 1891, 8210, 8215, GVHP1240, 1241, 1247, 1248, VCP400, VCP4130, 4300, 4301, 4305, 4306, 4310, 4311, 4315, 4316, 4320, 4321, 4326	1300p
G.E.C.	
4000H, 4001H, 4002H	1200p
V4001H, V4004	1200p
V4005H	1500p
GRANADA	
CS1, DS2	1600p
VHSAH1	1100p
VHSAH3	2400p
VHSAN3	800p
VHSAY3	1200p
VHSBH1, VHSCH1	2100p
VHSBP1	850p
VHSBY3	2600p
VHSD52	1600p
VHSEH2	1600p
VHSEY1, VHSEY2	1400p
VHSFG2, VHSFG4	1300p
VHFS1, VHSFS2	1300p
VHSTJ1, VHSTJ2, VHSTJ3, VHSWJ3, VHSYJ2	700p
VHSVH4, VHSWH1, VHSXH1, VHSYH2	1600p
VHSWJ1, VHSXJ3	700p
GRAETZ	
4312, 4605, 4905, 4912, 4913, P4833, TR4605, TR4812, TR4905, TR4912, TR4913, TR4914, TR4943	650p
4935, 4943, 4963, 4985, 4993, TR4833, TR4935, TR4985, TR4993	650p
4920, 4927, 4930	1700p
4946, TR4906, TR4916	1600p
TR4994	2300p
TR4995	3300p
GRUNDIG	
VS410, 450, 460, 500, 505, 510, 520, 521, 530, 546	1600p
BARCELONA, MVS400, 440, 500, 600, SE5100, 6100, 6110, 9100, TVR4500, 4510, 5510, VS400, 440, 500, 505, 510, 518, 600, 610, 5180, VS6190, 700, 900	1400p
MADRID, SE5140, VS540, VS5480	3000p
MVS550, 620, VS550, 620, 630, 640, 790, 930, 940	2400p
VS120	2300p
VS680	4600p
VS160, VS740	4400p
VS170	4600p
MVS660, SE6160, VERONA, VS660, VS6690	3500p
MVS710, 720, 910, SE7120, 9120, VS710, 720, 800, 810, 910, 920	1700p
HINARI	
VXL2, 3, 4, 20, 35	1150p
VXL5, V20H	1300p
VXL6	1500p
VXL7	2200p
VXL8, 9, 10, 11, 90, VCR34H, VTV200	1300p
HITACHI	
VT11, 14, 15, 16, 30, 33, 34, 330, 340, 503, 640, 5030, VTP10, 30	1000p
VT7, VT17, VT18, VT19	2200p
VT35, VT38, VT39	2400p
VT100, 110, 111, 112, 113, 115, 118, 120, 125, 128, 220, 225, 400, 405, 410, 413, 414, 415, 418, 510, 518, 520, 525, 526, VTM625, 626, 725, 726, 728	1400p
VT3000	800p
VT4000, 4200, 5000, 5500, 5600	1100p
VT77, 680, 6500, 6700, 6800, 7000, 8000, 8030, 8040, 8100, 8300, 8500, 8700, 9000, 9300, 9500, 9700, 9900	1000p
VT8, 9, 56, 57, 570, 575, 576, 580, 585, 588	3400p
VT65	2400p
VT130, 135, 138, 145, 250, 255, 258, 420, 425, 426, 428, 430, 431, 435, 438, 535, 536, VTL30, 301, VTM630, 635, 636	2000p
VT52, VT60, VT61E, VT62E, VT63, VT64, VT640	1300p
VT168, VT150, VT260, VT498 (4 HEAD)	2600p
VT530	2500p
VT522, VTM620, VTM622, VTM720, VTM722, VTM822	1900p
VT660E	2600p
H.M.V.	
HV1000, HV2000, HV3000	650p
HV4000, HV7000, HV8000p	
I.T.T.	
VR3605, 3905, 3935, 3943, 3954, 3958, 3985, 3993, 4993	650p

Model	Price
VR3833, 3912, 3913, 3914, 3963, 3975, 4913, VRP3833	650p
VR3986	2000p
VP3826, 3906, 3916, 3926, 3946, 3948	1550p
VR3927	1400p
VR3976	2300p
VR3977	2700p
VR3984, VR3994	2300p
VR3995, 3997	1800p
VR3917	1400p
VR3730, VR3731, VR3749	2500p
VR3918, VR3919, VR3938	1500p
VR3520, 3701, 3719, 3720, 3721, 3759, 9720	2000p
VR3907, VR3908	1600p
VR3968	700p
J.V.C. & FERGUSON	
HR2200, 3300, 3320, 3330, 3350, 3360, 3660, 3750, 3860, 4100, 3292, 8900, 8901, 8902, 8903, 8906, 8922, 8928, 3V01, 3V05, 3V22	600p
HR3660, 7600, 7610, 7650, 7700, HRD110, 111, 120, 121, 220, 225, HRS100, 8904, 8923, 8924, 8925, 8929, 8935, 8941, 8943, 8944, 3V16, 3V23, 3V24, 3V31, 3V35, 3V36, 3V38, 3V39, 3V49	625p
BR1600, HRD140, 141, 142, 143, 150, 152, 156, 157, 158, 160, 5101, HRS10, 8947, 8948, 3V42, 3V44, 3V45, 3V46, 3V47, 3V52, 3V54, 3V55, 3V56, 3V57	1250p
HRD154, 170, 171, 210, 211, 217, 320, 321, 350, 521, 522, 525, 526, 527, 550, 8950, 8951, 3V64, 3V65, FV10, FV11, FV20, FV21, FV26	1400p
HRD565, HRD566, 3V48	2450p
HRD725, HRD755, 3V43, 3V53	3150p
8930, 8931, 8933, 8940, 3V29, 3V30	700p
8945	2400p
3V00, 8902, 8903, 8909, 8912, 8922	1000p
FV31	1500p
FV37, FV43H, HRD860	3500p
BR7000E, BR7000S	2800p
HR7200, 7300, 7350, 2650, BR6200	700p
HRD455	2000p
HRD520	1400p
HRD300, 400, 580, 600, 620, 650	2300p
HR4100	1000p
HRD750, HRD830	3300p
HRD250, HRD257	2700p
3V32, 8942, HR7655	2300p
HRD180, 190, 230, 610, 3V59, FV12L, FV20B, 26, 30, 32, 33, VC141L	2450p
HRD370, HRD430, HRD470, 3V58, FV13H	2300p
HRD530, HRD700, FV14T	3100p
GRC1, GRC2, 3V41	2800p
HRD330, 337, 440, 637, 641, 660, HRFC100, FV44L	2100p
KENWOOD	
KV901, KV903, KV905	650p
KV917	2450p
LOGIK	
VR960	1500p
VR950	1400p
LOEWE	
OC410, OC420, OC440	2400p
OC50, OC55, OC60, OC65	1500p
LUXOR	
9225, 9256	1800p
9245, 9251, 9254	1225p
9270, 9271, 9273	1800p
9272, 928217	2700p
9252	2500p
928017, 928077, 928097, 929107, 928117	1700p
9253	2500p
9281	2700p
9284, 9295, VR3701, VR3721, VR3731, VR3761	2100p
MATSUI	
VX500E, 800A, 810A, 820, 80A, 770B, 773B	1200p
VCRL3, VX730, VX750	1450p
VX735, VX755, VX990	1500p
VX735A, VX765, VX850	1750p
VX600	1100p
MITSUBISHI	
HS303, HS304, HS320, HS700	1500p
HS306, HS318, HS710	1600p
HS307	2600p
HS319	2500p
HS330	2600p
HS400	2800p
HS349, HSE31, HSE32, HSB31	2400p
HS411	2900p
HSE30, HSB30	2400p
HS338	2200p
HSE10, HSE11, HSE20, HSE21, HSE41, HSB10, HSB20	2200p
HS300, HS301, HS302, HS310, HS273	1550p
HS200	650p
HS337, HS347	1500p
HSE12, HSE22, MX1	2200p
HS411EZ, HS411GZ	2900p
HSB11, HSB21	2200p
HSE50	3300p
NATIONAL PANASONIC	
NV300, 322, 333, 390, 2000, 2010, 3000, 7000, 7500, 7800, 7850, 8170, 8200, 8400, 8600, 8610, 8620	625p
NV777, NV330	1500p
NV8050, NV8051	2800p
AG1000, AG1050, NV260, NV280, NV460, NV470, NV480	1600p
AG6010, AG6015	2500p
AG6840	2400p
NV100, NV200, NV370, NV380, NV630	725p
NVD80, NVH65	3900p
NVF65, NVH75	3200p
NVF51	4200p
NVG19	2300p
NVJ30, NVHJ33, NVL20, NVL21, NVG30, 31, 40, 130	1800p
NVJ35, NVG46	2500p

Model	Price
NVM1, NVM3, NVM5	4200p
AG2100, AG2200	700p
NV430	1100p
NV730, NV770 4 HEAD	1550p
NV366	1850p
NV180, NVD48	2300p
NV788	2900p
NV810, NV830	2600p
NV850, NV950	2750p
NV870, NV890, NV970	3600p
NVG33, NVG46, NVL23, NVL25, NVL28	2000p
NVG10, 11, 12, 14, 16, 120, NV250, 280, 450, 465	1650p
NVG18	2000p
NVG20, 21, 22, 25, 28, 200, NVD48	2200p
NVG50, NVG300	2650p
NVG45	2000p
NVH70	3600p
NV688	2400p
NV600	1600p
AG6800, AH6810	2600p
AG6100, AG6200, AG6300	2800p
NVG7, NVG9, NV230	1200p
NV780	2800p
NVG15, NVG400	2600p
NVM7, NVMC20	3800p
NVF70	5200p
N.E.C.	
N9011, 9012, 9013E, 9014E, 9014G, 9015, 9016, 901A, 902A, 9033, 9034, 9040, 9053, 9054, 9055, 9063, 9065, 9066, 906, DX1000, 1600	1300p
N911A, 914C, 915A, 916A, 917, 9110, 9120	2400p
PVC600, 740, 744, 754, 763E, 764, PV2300, 2400, 760, 794, 770, 774	1650p
N380, N381, N830, N831, N832, N833, N834, N835, N836	700p
8261, AH1 (for model DX3000), DX4000, N9610	3000p
N895	3150p
N9052, N9530, DX2000	3400p
VCP1	1700p
PVC2300, 2400, 740, 744, 760, 764	1400p
DS6000	3500p
NORDMENDE	
460, 9-460, V100, 140, 200, 250, 304, 341, 450, 550	700p
V1001, 1005, 1015, 1025, 1035, 1041, 1055, 1065, 1105, 2005	1250p
V110, V333	2000p
V101, 102, 103, 112, 141, 142, 200, 300, 301, 302, 350, 500, 3005	700p
V1205, V1215, V1235, V1245	1400p
V1305	2450p
V380	2300p
V502, V503, V5005	3150p
ORION	
VH3, VH555, VH600, VH700, VH844, VH900, VH1000 (ALL MODELS)	1100p
VH1, VH2A	700p
PHILIPS	
VR6460, VR6520, 64VR60, VR6620	725p
VR6711 4 HEAD	1800p
6920, VR6440	2500p
VR6441, VR6540, VR6541, VR6640, VR6642	1300p
RANK	
BV6900AS	1800p
N830EA, RV300, RV310, RV320, RV330, RV340, RV350, RV380	700p
REDSON	
MR100	1700p
SABA	
2A10, 2A70, 2B20	1400p
4A10, 4B20	2450p
6A10, 6A70	2300p
8A10, VR6038	3150p
CVR6083, VR600, 66007, 6008, 6009, 7006, 7007	1250p
PVR6068, 6070, 8070, VR2000, 6000, 6010	600p
6012, 7000, 9010	1500p
VHR7000, VR5005	
VR6004, 6005, 6011, 6013, 6014, 6020, 6022, 6023, 6024, 7004, 7011, 7014, 7720, 7730, 8011, 8014	700p
VR6018, VR7018	2450p
VR6028	2300p
VR7016	2000p
SAISHO	
VR100, 605, 705, 805, 905, 1000, 1100, 1200, 1600	1200p
VR3300X, VR3600X, VR3650, VR3800	1400p
VR3200, VR3500	1400p
VR2000, VR3300, VR3600	1400p
SALORA	
6600, 6600	1600p
SV7300, SV8200, SV8300, SV9200	1500p
SV7400, 8400	1600p
SV8100	1200p
SAMSUNG	
SVX301, VB900, 910, VVT510, VT320, 5300, VX510, 511, 520, 616, 626, 627, 717, 614, 619, 629, 710, 712, 720, 730, 970, 971, 972, SV716, 717, SVX303, 305, VB510, 520, 610, 616, 617, 619, 620, 626, 627, 629, 710, 971, V1520, 616, 621, 626, 906, 910	1350p
VB770, V1730, V1770, VK8220, VX750, VK770, VK8225	1900p
VM1560, VN1561	2200p
SANYO	
VTC5000, 5400, 6000, 6500, VPR5000, VTC1500, VTCM10, 11, 20, 21, 25, VTC2000, 5100, 5150, 5300, 5400, 5350, 5370, VTCNX10, VTCNX15, 20, 30, VPR5800	1800p
VTC5500, 5550, 9100, 9300, 9350, 9355, 9455, 9500	1900p
VHR1110, VHR1150, VHR1300, VHR1700, VHR2300	1300p
VHR3200, 3270, 3100, 3150, 3300, 3400, 3310, VHRD500	1500p

Model	Price
VHR1100, VHR1200	1500p
VHR1500, VHR2500	2100p
VHR2700	2450p
VHR7900	3000p
SHARP	
VC390, VC393, VC496	2750p
VC488	4200p
VC779	1800p
VC789, VC790	2900p
VC200, 220, 300, 381, 383, 384, 385, 386, 387, 388, 471, 477, 481, 482, 483, 486, 3300, 8381, 9100, 9300, 9400, 9500, 9600, 9700	1100p
VC582, 583, 651, 681, 750, 780, 781, 683, 684, 402, 500, 571, 573, 580, 584, 600, 682, 693, 700, 772, 7810, 782, 7822, 783, 8481	1100p
VC6000, 6200, 6300, 7300, 7700, 7750, 8000, 8300	1800p
VC793	3000p
VC473, 785, 786	2200p
VC699, VCA501, VCA602	2800p
VC585, VC685	2000p
VC90ET	3900p
VFH815	2800p
SIEMENS	
FM350, FM352, FM355, FM361, FM362, FM363	1300p
FM364	1350p
FM391, FM392, FM461	1800p
FM394, FM464	2800p
FM462, FM561	1600p
FM468	2450p
FM484, FM485, FM602, FM604, FM622, FM624	1800p
FM585	1425p
FM600	1900p
SONY	
DSR-19R (FOR SL-T 9ME)	3100p
DSR-21R (FOR SLC 8-C9)	2800p
DSR-35R (FOR C20, C30, C40, SLF1UB, SLF1E) 2 PIN SLC24PS, SLC33E, SLC44PS, SLF30PF, SLF60PS, SLK85, SLT20ME, SLT30ME	1500p
DSR-43R (FOR SLC7 RANGE, SL5000, SL5100, SL3000) 1 PIN SLC6E, SL36ES, SL37E	1300p
SL3000, 8000, 8080, SLC5E, SLT7ME	1600p
SLV201, 202	2000p
SLK95, SLT50ME	2900p
SLV373VB	2600p
TOSHIBA	
V63	1500p
V9680	3400p
V8600, V8700	3000p
V21, V31, V33, V50, V51, V53, V9600	1450p
V55, V57	700p
V71, V73, V74, V75, V77, V80, V81, V82, V83, V84, V85, V86, V87	1200p
V80, V93	1450p
V5470, V5480	1300p
V600	2350p
V880MS	2600p
V700G	3700p
V500G, V509G	2500p
V9680	2900p
V300G, V301, V305, V309G	2550p
V61, V63	1700p
V110, V120, V130, V140, V210, V220	1800p
TRIUMPH	
VR9500, VR9501, VR9525	1100p
TELEFUNKEN	
A890	2700p
A920, VR1970, 2920, 2925, 2930, 410, 7921, 7926, 7931, 7970, 970	1250p
VR400, 410, 450, 510, 519, 520, 529, 540, 610, 620, 640, 920, 1920	700p
A930, 932, 935, VR2931, 2935, 2941, 3935, 4935, 4940, 4942, 4945, 5935, 7932	1400p
A935, VR3945, VR3950, VR7959	2450p
A940, VR1925, 1930, 1940, 1950, 2960, 440, 449, 530, 535, 539, 549, 550, 630, 650, 925, 930, 940, 950	700p
VR1980, VR7980, VR980	3150p
VR2915	1100p
VR2970, VR7971, VR975	2450p
VR7979	2300p
THOMSON	
TX8000, V309, 316, 320, 321, 323, 326, 4100, 4200, 4300, VX305T, 306T, 309BL, 3301, 312T, 410T, 411T	650p
TX8500, V318, 342, 343, 351, 352, 353, 4210, 4230, 4260	1250p
V333	1100p
V340	1100p
V357, VK309LP	2300p
V360, V5500	2450p
V364, V4400	2000p
V368, V6000, V8540	3150p
V410, 510, 610, 630, 715, 4240	1400p
V430, 530, 4340	2450p
V450	2300p
VK300T, VK301T, VK302T, VK303T, VK308P	650p
VM10, VM20	2700p

PINCH ROLLERS / VCR BELT KITS

Model	Price
AKAI	
VS10, VS9300, VS9500, VS9700, VS9800, VP7100, VP77	200p
VS1, VS2, VS3, VS4, VS5, VS6, VS8, VS9	200p
VS105, 112, 115, 116, 126, 205, 220, 240, 244, 245, 247, 248, 250, 512, 515, 516, VSX9	200p
VS201, VS301, VS303, VS304, VS603, VS606, VS607, VP58 P82	200p
VS125, VS155, VS165, VS220, VS240, VS250, VS512	200p
VS22, 23, 25, 35, 37, 38, 53, 66, 75, 422, 425, 426, 427, 462, 465, 467, 485, 965, 967, VSA77	200p
VSF260, 261, 262, 265, 270, 274, 280, 290, 410, 440, 450, 456, 480, 490, 497, 560, 599	200p
AMSTRAD	
VCR4500, 4600, 4700, 5200, 6000, 6100, 8600, 8602, 8603, 8604, 8700, 8704, 8714, 8800, 8804, 9000, 9340, DD8904, TVR1, 2, 3, 4	200p
VCR7000	200p
AIWA	
AV66, AV77	200p
G700, G900	200p
ALBA	
VCR3000X, VCR4000	200p
VCR5000, VCR6000	200p
AUTHENTIC	
N850	200p
BLAUPUNKT	
RVT100, 200, 202, 222, 224, 301, 306, 307, 309, 311, 312, 315, 316, 317, 319, 320, 328, 404, 414, 434, 444, 478, 707, RTX100	200p
RTV211, 214, 321, 322, 348, RTX250, 260	200p
RTV324, 325	200p
RTV330, 454, 520, 530, 535, 560, 660, 670, 720, 730, 740, 800, 810, 900, 910, 920	200p
DAEWOOD	
VCR12, VCR32, VCR52	200p
VCR30, VCR500	200
OECCA	
VR8300	200p
VRH8495DK (Pressure Roller Assembly)	
PS403 40205	450p
FERGUSON	
3V00, 3V01, 3V16, 3V22, 3V23, 3V24, 3292, 8900, 8901, 8902, 8903, 8904, 8906, 8909, 8912, 8922, 8923, 8924, 8925, 8929	200p
3V29, 3V30, 3V31, 3V32, 3V52, 8930, 8931, 8933, 8940, 8941, 8942	200p
3V35, 3V36, 3V38, 3V39, 3V42, 3V43, 3V44, 3V45, 3V48, 3V49, 3V53, 3V54, 3V55, 3V56, 3V57, 3V58, 3V59, 3V65, FV10, FV11, FV12, FV14, 8943, 8944, 8945, 8947, 8948	200p
3V62	200p
8950, 8951, FV10B, 11R, 13H, 14T, 20B, 21R, 26D, 31R, 32L, 41R, FV42L, 50B, 51R, 52L, VC141L	200p
FV44L, FV46T, FV43H	200p
FISHER	
FVHP420, 520, 530	200p
FVHP615, 618, 620, 622, 710, 711, 715, 716, 720, 721, 722, 725, 730, 830, 840	200p
FVHP905, 906, 908, 910, 911, 915, 916, 918, 970, 975, 980, 990, 5000, 5005, 5050, 5075, 5100	200p
VBR330, VBS3500, 7000, 7500, 7600, 9000, 9900	200p
FVHD250, 270, 370, 2000D, FVHP3, 210, 250, 300, 310, FVSD2095	200p
FIDELITY	
HQS200, VCR100, 600, 6100	200p
VTR100	200p
FUJITSU	
HS760, VX715, VX720D	200p
FUNAI	
V1, V2, VCR4000, 4500, 4530, 4540, 4600, 4800, 5200, 5400, 5600, 5800, 5840, 5843, 6000, 6400, 6600, 6800, 6803, 8007, 8103, VIP150, 3000, 5000, 6000	200p
VIP1000, VIP1400	200p
G.E.C.	
V4004	200p
GRANADA	
VHSAH1, 3, VHSVH4, VHSWH1, VHSXH1, VHSYH2	200p
VHSAN3, VHSBP1, VHSVN1, VHSVN2	200p
VHSAY3, VHSX42	200p
VHSBH1, VHSCH1, VHSFS1, VHSFS2, VHSEH2, VHSEH3	200p
VHSBY3, VHSCC1	200p
VHSDS2, VHSXN2	200p
VHSDP1, VHSFP2 (Pressure Roller Assembly) PS403 40205	450p
VHSEY1, VHSEY2, VHSFY2	200p
VHSFG2, VHSFG3, VHSFG4, VHSFH6	200p
VHSFJ2, VHSFJ4	200p
VHSF63, VBXAS1	200p

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Model	Price
VHSTJ1, VHSTJ2, VHSTJ3	200p
VHSWJ1, VHSWJ3, VHSXJ3	200p
VBXYB3	200p
VHSEH3, VHSES2	200p
VHSF34	200p
VHSFP2	200p
GRUNDIG	
BARCELONA, MADRID, MVS500, 510, 600, 620, 660, 710, 720, 910, 9105, SE5110, 5140, 6100, 6110, 7120, 9100, 9120, TVR4500, 4510, 5510, VERONA, VS500, 505, 510, 520, 530, 540, 550, 600, 610, 620, 630, 640, VS650, 660, 680, 700, 710, 720, 740, 790, 800, 810, 900, 910, 920, 930, VS940, 5180, 5480, 6190, 6690	200p
MVS400, 440, 400, 410, 440, 441, 450, 456, 460	200p
VS120	200p
VS150	200p
VS180, 200, 220, 226, 262, 265, 267, 300, 310, 315, 320, 326, 345, 380	200p
GOLDSTAR	
GHV51, 1221, 1232, 1240, 1241, 1242, 1243, 1244, 1245, 1246, 8000, 8200, 8210, 8215, GHVP1240, 1241, 1247, 1248, 1290, 1291, 1295, 1296, VCP4000, 4100, 4130, 4200, 4300, 4301, 4305, 4306, 4310, 4311, 4315, 4316, 4320, 4321, 4325, 4326	200p
HINARI	
V20H, VXL5, VXL6, VXL7, VXL8, VXL9, VXL10, VXL11, VXL19	200p
VXL2, VXL3	200p
VXL4, VXL20, VXL35	200p
HITACHI	
VT7, 11, 14, 16, 17, 19, 33, 34, 35, 38, 39, 88, 330, 680, 6500, 6800, 5000, 5500, 7000, 8000, 8300, 8500, 9300, 9500, 9700, 9900	200p
VT8, 52, 57, 61, 62, 63, 64, 65, 85, 86, 88, 100, 110, 111, 113, 115, 118, 120, 122, 125, 130, 135, 138, 145, 150, 168, 175, 220, 225, 250, 255, 258, 260, 400, 405, 410, 413, 414, 415, 418, 420, 425, 426, 428, 430, 431, 435, 438, 450, 498, 510, 518, 520, 525, 526, 576, 580, 585, 588, 640, VTD660, 665, VTF770, 775, VTL30, VTLC50, VTM620V, TM625, 626, 630, 635, 636, 640, 645, 646, 720, 722, 725, 726, 728, VTM730, 731, 735, 736, 740, 745, 746, VTS80, 85	200p
VT3000	200p
I.T.T.	
VR3605, 3826, 3905, 3908, 3916, 3926, 3935, 3946, 3948, 3976, 3985, 3986, 3995, 3997, 6348	200p
VR3913, 3914, 3943, 3954, 3984, 3993, 3994	200p
VR3907	200p
VR3908	200p
VR3912, VR3963, VRP3833	200p
VR3917, VR3833	200p
VR3927, 3929, 3968 (PRESSURE ROLLER ASSEMBLY) PS403-40205	450p
SVR3799, VR3520, 3701, 3719, 3720, 3721, 3730, 3731, 3749, 3759, VR3761, 3781	200p
VR3918, 3919, 3958, 3998	200p
VR670, VR680, VR681	200p
VR3927, VR3977	200p
VR482, VR580, VR581, VR582	200p
VR9720	200p
J.V.C.	
HR2200, 3300, 3330, 3360, 3660, 4100, 7700	200p
HR2650, 7200, 7300, 7350, 7600, 7610, 7650, 7655	200p
HRD110, 111, 120, 121, 140, 150, 157, 158, 160, 225, 257, 455, 565, 566, 725, 755, HRP50	200p
HRD520, 540, 550, 580, 600, 620, 637, 641, 650, 660, 830, 860, 960, HRS5800	200p
HRD170, 180, 210, 230, 300, 320, 321, 330, 337, 350, 370, 400, 430, 440, 441, 470, 500, 530, 700, 750, 950, HRS5000, 5500, 9000	200p
HRS10	200p
LOGIK	
VR955	200p
LUXOR	
9245, 9251	200p
8252, 8253, 8256, 8285	200p
9254	200p
9255	200p
9270, 9271, 9273, 9274	200p
9272, 928017, 928077, 928097, 928217, 929017, 929117, 929317	200p
9281, 9283, 9284, 9292, 9295, VR3701, 3721, 3731, 3761, 3781	200p
MATSUI	
VX850	200p
MITSUBISHI	
HS200, HS300, HS301, HS302, HS303, HS304, HS310, HS320, HS330, HS700	200p
HS306, HS307, HS318, HS319, HS337, HS338, HS347, HS349, HS400, HS410, HS411, HS412, HS421, HS710, HSB10, 20, 30, HSE10, 20, 30, 70	200p
HSE11, HSE12, HSE21, HSE22, HSE31, HSE32, HSE41, HSE51, HSE52	200p
NATIONAL PANASONIC	
NV100, 180, 300, 332, 333, 340, 366, 600, 688, 777, 788, 3321, AG6010, 6015, 6100, 6200, 6400, 6800	200p
NV230, 250, 260, 280, 370, 380, 430, 431, 433, 450, 460, 465, 470, 480, 630, 650, 730, 770, 780, 810, 830, 850, 870, 890, 2000, 2010, 3000, 7000, 7200, 7800, 8050, 8150, 8200, 8300, 8400, 8600, 8610, 8620,	
NVG14, NVG7, 10, 12, 15, 18, 30, 130, 400, AG1000, 1050, 1200, 1500, 2100, 2200, 6810, NVH70	200p
NVG9, NVG120	200p
AG6840, NVH65, 75, NVJ30, NVL20, 23, 25, 28, NVG300, NVF65, NVF70, NVFS1, NVFS100, NVG19, 20, 25, 33, 40, 50	200p
NVD48, NVD80, NVG21, NVG45	200p

Model	Price
N.E.C.	
N830, 831, 832, 833, 895	200p
PVC2300, 2400, 740, 744, 746, 760, 764, 766	200p
DX1000, 1600, 2000, 3000, N9012, 9013, 9014, 9016, 9033, 9034, N9053, 9054, 9055, 9066, 9110, 9120, 9510, 9520, 9530, 9610	200p
ORION	
VH1, VH2	200p
VC150, 180, VH3, 33, 200, 201, 205, 212, 250, 254, 288, 300, 303, 312, VH404, 555, 700, 704, 712, 770, 780, 844, 900, 1000, 2948, 3030, 3312, VHF2A, VP2948	200p
COMBI15000, 16000, HV03, LVH50, NEVH, NEVHM, NEVHML, TVP230RC	
VCP, VH04, 30, 103, 300, 358, 360, 362, 400, 416, 512, VH530, 532, 535, 536, 600, 630, 635, 640, 666, 730, 735, 744, 774, 790, 800, 820, 850, 888, 893, 900, 930, 940, 942, 974, 1012, 1040, 1050, 1060, 1070, 1100, 1120, 1204, 1440, 1500, 1660, 1800, 2004, 2151, 2308, 2204, 2400, 2500, 2600, 2700, 2960, 2970, 3050, 3060, 4000, 4008, 4010, 4012, 4015, 4020, 4300, 5020, VP10, 200, 220, 225, 245, VR821, 925, 1032, 2949, 2959, 2957, 2966, 2979, 2980, VTV300, VXL20, 25, 30	200p
PHILIPS	
VR6460, VR6920	200p
VR2020, VR2021, VR2022, VR2023, VR2024	200p
VR6711	200p
VR6540	200p
DV856, 586, VR702, 703, 6485, 6589, 6785, 6880, 6948	200p
VR445, VR6442, VR6542, VR6843, VR6943	200p
DV464, VR2220, 2300, 2324, 2330, 2334, 2340, 2350, 2414, 2480, VR2485, 2486, 2489, 2490, 2498, 2840, 6462, 6463, 6464, 6560, 6660, 6860, 6861, 6862, 6863	200p
N-1700, VR2870	200p
VR2025, VR6580	200p
VR6548, VR6648	200p
PRESSURE ROLLER ASSEMBLY PS403-40205, DV186, 190, 286, 291, 292, 486, 471, 562, 582, 571, 761, VR201, 202, 203, 302, 303, 305, 6180, 6182, 6185, 6285, 6290, 6291, 6293, 6362, 6367, 6390, 6391, 8393, 6467, 6468, 6470, 6561, 6570, 6581, 6670, 6876, 6760, 6761, 6762, 6870, 6970, 6975, 8681, 63SB7, 68SB4, 71SB4, 72SB8, 92SB31	450p
SANYO	
VHR1100, 1150, 1200, 1300, 1500, 2100, 2300, 2500, 2700	200p
VTC5000, 5150, 5300, 5350, 5400, 5500, 6000, 6500, 9100, 9300, VTCM10, 20, 11, 21, 31, 50, VPR5800	200p
VHR3100, 3300, 3310, 3400, 3700, 3800, VHRD500, 700	200p
VTC3000	200p
VHR4100, 4150, 4200, 4300, 4350, 4770, 5100, 5200, 5300, 5350, 5700, 7100, 7200, 7500, 7530, 7540, 7800, 8100, 8200, 8250, 8500, VHRD4400, 4410, 4500, 4600, 4610, 4710, 4890, 6700, VHRS700	200p
VCR100	200p
SHARP	
VC200, 381, 384, 385, 386, 388, 390, 393, 800, 2300, 3300, 6000, 6200, 7300, 7700, 7750, 8300, 9100, 9300, 9500	200p
VC300, 387, 402, 471, 473, 477, 481, 482, 483, 486, 488, 496, 500, 571, 573, 581, 582, 583, 584, 585, 8481, VC5F3, VC5W20E	200p
VCA1031	200p
VC600, 651, 681, 682, 684, 685, 693, 699, 700, 772, 750, 779, 780, 781, 782,	
VC782MK2, 783, 785, 786, 787, 793, 800, 7810, 7822, VCT72, VC6F3, VC6V3,	
VCA100, 102, 104, 131, 140, 170, 202, 203, 211, 234, VCA303, 501, 602, 5011,	
VCD801, 802, 851, 852, 881, 882, VCM73, VCT73	200p
VC220	200p
VCA10, 30G, 60, 103, 105, 106, 211, 244, 505, 605, 615, 1031, VCD806, 810, 815,	
VCH80, 865, 910, VCS1000, VCT310, 410, 610, VCT1314, 5313	200p
SAISHO	
VHL3, VR1000, VR2000, VR2500, VR3800	200p
SALORA	
SV6500, SC6600	200p
SV7300, SV8200, SV8300, SV9200, SC9300	200p
SV7400, 8400, 8420, 8500, 8520, 8550, 8600, 8620, 8700, 8710, 8720, 8800, 8830, 9500, 9600, 9810	200p
SV8000, SV8100	200p
SV601, SV800, SV900, SV901, SV6910, SV9800, SV9900	200p
SV6700, SV8710, SV8750, SV9700	200p
SV6800, 6900, 8820, 8850, 8870, 8910, 8920, 8970	200p
SAMSUNG	
SV716, 717, VB510, 520, 610, 616, 617, 619, 620, 626, 627, 629, 900, SV910, VI510, 520, 611, 616, 621, 626, 900, 910, VX510, 520, 616, 617, 619, 526, 627, 629	200p
SVX301, 303, 305, 307, 319, 322, VB710, 770, 971, 8220, 8225, V1730, 1790, 18220, 18225, VX710, 712, 720, 730, 750, 770, 790, 825, 970, 971, 972, 8220	200p
SANSUI	
SVR5030	200p
SVR7010	200p
SIEMEN	
FM350, FM352, FM355	200p
FM361, FM362, FM363, FM364	200p
FM391, FM392, FM394, FM461, FM462, FM464, FM468, FM561	200p
FM484, FM485	200p
FM585, FM602, FM604, FM622, FM624, FM627	200p
FM600	200p
FM204, 303, 304, 314, 325, 328, 374, 375, 376, 384, 386, 388, 404, 424, 428, 429, 488, 489	200p

Model	Price
FM556, FM558, FM560, FM562, FM564, FM574, FM578	200p
FM601, 603, 605, 607, 608, 617, 619, 620, 621, 623, 625, 626, 628, 630, 632, 634, 636, 638, 639	200p
SOLAVOX	
NCVR1000, NCVR5000	200p
SONY	
SLC5, 6, 7, SL3000, 8000, 8080, 8200, SLJ10, SLT6ME, SLT7ME	200p
SLC9, 20, 24, 30, 33, 44, SLHF100, SLF1, 11, 20, 25, 30, 60, 100, 200, SLF60PS, SLF90E, SLHF150, 850, SLK88, 95, SLT20ME, SLT30ME, SLT50ME	200p
BMC100, BMC200, BMC500	200p
SLV201, 202, 301, 302, 401, 402, 801, 802	200p
SLV210, 270, 273, 275, 300, 353, 373, 410, 415, 474, 656, 715, SLV757, 777	200p
SLV255	200p
TELEFUNKEN	
A920, 930, 932, 935, 940, 960, 980, 990, 1200, VR925, 930, 940, 950, 971, 975, 980, 1920, 1925, 1930, 1940, 1950, 2920, 2925, 2930, 2931, 2935, 2941, 2960, 2970, 2671, 3935, 3945, 3950, 3965, 3975, 4935, 4940, 4942, 4945, 4970, 6000, 7921, 7926, 7929, 7931, 7932, 7970, 7971, 7979, 7980	200p
VR1935, VR2915	200p
VR1970, VR1980	200p
VR4400, 410, 440, 449, 450, 510, 519, 540, 549, 610, 640	200p
VR520, 529, 530, 535, 539, 550, 620, 630, 650, 920	200p
THOMSON	
SV1000, TX8500, V320, 321, 323, 326, 342, 343, 351, 352, 353, 360, 364, 368, 410, 430, 450, 510, 520, 530, 540, 620, 630, 640,	
4200, 4210, 4230, 4240, 4260, 4300, 4340, 4400, 5500, 5540, 6000, 8540	200p
TX8000, V309, 316, 357, 309, 410, 411, 3801, 4100	200p
V333, V340	200p
VX300, 301, 302, 305, 306, 312, 3301	200p
TOSHIBA	
DV55, 57, 61, 63, 65, 66, 67, 71, 73, 74, 75, 77, 81, 83, 85, 86, 93, 94, 80, 90, 96, 97, 200, 202, 205, 207, 300, 309, 500, 509, 700	200p
V5470, V5480	200p
V108, V109, V199, V209, V609	200p
PRESSURE ROLLER ASSEMBLY – PS403 40205, V91, V95	450p

VCR BELT KITS

AKAI	
VP7100, VS9300, VS9500, V9700, VS9800	120p
VS1, VS2, VS4, VS5	100p
VS10	65p
VSX9, VS105, 112, 115, 116, 205, 220, 24, 244, 245, 247, 248, VS250, 512, 515, 516	300p
VS22, VS23, VS25, VS35, VS37, VS38, VS53, VS55, VS66	100p
VS4, VS6	150p
VSA77	140p
AIWA	
AV66	125p
AV77	140p
G700	160p
G900	180p
ALBA	
VCR40000	130p
VCR5000, VCR6000	105p
AMSTRAD	
TVR123, VCR4600, VCR4700, VCR5200	140p
VCR7000	80p
VCR6000, 6100, 8600, 8602, 8603, 8604, 8700, 8704, 8714, 8800, 8804, 9000, 9340, DD8900, DD8904, TVR4	160p
AUTHENTIC	
N850	120p
BLAUPUNKT	
RTV100	200p
RTV200, RTV222, RTV224	90p
RTV202, RTX200	150p
RTV322, RTV248	100p
RTV306, 307, 309, 310, 311, 312, 328, 414, 434, 444, 707	135p
RTV211, RTV214	140p
RTV324, RTV325	65p
RTV315, RTV316, RTV319, RTV320, RTV317	50p
RTV301, RTV333, RTV338, RTV404, RTV424	85p
BONDSTEC	
BT100	110p
BT300, BT310	170p
BT350	140p
BT50	150p
BOSCH-BAUER	
VRH50	100p
VRH60	140p
VRP20	180p
DAEWOOD	
VCR12, VCR32, VCR52	110p
VCR30DAP	150p
VCR30DBD, VCR500BD, VCR50DFD, VCR50DFP	170p
DECCA	
VR8300	90p
VRH8945DK	80p
DUAL	
VR4430	90p
VR91, VR93, VR97	75p
VR70, VR71, VR74, VR81, VR90	85p
VR80	90p
VR96	85p

Model	Price
FERGUSON	
3292, 3V00, 3V01, 3V16, 3V22, 8900, 8901, 8904, 8906	135p
3V23, 8923, 8924, 8929	65p
3V29, 3V30, 8930, 8931, 8933, 8940	90p
3V31, 3V32, 8941, 8942	85p
3V35, 3V36, 3V38, 3V39, 3V49, 8943, 8944	85p
3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57, 8946, 8947, 8948	65p
3V43, 3V44, 3V58, 3V65, 8950, 8951, FV10, FV11, FV12, FV13, FV14, FV20, FV21, FV22, FV26, FV32, CV141L	80p
FV31R	125p
FIDELITY	
HQS200, VCR600	
VCR6100	180p
VCR100	160p
VTR1000	100p
FINLUX	
VR2005, VR2010, VR2020, VR2025, VR2040	105p
VR2008	160p
VR3009	140p
FISHER	
VBS7000	245p
VBS9000	120p
FVHP520, FVHP530, FVHP420	60p
FVHP615, 618, 620, 622, 710, 711, 720, 721, 722, 725, 730, 840	100p
FVHP905, 906, 908, 910, 911, 915, 916, 918	100p
VBR330, VBS7500, VBS7600, VBS9900	100p
VBS3500	75p
FUJITSU	
HS760, HS750, VGX715, VGX720D	160p
FUNAI	
V1, V25, VCR4600, 4800, 5200, 5400, 5600, 6400, 6600, VIP3000, VIP5000	160p
VCR4530, 5840, 5843, 6800, 6803, 8007, 8103, VIP150, 6000	160p
G.E.C.	
4005	100p
V4004	100p
GOLDSTAR	
GHV1221, 1232, 1241, 1242, 1243, 1244, 1245, 1246, 1247, 1248, 8210, 8215, VCP4100, VCP4130	80p
GHV1290, 1291, 1295, 1296, VCP4000, 4200, 4300, 4301, 4305, 4306, 4310, 4311, 4315, 4320, 4321, 4325, 4326	120p
GRANADA	
VHSAH1, VHSAH3	100p
VHSVH4, VHSWH1, VHSXH1	60p
VHSYH2	50p
VHSBH1, VHSCH1	150p
VHSBP1	135p
VHSAN3	110p
VHSDS2	125p
VHSAY3	125p
VHSBY3	100p
VHSEY1, VHSEY2	70p
VHSCC1	100p
VHSDP1, VHSFV2	80p
VHFTJ1, VHSTJ2	150p
VHSTJ3	65p
VHSWJ1, VHSWJ2	120p
VHSXJ3	85p
VHSFJ2	140p
VHSFS1, VHSFS2	130p
VHSFG1, VHSFG4, VHSF63	180p
GRUNDIG	
MVS400, MVS440, VS400, 410, 440, 441, 450, 456, 460	55p
VS180, 200, 220, 226, 262, 265, 267, 2X40800, 0850, 0880, 1600, 2000, 2080, 2200, 2280, MVS200RC	90p
VS150	160p
VS310, VS315, VS320, VS326, VS340, VS345, VS380	85p
HINARI	
VXL2	80p
VXL7, VXL8, VXL9, VXL10	180p
VXL4, VXL35	70p
VXL5, VXL6	160p
VXL3, VXL20	90p
HITACHI	
VT11, 14, 17, 19, 33, 34, 35, 38, 39, 88, 165, 330	90p
VT5000, VT5500	120p
VT7000, VT8000, VT8300, VT8500	60p
VT680, VT6500, VT6800, VT9300, VT9500, VT9700, VT9900	80p
VT52, VT57, VT61, VT62, VT63, VT64, VT65, VT85, VT86, VT640	120p
VT3000	120p
VT100, 110, 111, 113, 115, 118, 120, 125, 128, 130, 135, 138, 145, 150, 168, 175, 220, 225, 250, 255, 258, 260, VTL30	130p
I.T.T.	
VR3605, VR3905, VR3935, VR3954, VR3985	90p
VR3913, VR3914	70p
VP3826, VR3906, VR3916, VR3926, VR3946, VR3948, VR3976, VR3986, VR3995, VR3997, VR6948	65p
VR3927, VR3977	65p
VR3993, VR3994	75p
VR3963	65p
VR3912	130p
VR3917	150p
VR3929, VR3968	85p
VR3907	100p
SVR3799, VR3520, 3701, 3719, 3720, 3721, 3730, 3731, 3749, 3759, 3761, 3781	90p
VR3908	180p
VR3918, VR3919, VR3958, VR3998	115p
J.V.C.	
HR3300, HR3330 HR3360, HR3660, HR4100	130p
HR7200, HR7300	70p
HR7350, HR7600, HR7610, HR7650, HR7655	75p
HR7700	75p
HRD110, HRD111, HRD120, HRD121, HRD225	90p
HRD140, 150, 157, 158, 160, 250, 257, 455, 565, 566, 725, 755, HRP50	65p
HRD170, 180, 210, 230, 300, 320, 321, 330, 337, 350, 370, 400, 430, 440, 441, 530, 700, 750, 950, HRS5000, 5500, 9000	65p

VCR BELT KITS / REPLACEMENT VIDEO LAMPS

Model	Price
HRD520, 600, 620, 637, 641, 650, 830	95p
HRD540, 550, 580, 660, 860, 960, HRS5800	130p
KENWOOD	
KV901	70p
KV903	90p
LOEWE	
OC11, OC40	95p
OC410, OC420, OC440, OC460	130p
OC50, OC55, OC60, OC65, OC70, OC75	120p
LOGIK	
VR955	180p
LUXOR	
9245, 9251	130p
9252	140p
9253	140p
9254	100p
9255	130p
9256	130p
9270, 9271, 9273, 9274	115p
9272, 9280	140p
9281, 9284, 9285, 9292, VR3701, 3721, 3731, 3761, 3781	95p
MATSUI	
VX850	75p
MITSUBISHI	
HS200	200p
HS300, 301, 302, 307, 310, 337, 338, 347, 349, 411, 412, 421, HSB10, 20, 30, HSE10, 20, 30, 70	150p
HS303, HS304, HS306, HS307, HS330, HS400, HS700	150p
HS318, HS319, HS410	130p
N.E.C.	
N830, N831, N832, N833	100p
N895	80p
PVC2300, PVC2400	180p
DX1000, 1600, 2000, 3000, N9012, 9013, 9014, 9016, 9033, 9034, 9053, 9054, 9055, 9066, 9110, 9120, 9510, 9520, 9530, 9610	95p
NATIONAL PANASONIC	
NV300, NV332, NV333, NV340, NV366	125p
NV777, NV788	100p
NV2000, NV2010, NV3000	130p
NV7000, NV7200, NV7800	95p
NV8600, NV8610, NV8620	145p
NV230, 250, 280, 430, 431, 433, 450, 460, 465, 470, 730, 770, 810, 870, 890, AG1000, 1050	125p
NV370, NV380, NV480, NV630, NV780, NV830, NV850	100p
NV600, NV688, AG6010, AG6015	110p
NVG7, 10, 12, 14, 15, 18, 30, 130, 400, NVH70	70p
NORDMENDE	
V100, V140	70p
V1000M, 1005M, 1205, 1215, 1235, 1245, 1305, 1403, 1405, V1500P, 1503, 1505K, 1805K, 2000D, 2405, 2500H, 3000H, V3405H, 3105, 4405H, 5000, 8005, 900, 905	65p
V1001, 1005, 1015, 1025, 1035, 1041, 1055, 1065, 1105, 3005, 304, 5005, 502, 503	80p
V101, V102, V103, V112, V141, V142, V301, V302	90p
V110, V333	110p
V1500T, V2000B, V2000P, V400H	95p
V250, V460, V9460, V20035542, V20035543	130p
V300, V303, V380	75p
V500	75p
ORION	
COMBI15000, 16000, NEVHM, TVP230RC, 960MVH1012, VH1030, 1040, 1060, 1070, 1100, 1120, 1440, 1500, 1660, 1800, 2150, 2308, 2400, 2500, 2600, 2700, 2960, 300, 358, 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, 668, 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
PHILIPS	
VR6460, VR6920	170p
VR6540	100
DV186, 286, 291, 292, 468, 471, 562, 571, 761, VR201, 202, VR20DV1, 20DV2, 20RW7, 25BO1, 25BO2, 302, 303, 305, VR30DV2, 35BO2, 35BO3, 635B7, 715B4, 715B5, 71588, 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, VR49SB620, VR644869S	110p
SABA	
VR6420, 6435, 6440, 6460, 6480, 6620, 6770, 7200, 8420, 2A10, 70, 2B20, 3B20, 4A10, 4B20, 6A10, 6A70, 6B20, 8B20	85p
VR6004, 6005, 6011, 6014, 7004, 7011, 7014, 8011, 8014, BERLIN	90p
VR2000, VR6000, VR6012, VR7000, VR7720, PVR6068	130p
VR5005, VHR7000	135p
VR6006, 6007, 6008, 6009, 6015, 9016, 9018, 6038, 7006, 7007, 7016, 7018, 9006	65p
VR6010, VR9010	70p
VR6020, VR6022, VR6023, VR6028, VR7730	75p
VR6024	75p
VR6520, VR6540, VR6560	90p
VR6710, VR6720, VR6735, VR8720	130p
VR6720, VR6730, VR6760, VR6775, VR6780	160p
SAISHO	
VR2000, VHL3	90p
VR3800	75p
SALORA	
SV6500	100p
SV6600	150p
SV8000	120p
SV8100	60p
SV8500, SV8520, SV9500	150p
SV7400, SV8400, SV8420, SV8550	120p
SV6700, SV8710, SV8750, SV9700	120p
SV6800, 6900, 8810, 8820, 8870, 8910, 8920, 8970	95p
SV8600, 8620, 8700, 8720, 8830, 9600, 9810	130p
SAMSUNG	
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	100
VB900, VB910, V1900, V1910	110
PX980, 981, 982, SE9001, SV9001, SVX307, 319, 322, VB770, 8220, 8225, V1770, 790, 8220, 8225, VK8220, VPX31, VX750, VX790, 8220, 8225	135p
SVX301, 303, 305, SX7301, VB710, 971, V1730, 710, VX712, VX720, 730, 970, 971, 972	230p
VX9880	110p
SANYO	
VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	75p
VTC5300, VTC5350, VTC5400, VPR5800	100p
VTC5500	95p
VTC9100, VTC9300	220p
VTC1100, 1300, 1500, 1100, 1150, 1200, 1300, 1500	90p
VHR2100, VHR2300, VHR2500, VHR2700	150p
VHR3100, 3300, 3310, 3400, 3700, 3800, VHRD500, 700	110p
VHR4100, 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	90p
SHARP	
VC200, 384, 385, 386, 388, 390, 9300, 9500, 9700	100p
VC7300, VC7700, VC7750, VC7800, VC8000	150p
VC8300	150p
VC300, 387, 471, 473, 481, 482, 483, 486, 488, 496, 8481	80p
VC402, 500, 571, 573, 581, 582, 583, 584, 585, VCSF3	80p
VC600, 651, 682, 684, 685, 693, 783, VC6F3, VC6V3	70
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, VC51000, VCT310, 410, VCT1314, VCTS312	115p
SIEMENS	
FM350, FM352, FM355	60p
FM484, FM485	55p
FM391, FM392, FM394, FM462	100p
FM461, FM464, FM468, FM561	150p
FM361, FM362, FM363, FM364	120p
SONY	
SLC6, SLJ10, SLT6ME	140p
SLC5, SLC7, SLJ7, SLJ9	140p
SLC9, SL8000, SL8080, SLT50	165p
SL8000E, SL8080E, SL8200, SL8600	175p
SLV255	95p
TELEFUNKEN	
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, 7981, 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
THOMSON	
SV1000, V410, 430, 450, 510, 520, 530, 540, 620, 630, 640, 4240, SV5540	65p
TX8000, V309, V357, VK411	75p
TX8500, 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
TOSHIBA	
V55, V57	85p
V33, V31, V51, V53, V9600, V9680	85p
V61, V63, V65, V66, V67	150p
DV80B, DV80D, V71, 73, 74, 75, 81, 83, 85, 86	120p
V108, V109, V199, V209, V609	120p
V91G, V95G	115p

Models & Description	Order Code	Price
UNIVERSAL VIDEO LAMP 9V 80mV (310mm WIRES)	VL01	25p
PANASONIC VIDEO LAMPS	VL02	35p
SHARP VIDEO LAMPS	VL02	35p
HITACHI 5381682 (VT63, VT64) VIDEO LAMPS	VL04	135p
AIWA, AKAI, ALBA, AMSTRAD, BLAUPUNKT, FERGUSON, FIDELITY, FISHER, FUJITSU, FUNAI, G.E.C., GOLDSTAR, GRANADA, GRUNDIG, HINARI, HITACHI, ITT, JVC (HRD SERIES), MATSUI, MITSUBISHI, NEC, ORION, NATIONAL, PHILIPS, SAISHO, SALORA, SAMSUNG, SANYO, SHARP, SIEMEN, SONY, TELEFUNKEN, THOMSON, TOSHIBA	VL05	150p
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
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
AKAI (VS10), GRANADA (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)	VL06	40p
AUTHENTIC (N850), DECCA (VR8300), GRANADA (VHSTJ3, WJ1, WJ3), ITT (VR3913, 3914, 3963), JVC (HT7200, 7300, 7350, 7700), TELEFUNKEN (VR450, 520, 529, 540, 549, 620, 640, 920, 1920), THOMSON (V4100, VK308, 309, 312, 410), FERGUSON (3V23, 29, 30, 8923, 8924, 8929, 8930, 8931, 8940)	VL07	40p
GRANADA (VHSAY3), SHARP (VC200, 381, 384, 385, 386, 388, 390, 393, 9300, 9500, 9700)	VL08	60p

PANASONIC MODE SWITCHES

NV2000, 2010, 7000, 7200, 7800 (VSS0048)	£2.25
NV230, 260, 430, 810, 870, 2300, 4300 (VSS0110)	£2.25
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NV300, 333, 340, 366, 688, 777, 778 (VSS0060)	£3.75
NVG21, 25, NVH65, NVD80 (VSS0175A)	£2.00

ON/OFF MAIN SWITCHES

GRUNDIG
PART NO: 29703, 29102
USED ON: C7500, C7500TT, C8500, C8502, C8712, C8714, C8894, M68-190, M68-190/99, M70-195, P40-345, ST66-1602, T55-340, V7722
PRICE: £3.00

ITT
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
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PART NO: LFC 005
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USED ON: K30, K35, K40, KT3, KT4
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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
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PART NO: (POWER SWITCH + REMOTE SWITCH)
USED ON: KV2022, KV2024
PRICE: £3.25

PART NO: (POWER SWITCH)
USED ON: KV1810 MK1, KV1810 MK2, KV1820, KV1822, KV2000 MK1
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PART NO: (POWER SWITCH 21mm + REMOTE SWITCH)
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PRICE: £2.50

PART NO: 2 PIN (FUNCTION SWITCH)
USED ON: KV1612 MK1, KV1612 MK2, KV2052, KV2056, KV2212, KV2215, KV2216, KV2252, KV2256, KV2704, KV2705, KV2706, KV275PE3, KV2756PE3
PRICE: £0.45

PART NO: (4 PIN FUNCTION SWITCH)
USED ON: VARIOUS
PRICE: £0.50

REPLACEMENT IDLER TYRES

AKAI	M132773	IT01
	MZ366960J2	IT02
GOLDSTAR	VXP0521	IT17
HITACHI	6861471	IT03
	6861482	IT04
	6886971	IT05
JVC/ FERGUSON	PU 48967B	IT06
	PU 51380	IT07
	PU 51402A	IT08
	PU 55373	IT09
	PU 55374	IT10
NATIONAL PANASONIC	VXP 0329	IT11
	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
	NPLY0107GEZZ	IT22

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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		*Economy Kit Contents*	
BELT SET. PINCH ROLLER CLUTCH MECHANISM. TENSION BAND		BELT SET. PINCH ROLLER SUPPLY CLUTCH. TAKE UP CLUTCH	
Order Code: SK37	**£17.50**	**Order Code: SK38**	**£9.50**

3V58/59/64/65

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

HRS5000

Contents

BELT SET. PINCH ROLLER. IDELR ARM. TENSION BAND

Order Code: SK44 **£8.50**

3V29/3V30

HR7200/7300/7350

Contents

BELT SET. PINCH ROLLER. TENSION BAND. IDLER TYRES

Order Code: SK05 **£6.00**

3V35/36 38/39/49

HRD110/111/120/225

Contents

BELT SET. PINCH ROLLER. TENSION BAND. IDLER TYRES

Order Code: SK04 **£5.50**

3V31/3V42

HR7600/7610/7650/7655

Contents		*Economy Kit Contents*	
BELT SET. T/U REEL TABLE TYRE. PINCH ROLLER. REEL IDERL. T/U CLUTCH. T/U IDLER. TENSION BAND. VIDEO LAMP		BELT SET. T/U REEL TABLE TYRE. PINCH ROLLER. REEL IDLER TYRE. T/U IDERL TYRE. T/U CLUTCH	
Order Code: SK33	**£12.00**	**Order Code: SK34**	**£5.50**

3V35/36/38/39/49

HRD110/111/120/121/225

Contents		*Economy Kit Contents*	
BELT SET. T/U REEL TABLE TYRE. SUPPLY REEL TABLE TYRE. PINCH ROLLER. T/U CLUTCH. T/U IDLER. REEL IDLER. TENSION BAND		BELT SET. T/U REEL TABLE TYRE. SUPPLY REEL TABLE TYRE. PINCH ROLLER. T/U CLUTCH. T/U IDLER TYRE. REEL IDLER TYRE	
Order Code: SK35	**£10.50**	**Order Code: SK36**	**£5.80**

3V29/3V30

HR7200/7300/7350

Contents		*Economy Kit 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		BELT SET. T/U REEL IDLER TYRE. SUPPLY REEL TABLE TYRE. PINCH ROLLER. REEL IDLE TYRE. T/U IDLER TYRE. T/U CLUTCH	
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3V44/45/48/53/54/55/57

HRP50/HRD140/150/158/160

HRD250/257/565/566/755

Contents		*Economy Kit Contents*	
BELT SET. PINCH ROLLER. CLUTCH MECHANISM. TENSION BAND		BELT SET. PINCH ROLLER	
Order Code: SK39	**£15.00**	**Order Code: SK40**	**£9.50**

FISHER

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

Contents		*Economy Kit Contents*	
BELT SET. PINCH ROLLER. IDLER. GEAR IDLER UNIT. TENSION BAND		BELT SET. PINCH ROLLER. IDLER TYRE	
Order Code: SK57	**£13.00**	**Order Code: SK58**	**£5.00**

FVHP615/618/620/622/710/711/715/716/720/721/722/725/730/830/840

Contents		*Economy Kit Contents*	
BELT SET. PINCH ROLLER. IDLER. GEAR IDLER UNIT. TENSION BAND		BELT SET. PINCH ROLLER. IDLER TYRE	
Order Code: SK68	**£12.50**	**Order Code: SK69**	**£3.60**

HITACHI

VT11/VT33

Contents

BELT SET. PINCH ROLLER. TENSION BAND. IDLER TYRES

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VIDEO SERVICE KITS *(Cont.)*

VT11/VT33

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

VT52/61/62/63/64/65/85/86/640

Contents		*Economy Kit Contents*	
BELT SET. PINCH ROLLER. FF/REW ARM. CLUTCH PLATE. TENSION BAND		BELT SET. PINCH ROLLER. FF/REW IDLER	
Order Code: SK49	**£14.00**	**Order Code: SK50**	**£3.25**

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

Contents

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

Order Code: SK52 **£11.50**

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		*Economy Kit Contents*	
BELT SET. PINCH ROLLER. TENSION BAND. IDLER TYRES		BELT SET. PINCH ROLLER. TENSION BAND. IDLER TYRES	
Order Code: SK03	**£6.25**	**Order Code: SK02**	**£5.50**

NV7000/NV7200/NV7800

Contents

BELT SET. PINCH ROLLER. TENSION BAND. IDLER TYRES

Order Code: SK02 **£5.50**

NV300/NV330/NV333/NV340/NV366

Contents

BELT SET. PINCH ROLLER. TENSION BAND. IDLER TYRE

Order Code: SK01 **£5.50**

NV2000/NV2010

Contents		*Economy Kit Contents*	
BELT SET. PINCH ROLLER. FF IDLER. PLAY IDLER. TENSION BAND. VIDEO LAMP		BELT SET. PINCH ROLLER. IDLER TYRE. PULLEY TYRE	
Order Code: SK13	**£8.00**	**Order Code: SK14**	**£4.50**

NV7000/NV7200/NV7800

Contents		*Economy Kit Contents*	
BELT SET. PINCH ROLLER. IDLER UNIT. PLAY IDLER TENSION BAND		BELT SET. PINCH ROLLER. IDLER TYRE. CLUTCH TYRE	
Order Code: SK11	**£8.50**	**Order Code: SK12**	**£4.20**

NV300/NV330/NV333/NV340/NV366

Contents		*Economy Kit Contents*	
BELT SET. PINCH ROLLER. IDLER UNIT. PLAY IDLER. TENSION BAND		BELT SET. PINCH ROLLER. IDLER TYRE. PLAY IDLER TYRE	
Order Code: SK15	**£7.50**	**Order Code: SK16**	**£4.00**

NVG7/NVG9/VNG10/NVG11/NVG12/NVG14/NVG15/NVG16/NVG18/NVG30/NVG120/NVG130/NVG400/NVH65 (PX/AC)/AG1810 (P/K)

Contents		*Economy Kit Contents*	
LOADING BELT. CAPSTAN BELT. PINCH ROLLER. IDLER TENSION BAND		LOADING BELT. CAPSTAN BELT. PINCH ROLLER. IDLER TYRE	
Order Code: SK27	**£8.00**	**Order Code: SK28**	**£4.00**

NV332

Contents		*Economy Kit Contents*	
BELT SET. PINCH ROLLER. PLAY IDLER. FF/REW IDLER. TENSION BAND. FF/REW TYRE		BELT SET. PINCH ROLLER PLAY IDLER TYRE. FF/REW IDLER TYRE	
Order Code: SK29	**£12.00**	**Order Code: SK30**	**£5.10**

NV230/250/260/280/430/450/460/470/650/810/890/AG1200PK/AG1500PK

Contents		*Economy Kit Contents*	
BELT SET. PINCH ROLLER. IDLER. TENSION BAND		BELT SET. PINCH ROLLER. IDLER TYRE	
Order Code: SK23	**£6.00**	**Order Code: SK24**	**£3.50**

NV600/NV688

Contents		*Economy Kit Contents*	
BELT SET. PINCH ROLLER. PLAY IDLER. FF/REW IDLER. TENSION BAND		BELT SET. PINCH ROLLER. PLAY IDLER TYRE. FF/REW IDLER TYRE	
Order Code: SK25	**£12.00**	**Order Code: SK26**	**£6.00**

NV730/NV770

Contents		*Economy Kit Contents*	
SLOT IN BELT. LOADING BELT. PINCH ROLLER. IDLER UNIT. TENSION BAND		SLOT IN BELT. LOADING BELT. PINCH ROLLER. IDLER TYRE	
Order Code: SK19	**£6.50**	**Order Code: SK20**	**£4.00**

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

Contents		*Economy Kit Contents*	
BELT SET. PINCH ROLLER IDLER. TENSION BAND		BELT SET. PINCH ROLLER. IDLER TYRE	
Order Code: SK21	**£6.00**	**Order Code: SK22**	**£3.00**

NV777/NV788

Contents		*Economy Kit Contents*	
BELT SET. PINCH ROLLER IDLER UNIT. TENSION BAND		BELT SET. PINCH ROLLER. IDLER TYRE	
Order Code: SK17	**£7.00**	**Order Code: SK18**	**£4.00**

VIDEO SERVICE KITS *(Cont.)*

SHARP

VC381

Contents		*Economy Kit Contents*	
BELT SET. PINCH ROLLER. REEL IDLER. TENSION BAND. VIDEO LAMP		BELT SET. PINCH ROLLER. REEL IDLER TYRE	
Order Code: SK47	**£9.00**	**Order Code: SK48**	**£4.75**

VC500/VC571/VC581/VC582/VC583/VC584/VC5F3

Contents		*Economy Kit Contents*	
BELT SET. PINCH ROLLER. REEL IDLER. TENSION BAND		BELT SET. PINCH ROLLER. REEL IDLER	
Order Code: SK60	**£9.50**	**Order Code: SK61**	**£6.50**

VC781/VC7810/VC7822/VC785/VC786/VC793/VC800/VCA100/VCA102/VCA104/VCA202

Contents		*Economy Kit Contents*	
BELT SET. PINCH ROLLER. REEL DRIVE UNIT. TENSION BAND		BELT SET. PINCH ROLLER. REEL DRIVE UNIT TYRE	
Order Code: SK64	**£13.50**	**Order Code: SK65**	**£6.25**

VC681/VC682/VC684/VC685/VC693/VC699/VC6F3/VC700

Contents		*Economy Kit Contents*	
BELT SET. PINCH ROLLER. REEL DRIVE UNIT. TENSION BAND		BELT SET. PINCH ROLLER REEL DRIVE UNIT TYRE	
Order Code: SK62	**£13.50**	**Order Code: SK63**	**£6.00**

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ITT CT3326 MUL	1500p	LOT28
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PANASONIC TLF14568F Used On: TX2231, TX2244	1850p	LOT40
PANASONIC TLF14584F Used On: TC2210, TC2160, TX1752, TX2112 TX2112, TX2162, TXC22	2350p	LOT41
PANASONIC TLF14586F TC1651, TC2051, TC2061, TC2253, TC2263, TX5500	2350p	LOT42
HINARI Used On: CT15	1600p	LOT43
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VP7100, VS9300	UNLOADING	PU46381	£4.00
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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 3V39, 3V49, 8943, 8944	REEL IDLER	PU55374	200p
3V35, 3V36, 3V38 3V39, 3V49, 8943, 8944	T-UP CLUTCH	PU55373	150p
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3V42, 3V43	CLUTCH ASSY	PU55822	1200p
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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
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FISHER

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FVHP975, 980, 990, FVHP999, 5000, 5005 FVHP5050, 5075, 5100	IDLER	FI1430420400700	300p
FVHD40, 55, 140 FVHP1, 10, 20	REEL DRIVE ROLLER		£6.00
FVHP975, 980, 990	CLUTCH	F12430510404200	£9.50
FVHP420, 520, 530	IDLER		£2.80
FVHP420, 520, 530	TAKE UP IDLER		250p
FVHP990	LOADING GEAR		90p
VBS3500	REEL DRIVE PULLEY		£3.20
VBS3500	IDLER		250p
VBS7000	REW IDLER		95p

GOLDSTAR

GHV1221, 1232, 1240	CLUTCH GEAR	435038A	£2.50
GHV1241, 1242, 1243, GHV1244, 1245, 1246, GHV1247, 1248, 8000, GHV8200, 8210, 8215, GHVP51, VCP4100, 4130			
GHV1221, 1232, 1240	IDLER		110p
GHV1241, 1242, 1243, GHV1244, 1245, 1246, GHV1247, 1248, 8000, GHV8200, 8210, 8215, GHVP51, VCP4100, 4130			

HINARI

VXL3, VXL20	REEL IDLER	40000009	110p
VXL2	IDLER		110p
VXL4, VXL35	IDLER		£2.75
VXL4, VXL35	CLUTCH		£6.50
VXL4, VXL12, VXL25 VXL30, VXL35, VTV300	LIMITER POST		£1.30
VXL5, VXL6	CLUTCH		£3.75
VXL5, VXL6	GEAR HOLDER		£3.50
VXL7, VXL8, VXL9	CLUTCH		£3.80

HITACHI

VT11-33, VT63-64 VT14, 17, 19, 38, 57, 86, 88, 34, 35, 39, 52, 61 62, 65, 85, 330, 640, VT16S	CLUTCH ASSY	6879515	£7.50
VT120-220, 100, 110 111, 113, 115, 118, 200 125, 128, 130, 135, 138, 145, 150, 175, 225, 250, 255, 258, 260, VTL30	CLUTCH ASSY	6886824 6886972	£7.50
VT8000-8300, 7000 VT8500-8700	FF-REW IDLER	6413663	£2.80
VT8000-8300, 7000 VT8500-8700	PLAY IDLER	6414221	290p
VT8000-8300, 7000 VT8500-8700	FF-REW PULLEY	6383531	80p
VT9300-9500, 6500 VT680, 6800, 9700, 9900	FF-REW IDLER	8681471	250p
VT9300-9500, 6500 VT680, 6800, 9700	PLAY IDLER	6861482 6861481	230p
VT9300-9500, 9700 VT9900, 6500, 680, 6800	IDLER	681505 687043	230p £3.80
VT11-33, VT63-64 VT14, 16S, 17, 19, 34, VT35, 38, 39, 52, 61, 62 VT65, 85, 86, 88, 330, 640	FF-REW IDLER	6886971	125p
VT1000, 110, 111, 113 VT115, 118, 119, 120, 125, 128, 130, 135, 138, 145, 150 VT175, 220, 225, 250, 255, 258, 260, VTL30	FF-REW ARM	6886792	240p
VT400, 405, 410, 413 VT414, 415, 418, 420, 425, 426, 428, 430, 431, 435 VT438, 450, 498, 510, 518, 520, 525, 526, 530, 535 VT536, 540, 545, 546, 548, 570, 575, 576, 580, 585 VT588, VTM625, 626, 630, 635, 636, 640, 645, 646, VTS80, 85	FF-REW ARM	6897094	£1.30
VT400, 405, 410, 413 VT414, 415, 418, 420, 425, 426, 428, 430, 431, 435 VT438, 450, 498, 510, 518, 520, 525, 526, 530, 535 VT536, 540, 545, 546, 548, 570, 575, 576, 580, 585 VT588, VTM625, 626, 630, 635, 636, 640, 645, 646, VTS80, 85	CLUTCH BASE	6896951	£3.25
VT3000	T-UP IDLER (LARGE)		£4.50
VT3000	REW IDLER		£6.00
VT680, 6500, 6800 VT9700, 9900	FS BRAKE	6861505	230p

HITACHI TV

OUTPUT MODULE HM 6251		£5.50
OUTPUT MODULE HM 6232		£8

JVC

HR330, 3660, 4100	T-UP IDLER SML	PU49280	£5.50
HR7200, 7600, 7650	T-UP CLUTCH	PU53462A	220p
HR7655, 7300, 7350, 7610			
HR7200, 7300, 7350	REEL IDLER	PU48967	175p
HR7600, 7610, 7650, 7655, 7700			
HR7600, 7610, 7650	ROLLER ASSY	PU49042A	350p
HR7655, 7700			
HR3300, 3660, 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,	T-UP CLUTCH	PU55373	150p
HRD225, HRD111, HRD110, HRD120-121, HRD225, HRD111	IDLER ARM	PU55374-3-8	280p
HRD170, 180, 210, 230 HR0320, 370, 400, 430, 470, 530, 700, 750, 950, 3000	IDLER ARM	PU58465	£2.25
HRS5000, HRS5500			
HRD455, HRD725	CLUTCH MECH	PU55822	1200p
HRD140, 150, 157, 158	CLUTCH MECH	PU57658	1050p
HRD160, 250, 257, 565, 566, 755, HRP50			
HR3300, HR3330 HR3660, HR4100	REW IDLER	PU46380	500p
HRD140, 150, 157, 158	TAKE UP CLUTCH	PU56043-1-4	240p
HRD160, 250, 257, 455, 565, 566, 725, 755, HRP50			
HRD140, 150, 157, 158 HRD160, 250, 257, 455, 565, 566, 725, 755, HPR50	TAKE UP CLUTCH	PU56044-1-5	160p

MATSUI

VX730, 735, 750, 755, VX810, 820, 850, 880, 990	CLUTCH	850A00005	420p
VX730, 735, 750, 755 VX770, 800, 810, 880	LIMITED POST LEVER ASSY		£1.30
VX990			
VX800A, VX900 VX800A, VX820	IDLER REEL REEL UNIT CLUTCH		£1.50 280p

MITSUBISHI

HS306, 307, 318, 319, HS400, 410, 710	GEAR ASSY	522B00201	£6.25
HS337, 338, 347, 349 HS411, 412, 421, HSB10, HSB20, HSB30, HSE10, HSE20, HSE20, HSE30, HSE70	IDLER	552B01701	325p
HS306, 307, 318, 319 HS400, 410, 710	IDLER	641C34301	£2.00
HS347, 349, 412 HSB10, HSB20, HSB30, HSE10, HSE20, HSE30, HSE70	IDLER	522902002	£3.00
HS337, 338, 411, 421	IDLER	552B01801	320p
HS200	TAKE UP IDLER (LARGE)		£4.50
HS200	UNLOADING IDLER		£4.00
HS200	REWIND IDLER		£8.00
HS306, 307, 318, 319 HS400, 410, 710	SUPPLY REEL DISK	522A00101	£3.20
HS306, 307, 318, 319 HS400, 410, 710	TAKE UP REEL DISK	522A00102	£3.20
HS320	REEL DISK	522C06301	£3.00
HS337, 338, 411, 421	REEL DISK	522P00601	£5.00
HS300, 301, 302, 310	PULLEY	522C05201	£2.25
HS306, 307, 318, 319 HS400, 410, 710	GEAR WHEEL	641D71101	£1.50
HS306, 307, 318, 319 HS400, 410, 710	GEAR WHEEL	641D71001	£1.50

NEC

N830, N831, N832, N833	TAKE UP CLUTCH	150p
N830, N831, N832, N833	TAKE UP IDLER	100p
N830, N831, N832, N833	REEL IDLER	200p
N895	TAKE UP IDLER SMALL	550p
N911, N915, N916, N917	REEL DRIVE PULLEY	350p
N9012, 9013, 9014, 9016, 9033, 9034, 9054, 9055, 9066, 9110 N9510, 9520, 9530, 9610		

NATIONAL

NV322, NV600, NV688, NV777, NV788, NV332, AG6100, 6200, 6800, 6810	IDLER UNIT	VXP0463	£2.75
NV300, NV333, NV340 NV366	IDLER ARM	VXL0997	£3.80
NV300, NV330, NV333 NV340, NV366	IDLER UNIT	VXP0401	60p
NV300, NV330, NV333 NV340, NV366, NV8620	PLAY IDLER	VXP0433	£2.75
NV300, NV332, NV333 NV340, NV366, NV600, NV777, NV788, NV2000, NV2010, 3000, 7000 AG6010, AG6015	ACTION GEAR	VDG0016	£0.60
NV333, NV688, NV2000 NV3000, NV7800	LOADING GEAR	VXP0325	£2.00
NV300, NV332, NV333 NV340, NV366, NV600, NV777, NV788, NV2000, NV2010, 3000, 7000 AG6010, AG6015	INTERMEDIATE GEAR	VXG0017	£0.65
NV330, NV333, NV340 NV366, NV777, NV788	CAM GEAR	VXG0158	£1.00
NV230, NV250, NV260 NV280, NV370, NV380, NV430, NV450, NV460, NV465, NV470, NV480 NV630, NV650, NV730, NV780, NV810, NV830, NV850, NV870 NVG7, NVG9, NVG10, NVG11, NVG12, NVG 14, NVG15, NVG16, VG18 NVG30, NVG400, AG1000, AG1200, 1500, 1810, 2100, AG2200, NVH65, NVH70	IDLER ARM	VXP0521	110p
NV370, NV430, NV870, NV730, NV830, NV850, NVG10, NVG12, NVG18	CAM GEAR	VDG0200	£1.20
NV730, NV770	IDLER UNIT	VXP0581	£2.50
NV2000, 2010 3000	IDLER UNIT	VXP0331	80p
NV2000, 2010, 3000	IDLER UNIT	VXP0329	80p
NV2000, NV3000	CAM GEAR	VDG0069	£1.00
NV7000, 7200, 7800	IDLER UNIT	VXP0344	75p
NV7000, 7200, 7800	CLUTCH	VXP0343	300p
NV8150, 8200, 8300, NV8400, 8600, 8610, 8620	IDLER UNIT	VXP0245	80p
NV8200, 8400, 8600 NV8610, 8620	PLAY IDLER	VXP0243	80p
NV8620	CLUTCH	VXP0343	250p
NV332, NV600, NV688	IDLER	VXP0488	300p
NVG20, NVG21, NGV25 NVG40, NVG45	PULLEY UNIT	VXP0767	400p
NV230, NV250, NV280 NV430, NV450, NV460, NV465, NV650, NV730, NV770, NV810 NV870, NV890, AG1000	WORM WHEEL	VXP0604	160p
NV370, NV380, NV630 NV780, NV830	IDLER	VXP0523	300p
NV370 NVG7, NVG11, NVG12	CLUTCH GEAR WORM WHEEL	VXP0595 VXP0691	£1.00 £1.50
NVG14, NVG15, NVG18, NVG30, NVG120, NVG130, NVG400, NVH70			
NV2000, 2010, 3000 NV7000, 7200, 7800, 8050	LOADING GEAR	VDG0035	£0.60
NV230, NV250, NV370, NV430, NV450, NV460, NV630, NV730, NV770, NV780, NV810 NV830, NV890, NVG7, NVG10, NVG12, NVG15, NVG30, NVG120 NGV130, NVG400, NVH70, AG1000	LOADING GEAR	VXP0520	£1.50
NV230, NV250, NV260 NV280, NV430, NV450, NV730, NV770, NV810, NV870, NV890 NVG7, NVG10, NVG11, NVG12, NVG14, NVG15, NVG18, NVG30 NCG120, NVG130, NVG400, NVH70, AG1000	CLUTCH GEAR	VXP0520	£2.50
NV230, NV250, NV260 NV280, NV300, NV333, NV340, NV366, NV370, NV430, NV450, NV460 NV465, NV630, NV650, NV777, NV780, NV788, NV810, NV830, NV850, NV870, NV890, NV2000, NV2010, 7200, 7800, NVG7, NVG10, NVG12 NVG14, NVG15, NVG18, NVG30, NVG120, NVG130, NVG400, NVH70, AG1000	LIMITER ROLLER		£1.50

ORION

MULTIPLE MODELS	IDLER	850A200004	280p
MULTIPLE MODELS	IDLER	850A200005	420p
VC150, VC180, VH200 VH201, VH205, VH212, VH250, VH254, VH288, VH300, CH303, VH312 VH404, VH555, VH700, VH704, VH708, VH712, VH780, VH844, VH900, VH3, VH33	IDLER		110p

SAISHO

VR605, VR800, VR900 VR1100, 1200, 1600, 2500, 3200, 3300	CLUTCH	850A20000	420p
VR3500, 3600, 3800 VR1100, 1200, 1600, 2500, 3200, 3300, 3500, 3600, 3700	LIMITER POST		£1.30
VR605, VR800, VR900	IDLER		280p
VR2500, 3200, 3300, 3500, 3600, 3800 VR705, VR805, VR905	IDLER		110p

SANYO

VHR1110, 1150, 1200 VHR1300, 1500	IDLER	143-0-662T-14730	£5.00
VTC5000, 5150, 6000 VTC6500, VTC7410, M11, M20, M21, M30, M31, M50	FF-REW IDLER	143-0-741T-20001	250p
VTC9100, VTC9300	IDLER	143-0-551T-01400	95p
VTC9300	FF ROLLER ASSY	143-0-547T-00200	200p
VTCM10, M11, M20, M21 VTCM30, M31, M50	REEL DRIVE PULLEY	143-0-662T-10350	£5.00
VHR2100, 2300, 2500 VHR2700	IDLER	6130374899	300p
VTC5000, 5150, 6000 VTC6500	PULLEY	143-0-662T-01201	£5.20
VTCM10, M11, M20, M21 VTCM30, M31, M50	PULLEY	143-0-662T-10350	£5.50
VHR3100, 3300, 3310 VHR3400, 3700, 3800 VHRD500, VHRD700	REEL DRIVE ROLLER	143-0-662T-15621	350p
VPR5800, VTC5300 VTC5400	LOADING ROLLER	143-0-661T-03800	80p
VTC3000	FWD LIMITER		£3.50
VTC3000	IDLER		750p

SHARP

	IDLER ASSY	NIDL0005GEZZ	110p
	IDLER	NIDL0006GEZZ	110p
VC600, 651, 681, 682	IDLER ASSY	NPLYV0107GEZZ	£6.15
VC684, 685, 693, 699, 700, 783, VC6FR, VC6V3 VC7300, VC7700, 7750	PLAY IDLER KIT	NPLYV0041+ NDA1V1007	£7.50

REMOTE CONTROLS

Description	Order Code	Price
GRUNDIG		
TP160E	RC 107	900p
TP200, TP300	RC 380	800p
TP400	RC 401	800p
TP590-600	RC 600	850p
TP390,TP610	RC 610	850p
TP621	RC 621	850p
TP630, TP650	RC 650	850p
TP660	RC 660	850p
TP661	RC 661	850p
HITACHI		
CLE800-CLE830	RC 140M	850p
A617402/655602	RC 192	875p
A512120/230	RC 900	800p
A514790	RC 901	850p
A5088470	RC 902	800p
A518612	RC903	900p
SCL002	RC904	850p
C2096	RC 905	850p
A511940	RC 906	800p
655602H	RC 907	850p
ITT		
IFB13, 14, 15	RC 143	875p
FS4	RC 148	850p
RG305	RC 305	825p
RG306	RC 306	825p
FS9/1-10/1	RC 307	850p
VS5 RUK	RC 308	825p
VS4-1	RC 310	850p
MULTICONTROL (17C20)	RC 311	800p
KORTING		
18279, 18396, 18460, 18521 SE	RC 108	850p
40540 VTS	RC 108	900p
LOEWE		
DC11	RC 146	850p
MATSUI		
010270601	RC 889	850p
VX770	RC 892	850p
METZ		
JAVA COLOR (6890)	RC 166	850p
COLOR (7156)	RC 183	850p
JAVA (7180)	RC 184	850p
MITSUBISHI		
939P/03607, 939P/03609	RC 140M	850p
NOKIA		
SATELLITE	RC 550	850p
NORDMENDE		
TC2336	RC 351N	850p
CMC1, TC3519	RC 356	875p
OCEANIC		
390C9500	RC 339	900p
ORION		
RC53	RC 892	850p
PANASONIC		
EUR51200	RC 200	850p
TC2200	RC 201	850p
VSQ0357/NV730	RC 202	875p
TNQ1621	RC 203	900p
PHILCO		
CARVEL, CONCORDE, MERCURY, TELESTAR	RC 108	850p
TC10	RC 152	900p
PHILIPS		
RC5002,5154	RC 134	850p
KT3 NON TEXT	RC 135	825p
69117032	RC 178	875p
69117194	RC 180	875p
RC5991-UNIV	RC 300	850p

Description	Order Code	Price
PHILIPS (continued)		
RC38	RC 301	875p
KT3 TEXT	RC 5301	800p
RC5352	RC 5352	800p
RC5375	RC 5375	850p
RC5 STANDARD	RC 5534	850p
RC5901	RC 5901	850p
RC5903	RC 5903	800p
SABA		
T6772	RC 149	900p
TC319-320	RC 328	875p
TC356	RC 356	875p
TC358	RC 358	850p
TC360	RC 360	800p
TC365	RC 365	800p
SALORA		
SERIES L	RC 190	875p
86173	RC 882	850p
SANYO		
RC218, RC222, RC228, RC238	RC 140M	850p
JXGE	RC 878	850p
JXDE	RC 884	850p
VHR2300	RC 890	850p
RC628	RC 865	900p
SHARP		
G0121CESA, 123CESA, 204, 251	RC 140M	850p
SIEMENS		
FC616	RC 130	850p
FC631	RC 132	850p
FC742	RC 164	900p
SONY		
RM604, RM605, RM606	RC 140	850p
32 CHANNEL	RC 140M	850p
RM613	RC 141	850p
RM632, RM636	RC 160	850p
TATUNG		
FXA	RC 877	850p
RC70	RC 883	750p
FX70 FASTTEXT	RC 894	850p
TELEFUNKEN		
FB632	RC 632 ST	850p
FB639	RC 639 ST	850p
THORN/FERGUSON		
3V35-42	RC 342	850p
3V31-32	RC 344	850p
3V57-58	RC 628	900p
TX10 TEXT	RC 732	750p
TX10 STEREO TEXT	RC 738	750p
TX9-90-100	RC 740	750p
3V55, FV11	RC 783	900p
TX100 FASTTEXT	RC 785	800p
TX100 STEREO FASTTEXT	RC 789	800p
PROFESSIONAL	RC 790	800p
TOSHIBA		
CT937	RC 950	850p
CT9117	RC 951	850p
201R4B	RC 952	850p

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* VCR ADJUSTMENT TOOL	* 1.60mm
	* 2.00mm
	* 2.40mm
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250mA	FUSE02	75P	FUSE18	60P
315mA	FUSE03	75P	FUSE19	60P
400mA	FUSE04	75P	FUSE20	60P
500mA	FUSE05	75P	FUSE21	60P
630mA	FUSE06	75P	FUSE22	60P
800mA	FUSE07	60P	FUSE23	60P
1A	FUSE08	60P	FUSE24	60P
1.25A	FUSE09	60P	FUSE25	60P
1.6A	FUSE10	60P	FUSE26	60P
2A	FUSE11	50P	FUSE27	60P
2.5A	FUSE12	50P	FUSE28	60P
3.15A	FUSE13	55P	FUSE29	50P
4A	FUSE14	55P	FUSE30	50P
5A	FUSE15	60P	FUSE31	50P
6.3A	FUSE16	60P	FUSE32	50P

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47uf at 63V	18
100uf at 63V	22
220uf at 63V	35
250V	
1uf at 250V	20
4.7uf at 250V	25
10uf at 250V	35
22uf at 250V	40
47uf at 250V	65
100uf at 250V	1.25
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1uf at 400V	23
4.7uf at 400V	35
10uf at 400V	70
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BA6121	2.99	M54648L	3.99	STR9012	6.00	TDA2030	1.30	BU208A	1.10	2SC1212	0.60
BA6122	1.99	M54649L	3.99	STR41090	6.00	TDA2170	3.00	BU500	0.99	2SC1399	0.60
BA6209	2.50	M54745L	2.99	STR44115	7.75	TDA2270	3.25	BU508A	0.99	2SC1413A	2.40
BA6219	2.99	MB3731	2.95	STR40090	5.99	TDA2575	2.00	BU508AF	1.30	2SC1454	3.25
BA6222	1.99	MB3732	2.99	STR50020	6.50	TDA2578	3.00	BU508DF	1.50	2SC1573	0.40
BA6229	2.80	MC13306T3	3.99	STR50103	4.99	TDA2579A	2.50	BU508DR	1.60	2SC1670	0.85
BA6238	1.99	MDA2061	5.99	STR50115	6.50	TDA2582	3.00	BU903	1.60	2SC1678	1.20
BA6239	2.50	MDA2062	4.25	STR54041	5.50	TDA2600	5.75	BU908	1.99	2SC1827	1.20
BA6304	1.90	STK430	7.00	STR55051	8.50	TDA2653A	3.50	BUT11A	0.85	2SC1922	2.75
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BA10324	1.99	STK459	5.99	STR10006	6.00	TDA3560	3.25	BUK444	2.99	2SC1969	1.60
BA10358	1.80	STK461	7.50	STR01806	6.00	TDA3561	3.00	BUX85	0.65	2SC2078	0.80
BA15218	2.20	STK463	10.00	STRD5541	7.99	TDA3562	3.00	BUW11A	1.40	2SC2235	0.40
CNY65	4.99	STK465	7.50	STRD6008	8.00	TDA3565	3.00	DTA114	0.70	2SC2335	1.20
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HA1377	1.99	STK2048	11.00	SAA1291	9.00	TDA3653	2.99	DTC144	0.55	2SC2577	1.20
HA1397	2.60	STK2129	7.00	SAA1293-03	8.50	TDA3654	1.99	MJ2955	0.75	2SC2579	1.30
HA11225	1.99	STK2250	8.00	SAA1294-03	13.00	TDA3300	5.00	MJE340	0.40	2SC2580	1.80
HA11227	2.20	STK3041	6.00	SAA5000	2.50	TDA4500	3.75	MJE13005	1.30	2SC2581	2.00
HA11235	1.99	STK3042II	6.50	SAA5010	4.30	TDA4501	4.75	MN650	4.00	2SC2791	2.60
HA11423	2.20	STK3062II	7.00	SAA5012	3.75	TDA4502	5.00	R4050	1.30	2SC3156	2.60
HA11711	6.50	STK4026	9.00	SAA5020	3.50	TDA4503	3.00	R4051	1.50	2SC3169	2.00
HA11717	4.75	STK4121II	7.00	SAA5030	4.99	TDA4505.3Y	4.00	S2000AF	1.50	2SC3182	2.50
HA11753	5.99	STK4122	8.00	TA7193	4.00	TDA4504	4.99	S2055AF	1.50	2SC3281	3.00
HA11758	5.00	STK4131II	6.50	TA7205	1.00	TDA4505 E	5.99	TIPL761A	1.75	2SC3284	1.60
HA13001	1.95	STK4132II	7.00	TA7222	1.20	TDA4505 M	12.99	TIPL791A	1.30	2SC3519	1.50
HA13008	9.99	STK4141II	6.50	TA7240	2.60	TDA4600	1.99	TIP112	0.70	2SC3679	2.00
HA13108	3.50	STK4141V	8.00	TA7241	2.60	TDA4601	1.99	TIP3055	0.60	2SC3944	1.60
HA13117	2.99	STK4142II	7.75	TA7264	4.99	TDA4950	1.99	2N3055	0.75	2SD315	0.80
HA13118	2.99	STK4151II	7.00	TA7269	5.50	TDA6200	8.00	2N3773	1.30	2SD400	0.20
HA13119	2.99	STK4152II	9.00	TA7270	2.50	TDA7240	3.00	2SA769	1.30	2SD401	0.50
HA13402	3.25	STK4161II	9.99	TA7271	2.50	TDA8170	2.99	2SA773	0.75	2SD424	3.50
HA13403V	5.50	STK4162II	8.00	TA7273	3.50	TDA8175	2.99	2SA965	0.25	2SD427	3.50
LA4182	1.99	STK4171II	9.99	TA7279	4.00	TDA8178	4.25	2SA985	0.65	2SD716	1.20
LA4270	2.99	STK4172II	9.00	TA7280	2.99	TDA8185	5.00	2SA999	0.20	2SD718	1.30
LA4282	6.00	STK4181II	9.00	TA7281	2.75	TDA8190	3.00	2SA1013	0.30	2SD725	3.50
LA4440	2.20	STK4182	9.99	TA7283	2.60	TPU2732	19.99	2SA1020	0.30	2SD837	0.80
LA4445	2.60	STK4191II	9.99	TA7288	2.20	TMS47C432	15.00	2SA1102	1.80	2SD845	2.50
LA4460	1.60	STK4192	9.99	TA7293	4.50	UPA81C	1.99	2SA1104	2.00	2SD856	0.80
LA4461	1.60	STK4372	6.00	TA7299	3.99	UC3844	2.99	2SA1106	2.00	2SD869	3.25
LA4465	2.99	STK4392	7.50	TA7680	4.00	U4646	8.50	2SA1141	2.00	2SD870	3.25
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LA4495	3.95	STK5332	3.50	TA8207	3.25	UPC1185	6.00	2SA1265	1.50	2SD1138	0.60
LA4496	3.99	STK5333	8.00	TA8210	3.50	UPC1188	4.00	2SA1302	3.00	2SD1207	0.50
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LA4505	2.60	STK5342	5.99	TA8215	3.99	UPC1238	1.80	2SA1535	1.60	2SD1292	0.50
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LA7330	4.99	STK5434	7.00	TA8400	3.99	UPC1278	2.40	2SB558	3.00	2SD1427	2.75
LA7520	4.99	STK5436	8.00	TA8659N	12.99	UPC1288	4.00	2SB560	0.40	2SD1432	2.75
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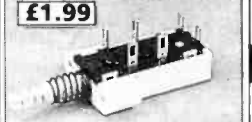

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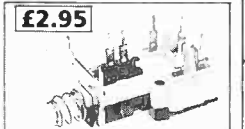

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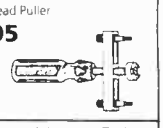

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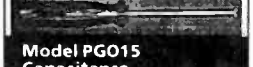

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Mixed Blessings and Missed Opportunities

Samsung's decision to invest £600m in an electronics manufacturing complex at Wynyard Park, Teeside, Cleveland is good news indeed. It will create 3,000 jobs in the five plants to be set up to produce microwave ovens, computer monitors, fax machines, colour c.r.t.s and personal computers. Apparently the success of Samsung's CTV manufacturing plant, in which the company has invested over £26m, at nearby Billingham contributed to Samsung's decision to increase its presence in the UK. All to the good: one success leading to another. And this is not an isolated case. On a smaller scale, Toshiba has recently decided to concentrate its European VCR assembly work at its Plymouth plant, while several other companies have recently increased their manufacturing investments in Scotland and South Wales. The UK has never before manufactured so many CTV sets, and the total output of electronics goods has never been greater.

What does all this say? If you wanted to put a dampner on it you could point out that the Department of Trade and Industry has been generous with regional selective assistance: it's understood to have contributed some £58m to Samsung's latest project. But this is a part of international trading life nowadays: most countries do something of the sort. Assistance of this nature helps, but is obviously only part of the story. Two other factors are much more significant. First that there seems to be no problem about recruiting suitable workforces at competitive rates in the UK, which has the great advantage of speaking the international language of electronics, English. And secondly that as part of the EU the UK is in one of the largest technological markets in the world. So we can produce electronics goods in the UK and we can sell and distribute them. The obvious question is why are there so few indigenous UK electronics companies? This seems to indicate a lack of competence, initiative and foresightedness amongst senior management in the UK, and a curious attitude to investment. Billions were wasted on the property boom of the late Eighties, while industry was left short of the wherewithall. Inflation didn't help either. It's difficult to lock funds into long-term developments when the value of money is falling and interest rates are, as a result, high. The management of "UK Ltd." has blundered monumentally in securing our long-term prospects as a techological manufacturing centre. Others, fortunately, have come along and seized the opportunities.

A word of caution is nevertheless appropriate. It is today all too easy to strip out plant and move it elsewhere when the economics of the situation change. Who would have thought that Singapore, a major electronics manufacturing centre in recent times, would lose out? Yet Thomson Consumer Electronics has just announced that it is to close its CTV plant in Singapore and move the operation to Bangkok in Thailand and Batam in Indonesia. The move is understood to have been precipitated by rising costs in Singapore: Didier Trutt of Thomson, Asia referred, in connection with the move, to the severe cost pressures associated with CTV manufacture worldwide. Japanese manufacturers have for decades been moving plant about in the far east. And following a degree of deregulation it seems that India could become an increasingly important electronics manufacturing base in the next few years.

So much for manufacturing. What about the R&D work that eventually leads to the installation of manufacturing lines? This is where the UK has signally failed in the past. So much work has been started – with LCDs, solid-state imaging devices and GaAs technology for example – but has seldom got off the ground. Yet there is today as much to go for as ever. One of the latest developments, which promises to revolutionise electronics in the future, is quantum-effect integrated circuits. We are talking about switching at atomic levels, five hundred times as fast as with current silicon technology; about components some ten atoms across in which the electrons behave as both particles and waves. A breakthrough has recently been announced in the practical development of such circuitry. As interesting as the technological advance is the fact that it has been achieved by a research team at Cambridge University. The team is funded by Toshiba. This seems to say it all: that the UK has the ability to innovate, develop technology and, eventually, carry out manufacture – but not to get its act together.

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COVER PHOTO

This month's cover photograph shows part of the microwave circuitry layout, including one of the signal probes, in a current LNB. See article on pages 90-92.

Repairing Satellite LNBs

Steve Rawlings

Most repair establishments seem to treat the humble LNB as a black box: if it doesn't work, throw it away and install a replacement or pay for costly repairs. It's true that to service such units fully expensive test gear is required. But if all you want to do is to get one working again, read on. There's no need for expensive test gear, just a digital voltmeter and a good power supply. In this article I'll explain how to recognise the different parts of the circuit and how to fault-find quickly.

What's Inside

So what's inside these little black boxes? The simplest thing is to think of the LNB as a kind of radio receiver, which of course it is. Fig. 1 shows a basic block diagram. Only we're concerned with microwave frequencies rather than r.f.

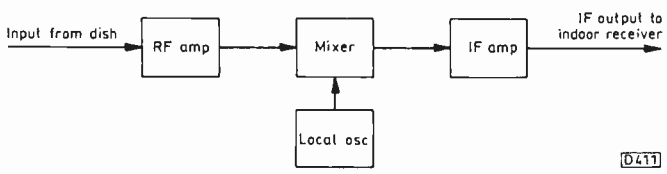

Fig. 1: Basic LNB block diagram.

The receiver circuitry within the LNB is mostly laid out in microstrip form, and all the components are surface mounted (see the cover photograph). Microstrip layout is used because of its efficiency at microwave frequencies. The width and length of the microstrip is directly related to the frequency in use.

The basic purpose of the LNB is to pick up the relatively weak signals reflected by the dish and pass them on to the receiver. The problem is that the dish and the receiver are usually some distance apart, and that at microwave frequencies losses are high. To overcome this difficulty the LNB converts the s.h.f. signals from the dish to a lower intermediate frequency (i.f.) band. Transfer of the signal energy to the receiver via the cable is then more efficient.

Polarisation

There are many different types of LNB, but they are similar in basic design. Perhaps the only major difference is the way in which selection between horizontally and vertically polarised signals is carried out.

The signals are picked up by a tiny probe. There are three different ways of selecting horizontally or vertically polarised transmissions. The simplest is to have two probes mounted at 90° with respect to each other and switch between the outputs they provide. This is the cheapest and most widely used method and is referred to as H/V switching. The feedhorn is connected to the LNB directly. This is the technique we will consider here, but for the sake of completeness we'll briefly mention the alternatives – the use of a mechanical or a magnetic polariser.

A polariser is mounted between the feedhorn and the LNB. The mechanical polariser has a single probe mounted in a piece of waveguide which is rotated so that the probe's orientation matches the signal's polarisation. A servo motor controlled by the receiver moves the polariser as required. This was the earliest approach but suffered from reliability problems. The magnetic polariser was devised as a cheaper and more reliable alternative, having no moving parts. Basically the idea is to alter, as necessary, the polarisation of the incoming signal before it arrives at the single probe. It consists of a coil wrapped round a ferrite core: the coil is current driven, the amount of current supplied determining the degree of wave bending that occurs. Back to the H/V type.

Typical LNB Layout

Fig. 2 shows a typical LNB signals circuitry layout with H/V switching at the input. The part at the top left is directly over the rear of the feedhorn. The two probes, 90° apart, can be seen, the one on the right for horizontal polarisation and the one at the bottom for vertical polarisation. They pick up the energy from the feedhorn and transfer it to the LNB circuitry.

The transistors are all of the field effect type (f.e.t.s). Tr1 and Tr2 provide the initial r.f. amplification, Tr1 for the vertically polarised signals and Tr2 for the horizontally polarised ones. H/V switching is achieved simply by switching one or the other transistor on electronically. Tr3 is the second r.f. amplifier stage. Note that there is no d.c. connection in the signal path between it and the transistors in the first stage – in fact a.c. coupling is used between all the transistors in the r.f. amplifier stages, to avoid d.c. components interfering with adjacent stages. Tr4 is the third r.f. amplifier. There are usually three stages in the r.f. amplifier section, but some designs may have more.

The amplified output from the final r.f. amplifier is fed

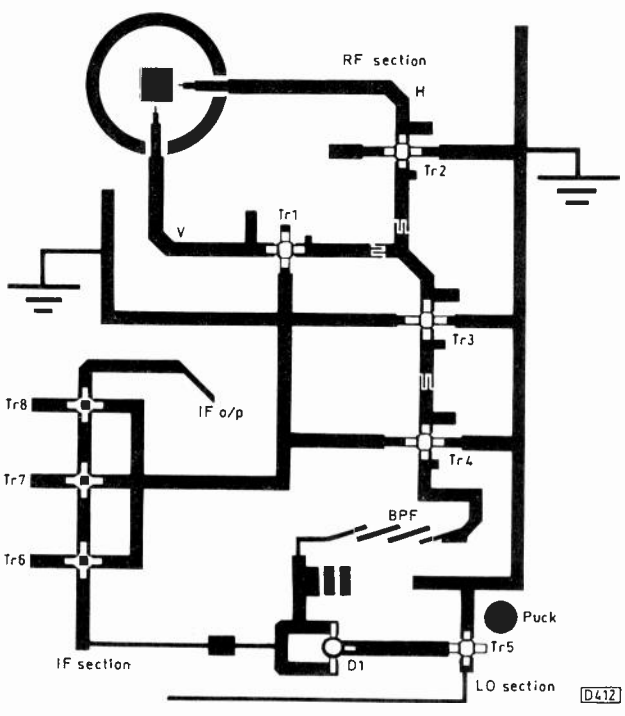

Fig. 2: A typical LNB signals circuitry layout.

via a microstrip bandpass filter to the diode mixer D1. In this stage the r.f. signal is mixed with the output from the local oscillator. This generally runs at 10GHz, though with the latest Astra 1D ready designs the frequency is 9·75GHz. Transistor Tr5 is part of the local oscillator circuit, which is of the DRO (dielectric resonant oscillator) type. The dielectric section is the small puck to the right of Tr5. Resonance is achieved when metal, in this case the lid, is placed over the top of the puck. There is also a local oscillator tuning screw over the puck: adjusting it enables the oscillator to be tuned 100MHz-200MHz either side of the basic 10GHz.

The i.f. signal thus produced (900-1,700MHz with a 10GHz oscillator) is passed to the i.f. section of the LNB. This usually consists of three amplifier stages and can easily be identified as the f.e.t.s are usually coloured black instead of white, the colour of the r.f. f.e.t.s.

Biasing circuitry (not shown in Fig. 2) is also required. In most modern units the bias for the f.e.t.s is set automatically. In older units such as the Marconi blue cap the r.f. stages are manually biased. A single 5V regulator, which is also easily identified, is bolted to the block. The only i.c. on the board is a Philips PC74HCT14T. This small, 14-pin device is used to switch between horizontal and vertical polarisation.

Fault Finding

Fault finding in such circuits is easier than it may at first seem. The first thing to do is to check whether the LNB works. This may sound silly, but it has not been uncommon to find that some amongst the hundreds of LNBs I've had in the workshop have been fault free. They are sometimes blamed when the cause of the fault lies elsewhere. So the first step is to note the on-screen symptoms. This will give a good indication of the sort of problem present. We'll consider possible faults, along with cures, in order of severity.

No Signal

This is the most difficult fault to diagnose by looking at a TV set's screen as there are several possible causes. If both sets of signals, horizontal and vertical, are missing and the dish alignment is correct, remove the LNB from the dish. Connect it to a 13V power supply and check the current drain. This should be about 200mA, though it's not uncommon to get a figure of 300mA with the Marconi blue cap type. No current probably means that the regulator has died or the input connector is dry-jointed. The latter is quite a common fault. A reading of less than 200mA could mean that a single device has failed. A higher current reading could mean the same. If the supply shows that there's a short-circuit it could be that water has got into the LNB. This is very common with Marconi blue caps, though later designs are much improved in this respect.

It's now time to open up the LNB. Be careful not to lose any screws – for correct local oscillator operation when the unit is reassembled they must all be refitted. Some LNBs have a separate enclosure for the oscillator section. This is a much better arrangement as the oscillator section shouldn't be disturbed unless absolutely necessary (a spectrum analyser is required to reset the local oscillator).

Once you've opened the LNB, take a few minutes to look over the circuit for any obvious faults or corrosion. Don't worry about the biasing section. In 99 per cent of cases there's nothing wrong with it. The fault may be in the r.f., i.f. or local oscillator section. Usually you'll find that the cause is failure of one of the f.e.t.s in the r.f. section. So circuit checks are the next step.

This can be done with a digital voltmeter – accuracy is not important, two digits being sufficient. Connect the DVM's negative lead to the LNB's chassis and use the positive lead to carry out checks. Start with Tr1 and Tr2 (Fig. 2). Check the bias voltage directly at the f.e.t. leads. The gates should be somewhere between –1·0 and –0·2V. Don't forget that one f.e.t. will be switched off. To switch each f.e.t. on-off, raise or lower the supply voltage. Any voltage outside the limits just mentioned will indicate that the f.e.t. is faulty – especially if the voltage reading is positive. The gate connection is at the signal pick-up probe side and can be identified by a small mark or the correct orientation of the LNB to read an identification letter, see Fig. 3. The drain connection is at the other side of the f.e.t. to the gate. The voltage here should be between 2·5V and 4V, ideally about 3V.

If one of the f.e.t.s seems to be faulty, it could be that the problem is with the H/V switching. So alternate the supply

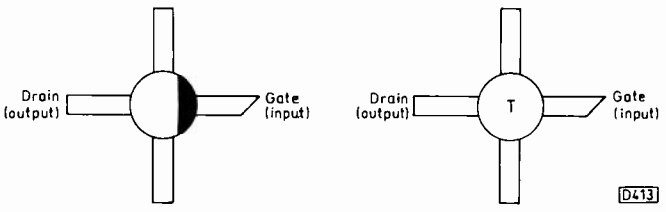

Fig. 3: F.E.T. pin connections. Correct orientation of the capital letter provides a guide.

voltage between 13V and 18V. Monitor the suspect f.e.t.'s gate voltage while doing this. The voltage should switch on and off. If it does, the f.e.t. is faulty. If it doesn't, check the switching circuit. In the majority of cases however the f.e.t. will be at fault.

Next check each of the other r.f. amplifier f.e.t.s in turn. The voltage conditions should be the same as with Tr1 and Tr2, but with no switching of course.

The local oscillator stage should be treated differently. It's very difficult to check whether this is working correctly. The best method is to reassemble the LNB and use a spectrum analyser to check the oscillator's radiation, whose amplitude should be approximately –60dBm. This is too low to give a microwave counter reading. The frequency should be 10GHz ±10MHz. If the frequency is higher than this the channels will be incorrect or, if the oscillator has drifted sufficiently, there will be no signal at all.

The only way to check the oscillator stage if a spectrum analyser is not available is to see if the f.e.t. is passing any current. There should be a resistor, usually with a low value of about 1Ω, next to the f.e.t.'s drain. If the f.e.t. is not working there will be no voltage drop across this resistor. With a Marconi blue cap LNB you should get voltage readings of about 3·4V and 3·2V at either side of the resistor. No voltage drop indicates a faulty f.e.t.

If the voltages checked so far all seem to be o.k. there could be a fault in the i.f. amplifier section. This is more reliable however, accounting in my experience for only about five per cent of failures. The voltages in this section are slightly different. The f.e.t.s are designed for lower frequency operation and are coloured black rather than white. You should get a reading of about 7·5V at the gate and 1·5V at the drain of the i f. transistors. Any voltages that are a long way from these figures indicate a faulty f.e.t.

That concludes the circuit checks. You'll notice that I have concentrated on f.e.t. failure. The use of microstrip layout and surface-mounted devices means that the rest of

the circuitry is pretty reliable. It's unlikely that you will ever encounter a faulty non-active device such as a resistor. Almost always a defective f.e.t. is the cause of the fault, in most cases one of the r.f. f.e.t.s.

H/V Switching Faults

If the symptom is failure to receive signals of one polarisation it's likely that Tr1 or Tr2, depending on the signals that are missing, is faulty. Before you carry out transistor checks, ensure that the switching is o.k. – both in the receiver and the LNB. If Tr1 or Tr2 has gone soft it may still work after a fashion, but produce a very poor signal level. In such cases ensure that reception of signals of the opposite polarity is good before replacing anything.

Poor Signal

If the quality of both the H- and V-polarisation signals is poor either Tr3 or Tr4 is likely to be faulty. But don't rule out Tr1 and Tr2: they could both be defective.

Intermittent Faults

If there's an intermittent fault, note the symptoms carefully. It could be that the LNB's performance is poor in bad weather. In this case ensure that the dish is aligned correctly then suspect that the gain of one of the f.e.t.s is poor. Slightly incorrect voltages will provide clues.

Simple things such as a poor cable could be responsible. In such cases it's sometimes best to try an LNB substitution test.

Poor Signal, Channels out of Sync

The channels being out of sync suggests that the local oscillator's frequency has drifted. This can also result in poor signal strength. Note the frequency and channels at the TV set. This is a difficult fault to deal with as easy access to a TV set and the LNB at the same time is required. Open the LNB to gain access to the tuning screw. Turn it slowly while watching a TV screen. Tune until the correct channel is seen. Clockwise rotation increases the oscillator frequency, half a turn changing it by about 30MHz. The total adjustment range is 100MHz-200MHz. The signal will be lost at about 20MHz out however.

Before altering the tuning ensure that the frequency drift is not caused by poor fit of the inner casing around the oscillator circuit.

Replacing Transistors

Transistor replacement may not be so easy. The devices I've used have come from either another LNB or from a surplus dealer. R.F. f.e.t.s come with varying degrees of noisiness. I use mainly NEC type NEC371 f.e.t.s, which I refer to as 'T' f.e.t.s because of the letter T on top. They have a noise figure of 0·8dBf and are adequate for even the most demanding satellite reception. Others in the NEC range are denoted R and J. R f.e.t.s would be used in the Tr3 and Tr4 positions. The J f.e.t.s, being the most noisy, would be used in the oscillator section where noise is not a consideration.

These f.e.t.s may be supplied by the manufacturer. But be warned, they are expensive: a single device may cost up to £5. Hunt around the radio rallies and surplus suppliers if you cannot find them anywhere else.

Don't be tempted to replace all the transistors in an LNB with good f.e.t.s in an attempt to improve the noise figure. Three 1dB f.e.t.s in series doesn't mean that the total noise figure is 3dB. The noise contributed by the first transistor has the greatest effect, being amplified by all the following transistors. So to improve the noise performance replace only the first f.e.t. Using this type of f.e.t. elsewhere will only waste its low noise performance.

Noise Figure

In my opinion too much emphasis is placed on LNB noise figures. I carried out an experiment and found that all the LNBs I tested had noise figures in excess of the manufacturer's specification, in some cases by as much as 0·5dBf. LNB manufacturers don't generally check the noise figure of every LNB they produce: the figures quoted are usually an average of the best noise-performance units.

It's better to achieve a good signal-to-noise ratio by increasing the dish size rather than lashing out on an expensive low-noise LNB. But having said that the reason, apart from better quality, why LNBs from the likes of Swedish Microwave are expensive is the fact that they are tuned for the best noise figure. Tuning a microwave device has to be done by hand by skilled personnel, using expensive test equipment. So the old saying is applicable, "you get what you pay for".

In Conclusion

The main thing is to do what I did, have a go. This article is based on information obtained from those who design LNBs and my own experience. After you've done a few LNBs you will wonder what all the fuss is about. They are a lot easier to repair than any TV. I hope you'll find that this article has been of some use – and that it removes the black-box mythology.

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Camcorner

Reports from David C. Woonott and Nick Beer

Panasonic NVMS2

There were two problems with one of these full-size S-VHS machines. First it produced a 'glitch' between recording sequences, giving a noisy edit. Secondly when going from record to pause it would sometimes back-wind the tape far beyond the normal point, thus losing the end of the previous sequence. The first problem was cured by replacement of the pinch-roller assembly, the second by replacement of the mode encoder switch.

Since this repair we've had two similar machines that displayed the same fault symptoms and were put right in the same way. **D.C.W.**

Sony TR Range

Failure of the flexible membrane that connects the VTR function keys and the zoom and trigger buttons is becoming a problem with some of the earlier models in this range. Unfortunately the membrane cannot be repaired. It's part of the complete switch block control assembly, which costs around £55 trade - a high price to pay for the loss of maybe just one function.

The membrane can become intermittent. As it's part of the key-scan control matrix this can result in various unrelated fault symptoms.

Later TR models have a replaceable membrane. **D.C.W.**

Canon E230E

The repair ticket said that this camcorder showed a picture outdoors only when the 1/4,000th sec shutter was used. At this speed there are of course no indoor pictures! The cause of the problem was seen once the casing had been removed: the iris assembly had 'fallen out' of the lens unit and jammed open.

With these lens assemblies the iris unit is removeable from the rest of the lens in one section without need to dismantle the whole assembly. Very nice for us! This one hadn't been seated properly and had literally fallen out. It's normally held in position by a retaining clip on the main lens moulding. **D.C.W.**

Sharp VLC750H

This one gave us some headaches. The playback pictures would sometimes be o.k. On other occasions there would be a noise bar either at the bottom or through the centre of the picture. If the drum was slowed momentarily the noise bar would shift, locking randomly at either one of the previously mentioned positions.

The servo section circuit diagram gives little away about its operation or the waveforms to expect at key points. We found that the drum FG and PG signals seemed to vary little wherever the noise bar appeared. With symptoms of this type one would expect there to be some problem with the PG signal, but with no guidance on waveforms etc. it's difficult to be certain.

A Sharp service bulletin told us that a likely cause of the problem is failure of the main servo chip IC701, but a replacement didn't provide a cure. What did put matters right was replacement of IC702. This chip's main job is to generate the four-phase head switching pulse train: it also combines the drum PG and FG signals into a form that's acceptable to the main servo chip IC701.

When we'd got the machine working properly we were unable to discern any difference between the waveforms obtained and those previously seen. **D.C.W.**

Sanyo VMD6P

Tape chewing and irregular mechanical functions were the rather obvious symptoms with this machine. The cause was a worn drive belt. The capstan motor drives two belts. Both are 'toothed' types and connect with the assembly bracket unit (part no. 636 023 8756). Several teeth were missing from the belt that's driven directly by the capstan. The belts are supplied as part of the assembly bracket. **D.C.W.**

Panasonic NVMS50B

There were some strange symptoms with this S-VHS, hi-fi sound, C-format machine. When, without operating the power switch, power was supplied via the d.c. lead the capstan motor would run for a short time then stop. No other signs of life were obvious, apart from the fact that the viewfinder would occasionally flicker into life for a few seconds.

The cause of these strange goings on was failure of Q1006 and Q1007 in the power supply. Both were leaky and even when 'off' they passed sufficient current to cause the symptoms described above. They are parallel-wired regulators that supply the main 5V rail. **D.C.W.**

Sony CCDTR305E

There were no mechanical functions with this young TR model. Inspection showed that a tooth was missing from the rotating part (mode control gear) of the mode switch. A pin had also broken off the Arm 1 assembly, a cam follower. We replaced these items and also cam TG1 as this is inclined to fail with the result that the back-tension pole assembly (arm assembly TG1) takes up the wrong position. This is easily seen in the eject mode as arm assembly TG1 then sits in the play position. After replacing these items we carried out the timing necessary to produce a working unit. **D.C.W.**

Sony CCDTR303E

I've had one or two of these camcorders with the complaint that the standby/lock switch is broken. In fact only one section of this multi-part knob fails, item 5. The part number is 394298501. **N.B.**

Panasonic NVMS50 – Correction

A transcription error occurred in my note on this model in the October issue (page 855). The excess friction was between the tape and the upper and lower drums, not between the two drums. **N.B.**

Teletopics

DISPLAY TECHNOLOGY

Sanyo has announced that it intends to start selling consumer products which use a newly-developed 3D liquid-crystal display by 1997. The display can produce 3D video and graphic images without the need for the viewer to use special glasses. Software splits a standard one-dimensional image to produce left- and right-hand views. Apart from that, little technical information has been released. According to Sanyo the display is small and cheap. The company plans to use it in TV sets, computer monitors and games machines and for applications such as simulators and medical systems.

While most of the investment that has gone into the development of flat-panel displays has been devoted to liquid-crystal systems a number of Japanese firms and organisations, including NHK, Fujitsu, NEC and Mitsubishi, have been working on plasma display panels (PDPs). These use gas (typically a neon/xenon mixture) discharge cells to produce the illumination. The gas mixture emits ultra-violet radiation when activated by accelerated electrons. This radiation in turn stimulates red, green and blue phosphors. The firms involved in this research consider that PDPs will offer the best solution for flat-panel HDTV displays. At present the main problems are insufficient light output, a relatively short life and of course cost.

Fujitsu has had a 21in., 1·26in. thick PDP in pilot production for over a year. Resolution is 640 x 480 pixels, with 8-bit colour per pixel. It costs around $10,000, but a dramatic fall is expected once high-volume production starts. Fujitsu is at present aiming to scale up the technology to produce 40in. panels – prototypes are due before the end of the year. The panel can be driven by RGB or NTSC signals. The New York Stock Exchange recently ordered 1,000 of the panels as part of its trading floor information display revamp.

NEC recently announced the development of a prototype 40in. PDP with a resolution of 840 x 480 pixels and 8-bit colour. The company has been experimenting with new gas mixtures (adding helium) to improve the light output and new cell structures to produce a finer spacing.

Mitsubishi has started pilot production of a 20in., 2·5in. thick PDP with a 640 x 480 pixel resolution and the capability of producing 16·7m colours.

According to an NEC spokesman the first large-screen TV sets with PDPs will become available in 1996. But they will not be for domestic use, a 40in. set being likely to cost around £6,000. Ten years is suggested as a probable time scale for the arrival of low-price consumer sets using the technology. At present the maximum light output achieved with a PDP is around 250 candela/sq. m, which compares with 300 candela/sq. m for a c.r.t. According to an NHK spokesman the aims of current R&D work are to increase the operational life from 3,000-10,000 hours (depending on cell structure) to 50,000 hours, a higher light output, reduction of the cell pitch to about 1mm and an in increase in screen size to in excess of 55in.

DIGITAL VIDEO

NTL's VCS4000 end-to-end MPEG-2 standard digital multi-channel TV system was briefly mentioned in this column last month. It's a fully-integrated system capable of multiplexing together up to eighteen TV channels under the control of a single computer, with all components configurable individually. The system fully conforms with the standards agreed by the 144 signatories of the Digital Video Broadcasting (DVB) Project, including the capability specified by the MPEG main profile/main level standard. It is the result of collaboration, initiated by News International, between NTL which contributed video compression expertise, News Datacom which contributed conditional access and subscriber management systems and Comstream which provided satellite and cable modulation technology.

Development of four extensions to the MPEG-2 standard are expected to be complete by the end of next year. These are 10-bit video coding for improved picture quality; a non-backward compatible mode to allow, for example, non-MPEG audio compression techniques such as Dolby Labs AC3 to be used; protocols for the control of remote storage media such as video-on-demand servers; and a real-time MPEG interface.

Several MPEG processing chips have been announced recently. IBM Microelectronics has a single-chip decoder that can handle either MPEG-1 or MPEG-2 digital video information. Mitsubishi has started pilot production of the M65770FP single-chip decoder whose features include a scan-conversion function that translates 24 frames/sec film material to 30 frames/sec video. Initial cost is £320 per chip: this should fall to below £60 once volume production begins. Toshiba has announced single-chip MPEG-2 encoders and decoders: sample decoder chips are priced at around £130.

VIDEO NEWS

Hitachi is developing a camcorder that will use 256Mbit flash memory chips to store the video signal. By using video compression Hitachi expects to be able to store half an hour of digital video in 400Mbytes of memory space. The camcorder, which could be the world's smallest and lightest, is expected to be launched in about five years' time at around $1,000.

JVC's latest camcorder, Model SV3, has a flip-over colour LCD screen that can be used as a viewfinder, a playback screen or, with an optional tuner, a TV set. There is also a video message recording facility: this works like a video answering machine – a green light on the front panel indicates that a message has been left. Quick record gives five-second shots, while re-take rewinds over the last scene for re-recording purposes. Price is £800.

Hitachi's VTM340E VCR includes a title-index system that automatically stores the date, time and channel number of over a hundred programmes.

JVC has launched a two-hour S-VHS-C tape in Japan. The recording time is 40 minutes in the standard-play mode, 120 minutes in the extended-play mode. It's expected to be available in the UK by the end of the year. The price in Japan is the equivalent of about £12. A VHS-C version is to follow.

Panasonic's S-VHS VCR Model NVSH1000, at around £1,000, incorporates a timebase corrector and an optional VITC adaptor (at £70). It is one-way compatible with the LANC command system used by Video 8 camcorders and can be used to control a Video 8 camcorder or VCR.

JVC has launched six Video CD products based on the 2.0 standard in Japan. This standard includes provision for simple interactive branching programs and a higher resolution still-picture display. The XLSV1 is a stand-alone deck, the MXM500V a hi-fi system plus Video CD player, the

KPPV1 an integrated karaoke system with three changers, the KXDV55 a home karaoke system that accepts up to a hundred discs, the XLMV55 an autochanger system and the XLCV55 a controller for three auto changers. No UK launch details have been announced. Panasonic, Hitachi, Sharp and Sony also showed Video CD equipment at the recent Japanese consumer electronics show.

CABLE AND SATELLITE FIGURES

According to market research company GfK the number of cable subscribers in the UK increased by 39·7 per cent, to 841,000, during the year to the end of last July. During the same period the number of homes with satellite TV increased by 19 per cent to 2·7m.

TRADE AND BUSINESS NEWS

JVC (UK) Ltd. has appointed Willow Vale Electronics Ltd. the Approved Distributor for the supply of spare parts to non-JVC account holders.

Wizard Distributors has been appointed an official spares stockist by Grundig Satellite Communications Ltd. Wizard's 1994-95 spares catalogue has just been published and is free of charge to trade customers. Apply to Wizard Distributors, Empress Street Works, Empress Street, Manchester M16 9EN (telephone 061 872 5438, fax 061 873 7365).

Philex Plc, Philex House, 110-124 The Broadway, West Hendon, London NW9 7BP (081 202 1717, fax 081 202 0014) has introduced a four-way preprogrammed universal remote control unit. Features include teletext with Fastext, a four-digit set-up facility and a very clear large-key layout. It offers TV, video, cable and satellite receiver control for thousands of models, with auxiliary options, and can replace up to eight separate remote control units.

Toshiba is to move its European VCR production from Germany to Plymouth early next year. The Plymouth plant is likely to become Toshiba's sole brown goods factory in Europe. We may also see Indian manufactured Toshiba VCRs before long. The company has placed an order for 100,000 VCRs with Videocon, a leading Indian consumer electronics group. The machines, which use Toshiba technology, will be sold worldwide. Toshiba may increase its purchases to 300,000 VCRs a year, and is also considering the purchase of colour TV sets from Videocon.

Samsung is to invest £600m on five production plants at Wynyard Park, Teeside, Cleveland. The first two plants, due to come into operation next August, will produce microwave ovens and computer monitors. Later plants will produce fax machines, colour c.r.t.s and personal computers. Over 3,000 jobs are likely to be created. Samsung already has a CTV production plant nearby at Billingham.

STOLEN TOSHIBA CTVs

A quantity of 21in. FST Toshiba colour TV sets were stolen from Plymouth on October 3rd 1994. The 273 sets, Models 2140TS, 2140RS and 2132DT, are valued at £100,000. They were destined for overseas markets – Russia, Scandinavia and Italy – and are thus not compatible with the UK system. It's felt that attempts may be made to get TV engineers to modify them.

A substantial reward has been promised for information leading to the arrest and conviction of those responible for the theft and the recovery of the TV sets. Anyone with any information to offer should contact DC Harrison, Plymouth CID, Devon on 0752 701 188

Next Month in TELEVISION

SERVICING THE PHILIPS 10CX1120

This 10in. colour set dating from the mid-Eighties was of Loewe-Opta design and also appeared as the Pye 25KX1201. It was popular because of its small size, direct video and RGB facilities and the fact that it can be operated from a 12V battery. Many have been condemned because the sets tend to suffer from various intermittent faults that can be quite unusual. There are known causes however. Richard Newman on servicing and fault-finding procedures.

CONFESSIONS OF A TLO

The Technical Liaison Officer appears to be a dying breed as manufacturers cut back left, right and centre. His was a varied and interesting life, with all sorts of responsibilities. Mark Paul reveals the inside story.

SERVICING AUDIO POWER AMPLIFIERS

Although audio power amplifiers appear to be straightforward servicing them is not always as simple as you might expect. Problems frequently occur when incorrect procedures have been followed. Joe Cieszynski looks at the difficulties that can arise and ways of avoiding them.

SATELLITE TV

Brian Ewan on modifications to enable the Uniden UST8008 receiver to be used with the standard or bullet type Marconi LNB. Ian Martin reviews the recently introduced Grundig GRD250 IRD, which features ease of use and a low-threshold tuner.

BUYING SECOND-HAND STOCK

Renting out or selling second-hand TV sets and VCRs can be more profitable than dealing in new goods. But care is required in the selection of suitable stock. David Chaplin on the various pitfalls and how to go about it.

The Os-Con

Eugene Trundle

Electrolytic capacitors combine high capacitance values with relatively small size and weight. They are widely used for this reason. Until recently two main types were available, aluminium and tantalum – these are the materials used for the positive electrode, in foil or solid form. The aluminium type was fully described in Ray Porter's article on page 194 of the January 1993 issue of *Television*. Much of what was said there is also true of the tantalum type, whose main advantages over the aluminium type are lower losses and better temperature ratings.

Recently Sanyo has developed, and is now actively marketing, a new type of electrolytic capacitor whose electrolyte is in solid form rather than the gel or solution of semiconducting manganese dioxide used in conventional types. Known as the os-con (Organic SemiCONductor), its electrolyte is based on the organic semiconductor TCNQ, a complex salt in a fine-powdered black crystalline form with a resistivity of about 3Ω/cu cm – the full name is N-n-butyl isoquinolinium. In production this material is melted, inserted, immersed and cooled in carefully-controlled conditions.

Os-Con Construction

Fig. 1 shows the construction of an os-con. The metal used is aluminium, the dielectric being aluminium oxide. Instead of a porous or vented seal the os-con has an impervious resin seal – there's no electrolyte evaporation when it's in solid form. Os-cons are produced in conventional tubular and surface-mounting forms. For a given type (capacitance value and working voltage) they are roughly equivalent in size and price to solid tantalum electrolytics, i.e. slightly bigger and rather more expensive than aluminium types. Os-cons are available with capacitance values from 0·1μF to 220μF and voltage ratings from 6·3V to 25V. In appearance they differ little from conventional electrolytic capacitors, but in performance they are vastly superior in every respect, as we shall see.

Characteristics of the Os-Con

The greatest advantage of the os-con is its good high-frequency characteristic, which approaches that of a film capacitor – much better than that of a conventional electrolytic. This is shown in Fig. 2 which compares the h.f. characteristics of os-cons and the best types of aluminium and tantalum capacitors. At frequencies above 100kHz a 47μF os-con is superior to a special low-impedance 1,000μF aluminium capacitor whose physical size is twenty times greater.

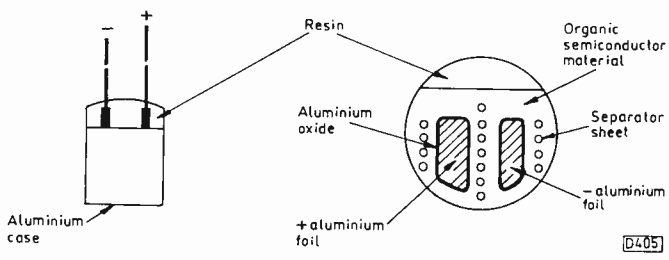

Fig. 1: Os-con construction.

Fig. 3 plots the impedances and ESRs (equivalent series resistances) of four widely different sizes and types of os-con. In the 1MHz range the increase in impedance is caused entirely by the inductance of the lead-out wires, which should be kept as short as possible in production and assembly.

As Fig. 4 shows, below 0°C the temperature coefficient is much better than that of an aluminium capacitor and virtually as good as that of a tantalum type. This graph is also interesting as it shows the very poor temperature characteristic of ceramic capacitors and the very good one of film types (Mylar in this case). The much better performance of tantalum and os-cons compared to aluminium electrolytic capacitors at sub-zero temperatures makes them particularly suited to outdoor equipment like cameras and radio communication units. The os-con is smaller and cheaper than an equivalent film capacitor.

Another way of considering the temperature characteristics of different types of capacitor – a more important one in some applications – is in terms of their effective series resistance. As Fig. 5 shows, there is nothing as good as the os-con in extreme cold. The ESR of ceramic capacitors is lower than that of os-cons at normal and high temperatures, though in both cases we're talking about fractions of an ohm and lead length and other physical characteristics are often more significant than the actual capacitor performance.

Ageing

While an aluminium electrolytic capacitor has a definite life span, governed by the rate at which its electrolyte evaporates (this is greatly accelerated by high operating temperature) and deterioration of the aluminium foil, the ageing characteristic of an os-con is different: there's a very gradual and relatively small capacitance loss over a very long time – it has no electrolyte solution to dry out. Thus after 6,000 hours' operation at 105°C a typical os-con will have lost about eight per cent of its original capacitance while its leakage current change will be imperceptible. With similarly rated capacitors working at 65°C the life span of an aluminium type comes out at 3,200 hours (3 6 years) compared with 200,000 hours (22 years) for the os-con: at 45°C the figures are 128,000 hours (14·6 years) and two million hours (220 years) respectively.

Ripple Current

With any electrolytic capacitor the permissible ripple current is determined by its power loss and varies in propor-

Table 1: Comparison of electrolytic capacitor ripple current ratings (A r.m.s.).

Case size (mm)	*Os-con*	*Aluminium*	*Tantalum*
4 x 7	0·31	0·08	0·03
5 x 7	0·50	0·12	0·05
6·3 x 7	0·92	0·2	–
6·3 x 10	1·3	0·25	0·12
8 x 10	1·8	0·51	–
10 x 10	2·3	0·63	0·19

Case size is diameter x length.

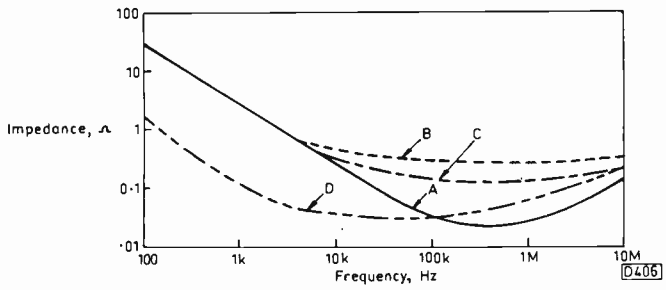

Fig. 2: Frequency characteristics of different types of electrolytic capacitors (at 25°C). A os-con (47µF, 16V, 6·3 x 9·8mm); B low-impedance aluminium electrolytic (47µF, 16V, 8 x 11·5mm); C tantalum electrolytic (47µF, 16V, 6 x 11mm); D low-impedance aluminium electrolytic (1,000µF, 16V, 16 x 25mm).

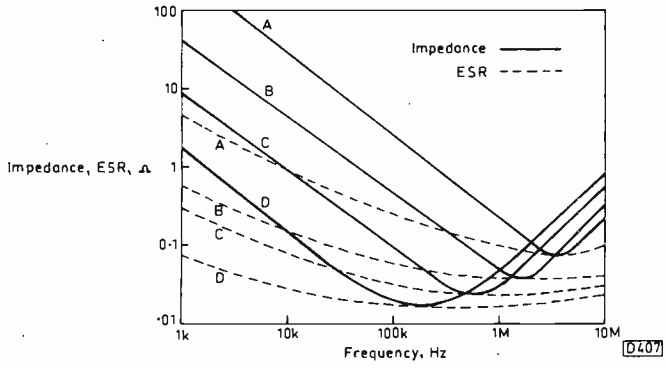

Fig. 3: Os-con impedance and ESR ratings over the frequency range 1kHz-10MHz (at 25°C). A 0·47µF, 25V; B 4·7µF, 25V; C 22µF, 6·3V; D 150µF, 16V.

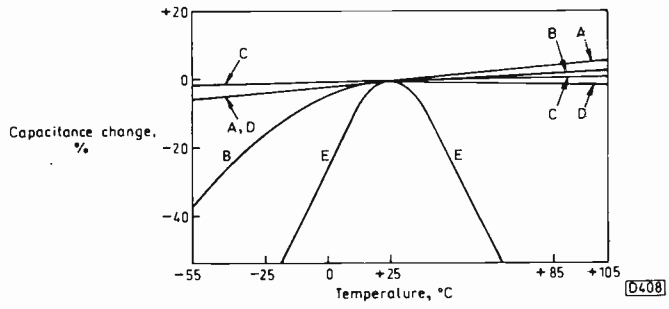

Fig. 4: Temperature/capacitance characteristics of different types of capacitor. A os-con; B aluminium electrolytic; C tantalum electrolytic; D Mylar film capacitor; E ceramic capacitor.

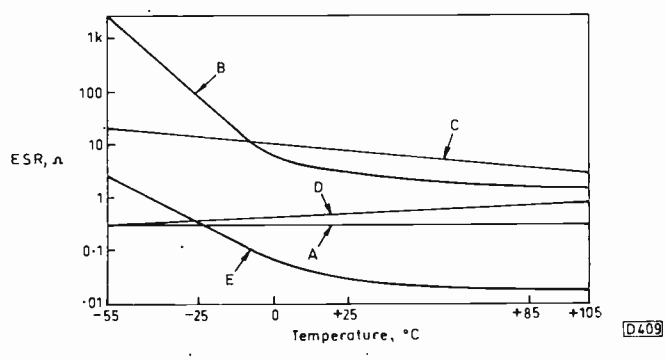

Fig. 5: ESR/temperature characteristics. A os-con; B aluminium electrolytic; C tantalum electrolytic; D Mylar film capacitor; E ceramic capacitor.

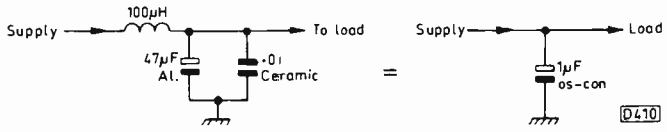

Fig. 6: The temperature and frequency characteristics of an os-con are such that it can replace three components in a noise/ripple filtering circuit. These two configurations both provide similar filtering over a wide temperature and frequency range.

tion to its physical volume or case size. Table 1 compares the ripple-current ratings of various types of capacitor in six different body sizes. At 100kHz and 85°C, which are fairly typical conditions in a switch-mode power supply for example, the permissible ripple current with an os-con is about four times that of an aluminium electrolytic and about ten times that of a solid tantalum type.

Applications

The high performance of os-cons makes them superior to other types of electrolytic capacitor in all circuit applications. In a filtering/decoupling role the noise performance of aluminium electrolytics is relatively poor: in a typical case of a 5V supply carrying a superimposed 1V peak-to-peak sinewave it was found that increasing the value of an aluminium electrolytic decoupler ten times (10µF to 100µF) reduced the ripple voltage just 1·3 times. So much better is the noise performance of an os-con that in certain applications, at high frequency and low temperature, the same ripple rejection was provided by a 680µF aluminium electrolytic capacitor, a 47µF tantalum capacitor and a 10µF os-con.

This brings us to Fig. 6, which shows that in a conventional supply line filter a single small os-con will do the job of a coil and two capacitors, one for l.f. and the other for h.f. decoupling.

This opens the way to smaller and much more efficient switch-mode power supplies for example. SMPSs are used in all sorts of equipment nowadays, not all mains operated: they bang away in battery-operated and portable equipment such as computers, lap-tops and personal electronic notebooks, to quote just a few examples at random, with efficiencies approaching 90 per cent. Around 90 per cent of current power supply designs are of the switch-mode type.

Other os-con applications include time-constant circuits (in TV timebases for example), audio and scan coupling and d.c. motor control circuits. There are many others.

Servicing

As os-cons start to appear in the equipment that lands on your bench make sure that you don't, unawares, replace them with ordinary aluminium or tantalum electrolytics, otherwise you could have trouble on your hands.

In Conclusion

Although research is being carried out on other uses for organic semiconductors in electronics, such as superconduction and active junctions, the os-con is their first commercial, mass-production application. The basic crystal formulation was first synthesised by DuPont as long ago as 1960, and was studied for capacitor use by Sprague in 1962. Production has been held up by difficulty with manufacture and processing. Sanyo's development of the melting immersion method has overcome this.

TV Fault Finding

Reports from Philip Blundell, AMIEEIE, Ian Bowden, Brian Storm, David Belmont, Nick Beer, Chris Watton, Terry Lamoon, Michael Dranfield and John Edwards

Philips Anubis B-AA Chassis

If you replace the ST24C02P EEPROM IC7685 you'll need to program the new device via the on-screen menus. The only snag is that with an empty EEPROM the language is set to Norwegian and the child lock will be active. When this is the situation the word 'Barnlas' is displayed. To clear the child lock using Norwegian select special functions option C on the main menu. The next menu will show Barnlas (child lock) as option A: set this to Fran (off). Once the child lock has been cleared you can change the language to English and set up the other parameters. **P.B.**

Philips GR1-AX Chassis

The sound was slow to come back when the channel was changed, and if search tuning was tried it continued when a channel was found. We discovered that the 'ident' signal to the microcontroller chip was permanently low because transistor Tr7046 (BC558) was short-circuit. **P.B.**

Grundig CUC3600 Chassis

If there's no picture, just a dim vertical band on the screen, check the line output transistor's base drive waveform. If the amplitude of the waveform is low and it occurs at twice the normal rate, check by replacement C507 (100µF) or IC550 (TDA8140) as necessary. **P.B.**

Philips 2A Chassis

This set was dead, though a ticking noise came from the power supply. With the line output stage disconnected and a dummy load connected in its place the power supply produced the correct 140V h.t. output. When the line output stage was reconnected the protection thyristor Thy6698 fired. The 6·8V zener diode D6700 was leaky. **P.B.**

Philips Anubis A-AC Chassis

This new set worked all right until it was put into the standby mode. The standby LED then pulsed and a thumping noise came from the loudspeaker. When standby is selected thyristor Thy6570 conducts and the +5B supply rises. This voltage increase is sensed by the 6·2V zener diode D6568, which switches transistor Tr7553 on. The cause of the fault was that D6568 was leaky: a new LLZ F6V2 diode was needed. **P.B.**

Ferguson A10R (TX80 Chassis)

A picture was present but it had a bright red cast with flyback lines on top of it. We looked at the R – Y drive signal at the base of the red output transistor TV101 on the c.r.t. base panel and found that it was very similar to the other colour-difference drive signals. A check at its collector showed that there was just a steady d.c. level however. RGB matrixing in carried out in the output stages in this chassis, the luminance signal (–Y) being fed to the emitters of the output transistors via preset potentiometers. A check across the red preset PV104 showed that there was no voltage drop across it, as there was across the equivalent presets in the G and B stages. Close examination of the print revealed that there was a tiny fracture between the end of RV110, which is in series with PV104, and TV101's emitter. With this linked across normal operation was restored. **I.B.**

Finlux 3621

The picture had slipped to the right. It was perfectly locked but the line phasing was incorrect: there was a blank vertical area about three inches wide near the left-hand side of the screen, with the right-hand side of the picture to the left of it. We soon found that the line flyback reference pulses that are fed back to the TDA2579A sync/timebase generator chip were virtually non-existent – a scope check at pin 12 showed a pulse waveform of less than 100mV peak-to-peak. The pulses come from an emitter-follower transistor, Tz1, on the power supply/deflection PCB. This transistor's input is taken from the collector of the line output transistor via two series-connected resistors with values of 270kΩ and 27kΩ. The 27kΩ resistor was open-circuit. **I.B.**

Panasonic TX28W3 (Euro-1 Chassis)

Slight right-channel distortion when receiving a Nicam transmission led us a merry dance with this set. IC1401 was first accused, as it's the Nicam and normal sound processor chip. A replacement proved that it was innocent however. The culprit was eventually found to be C1423 as it had never been soldered in at one end. It's part of IC1401's oscillator circuit. **B.S.**

Panasonic TX25T2 (Alpha 2 Chassis)

This one must come top of my horrible field faults list: bad distortion, line doubling and horizontal striations were present all at once. Various chips and capacitors were accused in turn and found to be entirely blameless. After much travail a nice man at Panasonic, Ali Mirza, led us to R469. This small resistor in the field feedback circuit had increased in value from 470Ω to many thousands of ohms. Thanks Ali. **B.S.**

Panasonic TX24A1 (Alpha 2W Chassis)

After about four hours' operation the safety resistor (R567) in the h.t. feed to the line output stage would blow. This would be accompanied by various shrieks and whistles, and at this point the line output transistor Q551 would be very hot indeed! Extensive checks were carried out in both the power supply and the line output stage, all to no avail. After

many hours of frustration and heartache we eventually found that C502 in the line oscillator circuit had been fitted incorrectly, with one leg loosely attached to the adjacent solder. **B.S.**

Panasonic TC1485 (Z3 Chassis)

This portable would cut out when the brightness was increased. Tests showed that the contrast didn't decrease as the picture became over bright, although the beam limiter operated to shut down the line drive. We found that R316 (47kΩ), which applies the beam limiting control voltage to the video section of the receiver, was open-circuit. **B.S.**

Sanyo CBP2572 (ED1 Chassis)

The 3·9Ω, 15W surge limiter resistor R301 was open-circuit and the 2SC4429 chopper transistor Q303 short-circuit. The cause of the chopper transistor's failure was the fact that the resistor in the snubber circuit (R315) was dry-jointed. After attending to these items the set still failed to come on. The TEA2260 chopper control chip IC301 had also failed, a replacement finally restoring normal operation. **D.B.**

Hitachi C2858N

When this set had warmed up it displayed horizontal lines. The tuner was thermally defective. **D.B.**

Panasonic TX21T1 (Alpha 2 Chassis)

After about an hour's use and whenever a different channel was selected the channel information derived from the text would flash unlocked across the screen. There was also loss of teletext synchronisation. The cause of all this was C3511, which of course is a 10nF ceramic capacitor. **D.B.**

Salora J Chassis

This set was dead. The chopper transistors TB700 and TB701 were short-circuit while the mains fuse and RB713 were open-circuit. We replaced these items along with the 4·7µF chopper drive coupling capacitors but the set was still dead. At least the mains fuse held, and there was 320V at the collector of TB700. There were no start-up pulses however because the BR100 diac DB725 was short-circuit. A replacement got things going again. **D.B.**

Matsui 2091

We've had several of these sets in recently. The first one remained dead when brought out of standby. D401 (1N4003) in the supply to the line driver stage was open-circuit.

Another set would go into standby when the mains switch was replaced. X901 (10MHz) was the cause of this fault.

For partial field collapse check D301 (1N4003). You will usually find that it's open-circuit. Replace it with a good-quality 1N4007 diode. **D.B.**

Grundig CUC2800 Chassis

Although this set was dead the power supply was working and the voltages on the unswitched side of relay RL652 were correct. There were no voltages on the switched side however, and further checks showed that the relay was being switched. Investigation showed that although the relay

was apparently working the contacts didn't make. A replacement put matters right. **D.B.**

Ferguson TX90 Chassis

The picture looked like that produced by a poorly tuned set. Sound was o.k. but there was no sync. A check on the video waveform showed that it was highly distorted. The video demodulator coil L105 required adjustment. According to the customer the fault had got gradually worse. **D.B.**

JVC AV28F1EK

There was intermittent loss of the picture and sound. When the fault occurred there was just a blank raster. We eventually found that the a.g.c. preset control was dry-jointed. **D.B.**

Sony KVA2912U

The picture flickered from colour to black-and-white very frequently. The cause was loss of the 5V supply on board B because the circuit protector that feeds the 5V regulator was open-circuit. **D.B.**

Solavox 142TT

The text would become unusable when the set had been in operation for a few hours – there would be severe corruption initiated by the clock stopping. The text would then appear over the TV picture without any prompting, and various blanking problems would be experienced. The SAA5243PE text processor chip was thermally faulty. **N.B.**

ITT CVC20 Chassis

When this old set warmed up its picture would shrink vertically. Freezing D508 (BY126) restored full scan but the cause of the overheating was the fact that the field output transistors were leaky. New transistors (TIP31 and TIP33) plus two new diodes, D508 and D506 (BA316), put matters right. **N.B.**

Panasonic TX28W2 (Alpha 3 Chassis)

This monster had no colour. Checks around the decoder showed that the chroma signal was present and correct, so attention was turned to the TDA3505 video control chip IC303. The voltage at the d.c. colour control pin (16) was low at 0·035V instead of about 3V. What could be the cause? My first check was naturally on the 0·01µF ceramic decoupler C644, which was virtually short-circuit (80·5Ω). With any other make the parallel zener diode would have been a far more likely suspect! **N.B.**

Samsung CI537V

Intermittently dead with a chattering relay was the complaint with this set. REL901 frequently suffers from burnt contacts, but the field engineer had cleared this possibility. When the fault occurred on the bench I found that the relay coil wasn't being earthed. Tracing back I discovered that there was a broken pin in connector PH01 (pin 3, the pink lead). **N.B.**

Granada C20AX5

The customer complained that this Hitachi-based set would go dead. It never did for me, but I found that there was a superb dry-joint at pin 4 of T901. When this was open-circuited the set was stuck in standby. **N.B.**

GoldStar CIS4361

No picture was the complaint with this set, but the fault took three weeks to show up. Its cause was loss of the tube's heater supply – the four-pin connector by the line output transformer had a tarnished pin. The same chassis is used in Bush sets. **N.B.**

Philips GR1-AX Chassis

I've had lots of these 14in. sets in lately. Most of them have had dry-joint problems or a faulty 2SC3795 line output transistor.

In one of them however the 2A mains fuse had blown because the posistor in the degaussing system had gone short-circuit. When this had been attended to there was no picture. The e.h.t. and heater supplies were present, also the RGB drives. When the first anode and focus controls were advanced there was dull, soft vision that could barely be discerned – and the adjustments interacted. A close look at the tube base showed that there had been spillage over the socket, which was very difficult to remove from the c.r.t. A new socket and a clean up restored normal operation. **N.B.**

Grundig CUC220 Chassis

There was no vision, sound or channel display. Checks on the power supply outputs proved to be fruitful: the 15V supply was very low, even off load. It comes from a standard 7815 regulator, which is one of three mounted on the finned heatsink above the c.r.t. base opening in the main panel. The input to the regulator was o.k., but there was a leak between its output and chassis. **N.B.**

ITT CT3425 (Compact 80 110° Mk 2 Chassis)

This set was dead. As the electronic fuse was in action I tried operating the power supply with a dummy load in place of the line output stage. This proved that the power supply was o.k., but there was no measurable short across the h.t. line. I suspected the line output transformer, which proved to be the cause of the trouble. Check ITT sets of this era carefully before ordering spares, to establish exactly which chassis is used. **N.B.**

Akita CW1492

This set would only occasionally come on. Checks in the power supply revealed that R802 and R803 (both 15kΩ) had gone high in value. Replacing them restored correct operation. They provide the power control chip with a start-up feed. **C.W.**

GEC C2288H (Hitachi NP81CQ Mk 2 Chassis)

There was just a bright white screen. A check at the tube's base panel showed that the h.t. supply at pin K2 was far too low at only 90V. The reservoir capacitor for the 180V supply is C715 (4·7µF, 250V) which is mounted close to the line output transformer. It was open-circuit. **C.W.**

Ferguson TX90 Chassis

The h.t. voltage was a little high and couldn't be adjusted, giving the trip symptom with the appearance that the line

speed was incorrect. R229 (47kΩ) in the power supply had gone high in value. To be on the safe side I also replaced R225 (33kΩ) which is in parallel with it. **C.W.**

Grundig CUC2401 Chassis

This set was dead though two of the power supply outputs were present. There was no line output stage operation or +C supply. Checks showed that the drive waveform at the base of the line output transistor was present and correct, and a small spark could be drawn from the e.h.t. pulse output of the transformer. But there was no voltage at the collector of the line output transistor because, curiously, the transformer's primary winding was open-circuit. **C.W.**

Philips CP90 Chassis

The main power supply was working and the tube's heaters were aglow, but there was no picture or sound. A check showed that the microcontroller chip's 6V supply was missing. The cause of this was D6733 (BAV19) which was open-circuit. **C.W.**

Alba CTV14RS/CTV55

Apart from volume control everything was o.k.: when volume up or down was pressed the display would show only a row of dots, as if the sound was turned to minimum. Replacement of the MN6030 memory chip IC601 restored the sound and the correct display. **C.W.**

Sanyo CBP2145 (E2 B21 Chassis)

There was a good picture when this set was switched on, but when the brightness was increased there was line tearing across the screen. I went for the electrolytics, which is always a good bet with these sets. C364 (100μF, 16V) was open-circuit, a replacement restoring normal operation. **T.L.**

Matsui 2190

This set was a dead as the proverbial dodo. It's always worth checking the secondary supplies with this model. We found that the standby 5V supply was missing. The special 4A fuse F802 had gone open-circuit while diode D807 was short-circuit. Replacements restored normal operation: a nice easy fault for a change. **T.L.**

Sony KVX2132

By the time I got this set, which had no field scan, another engineer had replaced IC502 and its feed resistor R802. But the fault was still present. A checked showed that there was still no supply to IC502. Following this back I found that R530 was open-circuit. A look at the circuit diagram then showed that both R802 and R530 are in the feed to IC502. Both had failed. Full scan was present when replacements had been fitted. **T.L.**

Matsui 1436

There was no field scan. By using the highly technical tap fault-finding technique I narrowed the cause down to a dry-joint at R602. Resoldering it restored the scan. **T.L.**

Hitachi CPT2508 (G7P Mk II Chassis)

This set was dead. It didn't take us long to find that the little blue capacitor (C919, 4·7nF 1kV) in the chopper transistor's snubber network had split open. In addition the 3·9Ω, 7W surge limiter resistor R901 was open-circuit. Strangely neither the chopper transistor nor the mains fuse had been damaged. **M.Dr.**

Sony KV2096

Picture shimmer on verticals, getting worse as the set warms up, can be cured by resoldering the connections to the field output heatsink. They are used to make an earth path connection. **M.Dr.**

Fidelity CTM2000T

The power supply was tripping because of a burn up around one leg of the 10nF line output stage tuning capacitor. Also the BU508A line output transistor was leaky.

If you intend to continue to use the old capacitor always check its value. We have come across cases where its value has changed, presumably as a result of the heat caused by the burn up. **M.Dr.**

Sony KV2096

For field foldover at the bottom go straight to the 470μF, 25V scan coupling capacitor C527. It dries up with age.

If the print is damaged by dry-joints around the snubber resistors in the chopper circuit a first-class repair can be achieved by fitting the Sony power supply modification kit part no. X-4377-097-2. It contains replacements for all the parts that have been damaged and a new piece of circuit board which you bolt on to the top of the main PCB. **M.Dr.**

Matsui 1455

For field collapse check whether D306 is short-circuit and R310 (10Ω) open-circuit. **M.Dr.**

Saba SB9221 (Thomson/Ferguson ICC7 Chassis)

The report said that the field scan collapsed then the set went off completely. On test we found that the power supply was tripping. Further investigation showed that there was a dead short between the field scan coils and chassis: the culprit was the TDA8178FS field output chip IF01. **M.Dr.**

Sony KV2201 (YE Chassis)

Line sync was lost whenever the channel was changed. Slight fine tuning would produce a locked picture until a different channel was selected, whereupon the procedure would have to be repeated. I didn't have the circuit diagram but noticed that D811, R825, D810 and R838 on board E were badly dry-jointed. It seemed sensible to make good the soldering to these components before concentrating on the fault. To my surprise and pleasure this cured the fault! A long test run with many channel changes proved that all was well. **J.E.**

Amstrad TVR1

The TV section of this unit was dead. Replacing the STR7348 regulator, C1509 (3,300pF, 1kV) and the 8·2Ω, 5W surge limiter and 33Ω, 10W resistors restored normal operation. **J.E.**

Long-distance Television

Roger Bunney

The arrival of autumn brought the effective end of Sporadic E activity for the year: it was a relatively short-lived season with poor results. Autumn often brings good tropospheric conditions, from late September through into October. There was a minimal trop harvest during September, but a well-placed high-pressure area over the UK and the nearby Continent is tending to provide a lift during the first few days of October. Hopefully this may develop into a good opening.

Random meteor scatter signal pings have provided the main reception. Such pings produce Band I signals that last for a few seconds upwards to a minute (particularly when additional coincident-path meteorites are burning up). With no worthwhile SpE reception having been noted during September, it's interesting to look at Roger Fussell's log (Plymouth). It shows repetitive MS reception, and also indicates an optimum skip-distance for Band I MS signals.

5/9/94	TVE (Spain) chs. E2, 3; DR (Denmark) E3; ARD (Germany) E2 (Grunten).
6/9/94	TVE E2, 3; DR E3.
9/9/94	TVE E2, 3, 4; NRK (Norway) E2; SVT (Sweden) E2.
11/9/94	DR E3.
14/9/94	TVE E2; DR E3; RAI (Italy) IA.
17/9/94	TVE E2; DR E3; Canal Plus L2.
19/9/94	TVE E2, 3.
21/9/94	TVE E3; DR E3.
22/9/94	TVE E2, 3, 4.
25/9/94	TVE E2, 3; DR E3; RAI IA.
26/9/94	TVE E2, 3.
29/9/94	TVE E2, 3; DR E3.
30/9/94	TVE E2, 3.

The distance between Plymouth and Madrid (TVE ch. E2) is approximately 660 miles. Roger can rely on reception of sorts from that transmitter on most days. Reception from Denmark is over a distance of some 700 miles. On this basis Iain Menzies near Aberdeen would most likely receive signals from the Benelux countries and France. Roger reports no ch. E4 signals. As the frequency increases, the incident signal has to pass farther into the ionised MS trail before refraction and return to earth, so the skip distance will be longer.

Surplus Satellite Equipment

DRS Trading, Unit A, Sprint Industrial Estate, Chertsey Road, Byfleet, Surrey KT14 7BD (0932 355 527) tells us that the company has a warehouse full of surplus and second-hand satellite equipment. Manually (rotary) tuned receivers, which are popular with TV-DXers, are available at prices from £10 upwards. DRS refurbishes much of the second-hand equipment it receives, but customers can visit the warehouse and select equipment on an as-seen basis. Dishes, actuators and all satellite receiving equipment is available. DRS is the UK agent for Jagger HH mounts and actuators.

Satellite Sightings

The fiftieth anniversary of the Arnhem battle on September 19th produced extensive coverage from various Eutelsat transponders. A BBC OB picture (no sound in syncs) via the Telecom satellite at 16°E carried a quiet audio subcarrier – very odd. At the end of the Eutelsat II F3 feed at 16°E the caption 'TF1, Moscow en direction du Paris, WTN Moscow' came up, but with the Reuters sound identification tape loop!

The BBC news feed to Orbit's Rome studio for redistribution via Arabsat is normally carried by Eutelsat I F4 at 25·5°. On two occasions in recent weeks however the feed has been via Telecom 1C at 3°E. Unfortunately trees make 25·5°E invisible here for most of the time: but with the leaves falling the signals are becoming progressively stronger.

The Haiti intervention produced extensive coverage. Many hours of shots taken in Port au Prince were relayed via Intelsat K at 21·5°W from a convenient hill-top site where the media had established several uplink facilities in advance. Cameras within the city were being microwave linked to the hill-top site. For east-bound material the main Intelsat K transponders to check are 11·499GHz H and 11·532GHz and 11·599GHz V. Bob French noticed that the Intelsat 601 IDB Atlantic Express lease (11·017GHz H) also carried many live news feeds to Europe, both NTSC/525 and PAL/625.

The sinking of the Estonia on the 28th brought coverage from Finland and Estonia via Eutelsat II F1 at 13°E and II F3 at 16°E: John Locker reports that the usually quiet

Left: Ryn Muntjewerff (The Netherlands) took this photograph of a German Band III PALplus test transmission. Such pictures have been seen in the UK via Astra transponder downlinks. Centre: No, this isn't enhanced SpE. The identification was seen via an Intelsat 21°W feed. Right: A United Nations conference held in Reykjavik, Iceland produced a flurry of satellite news feeds.

Kopernikus 2 (DFS-2) at 28·5°E carried many feeds.

Satellite zappers in the UK have been attempting, with little success, to receive signals from the new Turksat 1B at 42°E. Large dishes have produced signals in Scandinavia, and it seems that signals have been received in Norfolk using a 1·8m dish.

Readers may recall the problems Andrew Sykes had with a noisy, wall-mounted tracking dish system. He has now moved to King's Lynn where he has installed a fast-tracking 90cm Winegard dish on a wall-mount. This is virtually silent. More details on this next month.

News Items

Germany: SDR and SWF have announced plans for DAB (digital audio broadcasting) transmissions in Band III (ch. E12) and the microwave L band. In the first phase four low-power transmitters are to be brought into operation in ch. E12. Twenty ch. E12 TV relay stations will then be converted to DAB use, the TV transmissions being moved to u.h.f. Transmitter powers will subsequently be increased to 1kW e.r.p., and by the spring of 1996 several large areas will have DAB coverage. A main network will eventually be established, using existing ch. E12 stations with L band fill-ins.

Poland: Following a period during which illegal transmissions were common the National Radio and TV Committee has produced a plan for regional and national TV networks. There will be three regional networks as follows: Wielkopolska Telewiza Regional covering western Poland (Poznan), Wisla TV covering southern Poland (Cracow, Opole and Katowice), and NTP Plus covering northern/central/western Poland (Plock, Lodz, Warsaw, Gdansk and Szcecin). Canal Plus is to have a scrambled service with virtually national coverage.

France: France 3 is now using Ceefax text. Both France 1 (TF1) and France 2 will change from Antiope to Ceefax by Christmas. TF1 is also to use Nicam stereo sound – the TF1 Eiffel Tower transmitter has already been converted.

Belgium: A new BRTN TV2 transmitter is in operation on ch. E25, with 1,000kW e.r.p. The Brussels-RAC low-power ch. E25 10kW transmitter has closed down. RTBF is testing the 16:9 format: during September a test pattern with the identifications 'RTBF' and 'PP' was in use, PP standing for PALplus. The pattern has been seen on chs. E4, E8 and E57.

The Netherlands: Zuid-Holland TV (ZH-TV) has closed down. The 'Nozema' test pattern is no longer radiated and ch. E49 is empty.

Russia: The Ostankino TV tower in Moscow is being modified structurally. After completion of the work there will be additional TV transmissions: five main network services, six local commercial services and up to twenty satellite TV channels transmitted via MMDS.

Sudan: The BDXC reports that the Sudan Television Corporation is to open a 5kW e.r.p. transmitter at Port Sudan. A relay at Jabal Irba will complete coverage of the northern Red Sea area.

A Bit of History

Bill Higginson, an old friend, has recently moved to southern Spain. Before leaving he presented me with a large box of *Practical Wireless, Amateur Wireless* and *Practical Television* issues dating mainly from 1936/7 but some going back to the mechanical scanning days of the late Twenties and early Thirties.

Some years ago I included in this column an off-screen shot of Alexandra Palace received on the US east coast in about 1938. These magazines have produced evidence of even earlier real DX-TV. A magazine dated July 31st 1937 reports that the first Russian high-definition TV centre should be in operation by the end of that year. The equipment was supplied from the USA, despite mechanical scanners having been recently purchased from the UK. Russian 30-line low-definition transmissions could apparently be received in the UK by those who had one of the by then obsolete 30-line receivers. The article mentions a Birmingham resident who received Russian pictures, showing a dancer, at over 1,200 miles. BBC 30-line transmissions during 1932-5 could sometimes be received in Europe. The same issue records the death of His Excellency the Marchese Guglielmo Marconi, at the age of 63.

There is a report in a magazine dated March 27th 1937 of 90-line low-definition tests being carried out in Italy, using Fernseh AG equipment from Berlin. Apparently the pictures were "outstandingly good". But mechanical TV was being phased out in that country in favour of electronic scanning: 375 lines interlaced at 50 frames/sec with TV sets that used only fifteen valves.

An issue dated September 19th 1936 reports that Philips CD of Eindhoven had been making good progress with TV research. Though the company had previously been working with the German 180-line system it now opted to use the EMI 405-line system.

A remarkable story tells us that Marconi's original radio mast dating from about 1900, used for experiments in the Isle of Wight and of 160ft total height, was eventually cut down to 60ft and used as a flagpole. It was bought by Marconiphone in 1935 and moved to the company's head

office, Radio House, in London. Still featuring a gaff mast with Union Jack, it also carried the very first TV aerial in London's West End – for experiments and public demonstrations.

The French, always different, were still testing four alternative systems in January 1938: two versions of a 455-line 50-frame standard, a 450-line 50-frame standard and a 375-line 50-frame standard.

Some readers are active in restoring old 405-line equipment. If anyone would like a photocopy of a January 1936 c.r.t. listing that appeared on page 592 of the same magazine, just send me a 9 x 4 s.a.e. and a second-class stamp.

Satellite TV

Bindu Padaki (Bangalore) reports that transmissions at 754MHz from the Ekran satellite have now ceased. The Malayan-language channel Asianet has moved to the Russian Rimsat satellite at 130°E (in C band). The Star Movies film channel is now scrambled, using VideoCrypt 2. Star TV has added the EL Hindi-language channel via AsiaSat 1 at 105·5°E (southern footprint). There are also to be two Hindi-language channels available via the Russian Stat 7 craft at 140°E.

Dish bans have been introduced in Vietnam, Saudi Arabia and Iran. Home dish ownership regulations have been tightened in mainland China: a permit is required for all receiving equipment.

CMT (Country Music Television) has increased its transmission hours via Astra and is extending its service to Asia via the PanAmSat PAS-2 craft and Latin America via PAS-3. The Asian footprint covers China, Australasia, Japan and parts of eastern Russia. PAS-2 is at 169°E.

RTL-TV has chosen Smartcrypt encryption for the service via Telecom 2B at 8°W. The decoder will cost £120 inclusive of three years' free viewing. It's likely that this encryption standard will be used by the French news channel LCI when it moves to Telecom 1C at 3°W.

Check the out-of-band frequencies 10·820GHz and 10·835GHz (circular polarisation) at 15°W for signals from the ZSSRD-2/MIR space station downlink. John Locker (Wirral) recently spotted video taken during a space walk on the former frequency – the latter frequency has been used previously. The data downlink at 11·385GHz is the easiest check as it provides strong signals via a 1·5m dish.

CD Player Casebook

Reports from Nick Beer and Mike Leach

Goodmans System 3500

The CD section didn't register discs because, we found, there was no laser light. The cause of the problem was tarnished connections on the plug-in looms at the laser assembly end. This player uses the Sony laser unit. **N.B.**

JVC UXT1

We were told that the CD section of this midi system had operated intermittently for some time. It usually worked all right from cold, but would then stop while playing a disc. After that it wouldn't work for some time – it had to cool down first.

I inserted a disc and, when the fault condition started, carried out a few d.c. and scope checks. The focus drive waveform was present at the laser plug (pins 12 and 15 of CN501), but it seemed that the laser wouldn't light up. The laser supply should be present at pin 9 of CN501. When I connected the meter probe to this point I found that the supply was sometimes low and sometimes non-existent. This suggested the presence of a dry-joint or a print crack. A crack was found in the print around transistor Q501, which provides the laser supply. **M.L.**

Pioneer PDM601

This CD player caused us trouble over a period of time. It appeared in the workshop three or four times with different reported faults but on each occasion we couldn't find anything wrong.

Eventually we found a blown circuit protector in the power supply. When this had been replaced the machine worked all right for a while then stopped and refused to read a disc until cold again. A d.c. check showed that there was no laser supply. The cause of this was the ribbon cable that connects the main panel to the laser assembly: one of the strands was open-circuit. I soldered a flying lead between the two points and the machine then worked all right. We left it on soak test but after a week or so it again stopped. This time the focus drive waveform had disappeared, again because of a break in the ribbon cable.

When a replacement cable had been ordered from Pioneer and fitted the intermittent faults all disappeared. The cable is not listed in the service manual: its part no. is PNP1343. **M.L.**

Inside the Ferguson ICC6 Chassis

Part 3

Mark Paul

In this concluding instalment we'll take a brief look at the timebase circuitry and finally describe the watchdog circuit. The latter monitors various parameters in the chassis: in the event of a fault condition being detected it switches the set to the standby mode.

Synchronisation

The sync separator in IV01 (STV2110) feeds pulses to an internal field sync stage and flywheel line sync system. This chip provides the line drive output at pin 15 and a field pulse output at pin 14. The latter is used to trigger a ramp generator in the TDA1771 field generator/output chip. Both these outputs are derived from a voltage-controlled oscillator which is driven by the 503kHz resonator connected to pin 11.

Fig. 1 shows in block diagram form this part of the STV2110 chip. Following normal practice in modern receivers there are two phase detectors in the flywheel line sync system. The output from the first is used to lock the oscillator to the incoming sync pulses. The second phase detector receives the feedback signal from the line output stage, at pin 13. It controls the phase of the line drive output at pin 15. Feedback pulses of about 30V p-p amplitude from the line output transformer are fed to the emitter of transistor TV71 which acts as a pulse slicer. The slicing action is determined by the values of the resistors (RV73 and RV74) that set TV71's base voltage: on-screen distortion is reduced by selecting the most symmetrical portion of the feedback pulse. RV78 and CV77 integrate the pulse, producing the required sawtooth for the phase detector at pin 13.

There's a soft-start arrangement (not shown here) for the line drive output. This is based on transistor TV62 which provides a delay in the supply to pins 1 and 41 of the chip. At switch on the mark-space ratio of the output pulses is 20:80. It changes to the normal running 40:60 when TV62 switches on.

The field output pulse at pin 14 is derived from the 503kHz oscillator via counters and is of ten-line duration.

The mute output at pin 27, mentioned last month, is obtained from a coincidence detector that receives a sync pulse input and a pulse input from the divider circuit.

Line Deflection

There are two transistors in the line driver stage, TL30 and TL31. In the standby mode the stage is powered from the 24V UA supply via DL30 and DL31. Once the receiver comes into full operation the line output stage derived UL1 supply takes over.

The line output stage is conventional with no need for EW correction circuitry as the chassis is designed to drive 90° tubes. Various items change for different types of tube however. These are: the Usys voltage (h.t.); the line output transformer; the line linearity coil; the flyback tuning capacitor; the S-correction capacitor; and the components in the impedance matching network (LL23, CL23, RL23) which is connected between the collector of the line output transistor TL19 and the line output transformer. The efficiency diode in parallel with TL19 may be external or within the same package.

A network consisting of CL26, CL27, DL26 and RL25 damps out any ringing that could be caused by the combined

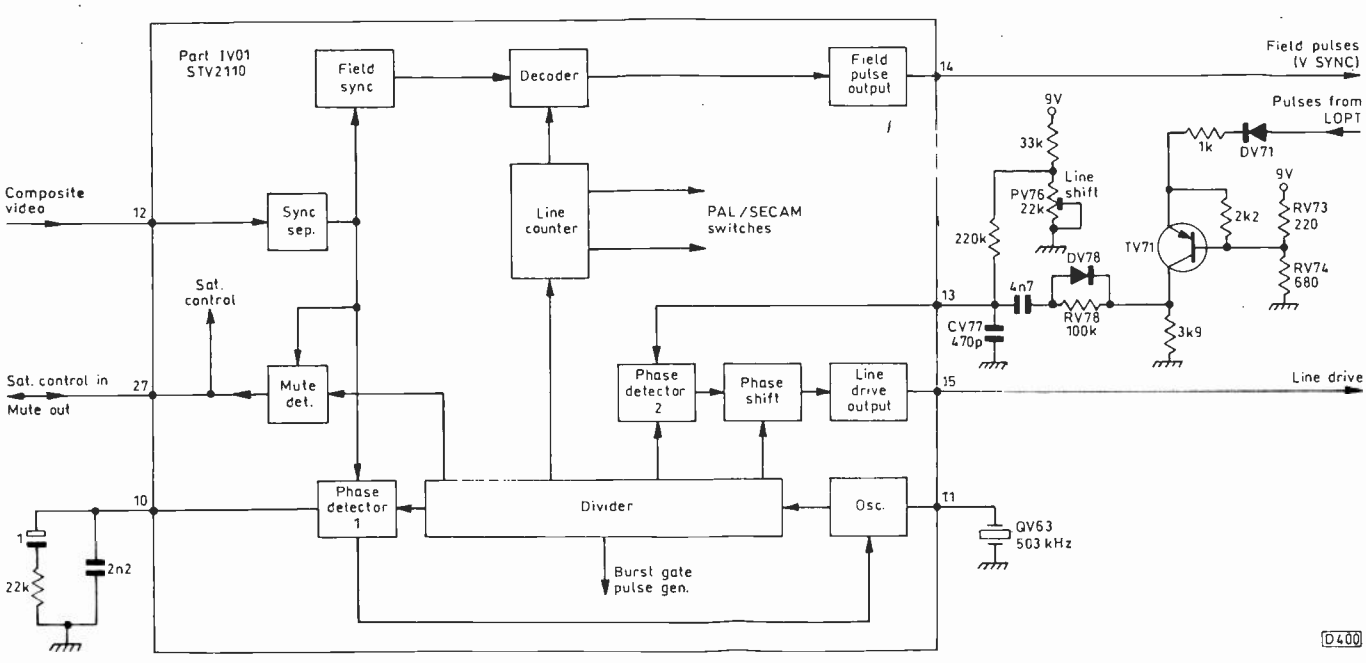

Fig. 1: The sync and line generator system in the STV2110 chip IV01.

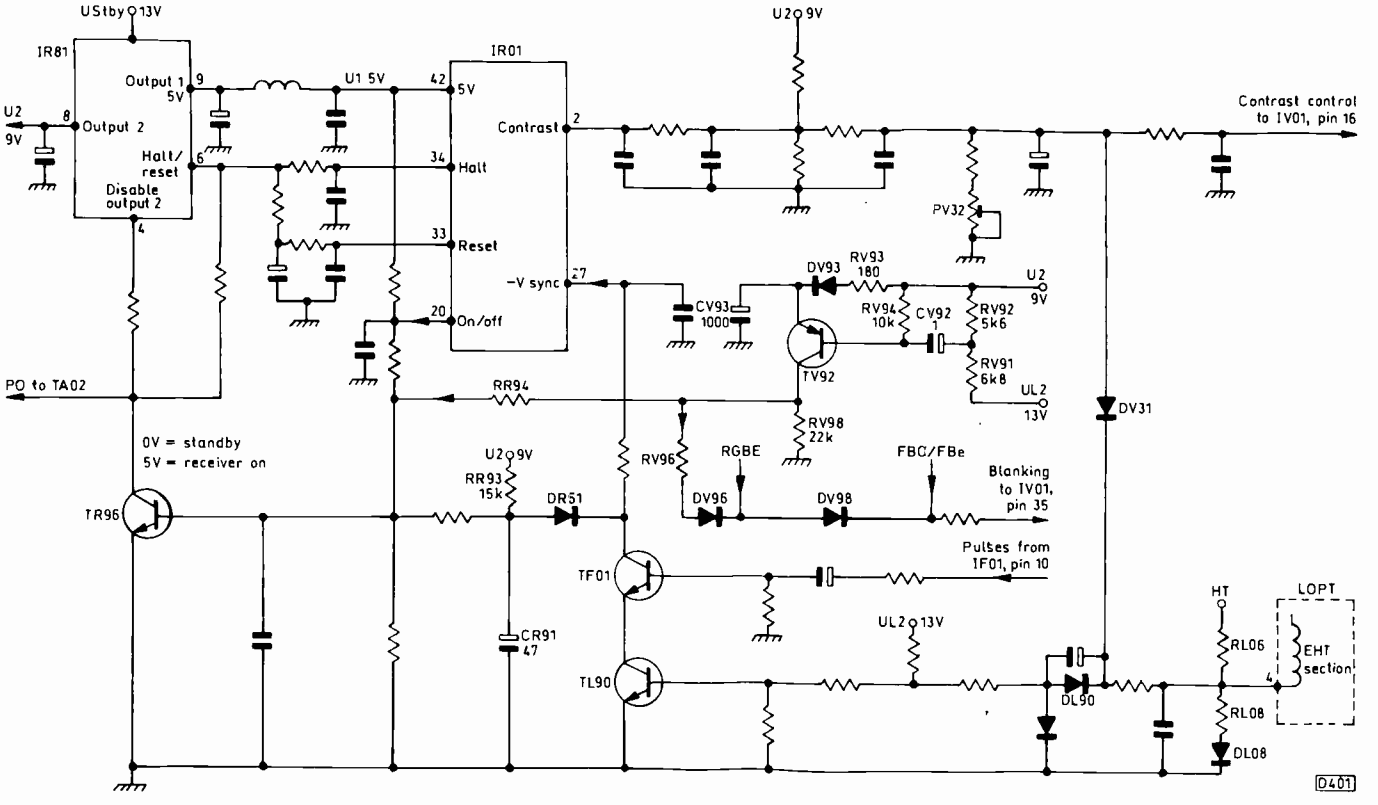

Fig. 2: The watchdog circuit, including the beam limiter system.

effect of the line output stage tuning capacitor and the circuit inductance. It's connected in parallel with the S-correction capacitor CL24, which is on the earthy side of the scan coil circuit.

The earthy end of the e.h.t. section of the line output transformer (pin 4) is connected to a conventional beam sensing network.

Field Deflection

The TDA1771 field timebase chip is a conventional device with a ramp generator (CF22 is the sawtooth charging capacitor), a power output stage, a flyback generator and thermal protection. There are only a couple of points worth particular mention here.

First there's breathing compensation to counter the effect of beam current change. This feature is provided by transistor TF31 whose base is connected to the beam sensing network. TF31's collector is linked to the ramp charging circuit via RF34 (3·3MΩ) and to the scan coil circuit via RF35 (150kΩ). The latter link compensates for any tendency to vertical shift with beam current variation.

Secondly a signal from pin 1 of the microcontroller chip IR01 is fed to the ramp generator circuit to provide height adjustment for 16:9 aspect ratio displays.

The Watchdog Circuit

The watchdog circuit is shown in Fig. 2. In the event of a fault being detected in one of the circuits it monitors it will switch the receiver to standby. The pivotal item is transistor TR96, which produces at its collector the PO (power on/off) signal. 5V at the collector of TR96 is power on, 0V power off (standby). When TR96 switches on for standby, pin 4 (disable) of IR81 is at 0V and the U2 (9V) supply is switched off. Since this supply powers the line generator in IV01 the line output stage and all the supplies obtained from it shut down, i.e. the standby condition is entered. To select standby or on, pin 20 of the microcontroller chip IR01 switches between 5V and 0V respectively on receipt of the relevant command from the remote control unit.

Rapid Switch-off

The watchdog circuit is also used to ensure rapid receiver switch-off when the mains supply is disconnected. Transistor TV92 and its associated components provide this action.

The first effect when the mains supply is switched off is that the Usys (h.t.) voltage collapses. As a result there's a proportional collapse of the voltages derived from the line output transformer. The 5V supply to the microcontroller chip maintains its value for a longer period because it's derived from the 13V USTby supply.

During normal receiver operation CV93 is charged via DV93 from the 9V (U2) line. Because of the voltage drop across DV93 and RV93, CV93's charge doesn't reach 9V and TV92 is biased off (its base is conected to the 9V supply via RV94). There's a small charge across CV92. When the UL2 supply collapses at switch off a negative-going pulse will be applied via CV92 to the base of TV92 which will thus switch on, discharging C93. Thus a positive-going pulse appears at the collector of TV92, across RV98. This is communicated via RR94 to the base of TR96 which in turn switches on. This immediately disables the 9V output from IR81.

Watchdog Monitoring

The watchdog circuit monitors the field timebase for normal operation, the line output stage via the 13V (UL2) supply and the beam current. If a fault condition is discovered the 9V supply is switched off via TR96. We'll consider each of these monitoring actions in turn.

In normal operation the flyback generator in the TDA1771 field timebase chip IF01 produces positive-going pulses at pin 10. These are fed to the base of transistor TF01, which is thus periodically switched on. The negative pulses produced at its collector switch DR61 on with the result that the charge across CR91 is reduced to less than 1V. During the periods between these negative (referred to as –V) pulses RR93 charges CR91 to about 2·8V. In the event of field scan failure there are no pulses from IF01 so TF01 remains off and CR91 continues to charge. As a result TR96 conducts and the set is switched to standby. The line output transformer derived voltages then decay with the result that TV92 switches on, as previously described, keeping the 9V U2 supply disabled for a period of time. The receiver will then reset and try to start up, but with the continuing absence of pulses from the field output chip it will go through the cycle again.

The main purpose of this circuit is to blank the screen rapidly when the receiver is switched off. The voltage rise at TV92's collector is passed via RV96 and DV96 to pin 35 of IV01. This is the blanking input: when the voltage here reaches 2V the c.r.t. is driven to black level and is thus cut off.

Disabling the U2 (9V) supply in this way is of help only for fast switch off and to keep the receiver in standby until the voltage across CV93 has decayed and is no longer able to keep TV92 switched on.

Line Timebase Checks

The operation of the line timebase is checked via the 13V line, in two ways. First, if the 13V supply (UL2) falls for some reason this will be detected by TV92 and the 9V (U2) supply will be disabled as described above. Secondly, if the 13V supply is missing when the receiver is switched on TL90 will have no base bias. It will therefore remain switched off and as TF01's emitter will be without a chassis return it will produce no pulses at its collector. So we have the same situation as with field scan failure: CR91 continues to charge and the 9V supply is cut off.

Beam Limiting

Finally the watchdog circuit provides protection against excessive beam current. The beam current limiter (BCL) works in the usual way. The earthy end of the e.h.t. section of the line output transformer (pin 4) is returned to chassis via RL08 and DL08, which is forward biased from the h.t. line via RL06. This resistor's value sets the beam current limiting level: it varies with tube type (82kΩ or 75kΩ). In the event of excessive beam current DL08 switches off and the voltage at pin 4 of the line output transformer swings negatively. As a result DV31 and/or DL90 switch on. DV31 pulls back the beam current via the contrast control circuit. DL90 switches off TL90 with the result, as previously described, that CR91 charges up, TR96 switches on and the 9V supply is shut down. There are some carefully worked out time-constants in the BCL circuit to set the precise control action under different conditions.

In Conclusion

So there we have the main features of the ICC6 chassis. Much of the circuitry is straightforward and conventional, but there are quite a few details that are a little unusual and could cause confusion.

Video for the Disabled

George Cole

People with sight and hearing disabilities make up a considerable proportion of the UK's population. Around 7·5 million people are deaf or have a hearing problem: 2·5 million of them watch television regularly. Around a million people are blind or visually impaired (this figure doesn't include those who have to wear glasses to correct their vision), and many of them use TV for entertainment or information.

Around twenty per cent of the TV programmes at present broadcast by the BBC and the ITV companies have accompanying teletext subtitles. These help deaf viewers to follow the programmes, and the aim is to increase the figure to around fifty per cent by the turn of the century. During the past couple of years two new systems designed to help blind and deaf people gain greater enjoyment from television have come into use: Audetel and Closed Captioning.

Audetel

Audetel (Audio Described Television) provides an additional commentary to help blind viewers understand what is happening on the screen. Close your eyes when viewing TV and you'll soon appreciate the full significance of the visual information, particularly when there's no dialogue: an actor may walk across a room for example, open a drawer then pick up and read a letter without a word being spoken.

Audetel grew out of a similar system developed for the theatre, and audio described programmes have been available on US public service TV for over three years. A UK Audetel consortium was formed in 1991: the group includes the BBC, ITC, ITV Association, Philips, Motorola and the Royal National Institute for the Blind (RNIB). It has developed a prototype Audetel decoder, and a four-month trial began in mid-July. A hundred and forty of the prototype decoders have been made, half of which have gone into the homes of blind people. Together the BBC and the ITV companies are transmitting around three hours of audio described programmes a week, including films, soaps, comedies and documentaries.

Although Audetel was primarily designed for blind viewers, the Audetel group sees a wider market for the system. It could be used to help the elderly to understand TV programmes better, or for educational programmes. It could also be used by those who have TV on in the background while doing other things such as cooking, ironing or repairs of one sort or another. An ITC survey has found that 39 per cent of viewers regularly watch TV in this way. Another potential use is for audio tape recordings of TV programmes, so that they could for example be listened to while travelling to work. Audio tapes of popular novels ('talking books') are very popular these days.

Our cute picture shows a Closed Caption as displayed on screen. The video caption reader (decoder box) is sitting atop the TV set.

Technicalities

This all sounds very promising, but how does Audetel work? The Audetel signal is transmitted with the teletext service – the vertical blanking interval (VBI) is getting more and more congested these days, what with engineering test signals, programme source identification codes, PDC and teletext all jostling for space.

The Audetel group originally considered using the Nicam system to transmit its signal. Nicam transmits 728kbits of data per second, with 11kbits of the data stream unused. The Nicam-based transmission system developed by the Audetel group used 9·6kbits/sec for speech transmission and 1·5kbits/sec for control data. The system was tested in the London area in December 1992, but there were problems. Complaints of intereference with some Nicam equipment were received, and it was subsequently found that the sets from one TV manufacturer were incorrectly set up for receiving extra Nicam data. Another consideration was that many countries don't use Nicam – this would limit the system's export potential.

Up to 7·6kbits/sec of data can be transmitted on a teletext line. Audetel uses a compression algorithm called CELP (Codebook-Excited Linear Predictive) that was originally designed for mobile telephones. Motorola assisted with the decoder chip set design, and new algorithms

have helped to improve the speech quality with teletext's lower data rate. Incidentally, if the transmission is momentarily lost an interpolation process is used to fill in the gaps in the speech.

An Audetel specification has been developed in conjunction with the EBU: the system has been allocated Data Channel 4 (Packet 4/30) which is not recognised by ordinary teletext decoders. The data capacity of a teletext line is 45 bytes. Audetel uses it as follows: clock run-in 2 bytes; framing 1 byte; header 4 bytes (this identifies Audetel speech); speech data 38 bytes.

The Audetel Decoder

The prototype Audetel set-top decoder was developed by Portset Systems, and the Italian company Seleco is developing TV sets with built-in decoders. The decoder is compact and can handle three types of audio: Nicam, f.m. mono and Audetel. There are u.h.f. (aerial) and video plus audio (scart) inputs. Outputs are remodulated u.h.f. with added Audetel, baseband scart with Audetel, stereo headphone jack with Audetel, and hi-fi stereo phonos with Audetel. Tuning is automatic with station-selected memory – there are TV channel selection and volume controls on the front panel, with tone and Audetel/programme sound mix controls on the rear panel. Basically the decoder has to tune in and demodulate the u.h.f. transmission, decode the teletext signal then decode the Audetel speech and add it to the programme sound output. Note that users don't need a teletext set as a teletext decoder is built into the Audetel decoder.

Each prototype decoder costs around £350, though the Audetel group says that commercial versions could cost around £250. Philips has developed a prototype VCR that can record Audetel commentary. As the 7·6kbits/sec data rate is too fast for a domestic VCR to record, the Philips machine feeds the Audetel data stream to a RAM which expands the data output by a factor of four. The result is a data rate of 2kbits/sec, which can be recorded. The process is reversed during playback.

Producing the Commentary

The extra commentary is being produced by workers called audio describers. The trial uses three describers who compose, edit and record the commentary using special workstations that consist of a powerful 486 PC with video card and speakers, a video player, microphone, floppy disc reader or optical disc drive and a time-code recorder.

The audio describer controls the video player via the computer, watching the programme in a small video window that forms part of the computer monitor's display. Special software enables the describer to mark start/stop edit points. At each point a coutdown marker tells the describer when to begin and end the commentary, which is sampled at 8kHz with 16-bit quantisation. With the ITV system the recording is made on a high-density floppy disc, one hour of speech filling a 1·4Mbyte disc. The BBC stores the digitised speech on a laser disc. The Audetel commentary is then linked to the teletext transmission system and broadcast.

Producing Audetel commentary is very labour intensive. It takes around a week to create ninety minutes of commentary – two and a half weeks were required to produce the commentary for the film Close Encounters of the Third Kind. The hardware costs involved in creating, editing and broadcasting Audetel are relatively low, around £30,000-£50,000, but producing the commentaries is very expensive.

The trial service is free, but future funding for Audetel is uncertain. The consortium hopes that a full service will be started within the next few years. This will depend on the interest shown by commercial organisations. The technology to help blind people to get more from TV is certainly here: let's hope that the money to support it will also come.

Closed Captions

Over 260 prerecorded video cassettes that contain hidden captions which work in a similar way to teletext subtitles are now available in the UK. Between five and ten new captioned tapes are being introduced each month. The system, called Closed Captions, was developed by the North American National Captioning Institute (NCI), which was set up in 1979. It's well established in the USA, where over 4,000 captioned video tape titles are available. Many live and recorded broadcast TV programmes are captioned in the USA, where legislation requires that any new set with a screen size of over 13in. must have a built-in Closed Caption decoder. The NCI opened a UK branch in Peterborough in late 1992.

Closed Captions are designed for those with hearing disabilities and have the advantage that they can be seen only by those who have a special set-top decoder. This feature makes the system very appealing to the video software industry. Although ordinary subtitles can be recorded on video tapes they are 'burnt in', which means that the viewer doesn't have the option of removing them if they aren't needed. Video software companies are not keen to produce two versions of the same tape, one with and one without subtitles, and video retailers don't like stocking double-inventory products. Closed Captions enables all viewers to use the same tape.

Producing Captions

Closed Captions are produced as follows. A caption editor receives a time-coded copy of the master video tape and watches each scene, listening to the dialogue. Captions are typed on a PC, using a special keyboard that records words as phonetic codes. This enables an editor to type up to 260 words per minute. The computer converts these codes to words which are sent to the caption encoder and inserted, during the tape mastering process, on line 22 (PAL tapes), in the even field VBI.

Captioning is done in the USA and costs UK video companies around £1,000 an hour – though this falls to around £500 if the tape has already been captioned for the US market, since the main work then involves changing US spellings, e.g. color to colour. Live captioning is also possible. Around 400 hours of captioned programmes are broadcast in the USA each week. This system is not used in the UK, where the teletext service is used for the same purpose.

The Closed Caption Decoder

The Closed Caption decoder is a small box that plugs into any modern TV or VCR. It has r.f., composite video and stereo audio signal connections, measures 20 x 5·5 x 10·5cm and weighs just over 1kg. Cost is £100. Decoders can be bought from Blockbuster/Ritz Video shops, Radio Rentals and through Sound Advantage, a subsidiary of the RNIB. The text is displayed at the bottom of the picture. Closed Captioned tapes are identified by a talking TV logo.

Servicing PC Monitors

Ken Taylor

A previous article (August) described the various types of monitors, their differences and the basic servicing problems likely to be encountered. Here's the software we promised to assist with servicing, and some notes on the spares situation.

Software Programs

Before monitor servicing can be undertaken it's obviously necessary to be able to display something on the screen. The computer start-up display of Windows, or a listing of the directory, might be sufficient as a quick check. But more specific programs are needed. In addition to fault finding and repair it's necessary to be able to adjust a monitor's focusing, aspect ratio (height and width) and convergence.

Programs 1-3 should fulfil these requirements. They are written in BASIC, and are designed to operate in either of the three most common versions – QBASIC, QB Basic and GWBASIC. Those of you who can write in BASIC can combine, modify and improve on them. A low-cost disc that can be run as a normal PC program without the need for BASIC is also available – see later.

The programs have line numbers. Although these are regarded as old hat they are essential for GWBASIC and also make copying easier. The three programs are as follows:

Program 1 provides a screenful of Xs. This enables the focusing to be checked over the whole screen.

Program 2 provides red, green, blue or white screens. They can be used for purity and signal-tracing purposes.

Program 3 provides a circle and grid pattern for height and width setting, selectable for the CGA or EGA modes.

Loading the Programs

Most computers have a copy of one of the BASIC programs. This must be loaded first. Then each of programs 1-3 can be typed in. Save the program with a recognisable name before you try it, in case you have made a mistake which might cause a crash and lose the lot. Don't forget that BASIC has to be loaded, then one of these programs into it, each time before the program will run.

Using the Programs

Program 1 is self-explanatory: a screenful of characters for focus checks or general use. It can be displayed on any monitor.

In addition to its use for colour purity checks program 2 provides single selectable colour signals which can be useful for tracing through the signal paths. If a colour is missing and the circuit layout is difficult to follow, feeding the relevant colour signal to the monitor's input makes it easier to check through the circuit. A colour monitor is required with this program.

The grid pattern in program 3 can be used for convergence. The pattern will be displayed in the CGA or EGA mode. An EGA monitor usually works in both these modes and often has separate controls for each. The problem is to know in which mode the monitor is operating, and which controls apply. The pairs of controls are often marked 1 and 2, 1 generally being CGA. But check to see which control has the greatest effect when the display is set to CGA. As a double check you can use a coil, as described in the previous article, to ascertain the line frequency – lay the coil on the monitor's case, above the tube, and connect it to a frequency counter. CGA should be about 15·7kHz, EGA 21·8kHz.

Once the controls have been sorted out the circle can be used to check the aspect ratio. Adjust the height and/or width as necessary in each mode. Most monitors, even mono ones, will display the circle to provide an aspect ratio check.

Spares

The problem most often encountered when a specific spare part is required is finding the maker of the monitor. Although most monitors have a label which apparently gives the manufacturer and the date made, don't be mislead into thinking that you've cracked it. There can still be problems. The maker may be Taiwanese, or in some other far eastern country, and the label may not indicate the name of the importer or distributor. The named firm may have gone out of business. The name may be that of a computer assembler who has no interest in supplying spares for out-of-guarantee items.

Even if you successfully discover the manufacturer your problems aren't over. Some makers and distributors are reluctant to help with spares and would rather keep the business within their own organisation. Some charge exhorbitant prices for monitor spares when you compare them with the cost of similar TV items. Line output transformer prices for example can often make a repair uneconomic, and c.r.t.s are often as expensive as the new monitors you see on special offer.

Some manufacturers are happy to supply spares however, and the following list – while not being exhaustive – should help in such cases. As with TV sets, some of the larger manufacturers may be prepared to supply only their account holders. Anyone else has to obtain spares through the major stockists (WVE, CPC, SEME, Chas Hyde etc.). But as the demand for these spares increases, we should find more suppliers opening up in this market.

Program 1

```
10 REM SCREEN OF Ks
20 CLS
30 FOR n = 1 TO 1920
40 PRINT "X";
50 NEXT n
60 END
```

Program 2

```
10 REM SCREENS OF RED, BLUE, GREEN OR WHITE.
20 CLS
30 COLOR 1, 7
40 INPUT "ENTER R B G or W for the Colours. Q to
   stop."; A$
50 IF A$ = "R" OR A$ = "r" THEN F% = 4
60 IF A$ = "B" OR A$ = "b" THEN F% = 1
70 IF A$ = "G" OR A$ = "g" THEN F% = 2
80 IF A$ = "W" OR A$ = "w" THEN F% = 7
90 IF A$ = "Q" OR A$ = "q" THEN 160
100 B% = F%
110 COLOR F%, B%
120 FOR N = 0 TO 45
130 PRINT "                                        ";
140 NEXT N
150 GOTO 20
160 CLS
170 END
```

Note: Line 130 must have forty spaces between the quotation marks.

Technical help is also a problem, with the increasing complexity of some equipment. As far as possible the following list indicates where such help is provided.

Manufacturers

This list gives details of what the various manufacturers will supply to a non-account trade repairer.

Amstrad: Account customers only. Others can obtain spares from CPC.

Compaq: The company says that it repairs all its monitors, of any age, itself. It doesn't offer any help.

Hitachi: Telephone no. 081 569 1975, fax 081 569 1441. Non-account customers can obtain spares but not technical advice via these non-account spares numbers. Fax is recommended as the telephone line is very busy.

Microvitec: The company has a training course for approved repairers and deals only with these agents. Spares and technical help from these sources is unlikely.

Olivetti: Spares for non-account customers are available from CPC.

Panasonic: Spares available from SEME (0280 823 523). Technical help from Panasonic on 0344 860 133.

Philips: Account holders only. See official spares stockists below.

Samsung: Telephone no. 0952 207 171 for spares and service manuals, 0952 292 262 for technical advice.

Tatung: Telephone no. 0952 290 111. Spares and technical support available.

Taxan: Telephone no. 0344 484 646. Spares and technical support available.

Official Stockists

This list gives details of official stockists with the names of the manufacturers' spares they can supply. Some stock only particular components. As spares suppliers are only just beginning to stock computer and monitor items it's worth checking around for any difficult makes.

CPC Ltd.: Telephone no. 0772 654 455. Stocks spares for many makes including Amstrad, Commodore, Olivetti, Olympia, Philips.

Chas Hyde and Son Ltd.: Telephone no. 0759 303 068. No specific manufacturers but can supply replacement line output transformers for some models.

SEME Ltd.: Telephone no. 0664 65 392 or, for Panasonic equipment, 0280 823 523. All Panasonic spares. Line output transformers for a range of other monitors.

Willow Vale Electronics: Telephone no. 061 682 1415. Company says it can handle monitor spares for more makes

Program 3

```
10 CLS : REM GRID & CIRCLE for CGA & EGA.
20 GOSUB 1000: CLS
30 IF a$ = "Q" OR a$ = "q" THEN END
40 SCREEN M: PSET (1, 1)
50 FOR a = 0 TO 639 STEP 40
60  FOR B = 0 TO Ht
70   PSET (a, B)
80  NEXT B
90 NEXT a
100 FOR B = 0 TO Ht
110  PSET (a - 1, B)
120 NEXT B
130 FOR B = 0 TO Ht STEP S
140  FOR a = 0 TO 639
150   PSET (a, B)
160 NEXT a
170 NEXT B
180 FOR a = 0 TO 639
190  PSET (a, Ht)
200 NEXT a
210 Pi# = 4 * ATN(1!)
220 CIRCLE (320, C), R
230 LOCATE 12, 35: PRINT "PRESS any KEY"
240 IF INKEY$ = "" THEN GOTO 240
250 SCREEN 2
260 GOTO 10
1000 REM select modes
1010 PRINT "Do you want CGA (15.5kHz) = C"
1015 PRINT "      or EGA (21.6kHz) = E": PRINT :
     PRINT " Q to QUIT"
1020 PRINT : PRINT "Enter the Letter.": PRINT
1030 a$ = INPUT$(1)
1040 IF a$ = "" GOTO 1030
1050 IF a$ = "C" or a$ = "c" THEN M = 2: Ht = 199: S =
     20: C = 100: R = 200: RETURN
1060 IF a$ = "E" or a$ = "e" THEN M = 9: Ht = 349; S =
     35: C = 175: R = 200: RETURN
1070 IF a$ = "Q" OR a$ = "q" THEN SCREEN 2:
     RETURN
1080 CLS : GOTO 1010
```

than it can list. Contact the Manchester branch (telephone no. above) for details.

Wizard Distributors: Telephone no. 061 872 5438: Line output transformers, tubes and a comprehensive list of computer i.c.s are stocked. If it's a tube enquiry, ask for Peter or Barry.

Monitor Program Disc

As an alternative to the BASIC programs listed in this article a 3·5in. disc with six programs is available from K.P. Taylor, 15 Lindsay Road, Horfield, Bristol BS7 9NP. Price is £5.00 plus £1.00 post and packing (£2.00 outside the UK).

The disc loads from the DOS cursor and doesn't require BASIC. A menu is presented, and the programs can be selected and changed simply and quickly.

In addition to the previously described programs it has grey scale and colour bar programs and a helpline that provides instructions on the use of the programs. It's intended for use with colour monitors, and only one of the programs will operate a Hercules type monochrome monitor. As many mono monitors are mono CGA or VGA (MCGA or MVGA) some of the other programs may work with them.

Help Wanted

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.

Wanted: Complete working YC PCB, part no. 928B15101, for the Mitsubishi HS700B VCR. Robert Pyatt, 3 Meadowcroft, Sutton, St. Helens, Merseyside WA9 3XQ. 0744 817 995.

Wanted: Rear case/battery compartment for the Binatone Mobile 5FM 5in. TV/radio, also the brightness preset. Tape switch (or supplier) for the Stereomatic cassette/radio Model 01/2777 – or machine for spares. I have service and technical manuals for the Grundig SVR4000 for sale. T. Peel, 11 Beadnell Way, Gosforth, Newcastle upon Tyne NE3 3HB. 091 284 5488.

Wanted: Standby mains transformer for the Sentra GX9000 CTV or source for spares. C. Guilliatt, Ashby TV, 2a Alexandra Road, Ashby, Scunthorpe DN16 2SF. 0724 862 525.

Wanted: Service manual or circuit diagram or photocopy of these for the Philips D2MAC stand-alone decoder Model BBD900. Brian Webb, 42 Westways, Havant, Hants PO9 3LN. 0705 474 938.

Wanted: Circuit diagram for the RTL4/5 decoder. Lance Williams, Kemerton, Ribchester Road, Blackburn BB1 9EE. 0254 249 668.

Wanted: Miniature volume control (5kΩ log.) with switch for an HMV/Marconiphone transistor radio dating from 1965 (no model no.). Set covers LW/MW/SW/LUX and operates from PP7 battery. Shaft is 4mm. Also correct knob if possible. F.C. Bailey, 2 Elmridge, Leigh, Lancs WN7 1HN. 0942 675 299.

Wanted: Type TNP66035 tuning board for the Panasonic Model TX2024 (U3W chassis), or TMS3453N2L i.c. for this board. W.B. Marshall, 12 Chapel Street, Ripley, Derbyshire DE5 3DL. 0773 743 220.

Wanted: LOPT type MSH1FCB04 for the Sharp Model C1410. Justin Johns, 28 Woodland Road, Neath, West Glamorgan SA11 3AL. 0639 638 629.

Wanted: Complete working chassis for a Matsuo 2580 and a TA7650P i.c. P. Hackett, 20 Harold Road, Southsea, Portsmouth PO4 0LR. 0705 811 105.

Wanted: Circuit diagram (stat would do) for the Goodmans Model C141, J. Naughton, 40 Gala Crescent, Wishaw, Strathclyde ML2 7JR.

Wanted: Working remote control units for the Ferguson FV31 and FV32 VCRs. David Jordan, Central Electronics, 6 Queen Street, Stirling FK8 1HN. 0786 451 230.

Wanted: Front section of cabinet, new or secondhand, for the Amstrad TVA1 combined TV/VCR. Leon Electronics, 11 Woodend Close, Three Bridges, Crawley, West Sussex. 0293 520 536.

Wanted: Complete front panel for an ITT Model 3943 VCR – one from a scrap machine o.k. K. Allen, 4 Northbrook Road, Yeovil, Somerset BA12 5RQ. 0935 22 782.

Wanted: HV block (with H stat control) for the Sony Model KV1820. Also circuit diagrams for the Gould Advance OS2007Y and OS2006X scope plug-in units and the Amstrad PC10 VGA colour monitor. J.A. Fraser, 23 Albany Road, London W13 8PQ. 081 991 5444.

Wanted: Circuit diagram or service manual for the Ferguson 3V23 VCR. M. Brown, 159 Suttons Avenue, Hornchurch, Essex RM12 4LY.

Wanted: LOPT for the Panasonic Model TXC21. Part no. TLF14574F. Gary Burt, 3 Randall Close, Calmore, Southampton, Hants SO40 2SE.

Wanted: Remote control handset for the Dynatron Model CTV43 and a power supply for the Ferguson Model 3V56 VCR. Wayne Haverson, 139 Victoria Road, Emsworth, Hants PO10 7LX. 01243 377 746.

Wanted: Main PCB for the JVC Model HRD250 VCR or a scrap machine. P. Bolton, 47 Beech Avenue, Greenfield, Oldham, Lancs OL3 7AW. 0457 876 221.

Wanted: Line oscillator coil for the ITT Model CS610 (CVC9 chassis). Part no. is 32/405/05043. Silas Corley, 71 Ringway, Southall, Middx UB2 5SR. 081 574 4126.

Wanted: Service manuals, circuit diagrams or any information on the following VCRs: ITT VR580/05 (2000 format); ITT VR3984 (ref. 4225); Grundig 2 x 4 Super GB (2000 format), order no. 800. Philip Gay, Lee House, 13 Beaconsfield Road, Weston-Super-Mare, Avon BS23 1YE.

For disposal: January 1976-September 1990 issues of *Television*. Make an offer for the lot and collect! Alternatively single copies £1.50 each inc. post and packing as available. G. Beard, 26 Killarney Road, Wandsworth, London SW18 2DX.

Wanted: Complete chassis for the Pye Model 51KT2366/05T (Philips CTX-E chassis), working if possible. H. Turney, 135 North Road, Bellshill, Lanarkshire ML4 1QY.

Wanted: Teletext board (BS816.2.) and/or text circuit diagram for the Seleco Model Spa 25SS569UK TV receiver. Dave Quinnen, PO Box 22632, Windhoek, Namibia. Telephone/fax 010 264 61 42939.

Wanted: Service manual or circuit diagram (photocopy would do) for the Hewlett-Packard Model 175A oscilloscope, or advice on how to convert the line scan and e.h.t. section to solid-state circuitry. Also an audio/control head for the Grundig Model VS180GB. M. Henry, 42 Chapel Road, Dungiven, Co. Derry, N. Ireland BT47 4RT. 0504 741 558.

Test Case 384

Switch-mode power supplies have been standard practice in TV sets for over two decades now, and we've got used to dealing with the very wide variety of circuits that come our way for repair – good ones, bad ones and diabolical ones. The adoption of chopper power supplies by other types of domestic AV equipment has been more gradual. But we are now seeing them in such things as satellite receivers, audio gear and VCRs, where the power consumption is generally lighter than in a TV set. Many technicians do not welcome the presence of these more complex power supplies in such equipment. Like it or not however, they have to be dealt with when they go wrong. And thereby hangs the tale of a dead Sony VCR, which involved us in a protracted fault diagnosis.

It was a Model SLV715, about two years old, whose power supply was in a totally screened box. Inside this box there's a chopper transformer which is driven by a seven-leg power chip, an optocoupler feedback system, seven secondary rectifier circuits and a bunch of three-, four- and five-legged stabiliser chips. Par for the course maybe, but you would need a manual or a circuit diagram to be able to sort it all out. We certainly did.

At switch-on the machine appeared to be utterly dead, with no clock display and no standby LED illumination. Into the module then. The mains fuse was intact, and we found out the hard way that the mains rectifier's reservoir capacitor C105 was fully charged. Measured accurately with a meter, rather than momentarily with the fingertips, the voltage across this capacitor was found to be 340V. It was also present at the chopper transformer's primary winding and pin 2 (collector of the chopper transistor) of the MA231 power chip HIC101. The two 430kΩ start-up resistors R103/4 looked likely suspects but measured o.k. – after carefully discharging C105! There were no visible dry-joints or burns anywhere, and the three circuit protectors and three fusible resistors were all found to be intact. Time to delve deeper.

Although we didn't have a description, it wasn't hard to work out how the circuit (most of it, anyway) worked. We started by checking the rectifier diodes on the secondary side of the circuit with an ohmmeter. None of them were either short- or open-circuit, and there were no discernible shorts or heavy loads on the d.c. side of the seven rectifiers. To be sure that no faults in the VCR itself were loading the power supply the interconnecting plugs were pulled out, leaving the power module completely isolated. It still didn't perk up.

The scope was next brought into play. Intriguingly a burst of oscillation appeared for about half a second at each switch on – so long as C105 was fairly well discharged. This suggested that the start-up system was working but that oscillation couldn't be maintained. Why? Knowing the nasty habits of optocouplers, we replaced PC101. This had no effect whatsoever. Although the initial oscillation suggested that it was o.k., we replaced the power switching chip. Again this had no effect on the symptom or the behaviour of the circuit at switch on. All the resistors and capacitors associated with the chip, and those around the 'variable zener' device IC201, were checked cold and measured o.k.

We seemed to have reached an impasse! Stimulated by some workshop coffee however we hooked the scope to each d.c. output in turn, at the output ends of the rectifiers. With one exception they all (with the VCR feeds still disconnected) rose to some degree. There was only a very short-lived blip across the 38V reservoir capacitor C201 however. Was this a red herring? Certainly D201, D208, Thy201 and C201 were all perfectly all right. So what was wrong with the power supply? We couldn't turn to page 129 for the answer!

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BU508AF	X5	£5.00	TDA4601	X2	£2.55	VT11E etc. Belt kit	X5	£5.50
BUT11A	X5	£2.25	TDA3654	X2	£2.50	Standard video sensor lamp	X10	£2.50
Philips type 1.2 volt Back up battery				X5	£4.50	Standard video sensor lamp + plug	X10	£4.00
Philips type 2.4 volt Back up battery				X5	£8.75	Thorn TX9/10 Remote control	each	£7.49
Scart – Scart lead 1.5m Fully wired				X2	£2.90	Thorn TX10 Green spot LOPTX	each	£14.95

.....and now ask for a full price list.

(please add £1.00 handling all + VAT)

Satellite PSU Repair/Refurb kits

Experience in one of the largest repair centres has shown that all repairs to Power supply units require special treatment with not only the obviously faulty parts being replaced but a number of others also changed to ensure a satisfactory repair. Experience shows that up to 50% of all power supply repairs 'bounce' unless the correct procedure and the correct precautionary changes to certain components are made.

At last 4 repair kits are available to cover the majority of all Amstrad and Pace receivers each with a simple to understand instruction sheet to guide you through the correct way of repairing and refurbishing satellite receiver power supply units.

	MANUFACTURERS	MACHINE NO.		PRICE
SATKIT1	PACE	PRD800	PRD900	£6.95
SATKIT2	PACE	SS9000	SS9200	£6.95
		SS9010	SS9210	
		SS9020	SS9220	
SATKIT3	AMSTRAD	SRD510	SRD520	£6.95
SATKIT4	AMSTRAD	SRD500		£6.95

all + £1.00 handling and + VAT

IMPORTANT ANNOUNCEMENT

ALL SATELLITE RECEIVERS purchased before *MAY 1994*

It is almost certain that if you purchased your satellite receiver before May 1994 you will be unable to receive all the projected channels when they become available on ASTRA 1D neither will you be able to receive the lower two channels on ASTRA 1C. The lower two channels on ASTRA 1D are Filmnet Movies (H - 10.921) and RTL-5 (V - 10.934). These are broadcasting now. If you wish to receive these two channels now and the projected possible 16 channels on ASTRA 1D when it is launched later this year, you will need to purchase extra equipment. The SUPER 'D'CONVERTOR is a clever, low cost frequency convertor which can be purchased now. Millions of satellite receivers will need converting in Europe so it is good advice to buy now while stocks are readily available.

Can I receive ASTRA 1D YES!

Method 1
1) Purchase an enhanced satellite receiver with tuning range of 950 – 2050 MHz
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1) Purchase a *SUPER* 'D'convertor
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What is a SUPER 'D'convertor ?

The super 'D'convertor is a small box (110mm x 60mm x 50mm) which is inserted into the down lead from the satellite dish at the rear of the receiver (no power supply is required). A suitable connecting lead is supplied together with end user simple instructions. At the flick of a switch or in most cases a touch on the remote control, channels on ASTRA 1D can be tuned in when available. The bottom 2 channels on ASTRA 1C which up to now you may not have been able to tune in, will be immediately available.

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A Serviceman's Guide to Oscilloscopes

Part 2

David Botto

In Part 1 we looked at the operation of analogue oscilloscopes and some of their features and advantages. The Digital Storage Oscilloscope (DSO) is now fast gaining in popularity: it's the ideal instrument with which to investigate today's increasingly complex digital video and computer circuitry.

Advantages of the DSO

An analogue oscilloscope cannot normally deal with a waveform that occurs just once. With a DSO however you can capture and examine fleeting single-pulse waveforms such as those from the one-shot oscillators found in VCRs.

The DSO is also good for spotting glitches. These are nasty, hard-to-see little noise spikes that appear momentarily on a signal, during perhaps just one occasional pass of the waveform. See Fig. 1. Such short-period glitches on a repetitive signal cannot be viewed when an analogue scope is used to display the complete waveform. It's easy with a DSO. The significance of glitches is that they can be responsible for intermittent faults.

Signals that occur before the trigger point can be viewed with a DSO. Many of them also show the position of the trigger point. You can thus see the complete waveform, not just a part of it.

A DSO enables you to make automatic measurements with an accuracy that's not possible with an analogue scope. An automatic peak-to-peak measurement will show the maximum and minimum waveform amplitudes.

Waveforms can be stored and, with some DSOs, printed out via a printer. These features can be extremely useful for locating the cause of intermittent faults of a momentary nature.

How a DSO Works

While an analogue oscilloscope amplifies the input signal and uses it to drive the Y plates directly a DSO converts the signal, after initial amplification, to digital form, stores it in a RAM, reads it out as required then converts it back to analogue form to drive the Y display section. The waveform can be retained in the memory and/or on the screen indefinitely without deterioration. Some DSOs enable it to be stored on a floppy disc. Since the input and tube drive systems remain the same as in a wholly analogue scope, many DSOs operate in both modes.

Two developments have enabled DSOs to be produced at prices that put them within service department budgets. These are reasonably priced, fast and accurate analogue-to-digital (DA) and digital-to-analogue (DA) converters and secondly cheap memory chips that enable data in large quantities to be stored accurately at high speed.

Most DSOs use successive-approximation AD converters (ADCs). The advantage is that only a single voltage comparator is required. Conversion is a serial process however, so the operation is rather slow.

Single-shot measurements call for fast AD conversion. The parallel, or 'flash', ADC is best for this. It uses a number of parallel-connected op-amps to sample the signal waveform.

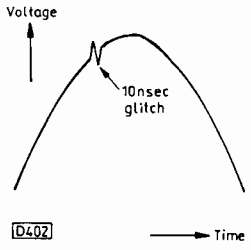


Fig. 1 (left): Waveform with 10nsec glitch.

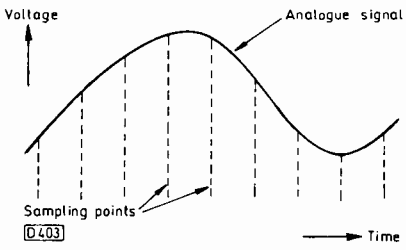


Fig. 2 (right): Real-time signal sampling.

Vertical Resolution

The scope's vertical resolution determines the fineness of the detail that can be displayed. So don't forget to check on this when choosing an oscilloscope.

With a DSO the vertical resolution is largely determined by the number of bits in the digital samples produced by the ADC. An eight-bit data word gives 256 possible signal levels, which is acceptable for many applications. A ten-bit data word gives 1,024 possible levels.

Beyond a certain limit however the use of more bits per word will not necessarily result in a higher resolution. It depends on the overall design of the scope, including the tube's performance.

Signal Sampling

Before its conversion to digital form the signal has to be sampled. Fig. 2 shows a simple analogue waveform being sampled at the points shown. The higher the sampling rate, the better the definition will be. This is known as *real-time* or *one-shot* sampling. The sampling rate must be somewhat higher than the signal frequency.

There are other sampling modes. *Repetitive* or *equivalent-time* sampling has certain advantages where the waveform is repetitive and doesn't change. Signal samples are taken at a different point or points during each signal cycle. This enables an approximation of the waveform to be built up in the memory. The advantage is that the signal frequency can be substantially higher than the sampling frequency. Two methods of repetitive sampling are commonly used, *sequential* and *random*.

With sequential sampling the waveform is examined at a preset time after each trigger point. The process continues until enough samples have been stored in the memory to form an accurate representation of the signal.

When the sampling is done without waiting for a trigger pulse it's known as random sampling. Note that random does not refer to the signal or the method of sampling but to the order in which the screen display is arranged. This

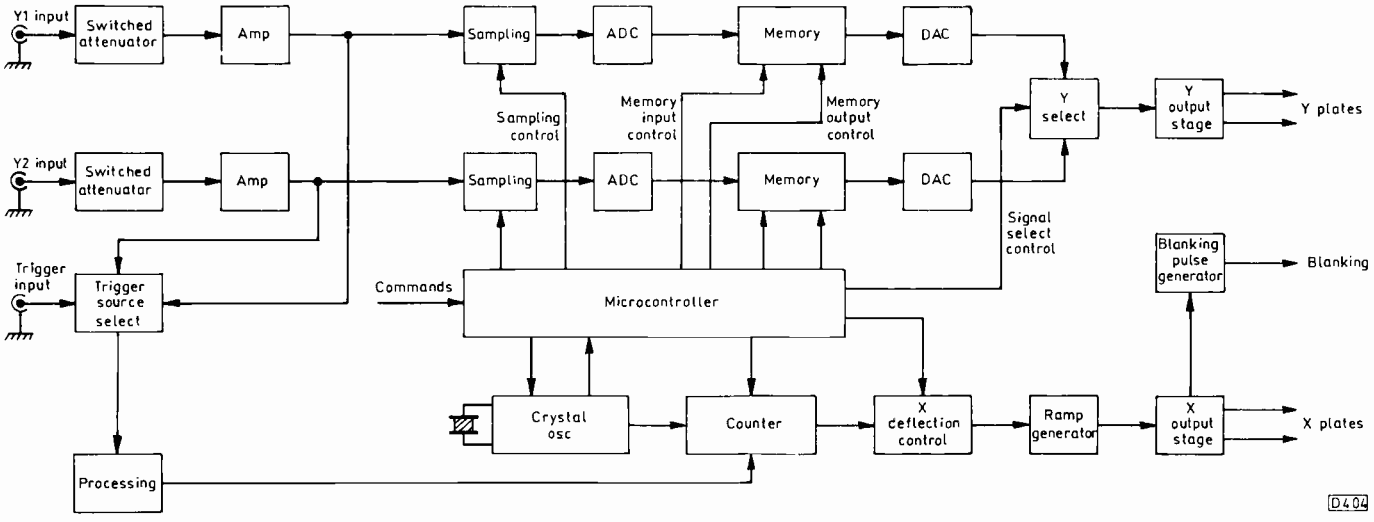


Fig. 3: Block diagram of a possible two-channel DSO arrangement.

method is fine for examining fast-rising waveform edges.

These sampling methods all have their advantages and disadvantages.

Storage Tube Scopes

Some older analogue storage scopes used a special tube to store the waveform. The technique involved bistable phosphors and mesh-storage levels. After a while the trace would fade and become fuzzy. With the modern DSO the waveform can be stored indefinitely and instantly retrieved. Other analogue storage scopes use sampling techniques.

Back to the DSO

A DSO can be used to examine many different types of signal: clock oscillator signals, pre-trigger parts of waveforms, l.f. signals that don't produce a good display with older analogue scopes and so on.

Fig. 3 shows in block diagram form a possible DSO arrangement with two Y channels – extra Y channels can be added in parallel. As there's a memory for each channel there is no need for the chop/alternate switching used with analogue scopes. The separate memories enable the DSO to store data simultaneously from all inputs. Operation of the system is self-evident.

Since the sampling rate might be 200MHz or higher the information has to be written into memory at a write cycle time of 5nsec or less. The write and read times can differ. Most DSOs use FISO memories (fast in, slow out) to store the data. Once stored the data is held indefinitely without loss or deterioration – provided the memory circuits remain powered.

Microcomputer control enables time intervals, frequency, sampling rates etc. to be set. This information, with voltages and other waveform data, can be displayed on the screen in figures and diagrams. The scope can serve as a digital voltmeter and frequency counter/timer while simultaneously displaying waveforms.

X deflection is controlled by a crystal oscillator instead of a linear sweep oscillator. Accuracy can be as high as 0·01 per cent.

Connect a component tester to the DSO and you can record and compare several component test waveforms simultaneously.

For most servicing the scope doesn't need to have more than two Y channels. The exception to this can occur when checking the logic lines in computers and other digital equipment. Many DSOs (and some analogue scopes) provide a choice of four or more Y input channels.

All new oscilloscopes, including analogue instruments, now contain a fair amount of digital circuitry.

The Roll Mode

A handy feature that most DSOs incorporate is a roll mode. Since the X deflection is crystal controlled, the frequency can be divided to capture l.f. signals, using a sweep as slow as one hour/div. This mode continuously moves (rolls) data across the screen from right to left. The advantage is that you can see dynamic changes with l.f. signals, for example when adjusting a preset control. The roll mode is particularly useful when testing power supply circuitry.

Select the Tektronix TDS320's peak detect feature and h.f. information buried within l.f. waveforms can be captured. In the peak detect mode glitches as narrow as 10nsec are exposed.

Other User Features

Many DSOs have screen cursors, a set of lines or markers that can be set to any place on the screen. These can be used for period and other special measurements of sections of the displayed waveform. The waveform section between the cursors can be expanded to fill the screen (zoom control).

Some DSOs have single-button set-ups, computer type on-screen menus, autoranging Y input amplifiers and autoset timebases. Auto set-ups sample the incoming Y signal and set the DSO to the correct range instantly.

What to Buy?

The first decision required is whether to choose an analogue scope or a DSO. For video/TV work the preferred type has long been an analogue instrument. It's considered to be best for reproducing complex video signals faithfully. Consequently many engineers feel more at home with an analogue oscilloscope. Many DSOs are now so good in this respect however that it's hard to spot the difference.

As more and more digital circuitry comes into use in TV sets and VCRs, and more computer repairs appear on your bench, you'll find the storage scope increasingly useful. It can handle pre-trigger viewing, fast sweeps, single-shot

pulses, low repetition-rate signals, store waveforms and do a whole lot more. In a short article like this it's possible to mention only some of the advantages of a DSO.

Some service engineers may decide that a combined analogue and digital storage scope is the best choice. One example is B&K Precision's moderately priced Model 2522A. With Philips' new CombiScope range, which combines top-quality analogue operation with powerful digital storage technology, you can change from one to the other at the touch of a button. In addition to waveform displays, number readouts and words provide the user with essential information.

The Hewlett-Packard HP54600 DSO combines the response of an analogue instrument with the measurement power of a DSO. While its upper response is 100MHz it can also detect and display waveforms with as low a frequency as 1Hz.

The Tektronix four-channel DSO Model TDS644A has a 500MHz bandwidth and a full-colour display. It doesn't use a shadowmask tube: the specially developed Tektronix NuColour display provides excellent contrast and convergence. Colour is especially useful when examining multiple, overlaying waveforms. This scope gives the user considerable insight into waveform behaviour and analyses and identifies logic functions – the relevant logic symbol is then displayed on the screen. Its price is £18,486 plus VAT however, putting it beyond normal service department use. We mention it for the sake of completeness and interest.

The Philips ScopeMeter Model 99 is a hand-held instrument that combines a 50MHz DSO with a full 3,000 count, wide-range true r.m.s. digital multimeter. It measures frequency and resistance and incorporates a component tester.

Tektronix's new TekMeter is a handy instrument for both bench and field servicing. It merges the power of a true r.m.s. multimeter with an autoranging scope in one compact, hand-held unit. Its large numerical display enables readings to be seen in most conditions. A linear bar graph is included. Weight is only 2·2lb. There are three models in the range: the top Model THM565 is the one to go for.

Before Buying

The specification details alongside provide a guide to scopes suitable for TV/video/computer servicing, over a wide price range. Only a small number of the excellent analogue and digital scopes available are listed: to include every scope would take up far more space than is available here. It's a good idea to check the advertisement pages in this magazine.

It is best to select an instrument with just a few more features and ranges than you think you'll ever need. You will then be ready for the developments in consumer electronics products on the way.

Before buying, try to get a copy of the manufacturer's brochure. Try to see the scope working and to get the feel of its controls and functions. You'll be using it every day for a long time.

Find out which accessories are included and the length of the warranty period. Check the stock and if necessary delivery situation. Remember that carriage charges can be expensive, so ask about them.

In Conlusion

To earn a decent income engineers must be able to locate faults quickly. Are you still struggling with an old scope of limited ability? If so the instrument, good as it may have been when new, is now costing you a lot of money. Right now is a good time to make life easier and more profitable by investing in a new high-tech scope.

BRIEF SPECIFICATIONS OF REPRESENTATIVE OSCILLOSCOPES

Prices are correct at the time of writing and exclude VAT. The following list is only a selection from a few ranges to indicate the variety of models available. MS = megasamples.

B&K Precision

2522A: Two-channel digital storage/analogue 20MHz scope. Sampling rate 20MS/sec. Maximum sensitivity 5mV/div. Timebase expander. Sweep magnification x10. Roll mode. Price £1,125 (trade £844).

2160: Dual-trace 60MHz analogue scope. Delay and dual timebase. Max. sensitivity 1mV/div. X-Y mode. Three trigger modes. Incorporates component tester. Price £1,205 (trade £903).

2120: Dual-trace 20MHz analogue scope. Two trigger modes plus TV H and V for video work. Trace rotation. Max. sensitivity 5mV/div. Price £553 (trade £415).

B&K Precision scopes come complete with two 10:1 probes and an instruction book. UK agent is Canadian Instruments and Electronics Ltd. Telephone 0602 770 075.

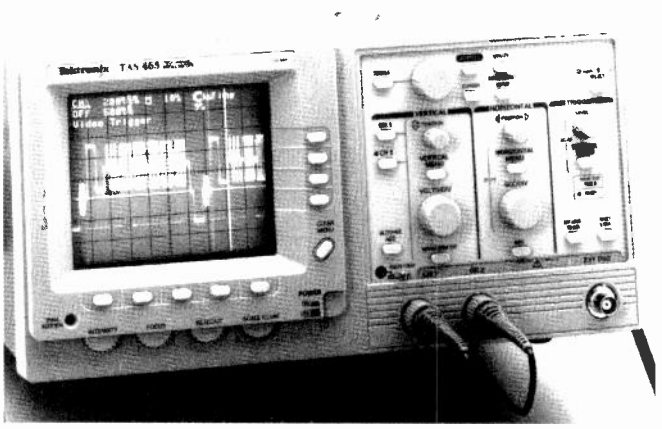
Hameg

HM1005: Three-channel, six-trace 100MHz analogue scope. Trigger and overscan LED indicators. Active TV sync separator. Sensitivity 1mV/cm. Price £847.

HM205-3: Two-channel 20MHz DSO. Max. sampling rate 2 x 20MHz. Two 2,048 x 8-bit memories. Dot joiner. Component tester. Printer/plotter output. Price £653.

HM303: Two-channel 30MHz analogue scope. Sensitivity 2mV/div. Trigger LED indicator. Squarewave calibrator. Component tester. Price £362.

Hameg scopes come complete with two probes and comprehensive manuals. There is free delivery and a two-year warranty. UK agent is BK Electronics. Telephone 0702 527 572.



The Tektronix TAS465 100MHz analogue scope.

Hewlett-Packard

HP54600B: Dual-trace 100MHz DSO with delayed sweep. Max. sensitivity 2mV/div. Menu-driven. Autoscale. Sampling rate 20MS/sec. 16 memories for storing front panel set-ups. Controlled by soft keys. Frequency, time and duty cycle measurements displayed in figures. Price £1,985. See test report in September issue.

HP54601B: Four-channel version of the HP54600B. Price £2,386.

HP54602B: Four-channel 150MHz DSO with delayed sweep. Channels 3 and 4 have a 250MHz bandwidth. Price £2,707.

UK agent Hewlett-Packard Ltd., Berkshire. Telephone 0344 360 000. Booklet HP part no. 9320-5776 available on complete range.

Philips/Fluke

PM3208-004: Two-channel 20MHz analogue scope. Sensitivity 5mV/div. TV H and V triggering. Two 10:1 switchable probes included. Price £498.

PM3050-004: Two-channel 60MHz analogue scope. Sensitivity 2mV/div. Autoset facility. Price £995.

PM3082-004: Two plus two channel 100MHz analogue scope. Sensitivity 2mV/div. Many features. Cursor modes. TV triggering. Price £1,725.

PM3394A CombiScope range: Combined analogue/DSOs. 200MHz bandwidth. Digital sampling at up to 200MS/sec. Four channels. Cursor measurements. Delayed timebase. X-Y mode. Numeric readout. Simultaneous display of the three CTV RGB signals. Designed for the service workshop. Prices range from £5,054 to £6,229.

ScopeMeter Model 99 Series II: Solid-state digital multimeter plus two-channel, 50MHz DSO. Pop-up menus, soft keys, roll mode. Batteries and charger included. Zoom. Signal generator and component tester. Price £1,450.

UK agent Fluke UK Ltd. Telephone 0923 240 511. Copies of oscilloscope basics/DSO booklets available on request.

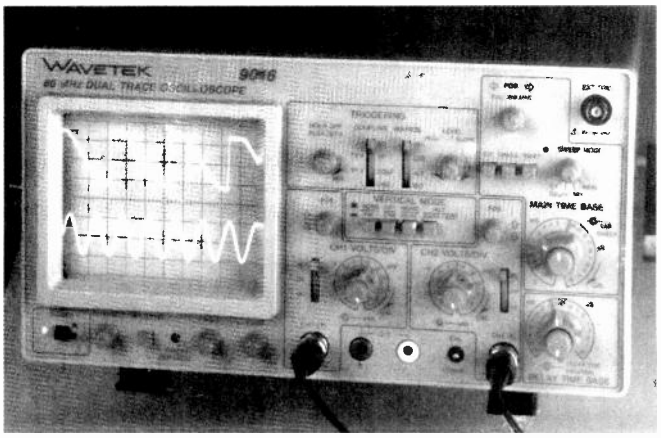
Tektronix

2205: Two-channel 20MHz analogue scope. Sensitivity 5mV/div. Front panel Z input. TV H and V triggering. X-Y operation. Includes two probes. Price £602.

2212: 60MHz analogue/DSO. Programmable. Sampling rate 20MS/sec. Parallel printer interface. Sensitivity 2mV/div. Price £2,422.

TAS465: Two-channel 100MHz analogue scope. Dual timebase. Autoset, cursor readouts, autoset button, save/recall set-ups. Sensitivity 2mV/div. New unit at no cost if scope fails within three-year warranty period. Price £1,728.

TDS320: 100MHz analogue/DSO. Sampling rate 500MS/sec. Two-channel real-time DS operation. 21 automatic measurements. 10nsec peak detect mode for high-speed glitch capture. Sensitivity 2mV/div. Price £2,596.



The Wavetek 9016 60MHz analogue scope.

TekMeter: True r.m.s. multimeter with autoranging scope. Linear bar graph. Weight 1kg. Powered by six AA batteries. Three models, THM550 at £700, THM560 at £799 and THM565 at £1,095.

TDS644A: Four-channel colour-display DSO. Bandwidth 500MHz. Sampling rate 2GS/sec. 25 automatic measurements. Built-in disc drive for recording/transferring waveforms to a PC. Many specialised display modes. Price £18,486.

UK agent Tektronix UK Ltd. Telephone 0628 486 000.

Wavetek

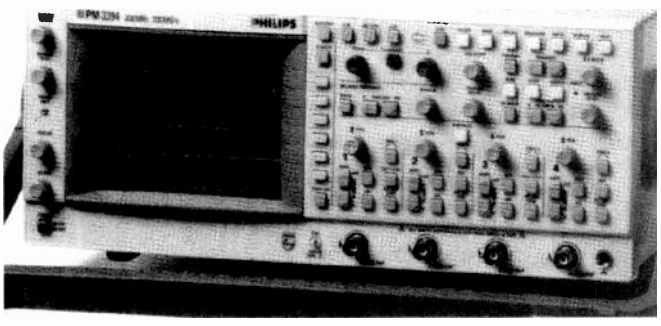
9302: Easy-to-operate dual-trace 20MHz analogue/DSO. Max. sensitivity 1mV/div. Max. sampling rate 10MS/sec. Stores events pre- and post-trigger time. Full-feature analogue operation at press of a button. Data output to external plotter. Includes probe set. Price £725.

9020: Dual-trace 20MHz analogue scope with delayed sweep. Max. sensitivity 1mV/div. Component tester. See review in December 1993 issue. Price £364.

9012: Dual-trace 20MHz analogue scope. Max. sensitivity 1mV/div. Component/signature tester. Independent dual-channel triggering. Price £345.

9016: Conservatively rated 60MHz analogue professional scope with dual timebase. Zoom-in feature. Variety of trigger coupling choices. Max. sensitivity 1mV/div. Delayed sweep facility. Component/signature tester. Price £839.

UK agent Wavetek. Telephone 0384 442 394.



The Philips PM3394 CombiScope.

VCR Clinic

Reports from Andrew J. Finn, Ronnie Boag, David Belmont, Gerald Smith, Ian Bowden, Simon Bodgett, Terry Lamoon, Nick Beer and Roger F. White

Akai VS23EK

If one of these machines has no display and a buzz comes from the power supply *unplug quickly* – the power supply is just about to self-destruct! Then replace C6 (220µF, 10V) under the metal can on the power supply. This will save you the cost of a replacement power supply. **A.J.F.**

Mitsubishi HSM57

A fault you can get with these machines is a half to three-quarter inch pattern at the bottom of the picture, worse with prerecorded tapes. Mitsubishi has come up with an answer. The cause of the fault is the fact that both video heads are in contact with the tape at the same time. As a result there's crosstalk between the heads, hence the patterning. Mitsubishi will, if requested, supply a new, specially-selected head drum (upper and lower). This doesn't cure the problem completely but does make a big improvement. **A.J.F.**

Finlux VR2040/05G

This Philips clone (DMP2 deck) came in to have its carriage refitted. Two days later it came back because there was no channel-change operation. The channel up and down buttons appeared to change the channels occasionally but there were no TV pictures. We then spotted that the infra-red sensor was visible. The dark blue infra-red plate that covers the receiver had slipped and dropped in front of the single channel number display, so that only above ten could be seen. **A.J.F.**

Amstrad VCR6200

If the cassette jams in the down position, with the belt screaming underneath, release the tape then clean the three switches on the side of the cassette housing. When the switch contact becomes poor the housing loads too far and jams. **A.J.F.**

Pioneer VR737

If there's no clock display check the 315mAT Wickman fuse in the power supply metal box. **A.J.F.**

Philips VR6180/DMP2 deck

The customer complained that there was no play at the beginning of a tape. On test an E240 cassette wound back to the beginning wouldn't play. The deck shuffled, then went back to the stop mode. The same thing happened in the fast forward mode.

It seemed that the brakes weren't operating correctly. We compared the operation with another machine. When play was selected this machine took up the tension briefly, by winding the supply reel slightly, then went into play. The faulty machine seemed to take up the tension too much, winding the tape back slightly so that the leader passed the end sensor and the machine shut down.

Brakes, reel table and belts were all swapped but this made no difference. After swapping further bits we consulted Philips, who told us to replace all the bits that had been swapped plus some more. So the following items were ordered: one bracket part no. 4822 403 1025; one lever arm, part no. 4822 403 52488; two disc reels part no. 4822 528 10523; two rollers part no. 4822 528 70638. The machine worked properly when the new bits had been fitted. **A.J.F.**

JVC HRD830

For no or intermittent tuner signals check the 2SD1863 transistor Q13 on the tuner board. It's easy to find this transistor: the board around it becomes discoloured as the transistor overheats and becomes defective. A 2SD1207 seems to be a more manly transistor for the job. **A.J.F.**

JVC HRD580

The complaint with one of these machines was that it made a "knocking noise". We found that the drive belt bush at the back of the capstan motor had split. A replacement capstan motor had to be fitted – this is becoming quite a common fault. **D.B.**

Saisho VR1000/Matsui VX800/Hinari VXL3

The customer complained about intermittent squeaking noises in the play and record modes. Cleaning and lubricating the bottom flywheel bearing silenced the squeaks. **D.B.**

JVC HRD560

The cause of no drum or capstan operation was traced to CP1 in the power supply being open-circuit. **D.B.**

Matsui VX1000Y

One of these machines couldn't be tuned in. We found that the tuner had no tuning voltage because R6045 was open-circuit. This resistor can also go high in value – the result is tuning drift. **D.B.**

JVC HRJ205

A rice-pattern effect on the playback picture can be caused by excess grease on the drum discharge brushes. The head drum motor and drive are on the top of the drum assembly in these machines.

To repair, remove the two screws that hold the drum drive board to the drum. Then loosen the grub screw that holds the bush to the shaft, noting its position carefully. Remove the upper drum and clean the grease off the brush assembly. Reverse this procedure to reassemble the unit. Remember to check/adjust the head switching point. **D.B.**

Toshiba V211

This Thomson based machine produced very noisy pictures. We found that the noise was on the 5V line and that it came from TT53. A replacement restored clear pictures. **D.B.**

Sony SLV225

This Sanyo based machine would intermittently stop in play, fast forward or rewind. The cause was a faulty reel sensor, part no. 1 808 723 11. **D.B.**

Matsui VX6600

There was no E-E or playback picture. We found that the cause was L01 in the on-screen display circuit. It had gone open-circuit. **D.B.**

Ferguson FV68

For very intermittent, poor or no Nicam, replace capacitors CM50 and CM51 using 5·6pF types (part no. 50876240). **D.B.**

Nokia VR3743VP

The playback sound and picture were faulty because the back-tension arm didn't come across fully. Replacing a broken lever, part no. 613-022-2015, cured the problem. **R.B.**

Sharp VCT310

The tape had jammed in the half-loaded position. On removing the tape manually and checking the alignment of the control cam and mode switch I found that the control cam was damaged. Replacing the control cam and mode switch and aligning them both cured the problem. **R.B.**

Nokia VR3722

There was a noisy squeak, mainly during rewind. The capstan motor, reels and gears were checked and found to be o.k. I then greased the reels, but this again made no difference. The squeak was found to be coming from the supply guide pole. Replacing this item cured the fault. **R.B.**

Samsung VIK320

The lift would shuffle back and forth with no cassette inserted. On inspection I found that the tape-start sensor was dry-jointed. Resoldering this cured the problem. We've since had the same symptom caused by dry-joints on the LED tower and tape-stop sensor. **G.S.**

Nokia VR3783VP

There was interference on the TV channels with the machine in the record mode. After much time had been spent checking around we found that the cause of the interference was chroma spray at r.f. from the head amplifier. Replacing IC181 in the head amplifier cleared the interference. **G.S.**

Samsung SI3240

There were various intermittent problems: no functions, tapes jamming, no or a flashing display and sticking in standby. We found that the all 5V rail was intermittently low or missing. It took some time to discover that the print track below the metal plate which covers the mode switch had been sparking across to the plate (earth). Some PCB sealant was applied and the machine was then given a good test run. After this it was declared to be o.k. **G.S.**

JVC HRS5800

The remote control system worked but there was no response from the on-board deck controls. There was also no function change when the audio-mix switch was operated. IC1 was the cause of the fault: one of its scanning outputs had failed. **S.B.**

JVC HRD4700

There was an intermittently noisy picture. It looked like head clogging, but this wasn't the cause of the fault. The lower drum assembly had to be replaced because of a problem with the ribbon cable that carries the r.f. signals to and from the heads. **S.B.**

GoldStar GHV1290

When this machine was tested we found that the drum and the capstan motor were running too fast. The thing to check in this event is the 4·43MHz signal that comes from the chroma circuit and is fed to the servo section. Follow it around, soldering and making good any bad connections. This should cure the fault – it certainly did with this one. **T.L.**

Samsung SI1260

This machine wouldn't load. So I got my meter and went to the loading drive i.c. to check the voltages, but it wasn't there! When the panel was lifted it was found at the bottom of the machine. Replacing it restored normal operation. Apparently a cassette had got jammed: it seems that the chip had so overheated while trying to load the cassette that the solder had melted. I fitted a new chip to be on the safe side. **T.L.**

Matsui VX1100

If you have any servo, sound erase etc. faults with these machines remove the mechanism and check the connections between it and the main panel. Resoldering the connections will clear many problems. **T.L.**

JVC HRD860

This machine worked perfectly except for fast forward and rewind. When these modes were selected they would start but fast operation, which should commence after about ten seconds, didn't take place. Fortunately I've had this problem many times before. So I changed the reel sensors. It's quite a common fault with these machies. **T.L.**

Matsui VP9301

This machine would load a cassette but then shut down. When I watched it I found that the drum sped up just before the fault occurred. By careful manipulation of leads I narrowed the fault area to the heads. So I removed the stator PCB that sits on the top of the video heads and found a nice little crack in part of the print. Careful repair got the machine working perfectly again. **T.L.**

B and O V6000

This machine makes extensive use of on-screen menus and displays. In the stop mode these displays were perfectly o.k., but in the playback mode the colours would gradually change phase, for example from the correct cyan lettering at

the left of a text line to orange at the right-hand side. A look at the circuit showed that there's a reference line, marked F H/2, that comes from the video/chroma area of the main board. A scope connected to this line showed that only noise was present. We traced back to transistors 7560 and 7513 and still found just noise. We then noticed that a surface-mounted capacitor in this area had a flattened blob of solder at one end. When this was heated with an iron to remove it the capacitor's end cap came away with the solder. The capacitor concerned is C2514 (10nF): it couples the signal to the transistor circuit mentioned above. A replacement capacitor restored normal operation. **I.B.**

Mitsubishi HS320

This machine laced up and played, with one head apparently clogged, then after about five seconds it stopped. The FG signal was not getting through because Q404, which is part of the FG pulse amplifier, had become very noisy. **R.F.W.**

Ferguson 3V35/JVC HRD120

The symptom gave the impression that one head was clogged, but the cause of the trouble was the fact that the SW25 signal was of very low amplitude. We found that the 9V supply was low at only 5V because the 9V adjustment potentiometer on the power supply board was faulty. **R.F.W.**

Ferguson FV11

The capstan motor was very slow and its drive chip was very hot. Unlike more modern DD motors, the chip is not part of the motor and doesn't cut out when it overheats. A new chip got the motor running but was getting hot. It's not an easy motor to dismantle, but once the bearings had been cleaned in alcohol and reassembled with fresh oil the motor ran at full speed without the chip overheating. **R.F.W.**

Akai VS485EK

The display didn't work because its heater supply was missing. The cause of this was capacitors C446 and C447 on the main board. **R.F.W.**

Panasonic NVL20/NVL28

After a mains supply fluctuation caused by a storm the machine's power supply wouldn't start. C1109 (1µF, 400V), which provides a start-up pulse, had gone low in value. The 12V supply was also missing because Q1102 was open-circuit. **R.F.W.**

JVC HRD230

There was no capstan rotation, so the machine would cut out in play or record as soon as it had finished lacing up. The M54644BL drive chip IC604 was found to be faulty, a new one restoring activity. But the wow and flutter were atrocious. No wonder since the motor was extremely tight. A new one prevented another drive chip biting the dust. **N.B.**

Ferguson FV44L

There was a buzz that couldn't be ignored on the playback sound. Checks around the audio circuit led me to conclude that the audio head's record side wasn't being earthed in the playback mode, confirmed by the fact that the relevant pin of IC1 was high, as it is in the record mode. Further checks showed that the 'record start low' line was low at about 9V. Thus Q6, a digital transistor that's connected to pin 25 of IC1, produced a high output as in the record mode. The record start low line comes from pin 34 of the M37418M6-263SP microcontroller chip IC601, which proved to be faulty. Interestingly, none of IC601's other ports were incorrect. **N.B.**

Sharp VCA30HM

Rewind and fast forward sometimes failed to operate. The capstan motor would rotate, but the idler gearing wasn't being engaged. Play, cue and review were fine. A new mode switch cured the problem. **N.B.**

Samsung SI1240

Cutting out during rewind was the complaint with this machine. On test we found that when a three-hour cassette was rewound the tape would slow after the one-hour point, the capstan would start to labour and the machine would then cut out. When the belt was removed from the capstan motor there was still plenty of torque. This was confirmed by the fact that fast forward was fine. As it's a full-lace machine I removed the tape from around the guides manually and let it run straight across the front of the cassette, to eliminate excessive friction in the tape path. This helped, but by no means cured the symptom. The cause of the trouble was excessive friction in the spools. Removing them then cleaning and lubricating the shafts cured it.

All the diodes were changed as they were the original ones. The FL motor chip was also replaced: this had been done previously, but the earth link modification in the power supply hadn't been carried out. **N.B.**

Akai VS23EK

This machine cut off in play, fast forward and rewind after a few seconds. The reel pulse input to IC505 was o.k. but the output at pin 7 was faulty. Replacing IC505 restored normal operation. **R.B.**

Sanyo VHR4350

At switch on the machine went into the fast forward mode automatically. We first checked the mechanism's alignment, which was o.k. A replacement capstan motor cured the problem. **R.B.**

Finlux VR2040

This machine would cut out in play. Fast forward and rewind were o.k. The cause of the problem was no play take-up: replacing the clutch cured it. **R.B.**

Toshiba V55

Although the display segments all lit, the machine didn't switch on. On investigation we found that there was a dry-joint at pin 1 of connector CN1 on the regulator PCB. Resoldering the plug connection cured the fault. **R.B.**

Mitsubishi HSB12

This machine would cut out after a few seconds in play, because the arm guide and arm tension lever didn't take up the tape. The arm tension post lever has a felt pad that rests against the take-up reel: the pad was missing. A replacement lever, part no. 591B551010, cured the problem. **R.B.**

Heath and Safety Legislation

Roy Baines

"Heath and safety? That must be someone else's responsibility. I've certainly not the time at present to look into it." How many times have you said or heard that? In reality it's everone's responsibility however, from the tea boy to the managing director. In this article we'll take a look at the history of health and safety legislation and the reasons for it. This will hopefully demonstrate the need for every one of us to be concerned about this important aspect of the workplace and thus promote healthier and safer working conditions.

History

Rapid industrial expansion followed the introduction of the steam engine and the water frame in 1769. By about 1800 reformers and legislators were beginning to take action over conditions in factories. Initial concern was for the environmental conditions in textile mills, safety not being the first consideration. Children as well as adults worked a fourteen hour day for six days a week: on sundays some would clean the machinery. Working conditions were cramped and awkward, and the lack of ventilation and cleanliness led to frequent epidemics and fever.

Sir Robert Peel introduced the Health and Morals of Apprentices Act in 1802 – it was the first legislation of its type anywhere in the world. But all it did was to restrict the hours of work and make some provision for cleanliness and ventilation. The practical results were negligible, because it applied only to pauper apprentices and there was no effective way of securing obeyance. Unpaid factory visitors were appointed by local magistrates. They were supposed to inspect the mills, but had little knowledge about what should be done and not much enthusiasm for the task.

Three more acts passed during the next thirty years failed for the same reasons. The Factory Act of 1833 didn't contain a single safety requirement, but did empower the government to appoint paid factory inspectors. It was not until 1878 that a Chief Inspector was appointed. The 1833 Act applied only to textile mills. At first there were only four inspectors and eight superintendents – to inspect some three-four thousand mills. The inspectors had the right of entry into factories at all times: they could take information under oath, and could even try and convict occupiers for breaches of the act.

The 1833 Act contained provision for children to receive twelve hours' schooling a week, the result being that the first compulsory eduction in this country was introduced. The first factory inspectors were also the first school inspectors.

A sharp rise in industrial accidents prompted the Home Office to ask the inspectors to look into the possibility of introducing safety legislation to protect children and others. This resulted in the Factories Act of 1844. It introduced a requirement for machinery guards, for safety measures when cleaning machinery, for an accident reporting system and for the provision of inspectors who would take legal proceedings on behalf of injured people, with damages awarded by the court to go to the victims of accidents. The drafting of the legal wording contained many loopholes however, and these hampered the inspectors in their efforts to get the law obeyed.

A meeting of manufacturers in 1854 led to the formation of the Factory Law Amendment Association, which a year later became the National Association of Factory Occupiers. Its main object was to oppose the factory inspectors. An Amending Act of 1856 made machinery guards and fencing compulsory only where women, children or young people were liable to come into contact with moving parts. "Safe by position" has been carried through successive legislation ever since.

In 1864 some non-textile factories were brought within the scope of the law. In 1867 iron foundaries, printing works and several other industries were added. By 1878 virtually all manufacturing industries were covered. Safety regulations for docks, wharfs and quays came along in 1904, and for shipyards in 1914. Building site legislation was introduced in 1948, and civil engineering and construction in 1966. Offices became subject to health, safety and welfare requirements with the introduction of the Offices, Shops and Railway Premises Act of 1963.

The Factory Act of 1961 was merely a consolidation of the Acts of 1937, 1948 and 1959, and was based on the thinking of the mid-Twenties. It also contained about 300 regulations and orders, many of which dated from the beginning of the century and were irrelevant to the late Twentieth century.

In 1967 the Department of Employment issued a consultative document that contained proposals for a new Bill. It was shelved because the view was taken that an Act based on the proposals would follow the old pattern. There were already nine separate groups of Health and Safety Statutes administered by five different government departments, using seven separate inspectorates and the local authorities. Despite all this legislation about four million workers were still unprotected. Instead of going ahead with a new bill Mrs. Barbara Castle, the then Secretary of State, appointed a Committee of Enquiry with Lord Robens as chairman. The Committee's report was published in 1972, after two years of searching enquiries. Parliament accepted the broad principles of the Robens' recommendations, and two years later the Health and Safety at Work Act of 1974 received the royal assent.

The Health and Safety at Work Act 1974

The Robens Committee found that "even though nearly all the measures that could be taken to prevent accidents in the physical sense, e.g. guarding machinery, partitioning, protective clothing, eye protection etc., had been taken the reported accident figures continued to rise." The Committee recommended a change of emphasis from the physical to the personal aspect of safety. It said that new

legislation should encourage better supervision, better training and communication, and joint participation in creating a safe environment. Out of these and other recommendations the Health and Safety at Work Act of 1974 was born.

The Act puts general duties on employers, employees, manufacturers, suppliers, importers and the self-employed. It did not remove any prior legislation – in fact it extended the requirement to workplaces not previously defined as "offices" or "factories".

The general aims and objectives of the Act are as follows:

(1) To maintain or improve standards of health, safety and welfare at work.

(2) To protect the general public against risks to health and safety arising out of work activities.

(3) To control the storage and use of dangerous substances (recently extended by the COSHH Act).

(4) To control certain noxious emissions into the air from certain premises.

Employers must, for the first time under the criminal law, eliminate risks to those who don't work for them: customers and the general public, contractors, workmen and drivers delivering to premises. So remember: the 1974 Health and Safety Act places a criminal responsibility on employers – to protect the general public as well employees from risk. To protect everyone affected by a company's business, the law now places seven major duties on employers. Three are concerned with people and four with things. Let's start with things. The four responsibilities are:

(1) "To provide a safe place of work." This means a building which is sound and without hazards. A storeroom with rotten floorboards and no easy way out in case of a fire would not be a safe place of work.

(2) "To provide safe plant." This is an obvious and long-standing requirement: that machinery should be safe to use. A bacon-slicing machine without a guard over the blade would count as "unsafe plant".

(3) "To provide safe systems of work." This means that work has to be organised to eliminate likely hazards. Working procedures that entail shinning up shelves to get boxes down would probably count as an "unsafe system".

(4) "To provide a healthy and safe working environment for employees." This covers many points not dealt with in detail. It clearly covers such things as adequate ventilation, hygiene and the suppression of noise.

These four duties of the employer are obligations which are much more demanding than the specific regulations that have existed in the past.

The three duties relating to people bring out the government's concern to involve everyone – both management and employees – in a new way. They are as follows:

(1) Employers must provide information and training for all staff about their own safety, the safety of those who work with them and the safety of the general public. A man handling inflammable goods for example should be informed about the hazards involved and the correct procedures to follow. Warehousemen who have to hump packing cases and boxes should be given proper training in lifting in order to reduce the risk of backache and strains.

(2) Employers must consult with staff representatives and provide all the information necessary to enable them to co-operate in promoting health and safety measures. If safety representatives require it, the company is obliged to set up a safety committee.

(3) Employers must provide a written statement of the company's policy on health and safety. The statement must also set out company procedures for implementing that policy. This applies to every company with five or more employees.

It's clear that the Act places severe burdens, some of a very general nature, on employers. It is a good idea to appoint a safety officer as a member of the management staff. In a large company this may be a full-time job, in others a part-time responsibility for someone with other duties. The job entails investigating methods of work and the condition of buildings and equipment. It also calls for accident reports so that hazards can in future be avoided.

Many companies own premises that they lease to other companies – warehouses, stores, shops, workshops, etc. The point here is that landlords face responsibilities as well. They have a duty to ensure that the premises are, as far as is reasonably practical, free from risks to safety or health. This involves eliminating dangerous features such as dark, steep staircases and providing adequate fire exits.

So much then for the role of management as employer or landlord. What about the employee, the individual for whose benefit much of this legislation was drafted?

Employees' Responsibilities

First the employee is called upon to take reasonable care of his own health and safety and that of anyone else who might be affected by his actions. So barging along a crowded shopping aisle with a loaded trolley could be an offense under the Act.

Secondly staff must co-operate with employers in their efforts, outlined earlier, to keep the workplace healthy and safe. An engineer who persistently broke the company's rules about overloading electrical sockets might be committing an offense.

Thirdly anyone who recklessly interferes with anything provided in the interests of health and safety will be in breach of the Act. Larking about with fire extinguishers could be an offense.

The three duties of employees – to take care, to co-operate and not to interfere – are backed by criminal sanctions. A breach can lead to prosecution.

Enforcement

These then are the main demands that the 1974 Act makes on employers and employees. The machinery for law enforcement is comprehensive and is backed by tough powers.

Safety legislation is the responsibility of the Health and Safety Commission, which is concerned with policy, and the Health and Safety Executive which puts decisions into practice and offers an

advisory service.

The 1974 Act is what's called enabling legislation. It gives powers for regulations to be made and for codes of practice to be approved. The Executive maintains a body of inspectors who have considerable powers. These inspectors include the factory inspectors with whom many managers are familiar. They have powers to conduct a full enquiry into an accident, can enter premises, take photos and seize samples, and can issue an improvement notice – used to put something right within a specified time. Or a prohibition notice can be used. This says that people must stop doing something at once if there is danger. Companies or individuals can be prosecuted: fines of up to £1,000 can be imposed – in certain cases fines are unlimited. The Act provides for jail sentences of up to two years. Breaches of the Act are liable to prosecution through the criminal courts, but when a crime has been committed it may also be regarded as a tort (a civil law wrong). Thus action could be taken in both the criminal and civil courts.

In Conclusion

Managers need to make sure that they have provided a safe work-place, safe plant, safe systems and a safe environment. They need to publish a policy statement, to consult with and inform their staff. They must ensure that safety rules, safety equipment and safety training are good enough.

Employees must take care of themselves and others, should co-operate with management and should not interfere with anything provided for safety.

More advice on health and safety and welfare regulations can be obtained from local authorities and from the Factory Inspectorate – you'll find the number in the phone book.

I hope that this outline has given you some idea of the work which has gone into the forming and enforcement of the HASAW Act, 1974. People have taken the time to protect us from everyday hazards: we should take the time to make it work. As I said at the start, it's all too easy to say "leave it to someone else". This won't do: you can no longer afford to leave things to chance.

Satellite Faults

Reports from Hugh Allison, Chris Watton and Nick Beer

Raynor 5000 Receiver

These dual-LNB input receivers with on-screen graphics and a positioner have been available on the surplus market at very low prices, 'sold as seen' but new. The following note may help you to get one going. You are entirely on your own if you do buy one of these receivers: I can't promise that the following cure will work in all cases, but it has worked with seven out of eight of the receivers that have passed through my hands. The receivers normally come with a handbook which, unusually, contains a circuit diagram.

If you connect the receiver to a TV set and tune it in with no LNB connected you see a satisfying increase in visible noise. Add an LNB which is not pointing at anything and there's a further increase in the noise. So far so good. Point the LNB at a satellite and the screen breaks up into two wide horizontal black and white bars. "Hum bars" I hear you say, "look at the power supplies." Well the first time I did and spent ages: I even tried running the whole receiver with external d.c. supplies, but there was no improvement.

While following the r.f. signal path I noticed that a scope probe connected to IC27's supply lines cured the fault. This MC10116 chip fits in a socket. Sometimes the simple act of removing then refitting the chip provides a cure. With others a capacitor connected between pins 1 and 16 does the trick. I am talking about soldering the capacitor directly to the pins, not beneath the board. Keep the leads as short as possible. Try various values: 1nF is a good value with which to start. Some receivers require an additional capacitor from one or both of the above mentioned pins to chassis to provide a cure. If all else fails, try connecting capacitors to pin 8 as well or, in desperation, remove the socket and solder the chip in directly. Although I've no experience of this cure myself, a colleague says that he removes the chip, plugs in one of those thin, four-pin i.c. decoupling capacitors, then puts the chip back in.

These sets are sensitive and the reed pulsing positioner is reliable. There is neither a built-in decoder nor a scart socket, but there are sufficient phono sockets to be able to get round most problems. The bandwidth, sound tuning and system and decoder routing are electronically variable and storable. These features probably make the receivers a reasonable gamble as a second set for the satellite enthusiast. **H.A.**

Amstrad SRD510

This receiver was dead. When the power unit's output plug was disconnected and a dummy load (a VCR lamp) was connected across the 5V rail we found that the supply was tripping. It seemed sensible to check the electrolytics: the culprit was found to be C611 (1µF, 50V) which couples the drive to the chopper transistor. **C.W.**

Pace SS9000 and Clones

If one of these receivers appears to work but a whistle comes from the power supply and lots of radiation causes interference to TV sets for miles around, check whether C11 (1µF, 16V) is open-circuit. It's the reservoir capacitor for D9. **N.B.**

Amstrad SRD510

The dead receiver symptom is becoming quite common with this model. The usual cause is the two 47kΩ start-up resistors R602 and R603 having gone high in value or open-circuit. You find a variety of arrangements – sometimes the resistors are on end, sometimes they are stood off the board, and some have sleeving on their legs. **N.B.**

Sony Camcorder Fault Notes

Keith T. Keeton

The following is a short list of some faults we've had with various Sony Camcorders.

Model TR50

Camera focuses once at start then won't focus again: Q621 (XN650) on board VC81P faulty. Part no. 872940219.

No E-E (black screen), no zoom and no focusing: IC361 (MC68HC05N4SC406667) on board VC81P faulty. Part no. 875903760. There were no signals on the check pin array.

No E-E luminance: C305 on board VC81P open-circuit.

E-E picture half white and half solid black: IC141 (CXD1209Q) on board VC81P faulty. Part no. 875233585.

No viewfinder picture, direct output o.k.: Flyback transformer T901 on board VF14P faulty. Part no. 143943111.

No camera/VTR power: IC601 (CXP80116) on board VS69P faulty. Part. no. 875281858. There were no output pulses at pin 43 of the chip.

No power to camcorder: IC601 (CXP80116) on board VS69P faulty. Part no. 875281858. There was no VTR DD on signal from IC601.

Mechanism loads up with no tape in: Replace encoder, part no. 157217311. Mechanism arms moved in and out erratically.

Noisy eject: Replaced slightly bent worm gear shaft. Part no. X37288681.

Tape riding up pinch roller: Adjust incorrectly set back tension.

Excessive playback dropouts. Flashing white lines sometimes present: IC203 (CX1200BQ) on board VS69 faulty. Part no. 875203440. Dropout pulses o.k. at pin 2 of chip but no correction.

No playback – mechanism loads up slowly without tape: Flexiconnector FP313 slightly away from PCB (CC52). Resolder or replace as necessary. Part no. 163649611.

Model TR105

Smeared E-E picture: CN801 on board VC104 open-circuit, with possible board print damage. Lens may have been knocked. Resolder CN801 or replace board if tracks damaged.

No E-E colour, playback o.k.: L721 (68µH) on board VC104 open-circuit or dry-jointed. Resolder/replace L721 as necessary. Part no. 141039111. Signal is o.k. at Q704 but no signal at Q706.

No E-E colour, record and playback o.k.: IC707 (CXD2100Q) on board VC104 faulty. Part no. 875233732. No output signal at pin 30.

No zoom. Focus and E-E o.k.: Sponge on lens pushing against zoom motor. Reposition sponge.

Viewfinder picture shakes: Dry-joint at R521 on board VF42.

Lines on top part of viewfinder display, data display corrupted: Dry-joint at C516 on board VF42.

FF/REW/PB/REC for few seconds then flashes fault present: Sensor board faulty. Replace MD chassis, part no. A7010369A – sensor not separate item.

Loads a tape but no FF/REW/PB/REC. Will not eject a loaded tape: Capstan faulty (no rotation). Replace, part no. 883532912.

Failure to eject. FF/REW very fast: No capstan feedback. Pins 17 and 18 of flexi W203 dry-jointed (board VS83). Resolder flexi.

Failure to load/eject. Guides only partly loading, with intake guide jamming against railbase assembly: Replace railbase assembly, part no. A7040289A.

Model TR705

This camcorder is very similar to the TR105 and has similar faults. We've had the following additional faults.

Failure to load a tape. Loads o.k. without a tape. Drum doesn't rotate: Replace faulty drum assembly (machine will not load fully until drum rotates).

Unstable playback picture when using Hi-8 tapes: Replace faulty guide rails. Part no. A7040251F/X39410272.

Model F500

No E-E colour, playback o.k.: Crystal X621 faulty. No 4fsc to encoder chip IC701.

No E-E sound, playback o.k.: MC36P (small PCB) faulty. Replace.

Intermittent playback sound, E-E o.k.: Hybrid chip IC580 on board VA43 faulty. Sound comes and goes when pressure is applied to IC580.

No colour with playback of own recordings. E-E o.k. Plays back prerecorded tapes with colour: IC364 on board VA43 faulty. Signal low at input to IC364, no output from it.

No playback picture, E-E o.k.: Input to IC362 low because metal shielding can is shorting to track. Bend can out of way.

No playback picture (black screen), E-E o.k.: IC360 faulty (no output at pin 56).

Playback for only fifteen minutes with battery operation: Unit consuming excessive current because Q001 and IC005 faulty.

No playback/E-E pictures: IC001 on board SS100P faulty. Input to bus decoder IC362 was found to be high instead of low.

No camera/mechanism power: Replace F991.

Model F550

Manual white balance and focus switches not working. LCD doesn't change when buttons pressed: Macro/auto-focus button jammed on by case (board CK20P). Free button or replace case.

No E-E picture (black screen). Data scrolling: Q509 defective. Fault area FU100.

No E-E picture (black screen), playback o.k.: IC501 on board VC67P faulty.

Dropout on playback, E-E o.k.: C224 on board VA46P was leaky.

Noisy playback – looks like dirty heads. Picture may be o.k. in pause mode: Head amplifier RP17 faulty.

Jumping picture. Noise bars at top/bottom: Impedance roller set too high. Reset and carry out complete tape path retrack.

EVF shows just line. Picture o.k. via AV output: C919 on board VF26P faulty.

No playback or E-E colour: IC203 on board VA46P faulty.

No operation after replacing IC501: Wrong version used – requires updated version. Fault area SS100P.

No EVF picture (blank screen). Picture o.k. via AV output. TX whining: C918 on board VF26P faulty.

Thick vertical line on EVF. TV picture o.k.: L903 on board VF26P open-circuit.

No playback or E-E sound: Q409/Q410 on board VA46P both short-circuit collector-to-emitter. (Sound present at pin 7 of IC403).

Model F355

This camcorder is very similar to the F350 for which fault notes were published in the August 1994 issue (see page 735).

Lines on E-E picture to start with, then fading away: C704 on board CV9 faulty.

Intermittent E-E luminance, playback o.k.: Dry-joint at FL601 on board CV9 (signal input but no output).

No E-E luminance, playback o.k.: IC501 (UPD6145G601) on board CV9 faulty.

No E-E picture but reappears after a short time: Leakage from C704 (120µF) on board CV9. Can cause damage to PCB beneath it.

EVF picture too bright with lines: Poor contact at c.r.t. yoke (no signal here though video o.k. at pin 1 of W901). Refit pin correctly.

Failure to record sound. Playback and E-E o.k.: Q401 (2SC1623) on board CO2P faulty.

Record and playback pictures very bright: IC203 (CXA1200BQ) on board CV9 faulty (black level wrong at output pin 47).

Recordings noisy, like dropout. Fault intermittent: C704 on board CV9 faulty.

EVF display has symbols flashing all over: IC501 (UPD6145G601) on board CV9 faulty.

Drum doesn't rotate. Vibrates slightly: IC507 (CX20114) on board CO2P faulty. Drive pulses from pin 24 incorrect.

Playback suffers from interference, E-E o.k.: Replace 5·17MHz filter FL203 on board CV9. Signal o.k. at pin 3 of IC203 but noisy at pin 4.

Garbled symbols on screen when data pressed: IC501 on board CV9 faulty (peaks on output signals at pins 13 and 15).

Answer to Test Case 384

– see page 115 –

The sort of conundrum we've described is by no means uncommon with switch-mode power supplies, as any practising technician will testify. Sometimes the cause of the trouble lies in the chopper system itself, sometimes in an overload protection system and sometimes heaven knows where. In this case a little more explanation is required to clarify the nature of the fault.

The 11·3V supply produced by D204 and C204 is monitored by zener diode D208. If the voltage is excessive, perhaps because of a break in the regulating feedback loop, D208 conducts, triggering the crowbar thyristor Thy201. This places a dead short across the cathode of the 38V supply rectifier D201, loading the transformer to the extent that the chopper circuit shuts down. It remains stalled until the mains power is removed for a sufficiently long time for C105 to discharge substantially. At the next switch on the start circuit fires HIC101 again to sample the load conditions. If the overload is still present, the chopper will shut down again almost immediately.

So much for theory. The situation in practice was that zener diode D208 was slightly leaky. This leak was sufficient for Thy201 to lock on as soon as anything at all appeared on the 11·3V line. A new diode, charged at fifty odd pence, cured the problem. The labour charge bumped this figure up somewhat. . .

What a Life!

Donald Bullock

When I was at school I used to build crystal sets. I can still recall the day I managed to tune in a programme with the first successful one. It was the Light Programme from the BBC's 1,500m Droitwich transmitter. Subsequently I started to knock up the sets and flog them. They were housed in matchboxes and I sold them for half a crown a time. When I started work I was paid seven pence and a half penny an hour, so I'd done quite well with the crystal sets.

I sometimes think of those days when I pass the Droitwich transmitter on the way to the airport. I thought of them particularly the other day when I opened an English-language Spanish newspaper.

Lots of people receive Sky TV there. I don't know why anyone should want to, but they do. The particular newspaper I was reading used to carry advertisements from firms that offered to supply pirate cards. They claimed they could and would update the cards each time Rupert thought of a wheeze to stop them working.

Well, the last time that Rupert switched the switching the ads stopped. As the weeks went by it was generally assumed that Rupert had finally won. But in the issue of the paper I had before me pirate cards were again on offer. They were different however. It was claimed that these were immune from Rupert's destructive signals. And some of the ads offered to make reception possible using Rupert's expired cards. Your move, Rupert!

I was chatting to the owner of one of the larger spares firms recently. He's also an enthusiastic technician and told me that he had the secret of building anti-destruction circuitry into expired cards.

All this got me thinking about the immense strides since I made and flogged those early matchbox crystal sets. Even outside the electronics industry, nearly all progress has been on the back of electronics. No one can dispute that those of us who stumbled into electronics at the beginning were in on the biggest breakthrough since civilisation began.

There's only one question: why aren't we all loaded?

A month or two ago I mentioned that Steven had taken our moggie to the vet and come back poorer by over a hundred quid. He'd also had the pleasure of seeing one of our tightest customers happily shelling out handfuls of cabbage to the vet.

Maybe we should have been vets. Or opticians. The latter reflection arises from a need for some new glasses recently. I came back even worse off than Steven.

Distorted Sound

On my return Cecil Stammer was waiting with a 14in. Samsung colour set, Model CI338GA (P50 chassis).

"Ah Mr. Buh Buh Buh Buh" he started.

I came to his aid. "Bullock?"

"Yuh yuh yuh yes. My Sam Sam Sam"

"Samsung" I propted.

"The suh suh suh"

"Sound?" I asked.

"Dis dis dis"

"Leave it with me and call back later" I said.

The sound turned out to be very distorted indeed. Recalling the patient man who struggled to teach us to think logically all those years ago I first tried another speaker. The results were the same.

So I moved back to the audio circuit and found that R614 was open-circuit while R601 (2·7kΩ) had risen in value to 6kΩ. Replacing them cured the trouble.

A Visit from the Milkman

Our milkman Clarence brought his Pace SS9000 satellite receiver in the other day, the complaint being of a liney, distorted picture on all channels – as though Rupert had got at his card. Steven soon found the cause of the trouble – that small 2·2μF, 50V electrolytic in the tuner unit (C416). It sat there looking as good as gold, near a little three-quarter inch chip.

Apparently the chip gets hot and dries out the electrolytic. Steve fitted a more manly one on the full length of its leads.

A few days later Clarence popped in for it.

"Hi Clarence" I greeted him. "The good news is that it's ready.

"And the bad news?"

"The milk's on you, for quite a while."

Accidents will Happen

As he departed Mrs. Whiner pushed Mr. Whiner through the door. He smelt like a brewery and was carrying a little monochrome 7in. set that bore a Boots badge. It was a pretty crimson colour, like Mr. Whiner, and was dead.

"I watches it in the kitchen" she said. "It can't be much as it was all right until I went out and left it with him."

Mr. Whiner smiled. "It was all right" he said.

We had no data on the set and opened it up on spec. It was soon apparent that the set had been dropped: there was a crack across the single panel, spreading from the line output transformer. Six or eight jumper leads later we had the set working again, but there was a nasty a.c. ripple on the picture, which pulled about and lost field sync. There was also no sound. The latter came up when another speaker was tried. We found that the 'spider' of the one in the set was detached and repaired it. We then noticed that there was a good deal of hum.

The set relies on an external 12V power supply, the sort that plugs straight into a 13A socket. We suspected this item and found that Mrs. Whiner had a spare one. She brought it in later and we tried it, but the ripple and hum were still present. Puzzled, we had another go at the set but got nowhere. We finally borrowed a power pack from one of the children's games and tried it. The ripple and hum disappeared.

So we had two dud power packs from Mrs. Whiner. We opened them both and found that in each case the main electrolytic had become detached from the tiny panel. When we studied the cases it was clear that the power supplies had also been dropped.

We'd originally felt a bit sorry for Mr. Whiner and hadn't intended to shop him. But this was too much! So when they came back for their set we let him have it.

"The set had been dropped, Mrs. Whiner" we said, "and so had both the power packs. Twenty pounds, please."

Mrs. Whiner turned to her spouse and elbowed him around his beer barrel. "You stupid clot" she grated, "you pay – you did it."

And he did. As he unbuttoned his overcoat he knocked the power packs on to the floor.

"So 'elp me Christ" said Mrs. Whiner, fetching him another jab.

Letters

ENTER THE TRADE? – DON'T!

I have a reply to the anonymous writer (letters August) who is thinking of becoming a self-employed TV/video service engineer: DON'T! You would have to be completely insane to want to go into this business these days – and if you're not you soon will be.

I set up on my own in 1981, in an area where there was a lack of servicing businesses, and did all right for a good while. I sold thoroughly refurbished TV sets at £130, with a good guarantee. But what happened? The nutters started to sell tube-boosted bangers at £39 and the public started to expect to get my sets for less than that (they couldn't be told of course). I've had a guy telling the customers that he was my "partner", and another whose advertising bills were sent to me.

At present, as a result of merger-related redundancies, this area is over-populated with self-employed engineers, some of dubious ability and/or scruples. So the cake is now being cut into much thinner slices. Then there's the equipment we're expected to work on nowadays. Regardless of what the make is it's all rubbish, the lot of it, from the plastic cabinets to the sent from hell innards. I would gleefully strangle the illegitimate individuals who came up with such delights as surface-mounted components, on-screen graphics and menus, digital gizmos, power supplies that contain a mountain of components and when one capacitor dries up it blows the lot of them, tuning and customer controls that no one can understand, VCRs with two-bit mechanisms that you need training from NASA to understand (no I don't want a VideoPlus, I want manufacturers with brains). Despite all the extras now built into TV sets what are we rewarded with? Manufacturers who refuse technical help and customer's whose favourite catch-phrase is "do you do free estimates mate?"

While we're on the subject of companies that refuse to assist us in our hour of need I'd say this: you are paying your man's wages regardless of whether he's advising someone who has or hasn't got an account. I don't have an account with any manufacturers but still buy my parts from them cheque with order, i.e. I don't present a credit risk. So why can't I have technical help? I have as much right to earn a living as an account holder, the owner of the equipment has every right to choose who they want to repair it while the manufacturer has no right to tell the customer where he must go to have a repair carried out. Manufacturers who won't assist with problems and/or make equipment that's incomprehensible to the user or uneconomic to repair after only a couple of years' use will not develop one of the things that's essential to their future – brand loyalty.

I went into this line of work because, I suspect like many of you, I was as a boy fascinated by valves glowing away in mono TV sets and record players. The job satisfaction was like a drug. I now feel, with all the junk that's flogged as TV sets and videos, like a kid who's had his favourite toy taken away.

So, Mr. Anonymous, I hope that if you do decide to try it works out well for you. But you've been warned. I believe this trade is doomed as more stuff is made to be thrown away. So don't expect it to see you through to old age. Mind you I'm only thirty five but feel as though it has already seen me there.

If this hasn't put you off, the customers almost certainly will.
Name and address supplied.

TRAINING TAPES AND SCRUTABILITY

In the October issue Eugene Trundle reviewed the Akai training video tape produced by Visions Video Productions. I would like to point out that we at CHS stock and sell this training video (part code VSAK1) at £19.95 and that it is an edited and up-dated issue – we sold the original Akai version (part code AKVID) some two years ago at £27.95 and, as far as I am aware, were the only component distributor offering this product to the service industry.

We have recently added the Akai Camcorder Video Training tape (part code VSAK2) which is priced at £18.95, the Ferguson ICC5 tape (part code VSFG1) priced at £19.95 and the Philips G Deck tape (part code VSPH1) which is priced at £24.95.

CHS has been selling training video tapes for several years and supplements this service to our customers by supplying the U-View range of circuit diagram books, the Euras Service Tips in book and disc form, the TV/VCR/SAT Fault Guides and also the Ferguson and Hitachi Fault Guide bulletins.

In a letter in the same issue Ian Rees comments that he found firms like CHS, SEME and HRS "inscrutable". I cannot agree when it comes to CHS! We like to think that we are anything but inscrutable, instead being a friendly outfit with a very experienced and stable staff who have on average been with us over ten years, the company itself being in its thirty fifth year.

Yes we do charge for our catalogue, but only to people who don't have an active account with us. This is because we get enquiries from non-trade members of the public. Any new or non-account customer who spends more than £50 will have the catalogue charge of £3.50 credited to their account or next transaction.

We also offer the facility, for people who have no credit references to give, of a small order account that has a credit limit of £100. This is reviewed after a period of account history. The small order account can be paid by cheque or Visa/Access credit card.

As well as being the sole non-account spares distributor for Hitachi and Sanyo, CHS is an approved distributor for Ferguson and Philips and one of the three main distributors for the Konig pattern parts of which Ian speaks so well.
Freddie Whipp, Sales Manager,
Charles Hyde and Son Ltd., Prospect House,
Barmby Road, Pocklington, York YO4 2DP.

AKAI MODIFICATION KITS

Modification kits are available for the Akai VSF30 and VSF33 VCRs. Considering that they consist of two electrolytic capacitors, two diodes, two wire links and instructions they are rather expensive. My advice to engineers repairing these machines is simply to replace C446. It works every time.
J. Luniss, Swindon, Wilts.

NOISY LOPTs

A tendency for the line output transformer to resonate at line frequency is common with some sets. This can at best be described as irritating and at worst renders the set virtually unusable. The transformers concerned are of the 'open' type, not the later, fully-encapsulated diode-split type. One

could replace the transformer of course, but as the problem arises mainly with older sets (Decca 80/100 chassis, Philips KT2/KT3 chassis, Grundig 8632 etc.) this is hardly practical on cost and sometimes availability grounds.

Common 'cures' for loose windings are the application of PVA (wood glue), epoxy resin (Araldite) or cyanoacrylate (Superglue). I've used this solution, with success in virtually every case, on mains transformers, scan coils, linearity coils and so on. For LOPTs Superglue, with its low viscosity when applied and high rigidity when cured, would seem to be ideal: indeed I did see its use for this purpose mentioned in the magazine, but only once.

The thing that concerns me is the insulation properties of Superglue. By using it to cure one relatively minor fault could tracking and flashover between windings be introduced, with the result that an almost serviceable set would have to be written off? I would welcome the opinions of other readers.

Nicholas P.B. Arnold,
Birmingham.

CLEANING LASER LENSES

In his article on CD player repairs in the July issue Les Austin referred to the use of isopropyl alcohol when cleaning laser lenses, mentioning that Sony recommends its use. David Meyer of Sony Consumer Products Company UK wrote denying this in the September issue and suggested that its use is a "gross error".

It's true that Sony recommends a special cleaning fluid, part no. J-250-100-0A, and a special swab, part no. J-250-102-3A. We follow this procedure in our workshop. It's also a fact however that on page 6 of a publication entitled "CD optical block checking procedures (portable/home type) revised", part no. 9-960-027-12, Sony recommends "use the exclusive cleaning fluid (KK-91 or isopropyl alcohol) but do not apply anything else, otherwise."

A gross error with bad results would be the use of an ordinary spray cleaner or ethyl alcohol.

Miguel Ricardo,
Portimao, Portugal.

THE SELF-EMPLOYED SERVICEMAN

I would like to comment on some of the points made by Eric Edwards in his letter (November). I agree that our trade has changed over the years. While it may not be as satisfying now to us older engineers – I mean I'm all of 32 – it's still an interesting trade. Where I disagree with Eric is in the key to success.

I'm one of the self-employed, working from home out of choice in a purpose-built workshop. The business was started with next to no capital. My customers don't regard me as a part-timer: they pay less than shop prices because of my lower overheads, not because they expect to. I'm not out to make myself rich, and charge what I believe is a reasonable rate. Does this make me a cowboy? I hope not – I'm C&G qualified and have sixteen years' experience. If not having a shop or charging high rates makes me a cowboy, what are the minority of shops in this area that charge ridiculous prices for slipshod work which I have to spend my time correcting? I repeat that it's only the minority of shops, but it proves my point that having a shop doesn't mean the person behind the counter is going to do a better job than an engineer working from home.

Steve Tayler,
Leicester.

COMEDY CORNER

We bady need something to help us look on the bright side in this trade. The following is a true story.

It was the first call of the day and the house looked quite normal from outside, as did the middle-aged lady who opened the door to me. Once inside, the large mound in the hall carpet should have served as a warning. The reported fault was no signals, and it didn't take long to establish that the cause of this was the absence of any aerial or even a lead. When I asked where the aerial was the lady's red face said it all. It was apparently her husband's practice to put the indoor aerial under the hall carpet whenever thunder was mentioned in a weather forecast. Only this time he'd neglected to tell his wife!

Perhaps others might like to share some of their lighter experiences.

Robert Philpot,
St. Leonards-on-Sea, East Sussex.

STOLEN

The following items of test equipment were stolen from my garage/workshop on September 15th: (1) HRS PG202 colour-bar generator (blue cased). (2) Meteor 600MHz frequency counter (digital). (3) Thurlby CM200 capacitance meter (digital). (4) HRS EA4003 0-30V variable power supply. (5) Leader LCT910 c.r.t. booster. (6) Altai SE6100 signal injector/tracer. (7) Weller soldering iron/station.

I would be grateful if anyone who might come across such equipment on offer would notify me. I can ill afford to replace these items.

Kevin Blackburn, 19 Herriling Street,
Tickhill, Doncaster, S. Yorkshire DN11 9UE.
Telephone no. 0302 744 330.

MEDICAL MATTERS

In a letter in the July issue Keith Cummins painted a gloomy picture for anyone wanting a polypropylene mesh patch hernia operation and not wishing to go private. My experience here was quite different. I had the operation recently at the Leicester Royal Infirmary, under the NHS, and there was no question of using any method other than the polypropylene mesh patch. Normally a patient spends two days in hospital and is advised to undertake only "light duties" and no driving for two weeks.

My advice to anyone needing this operation is to allow his (or her) GP to make the normal referral to a specialist and obtain all the details from that person.

H.R. Still,
Market Harborough, Leics.

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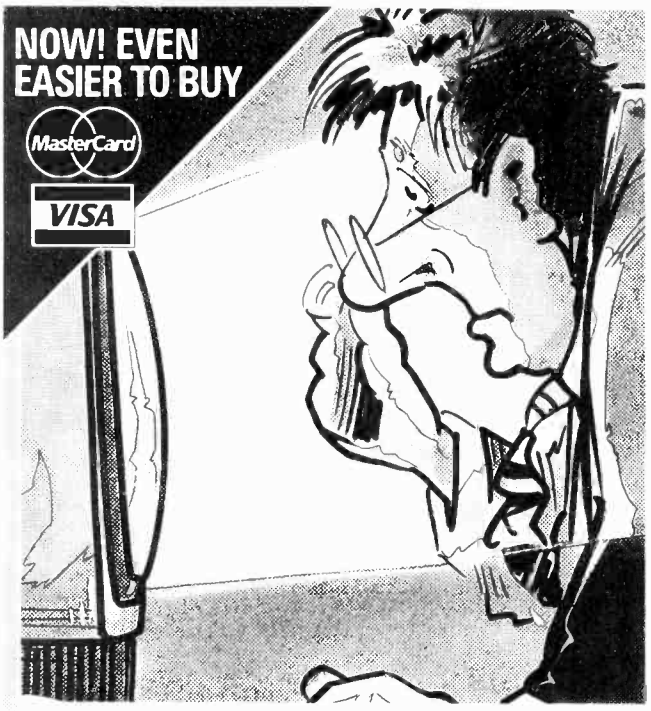

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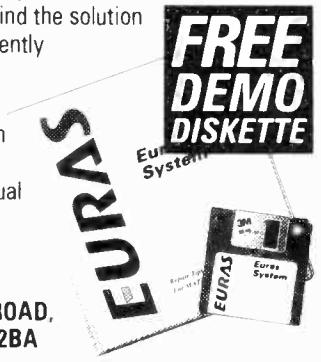

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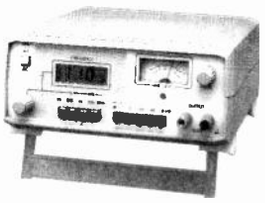

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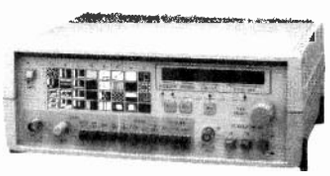

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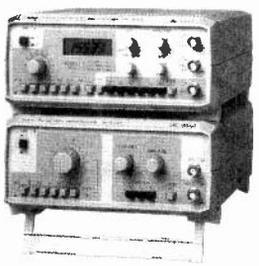

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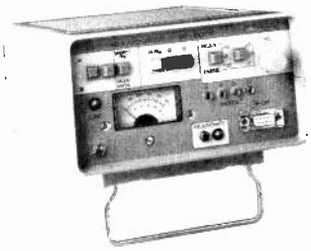

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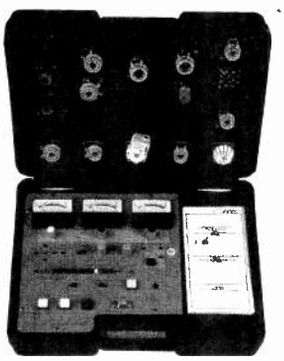

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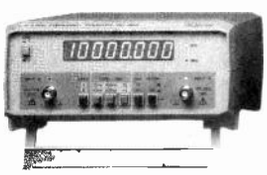

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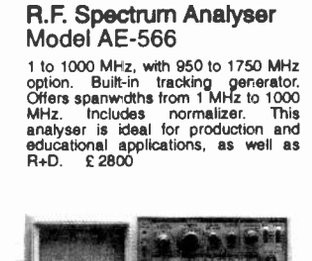

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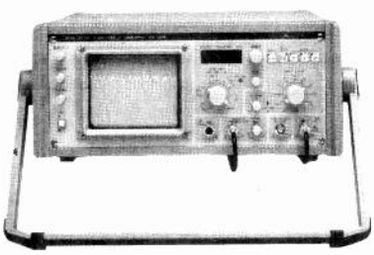

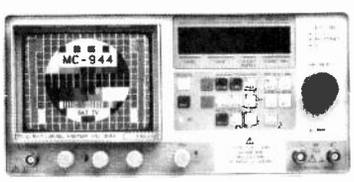

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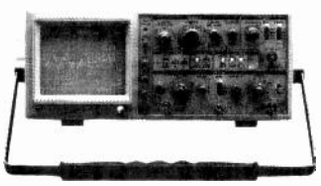

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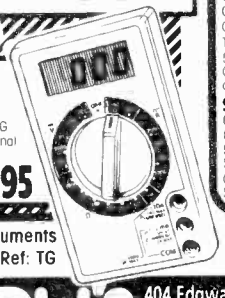

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DOS PACK Microsoft version 5 Original software but no manuals hence only £3 **REF: MAG3P8** 5.25" only

PIR DETECTOR Made by famous UK alarm manufacturer these are hi spec, long range internal units. 12v operation Slight marks on case and unboxed (although brand new) £8 **REF: MAG8P5**

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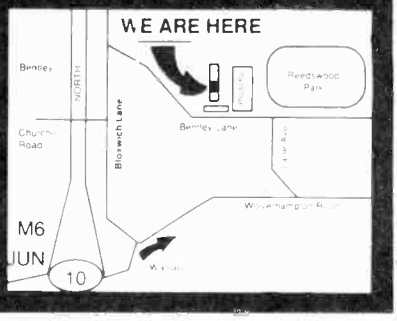

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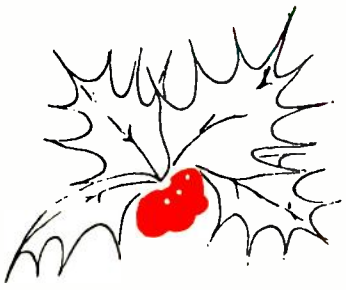

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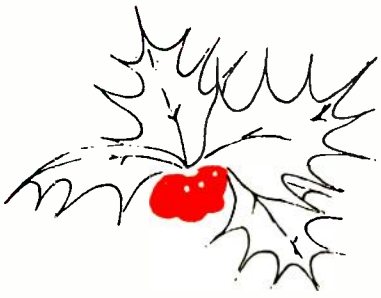

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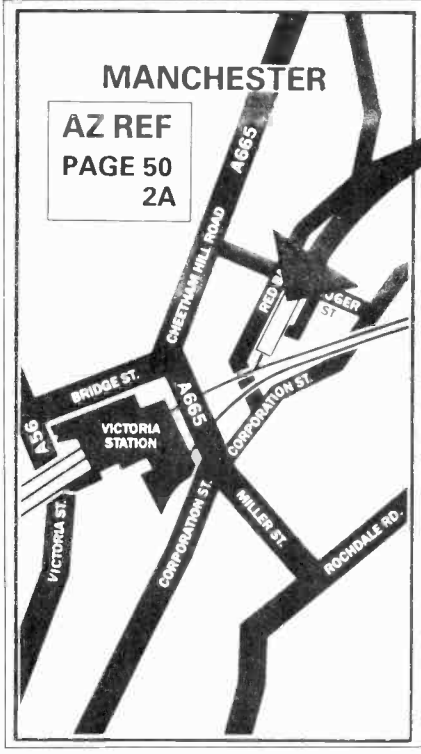

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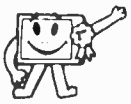

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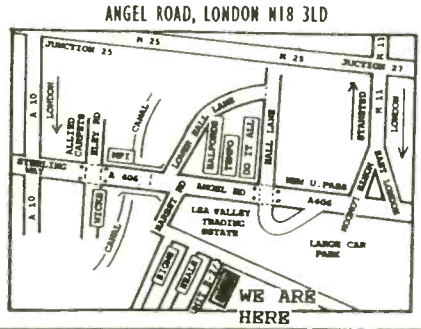

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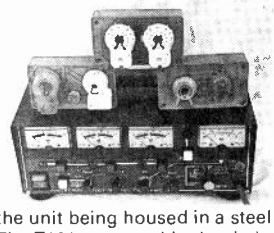

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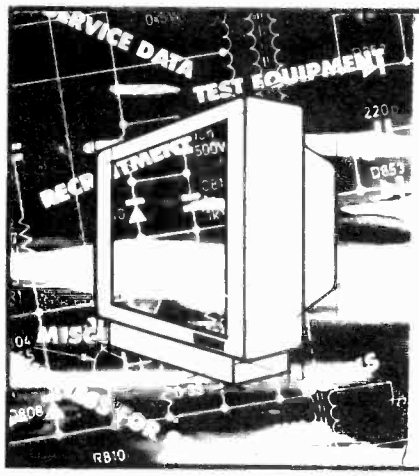

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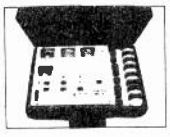

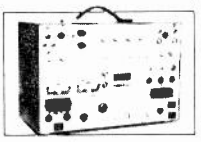

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and short Chassis
Power supply £4.00
Models 1991/1992

BU 208A £1.00
BU 508A £1.00
BU 508D £1.00
BU 508AF £1.00
BU 508DF £1.00
BU 808DF £1.00
BU 801 60p
2SD 1398 £1.00

2SD 1428 £1.00
2SD 1556 £1.00
2SD 1844 £1.00

TDA 2600 £1.50

TX90 Mains Transformer £10.00

TDA 3560 £2.00
TDA 3654 90p
TDA 3653AQ £1.00
TDA 3562A £1.00

STR 4211 £6.00
STR 6020 £6.00
STR 6602D £4.00

01 M4-412-001-RU1
8 WayPre sets for TX10-TX100 £3.00

Philips Handsets
RC 5353
RC5300
RC 5176
RC5177 £8.00 each

Philips 36832 2A LOPT. £15.00

2433274 LOPT £12.00

Line Transformers
Green Spot
White Spot £12.00
Blue Spot each
Yellow Spot

FERGUSON

KT3-K30 Tripler £5.00

U/V Tripler £4.00

Grundig Tripler with Focus Pot £7.00

BG 2087-642-1005 Triplers £7.00
BG 2032-642-3002 £7.00

PERDIO PV 1188 Hand sets £3.00

HANDSETS
Amstrad Export £3.00
Amstrad U/V £3.00
Amstrad 6800 £4.00
Amstrad 6000 £15.00
Amstrad 4700 £5.00
Amstrad 4600 £3.00

IQ081 GEC £3.00

FERGUSON Hand sets
BSB £1.50
ICC5 £5.00
IK2000 £5.00
IK7000 £5.00
SRD 2 £1.00
SRD 3 £1.00
SRD 4 £1.00

PANASONIC TV Video Handset
1993 models with door-
3 types £7.00 each

IRION Hand set
LCD Video Easy Programmer £10.00
RC18 £3.00

PHILIPS
U/V Handset TV/VCR/TXT
Remote RC 5903 £12.00

ORION Hand set
Video RC44 £3.00
Video RC07 £3.00
LCD-RCL £10.00

PANASONIC-TV Original
Handsets for models:
TC1632, TC1642, TC2232
TX2034, TX2044, TX2200
TX2234, TX2244, TX2300
TX2636, TX3300, RC201
replaces TNQ1411/2
£8.00 each

TOSHIBA Hand sets
CT 9511 £5.00

CT 9234 Hand sets
CT 9455
CT 2233
CT 938
CT 9268A
CT 9384
CT 9194
CT 9296
CT 9186
CT 9187A
£3.00 each

AMSTRAD Long Chassis
Display Panel 1992/1993 £4.00

Amstrad Tuner UE33-B01 £3.00

TX10 Focus Units 6 for £10.00

Conversion Kit ITT Teletext £8.00

Burglar Alarm Siren 12 Volt 50p

Amstrad 6000 Head with
motor LP £10.00
Good Lower Drum £3.00

HITACHI sets etc
STR454 £2.00
STR6020 £6.00
S2000AF line o.p. £1.00
2SC940 £1.00
BU105/04 80p
BU108 £1.00
BU124 50p
BU126 80p
BU180a 65p
BU204 60p
BU205 75p
BU206 £1.00
BU207 £1.00
BU208 80p
BU208A £1.50
BU208D 90p
BU222 £1.00
BU326 £1.00
BU407 60p
BU508A 90p
BU508AF £1.00
BU508D 80p
BU705 £1.00
BU806A £1.00
BU807 £1.00
BU808DFI £1.00
BU826 £1.00
BUK454/600 £1.00
BU824 50p
BUT11 50p
BUT11AF £1.00
BUT13 600V-28A £1.00
BUT18AF £1.00
BUW84 60p
BYW20-08-9 £1.00
BYW95 10p
BUX39 25A-150V £1.00
BUX84 50p
BUY49 20p
BUK444/800 £2.00
BUK445/600 £2.00
BUK454/600 £2.00
TDA3047 £1.00
TDA3048 £3.00
TDA3083 £2.00
TDA3190 £1.00
TDA3300B £5.00
TDA3301 £3.00
TDA3505 £3.00
TDA3506 £3.00
TDA3561 £3.00
TDA3560 £4.00
TDA3561A £3.00
TDA3566 £3.50
TDA3564 £4.00
TDA3565 £3.00
TDA3571A £2.75
TDA3581 £3.00
TDA3590 £3.00
TDA3591 £1.00
TDA3592A £3.00
TDA3650 £7.00
TDA3651 £3.00
TDA3651AQ £3.50
TDA3652 £3.50
TDA3653AQ £2.00
TDA3654 £2.00
TDA3654Q £2.00
TDA3710 £3.50
TDA3800 £4.00
TDA3803A £4.00
TDA3180 £2.00
TDA4260 50p
TDA4501 £3.00
TDA4505NE £3.00
TDA4420 £2.00
TDA4439 £2.00
TDA4600 £3.00
TDA4601 £2.00
TDA8190 £3.00
TDA8703 £3.00
TDA8349 £3.00
TDA9403 £1.50
TDA9503 £3.00
TDB2033 £1.00
TDD1610S 50p
TD6306P £2.00
TDA1060 £3.00
TEA1009 50p
TEA1039 £2.00
TEA1060 £2.00
TEA2029C £3.00
IK7 ST6391 B1 £3.00
ST 6393 B1/1M £3.00
BYX10 10p
BYX38/300 25p
BYX55/350 10p
BYX55/600 (Bead) 10p
BYT71/600 15p
BYV95B 10p
BYV95C 12p
BYV96D 10p
BYZ106 10p
BPW41 15p
BYW56 2A/1000vG11 8p
BYW29/50 15p
BYW95C 10p
2SC3795 30p
2SC3973B 30p
2SC4313 £1.00
2SC7350 15p
2SD180 TO3 80v/6A 15p
2SD200 £2.00
2SD401 £1.00
2SD716 £1.00
2SD787 30p
2SD789 30p
2SD820 £1.00
2SD868 75p
2SD880 30p
2SD1264 £1.00
2SD1266 £1.00
2SD1398 £1.00
2SD1415 £1.00
2SD1427 £1.00
2SD1432 £1.00
2SD1453 £1.00
2SD1556 £1.00
2SD1576 £1.00
2SD1577 £2.00
2SD1878 £1.00

SEND FOR "SECTION 2"
Please send SAE