

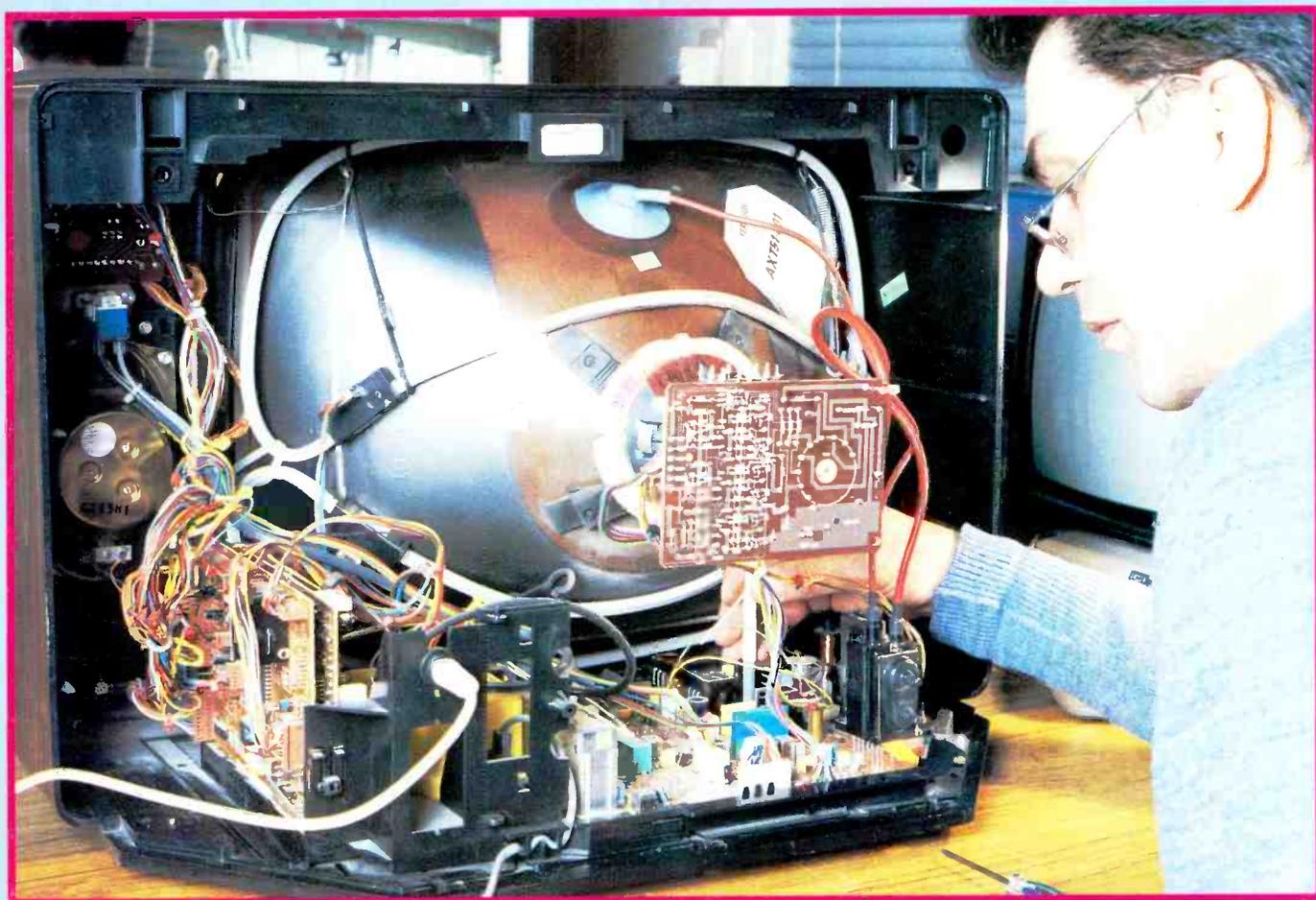
JUNE 1990

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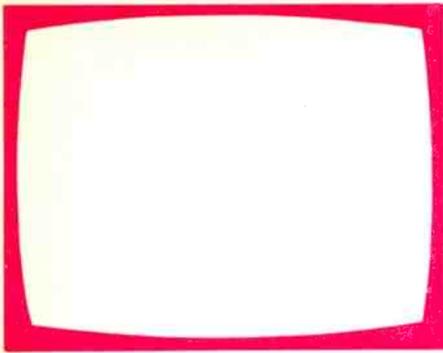
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TELEVISION

June
1990

Vol.40, No.8
Issue 476

On sale May 16th

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CORRESPONDENCE

All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", King's Reach Tower, Stamford Street, London SE1 9LS. Editorial correspondence should be addressed to "Television", IPC Magazines Ltd., King's Reach Tower, Stamford Street, London SE1 9LS.

INDEXES AND BINDERS

Indexes to Vols. 36 and 37 are available at 80p each from the Editorial Office (address above).

Binders that hold twelve issues of *Television* are available for £4.50 from Television Binders, 78 Whalley Road, Wilpshire, Blackburn BB1 9LF. Make cheques out to "Television Binders".

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Annual subscription £20 UK, £24 overseas by surface mail (air mail rate on application). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

BACK NUMBERS

Subject to availability, copies of issues published during the last 12 months are available at £1.80 each from Television, John Denton Services, Unit 13, Thornham Grove, Stratford, London E15 1DN. Please make cheques/postal orders payable to IPC Magazines Ltd.

QUERIES

We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television*, but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them. Correspondents should enclose a stamped addressed envelope.

this month

- 597 Leader**
- 598 Trees and UHF Reception, Part 2** *Bill Wright*
Some particularly tricky situations and the methods adopted to obtain reasonable signals.
- 601 Long-distance Television** *Roger Bunney*
DX conditions and reception and news from abroad. Italian private, Middle Eastern and African Band I transmitter lists to provide a guide for the 1990 SpE season.
- 604 Next Month in Television**
- 605 Letter**
- 606 Teletopics**
News, comment and developments.
- 608 Servicing the Ferguson TX100 Chassis** *J. LeJeune*
The TX100 has turned out to be highly reliable. A guide to the few problems you could encounter.
- 612 An Efficient Linear Power Supply** *Keith Cummins*
Most series regulator circuits have an unnecessarily high power dissipation. One way of reducing the dissipation is to use a thyristor to reduce the input voltage. This practical circuit could be adopted where power saving is sought.
- 614 Philips' Satellite TV Production** *George Cole*
Philips' BSB receivers are now being produced in quantity at the Le Mans plant.
- 616 The Sony Video Walkman** *Mick Dutton*
A look at the technology used in this interesting development, in particular the liquid-crystal display and its drive system.
- 617 Test Cast 330**
- 618 TV Fault Finding**
Reports from Roger Burchett, Alfred Damp, J.S. Ruwala, Nick Beer, Hugh MacMullen, Alan Shaw and Ian Bowden.
- 620 Attenuator Design Program** *John T. Beaumont*
Written in BASIC for the BBC Micro, this program could easily be adapted for use with other computers. It enables attenuator networks, pi and T in balanced or unbalanced form, to be worked out at the touch of a few keys.
- 622 CD Player Casebook**
Fault reports from Philip Blundell, AMIEIE and Mike Leach.
- 626 VCR Clinic**
Fault reports from Philip Blundell, AMIEIE, John C. Priest, Jim Littler, Jeff Herbert, Stephen Leatherbarrow, Nick Beer and Ian Bowden.
- 628 Servicing Compact Disc Players, Part 16** *Joe Cieszynski*
This time a look at the mechanical side of CD players and the problems that can arise here.
- 631 A Visit to Willow Vale Electronics** *Nick Beer*
Since increasing reliance is being placed on component wholesalers it's as well to be aware of the problems they face and the way in which customers can help by clear ordering.

OUR NEXT ISSUE DATED JULY WILL
BE PUBLISHED ON JUNE 20

AA119	9p	BD244	50p	BFY92	35p	R2010B	100p	2N.5320	90p	78GU1C	190p	AN-7178	270p	LA-1130	240p	M-51514	160p	STK-4021	425p	TA-2707	150p	TA-1524	350p
AA32	9p	BD245	50p	BFX29	20p	S2600D	52p	2N.5321	60p	78GU1C	215p	AV3-1015	290p	LA-1150	150p	M-51515BL	220p	STK-4025	600p	TA-2708	145p	TA-1541	1600p
AC107	40p	BD246A	50p	BFX84	20p	S2800M	72p	2N.5366	25p	79GKC	800p	AV3-1270	800p	LA-1185	150p	M-51516	200p	STK-4026	800p	TA-2709	140p	TA-1670A	300p
AC126	25p	BD265	45p	BFX85	20p	S2800M	72p	2N.5401	12p	VALVES		AV3-1350	450p	LA-1201	75p	M-51518	200p	STK-4028	620p	TA-2710	260p	TA-1701	320p
AC127	21p	BD268	45p	BFX86	20p	S2800M	72p	2N.5409	80p	VALVES		AV3-1512	450p	LA-1222	80p	MB-3515	240p	STK-4030	600p	TA-2711	45p	TA-1702A	450p
AC128	21p	BD278	50p	BFX89	30p	TP29	25p	2N.6107	40p	DJ92	50p	BA-311	65p	LA-1230	130p	MB-3712	140p	STK-4044	1000p	TA-2722	120p	TA-1870A	300p
AC128K	30p	BD311	100p	BFY17	30p	TP29A	22p	2N.6109	40p	DY86	50p	BA-301	60p	LA-1231	210p	MB-3713	130p	STK-4046	1100p	TA-2723	210p	TA-1872A	450p
AC141H	30p	BD312	100p	BFY22	30p	TP29C	22p	2N.6114	40p	DY87	60p	BA-313	60p	LA-1232	200p	MB-3714	270p	STK-4048	1280p	TA-2724	200p	TA-1901	120p
AC142K	30p	BD313	100p	BFY51	14p	TP30	25p	2N.6292	40p	DY87	60p	BA-313	60p	LA-1365	120p	MB-3722	200p	STK-4060	850p	TA-2726	290p	TA-1902A	120p
AC176	22p	BD314	100p	BFY52	14p	TP30C	30p	2N.6384	120p	EABC80	30p	BA-333	100p	LA-1368	220p	MB-3724	200p	STK-4101	850p	TA-2727	190p	TA-1908A	90p
AC176K	28p	BD315	150p	BFY64	14p	TP31A	24p	2N.6385	120p	E891	44p	BA-401	60p	LA-1385	170p	MB-3730	200p	STK-4111	850p	TA-2729	300p	TA-1940	280p
AC187	21p	BD316	150p	BFY65	25p	TP31C	24p	2N.6404	150p	EF80	45p	BA-402	60p	LA-1460	220p	MB-3731	200p	STK-4112	850p	TA-2730	200p	TA-1941	300p
AC187K	28p	BD317	150p	BFY66	25p	TP32	24p	3N.143	65p	EF84	45p	BA-402	60p	LA-2000	150p	MB-3750	200p	STK-4121	700p	TA-2732	250p	TA-1950	280p
AC188	21p	BD318	150p	BFY90	45p	TP32A	24p			EC282	80p	BA-511	180p	LA-2101	270p	MB-3759	200p	STK-4122	650p	TA-2733	250p	TA-2002	70p
AC188K	28p	BD331	40p	BLY48	85p	TP32C	24p			EC283	80p	BA-516	150p	LA-2200	190p	MB-8719	360p	STK-4131	550p	TA-2737	400p	TA-2003	80p
AC188	48p	BD361	60p	BLY49	85p	TP33	24p			EC284	70p	BA-521	160p	LA-3101	160p	MC-1468	85p	STK-4141	650p	TA-2739	300p	TA-2004	100p
AC188	48p	BD332	40p	BR100	14p	TP33C	50p			EC285	80p	BA-524	240p	LA-3102	160p	MC-1469	290p	STK-4152	950p	TA-2742	290p	TA-2005	100p
AD13	35p	BD333	30p	BR101	43p	TP34	50p			EC286	70p	BA-524	240p	LA-3220	100p	MC-1488	65p	STK-4162	820p	TA-2745	450p	TA-2006	90p
AD162	35p	BD370	30p	BR303	37p	TP34C	65p	AA119	9p	EC287	80p	BA-527	95p	LA-3300	140p	MC-1488	65p	STK-4172	820p	TA-2747	290p	TA-2009	200p
AD162	35p	BD371	30p	BR306	85p	TP35	65p	BY100	40p	EC288	80p	BA-536	180p	LA-3301	110p	MC-1488	65p	STK-4181	820p	TA-2749	290p	TA-2010	100p
AF124	50p	BD433	28p	BRY49	38p	TP41A	22p	BY103	32p	EC289	80p	BA-536	180p	LA-3302	110p	MC-1488	65p	STK-4191	820p	TA-2750	200p	TA-2010	100p
AF125	50p	BD434	28p	BRY58	33p	TP41C	22p	BY126	6p	EC290	80p	BA-546	180p	LA-3303	110p	MC-1488	65p	STK-4192	1000p	TA-2751	400p	TA-2030	90p
AF126	50p	BD435	31p	BR574	33p	TP42A	25p	BY133	8p	EC291	80p	BA-546	180p	LA-3304	110p	MC-1488	65p	STK-4272	720p	TA-2772	260p	TA-2038	90p
AF127	50p	BD436	31p	BSX26	15p	TP42C	25p	BY134	8p	EC292	80p	BA-546	180p	LA-3305	110p	MC-1488	65p	STK-4301	700p	TA-2773	350p	TA-2040	100p
AF139	30p	BD437	28p	BSX26	15p	TP47	25p	BY173	35p	EF85	65p	BA-616	160p	LA-3375	300p	MC-3401	45p	STK-4302	700p	TA-2774	350p	TA-2041	100p
AF239	30p	BD438	36p	BSX29	19p	TP48	40p	BY184	32p	EF89	85p	BA-684	400p	LA-4030	180p	MC-3403	60p	STK-4303	700p	TA-2775	350p	TA-2042	100p
AF379	30p	BD440	36p	BSX29	19p	TP49	40p	BY196	20p	EF89	85p	BA-684	400p	LA-4031	140p	MC-3403	60p	STK-4304	700p	TA-2776	350p	TA-2043	100p
AS215	100p	BD441	36p	BT106	100p	TP50	60p	BY204	150p	EF89	85p	BA-684	400p	LA-4032	140p	MC-3403	60p	STK-4305	700p	TA-2777	350p	TA-2044	100p
AS217	100p	BD441	36p	BT109	100p	TP51	120p	BY207	11p	EL34	250p	BA-1310	160p	LA-4100	85p	NE-553	75p	STK-4332	450p	TA-2780	330p	TA-2044M	120p
BA145	10p	BD442	40p	BT116	80p	TP52	120p	BY208	18p	EL36	90p	BA-1330	160p	LA-4101	85p	NE-555	20p	STK-4352	450p	TA-2781	270p	TA-2170	300p
BA148	10p	BD520	60p	BT138	60p	TP54	140p	BY210	22p	EL84	75p	BA-1360	160p	LA-4110	120p	NE-566	40p	STK-4362	625p	TA-2782	260p	TA-2270	340p
BA154	10p	BD521	60p	BT138	60p	TP54	140p	BY211	22p	EL84	75p	BA-1360	160p	LA-4111	120p	NE-566	40p	STK-4392	720p	TA-2783	260p	TA-2320	80p
BA157	12p	BD533	38p	BT146	99p	TP105	65p	BY226	18p	EL500	100p	BA-1403	220p	LA-4112	120p	NE-567	115p	STK-4773	1000p	TA-2789	400p	TA-2510	450p
BA256	18p	BD535	38p	BT151	58p	TP106	65p	BY227	19p	EL504	130p	BA-1403	220p	LA-4120	270p	NE-570	360p	STK-4793	1180p	TA-2790	100p	TA-2524	120p
BB1058	18p	BD536	38p	BT151	58p	TP106	65p	BY228	32p	EL504	130p	BA-1403	220p	LA-4121	270p	NE-570	360p	STK-4793	1180p	TA-2791	100p	TA-2524	120p
BB2058	24p	BD537	40p	BU100A	110p	TP107	67p	BY229	20p	EL504	130p	BA-1403	220p	LA-4122	270p	NE-570	360p	STK-4793	1180p	TA-2792	100p	TA-2524	120p
BC108	8p	BD643	40p	BU104	110p	TP110	50p	BY298	20p	EY86	45p	BA-5402	200p	LA-4135	250p	NE-5632P	140p	STK-4833	920p	TA-2793	210p	TA-2541	120p
BC109	8p	BD645	40p	BU105	80p	TP111	50p	BY298	28p	EY86	45p	BA-5402	200p	LA-4137	180p	NE-5632P	140p	STK-4833	920p	TA-2794	210p	TA-2541	120p
BC109	8p	BD645	40p	BU105	80p	TP111	50p	BY298	28p	EY86	45p	BA-5402	200p	LA-4137	180p	NE-5632P	140p	STK-4833	920p	TA-2795	210p	TA-2541	120p
BC109	8p	BD645	40p	BU105	80p	TP111	50p	BY298	28p	EY86	45p	BA-5402	200p	LA-4137	180p	NE-5632P	140p	STK-4833	920p	TA-2796	210p	TA-2541	120p
BC109	8p	BD645	40p	BU105	80p	TP111	50p	BY298	28p	EY86	45p	BA-5402	200p	LA-4137	180p	NE-5632P	140p	STK-4833	920p	TA-2797	210p	TA-2541	120p
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BC109	8p	BD645	40p	BU105	80p	TP111	50p	BY298	28p	EY86	45p	BA-5402	200p	LA-4137	180p	NE-5632P	140p	STK-4833	920p	TA-2799	210p	TA-2541	120p
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BC109	8p	BD645	40p	BU105	80p	TP111	50p	BY298	28p	EY86	45p	BA-5402	200p	LA-4137	180p	NE-5632P	140p	STK-4833	920p	TA-2801	210p	TA-2541	120p
BC109	8p	BD645	40p	BU105	80p	TP111	50p	BY298	28p	EY86	45p	BA-5402	200p	LA-4137	180p	NE-5632P	140p	STK-4833	920p	TA-2802	210p	TA-2541	120p
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BC109	8p	BD645	40p	BU105	80p	TP111	50p	BY298	28p	EY86	45p	BA-5402	200p	LA-4137	180p	NE-5632P	140p	STK-4833	920p	TA-2805	210p	TA-2541	120p
BC109	8p	BD645	40p	BU105	80p	TP111	50p	BY298	28p	EY86	45p	BA-5402	200p	LA-4137	180p	NE-5632P	140p	STK-4833	920p	TA-2806	210p	TA-2541	120p
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BC109	8p	BD645	40p	BU105	80p	TP111	50p	BY298	28p	EY86	45p	BA-5402	200p	LA-4137	180p	NE-5632P	140p	STK-4833	920p	TA-2808	210p	TA-2541	120p
BC109	8p	BD645	40p	BU105	80p	TP111	50p	BY298	28p	EY86	45p	BA-5402	200p	LA-4137	180p	NE-5632P	140p	STK-4833	920p	TA-2809	210p	TA-2541	120p
BC109	8p	BD645	40p	BU105	80p	TP111	50p	BY298	28p	EY86	45p	BA-5402	200p	LA-4137	180p	NE-5632P	140p	STK-4833	920p	TA-2810	210p	TA-2541	120p
BC109	8p	BD645	40p	BU105	80p	TP																	

LINEAR IC'S

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TLO-64	80p	25A-1006	120p	25C-1116	290p	25C-2230	40p	25C-3182	120p	25D-792	100p	25D-1612	425p
TLO-71	38p	25A-1008	120p	25C-1161	110p	25C-2233	100p	25C-3212	510p	25D-795A	140p	25D-1649	425p
TLO-72	55p	25A-1009	200p	25C-1162	35p	25C-2235	60p	25C-3225	100p	25D-811	450p	25D-1651	270p
TLO-74	92p	25A-1010	250p	25C-1164	600p	25C-2236	30p	25C-3244	80p	25D-819	400p	25D-1663	45p
TLO-81	40p	25A-1011	140p	25C-1172	150p	25C-2237	600p	25C-3246	70p	25D-820	450p	25D-1666	50p
TLO-82	46p	25A-1012	100p	25C-1173	45p	25C-2238	70p	25C-3260	300p	25D-821	550p	25D-1667	120p
TLO-83	67p	25A-1013	100p	25C-1174	25p	25C-2239	70p	25C-3262	250p	25D-822	250p	25D-1668	100p
TLO-84	50p	25A-1014	100p	25C-1212	120p	25C-2258	120p	25C-3263	350p	25D-826	100p	25D-1677	100p
ULN-2002	70p	25A-1016	40p	25C-1213	50p	25C-2259	80p	25C-3264	510p	25D-836	150p	25D-1739	450p
ULN-2003	69p	25A-1018	100p	25C-1214	40p	25C-2271	60p	25C-3277	60p	25D-836A	200p	25D-1783	115p
ULN-2004	69p	25A-1060	150p	25C-1215	60p	25C-2274	40p	25C-3280	300p	25D-837	80p	25D-1815	15p
ULN-2008	170p	25A-1076	280p	25C-1216	200p	25C-2275	50p	25C-3281	300p	25D-838	400p	25D-1825	120p
ULN-2803	130p	25A-1085	75p	25C-1226	75p	25C-2278	120p	25C-3283	85p	25D-841	160p	25D-1843	140p
ULN-2804	170p	25A-1085	75p	25C-1278	110p	25C-2290	1800p	25C-3298	120p	25D-844	200p	25D-1846	350p
UPC-16C	220p	25A-1094	190p	25C-1279	30p	25C-2291	125p	25C-3299	120p	25D-845	250p	25D-1884	300p
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UPC-554	130p	25A-1108	150p	25C-1308X	350p	25C-2298	120p	25C-3306	200p	25D-856	80p		
UPC-565	60p	25A-1103	200p	25C-1312	40p	25C-2307	500p	25C-3316	280p	25D-858	250p		
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UPC-574	60p	25A-1106	250p	25C-1325	400p	25C-2314	70p	25C-3333	120p	25D-866	120p		
UPC-575C2	90p	25A-1111	120p	25C-1327	20p	25C-2320	40p	25C-3355	90p	25D-866A	140p		
UPC-576	200p	25A-1123	70p	25C-1328	40p	25C-2324	120p	25C-3356	120p	25D-868	450p		
UPC-577	60p	25A-1124	80p	25C-1342	90p	25C-2331	150p	25C-3358	60p	25D-870	400p		
UPC-580	300p	25A-1127	60p	25C-1345	80p	25C-2332	200p	25C-3371	250p	25D-871	450p		
UPC-592	95p	25A-1141	350p	25C-1358	350p	25C-2333	200p	25C-3383	80p	25D-879	60p		
UPC-596	190p	25A-1142	150p	25C-1359	60p	25C-2334	240p	25C-3400	40p	25D-880	40p		
UPC-1010	170p	25A-1152	150p	25C-1383	35p	25C-2344	150p	25C-3402	50p	25D-882	80p		
UPC-1018	170p	25A-1156	60p	25C-1384	35p	25C-2347	60p	25C-3416	80p	25D-892A	100p		
UPC-1020	170p	25A-1170	500p	25C-1390	55p	25C-2353	120p	25C-3419	120p	25D-894	120p		
UPC-1023	60p	25A-1186	500p	25C-1393	80p	25C-2360	120p	25C-3420	120p	25D-895	200p		
UPC-1025	230p	25A-1198	70p	25C-1398	70p	25C-2361	150p	25C-3429	120p	25D-896	200p		
UPC-1026	95p	25A-1208	70p	25C-1403	500p	25C-2362	50p	25C-3422	110p	25D-897	400p		
UPC-1028	90p	25A-1209	100p	25C-1407	500p	25C-2369	100p	25C-3425	110p	25D-905	600p		
UPC-1031H2	180p	25A-1210	120p	25C-1413	240p	25C-2373	210p	25C-3427	110p	25D-912	130p		
UPC-1032	60p	25A-1211	140p	25C-1419	150p	25C-2389	45p	25C-3459	250p	25D-917	320p		
UPC-1158H2	720p	25A-1220	120p	25C-1426	100p	25C-2407	110p	25C-3460	300p	25D-923	350p		
UPC-1167CL	170p	25A-1262	150p	25C-1448	100p	25C-2412X	50p	25C-3466	350p	25D-947	100p		
UPC-1181	110p	25A-1263	280p	25C-1449	120p	25C-2413	50p	25C-3468	70p	25D-950	300p		
UPC-1182	110p	25A-1265	280p	25C-1450	200p	25C-2458	40p	25C-3470	300p	25D-951	350p		
UPC-1183	200p	25A-1290	150p	25C-1454	320p	25C-2472	40p	25C-3471	50p	25D-957A	500p		
UPC-1185H2	230p	25A-1294	450p	25C-1472	40p	25C-2481	120p	25C-3503	120p	25D-958	60p		
UPC-1186	80p	25A-1295	50p	25C-1475	40p	25C-2482	40p	25C-3504	120p	25D-965	100p		
UPC-1187	150p	25A-1301	350p	25C-1474	125p	25C-2483	40p	25C-3507	120p	25D-970	170p		
UPC-1188H4	400p	25A-1302	400p	25C-1475	60p	25C-2484	240p	25C-3568	200p	25D-973A	70p		
UPC-1197	140p	25A-1317	150p	25C-1505	80p	25C-2500	80p	25C-3583	170p	25D-985	120p		
UPC-1200	325p	25A-1318	150p	25C-1507	140p	25C-2519	60p	25C-3595	220p	25D-986	120p		
UPC-1222	130p	25A-1329	200p	25C-1514	85p	25C-2520	70p	25C-3597	130p	25D-1012	120p		
UPC-1230	210p	25A-1346	30p	25C-1515	60p	25C-2547	65p	25C-3626	280p	25D-1021	120p		
UPC-1238	120p	25A-1353	100p	25C-1520	110p	25C-2550	70p	25C-3637	280p	25D-1022	400p		
UPC-1283	230p	25A-1356	100p	25C-1541	110p	25C-2552	150p	25C-3639	60p	25D-1024	130p		
UPC-1277	240p	25A-1370	100p	25C-1545	120p	25C-2553	200p	25C-3678	280p	25D-1046	200p		
UPC-1278V	400p	25A-1371	100p	25C-1567	120p	25C-2555	150p	25C-3679	280p	25D-1051	130p		
UPC-1325V	320p	25A-1380	100p	25C-1569	140p	25C-2556	150p	25C-3715	120p	25D-1060	130p		
UPC-1350	115p	25A-1381	100p	25C-1570	140p	25C-2557	150p	25C-3717	120p	25D-1061	130p		
UPC-1353	160p	25A-1381	100p	25C-1571	140p	25C-2558	150p	25C-3719	150p	25D-1071	450p		
UPC-1363	190p	25A-1396	400p	25C-1583	30p	25C-2565	230p	25C-3746	120p	25D-1073	350p		
UPC-1365	320p	25A-1422	50p	25C-1584	30p	25C-2566	230p	25C-3789	75p	25D-1094	520p		
UPC-1368H4	425p	25A-1443	250p	25C-1586	40p	25C-2568	120p	25C-3792	120p	25D-1111	520p		
UPC-1373	85p	25A-1489	300p	25C-1617	340p	25C-2577	120p	25C-3795	200p	25D-1128	200p		
UPC-1378	210p	25A-1491	300p	25C-1625	150p	25C-2578	220p	25C-3798	200p	25D-1135	150p		
UPC-1382	110p	25A-1516	60p	25C-1626	130p	25C-2579	130p	25C-3799	200p	25D-1138	80p		
UPC-1384	170p	25B-324	55p	25C-1627	60p	25C-2581	290p	25C-3811	80p	25D-1159	190p		
UPC-1387	650p	25B-370	45p	25C-1674	50p	25C-2582	200p	25C-3832	200p	25D-1160	150p		
UPC-1403CA	750p	25B-546	70p	25C-1675	200p	25C-2583	200p	25C-3853	220p	25D-1163A	220p		
UPC-1409CA	750p	25B-560	35p	25C-1676	200p	25C-2584	200p	25C-3854	220p	25D-1164	120p		
UPC-1420CA	500p	25B-562	35p	25C-1684	45p	25C-2610	85p	25C-3883	280p	25D-1168	280p		
UPC-1458	500p	25B-645A	110p	25C-1685	60p	25C-2611	40p	25C-3890	150p	25D-1169	280p		
UPC-1458	500p	25B-645B	110p	25C-1686	60p	25C-2612	90p	25C-3920	280p	25D-1185	400p		
UPC-1458	500p	25B-645C	110p	25C-1687	60p	25C-2613	90p	25C-4021	280p	25D-1186	400p		
UPC-1458	500p	25B-645D	110p	25C-1688	60p	25C-2614	90p	25C-4022	280p	25D-1187	400p		
UPC-1458	500p	25B-645E	110p	25C-1689	60p	25C-2615	90p	25C-4023	280p	25D-1188	400p		
UPC-1458	500p	25B-645F	110p	25C-1690	60p	25C-2616	600p	25D-198	180p	25D-1190	150p		
UPC-1458	500p	25B-645G	110p	25C-1691	60p	25C-2617	60p	25D-199	180p	25D-1196	150p		
UPC-1458	500p	25B-645H	110p	25C-1692	60p	25C-2618	60p	25D-200	210p	25D-1207	50p		
UPC-1458	500p	25B-645I	110p	25C-1693	60p	25C-2619	60p	25D-201	210p	25D-1210	50p		
UPC-1458	500p	25B-645J	110p	25C-1694	60p	25C-2620	60p	25D-202	210p	25D-1211	50p		
UPC-1458	500p	25B-645K	110p	25C-1695	60p	25C-2621	60p	25D-203	210p	25D-1212	50p		
UPC-1458	500p	25B-645L	110p	25C-1696	60p	25C-2622	60p	25D-204	210p	25D-1213	50p		
UPC-1458	500p	25B-645M	110p	25C-1697	60p	25C-2623	60p	25D-205	210p	25D-1214	50p		
UPC-1458	500p	25B-645N	110p	25C-1698	60p	25C-2624	60p	25D-206	210p	25D-1215	50p		
UPC-1458	500p	25B-645O	110p	25C-1699	60p	25C-2625	60p	25D-207	210p	25D-1216	50p		
UPC-1458	500p	25B-645P	110p	25C-1700	60p	25C-2626	60p	25D-208	210p	25D-1217	50p		
UPC-1458	500p	25B-645Q</											

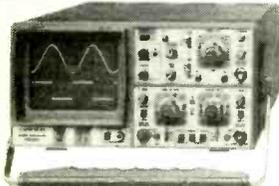
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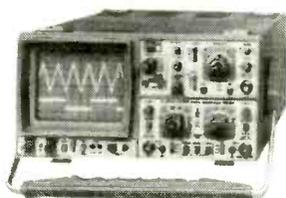
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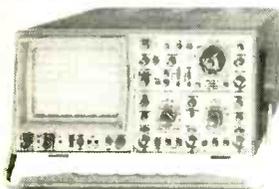
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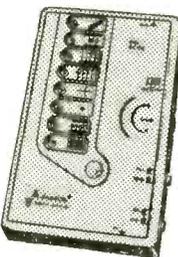
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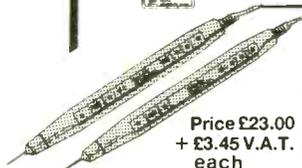
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		HA1481	2.90	TDA1512	3.50	UPC1182H	1.70			BD151	50
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		HA1481	2.90	TDA1670A	4.20	UPC1230H	4.35			BD153	50
		HA1481	2.90	TDA1770A	3.70	UPC1365C	4.20			BD154	50
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		HA1481	2.90	TDA2003	1.55	Z80ACPU	1.75			BD158	50
		HA1481	2.90	TDA2004	2.90					BD159	50
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		HA1481	2.90	TDA2540	1.70					BD168	50
		HA1481	2.90	TDA2541	1.70					BD169	50
		HA1481	2.90	TDA2560	1.95					BD170	50
		HA1481	2.90	TDA2576A	3.25					BD171	50
		HA1481	2.90							BD172	50
		HA1481	2.90							BD173	50
		HA1481	2.90							BD174	50
		HA1481	2.90							BD175	50
		HA1481	2.90							BD176	50
		HA1481	2.90							BD177	50
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		HA1481	2.90							BD191	50
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		HA1481	2.90							BD228	50
		HA1481	2.90							BD229	50
		HA1481	2.90							BD230	50
		HA1481	2.90							BD231	50
		HA1481	2.90							BD232	50
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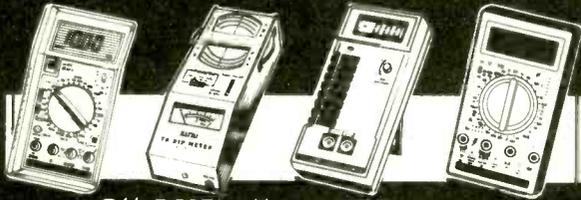
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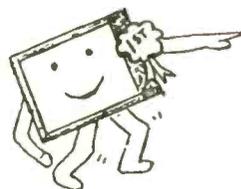
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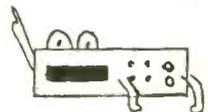
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ONE POUND PACKS

All packs are £1 each. Note the figure on the extreme left is the pack ref number and the next figure is the quantity of items in the pack, finally a short description.

- BD2 5 13A spurs provide a fused outlet to a ring main where devices such as a clock must not be switched off.
- BD9 2 6V 1A mains transformers upright mounting with fixing clamps.
- BD11 1 6 1/2in speaker cabinet ideal for extensions, takes our speaker. Ref: BD137.
- BD13 12 30 watt reed switches, it's surprising what you can make with these - burglar alarms, secret switches, relay, etc., etc.
- BD22 2 25watt loudspeaker two unit crossovers.
- BD30 2 Nicad constant current chargers adapt to charge almost any nicad battery.
- BD32 2 Humidity switches, as the air becomes damper the membrane stretches and operates a microswitch.
- BD42 5 13A rocker switch three tags so on/off, or change over with centre off.
- BD45 1 24hr time switch, ex-Electricity Board, automatically adjust for lengthening and shortening day, original cost £40 each.
- BD49 5 Neon valves, with series resistor, these make good night lights.
- BD56 1 Mini selector, one use is for an electric jigsaw puzzle, we give circuit diagram for this. One pulse into motor, moves switch through one pole.
- BD67 1 Suck or blow operated pressure switch, or it can be operated by any low pressure variation such as water level in water tanks.
- BD103A 1 6V 750mA power supply, nicely cased with mains input and 6V output leads.
- BD120 2 Stripper boards, each contains a 400V 2A bridge rectifier and 14 other diodes and rectifiers as well as dozens of condensers, etc.
- BD128 10 Very fine drills for pcb boards etc. Normal cost about 80p each.
- BD132 2 Plastic boxes approx 3in cube with square hole through top so ideal for interrupted beam switch.
- BD134 10 Motors for model aeroplanes, spin to start so needs no switch.
- BD139 6 Microphones inserts - magnetic 400 ohm also act as speakers.
- BD148 4 Reed relay kits, you get 16 reed switches and 4 coil sets with notes on making c/o relays and other gadgets.
- BD149 8 Safety cover for 13A sockets - prevent those inquisitive little fingers getting nasty shocks.
- BD180 6 Neon indicators in panel mounting holders with lens.
- BD193 6 5 amp 3 pin flush mounting sockets make a low cost disco panel.
- BD199 1 Mains solenoid, very powerful, has 1in pull or could push if modified.
- BD201 8 Keyboard switches - made for computers but have many other applications.
- BD211 1 Electric clock, mains operated, put this in a box and you need never be late.
- BD221 5 12V alarms, make a noise about as loud as a car horn. Slightly soiled but OK.
- BD242 2 6in x 4in speakers, 4 ohm made from Radiomobile - very good quality.
- BD252 1 Panostat, controls output of boiling ring from simmer up boil.
- BD259 50 Leads with push-on 1/4in tags - a must for hook-ups - mains connections etc.
- BD263 2 Oblong push switches for bell or chimes, these can mains up to 5 amps so could be foot switch if fitted into patress.
- BD268 1 Mini 1 watt amp for record player. Will also change speed of record player motor.
- BD283 3 Mild steel boxes approx 3in x 3in x 1in deep - standard electrical.
- BD305 1 Tubular dynamic mic with optional table rest.
- BD400 4 Books, useful for beginners, describes amplifiers equipment and kit sets.
- BD653 2 Miniature driver transformers. Ref. LT44. 20k to 1k centre tapped.
- BD548 2 3.5V relays each with 2 pairs changeover contacts.
- BD667 2 4.7 µf non-polarised block capacitors, pcb mounting.

There are over 1,000 items in our Catalogue. If you want a complete copy please request this when ordering.

12-220V INVERTER KIT. This kit will convert 12V DC to 220V AC. It will supply up to 130 Watts with a large transformer. As supplied it will handle about 15 Watts. Heatsink required. Price is £12.00. Ref: LP17.

TOASTERS. 2 slice toasters - may need slight attention. Only £3.00 each. Ref: 3P84.

PERSONAL STEREOs. Again customer returns but complete and with stereo headphones a bargain at only £3.00 each. Our ref: 3P83.

MAINS OPERATED MICROWAVE CONTROL PANEL with touch switches. This unit has a 4 digit display with a built in clock & 2 relay outputs - one for power & 1 for pulsed power level. Could be used for all sorts of timer control applications. Only £6.00. Our ref: 6P18.

EQUIPMENT WALL MOUNT. It is a multi-adjustable metal bracket that could be used for mounting flood light, loud speaker, TV camera, even a fan and on almost any sort of wall or ceiling even between wall and ceiling. Our price only £3. Our ref: 3P72. Or 2 for £5. Our ref: 5P152.

STABILIZED POWER SUPPLY KIT 2-25V 2A. A kit for a bench or lab power supply containing PCB, transformer, heatsink and all other components. Short circuit protected. Case required. Priced at £20.00. Ref: 20P25.

GEIGER COUNTER KIT. Complete with tube, PCB and all components. 9V operation. Only £39.00. Ref: 39P1.

COPPER CLAD PANEL for making PCB. Size approx 12in long x 8 1/2in wide. Double-sided on fibreglass middle which is quite thick (about 1/16in) so this would support quite heavy components and could even form a chassis to hold a mains transformer, etc. Price £1 each. Our ref: BD663.

POWERFUL IONISER

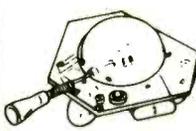
Generates approx. 10 times more IONS than the ETI and similar circuits. Will refresh your home, office, shop, workshop etc. Makes you feel better and work harder - a complete mains operated kit, case included £12.50. Our ref: 12P51.

REAL POWER AMPLIFIER for your car, it has 150 watts output. Frequency response 20Hz to 20KHz and signal to noise ratio, better than 60 dB. Has built in short circuit protection and adjustable input level to suit your existing car stereo, so needs no pre-amp. Works into speakers. Ref: 30P77 described below. A real bargain at only £58.00. Order ref: 57P1.

REAL POWER CAR SPEAKERS. Stereo pair output 100w each, 4-ohm impedance and consisting of 6 1/2" woofer, 2" mid range and 1" tweeter. Each set in a compact purpose built shell mounting unit. Ideal to work with the amplifier described above. Price per pair £30.00. Order ref: 30P7.

STEREO CAR SPEAKERS. Not quite so powerful - 70w per channel, 3" woofer, 2" mid range and 1" diameter. Again, in a super purpose built shell mounting unit. Price per pair: £28.00. Order ref: 28P1.

VIDEO TAPES. These are three hour tapes of superior quality, made under licence from the famous JVC Company. Offered at only £3 each. Our ref: 3P63. Or 5 for £11. Or for the really big user 10 for £20. Our ref: 20P20.



ELECTRONIC SPACESHIP. Sound and impact controlled, responds to claps and shouts and reverses when it hits anything. Kit with really detailed instructions. Ideal present for budding young electrician. A youngster should be able to assemble but you may have to help with the soldering of the components on the pcb. Complete kit £10. Our ref: 10P81.

12" HIGH RESOLUTION MONITOR. Amber screen, beautifully cased for free standing, needs only a 12v 1.5 amp supply. Technical data is on its way but we understand these are TTL input. Brand new in maker's cartons. Price: £22.00. Order ref: 22P2.

MICROWAVE TURNABLE MOTOR. Complete with weight sensing electronics that would have varied the cooking time. Ideal for window displays etc. Only £5.00. Ref: 5P165.

MAINS FANS. Small type construction approx 3" x 4" mounted on a metal plate for easy fixing. New. £5.00 each. Ref: 5P166.

COMPUTER KEYBOARDS. Brand new uncased. Only £3.00 each. Ref: 3P89.

PANEL METERS. 270 deg movement. New. £3.00 each. Ref: 3P89.

SURFACE MOUNT KIT. Makes a super high gain snoothing amplifier on a PCB less than an inch square! £7.00. Ref: 7P15.

CB CONVERTERS. Converts a car radio into an AM CB receiver. £4.00. Ref: 4P44.

EHT TRANSFORMER. Television type line output transformer, good for high voltage experiments. £2.00 each. Ref: 2P277.

COMPOSITE VIDEO KITS. These convert composite video into separate H, sync, V, sync and video. Price £8.00. Our ref: 8P39.

BUSH RADIO MIDSPEAKERS. Stereo pair. BASS reflex system, using a full range 4in driver of 40hms impedance. Mounted in very nicely made black fronted walnut finish cabinets. Cabinet size approx 8 1/2in wide, 14in high and 3 1/2in deep. Fitted with a good length of speaker flex and terminating with a normal audio plug. Price £5 the pair plus £1 post. Our ref: 5P141.

3 1/2in FLOPPY DRIVES. We still have two models in stock. Single sided, 80 track, by Chinon. This is in the manufacturers metal case with leads and IC connectors. Price £40, reference 40P1. Also a double sided, 80 track, by NEC. This is uncased. Price £60.00, reference 60P2. Both are brand new.

REMOTE CONTROL FOR YOUR COMPUTER. With this outfit you can be as much as 20 feet away as you will have a joystick that can transmit and a receiver to plug into and operate your computer and TV. This is also just right if you want to use it with a big screen TV. The joystick has two buttons and is of a really superior quality, with four suction cups for additional control and one handed play. Price £15 for the radio controlled pair. Our ref: 15P27.

ASTEC PSU. Mains operated switch mode, so very compact. Outputs: +12v 2.5A, +5v 6A, ±5v 5A, ±12v 5A. Size: 7 1/4in long x 4 3/8in wide x 2 3/4in high. Cased ready for use. Brand new. Normal price £30+ our price only £13.00. Our ref: 13P2.

VERY POWERFUL 12 VOLT MOTOR. 1/3rd Horsepower. Made to drive the Sinciar C5 electric car but adaptable to power a go-kart, a mower, a rail car, model railway, etc. Brand new. Price £20. Our ref: 20P22.

SINCLAIR C5 WHEELS INCLUDING INNER TUBES AND TYRES
13" AND 16" DIAMETER SPOKED POLY CARBONATE WHEELS
ONLY £6 EACH. 13" Ref 6P10, 16" Ref 6P11.

PHILIPS LASER
This is helium-neon and has a power rating of 2mW. Completely safe so long as you do not look directly into the beam when eye damage could result. Brand new, full spec, £35. Mains operated power supply for this tube gives 8kv striking and 1.25kv at 5mA running. Complete kit with case £15, ditto for 12v battery. Also £15. Our ref: 15P22.

ORGAN MASTER. Is a three octave musical keyboard. It is beautifully made, has full size (piano size) keys, has gold plated contacts and is complete with ribbon cable and edge connector. Can be used with many computers, request information sheet. Brand new, only £15 plus £3 postage. Our ref: 15P15.

FULL RANGE OF COMPONENTS at very keen prices are available from our associate company SCS COMPONENTS. You may already have their catalogue, if not request one and we will send it FOC with your goods.

12 VOLT BRUSHLESS FAN. Japanese made. The popular square shape (4 1/2in x 4 1/2in x 1 3/4in). The electronically run fans not only consume very little current but also they do not cause interference as the brush type motors do. Ideal for cooling computers, etc., or for a caravan. £8 each. Our ref: 8P26.

MINI MONO AMP. on p.c.b. size 4" x 2" (app.) Fitted volume control. The amplifier has three transistors and we estimate the output to be 2W rms. More technical data will be included with the amp. Brand new, perfect condition, offered at the very low price of £1.15 each of 13 for £12.00



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POPULAR ITEMS - MANY NEW THIS MONTH

JOYSTICKS for BBC, Atan, Dragon, Commodore, etc. All £5 each. State which required.

TELEPHONE TYPE KEY PAD. Really first class rear mounting unit. White lettering on black buttons. Has conductive rubbers contacts with soft click operation. Circuit arranged in telephone type array. Requires 70mm by 55mm cut out and is connected by 10-pin IDC socket. Price: £2.00 each. Order ref: 2P251.

SUB-MIN PUSH SWITCHES. Not much bigger than a plastic transistor but double pole. PCB mounting. Three for £1. Our ref: BD688.

AA CELLS. Probably the most popular of the rechargeable NICAD types. 4 for £4.00. Our ref: 4P84.

20WATT 400HM SPEAKER. With built-in tweeter. Really well made unit which has the power and the quality for hi-fi reproduction. 6 1/2in diameter. Price £5. Our ref: 5P155. It is heavy so please add £1 to cover postage if not collecting.

MINI RADIO MODULE. Only about 2in square with ferrite aerial and solid die tuner with its own knob. It is a superhet and it operates from PP3 battery and would drive a crystal headphone direct but be better with our mini mono amp. Price £1. Our ref: BD716.

BULGIN MAINS PLUG AND SOCKET. The old faithful 3 pin with screw terminals. The socket mounts through a 1 1/2in hole and the mains is brought in by the insulated plug. Used to be quite expensive but you can have 2 pairs for £1 or 4 of either plug or socket for £1. You could make yourself a neat and compact bench panel with these. Our ref: BD715, BD715S or BD715P.

MICROPHONE. If you want a low cost microphone then just arrived we have a very small hand-held dynamic mic with on/off switch in the handle, its lead terminates with one 3.5 plug and the other a 2.5 plug for remote control. Price only £1. Our ref: BD711.

MOSFETS FOR POWER AMPLIFIERS AND HIGH CURRENT DEVICES. 140v 100w pair made by the famous Hitachi Company. Reference 25K413 and its complement 25J118. Only £4 the pair. Our ref: 4P42. Also available in H pack. Ref: 25J99 and 25K343 £4.00 a pair. Ref: 4P51.

TIME AND TEMPERATURE LCD MODULE. A 12 hour clock a Celsius and Fahrenheit thermometer a too hot alarm and a top cold alarm. Approx 50 x 20mm with 12.7mm digits. Requires 1AA battery and a few switches. Comes with full data and diagram. Price £6.00. Our ref: 6P12.

REMOTE TEMPERATURE PROBE FOR ABOVE. £3.00. Our ref: 3P60.

A REAL AIR MOVER. Circular axial fan moves 205 cubic foot per min which is about twice as much as our standard 4 1/2in fans. Low noise mains operated 6 1/2in dia. brand new. Regular price over £30.00. Our price only £10.00. Our ref: 10P71.

600 WATT AIR OR LIQUID MAINS HEATER. Small coil heater made for heating air or liquids. With no corrode, lasts for years. Coil size 3in x 2in mounted on a metal plate for easy fixing. 4in dia. Price £3.00. Ref: 3P78 or 4 for £10.00. Our ref: 10P76.

EX-EQUIPMENT SWITCHED MODE POWER SUPPLIES. Various makes and specs but generally +5, +12, -12v lead bench supply. Only £8.00. Our ref: 8P36.

ACORN DATA RECORDER. Made for the Electron or BBC computer but suitable for others. Includes mains adaptor, leads and book. £12.00. Ref: 12P15.

PFTF COATED SILVER PLATED CABLE. 19 strands of .45mm copper will carry up to 30A and is usually undetectable. Available in red or black. Regular price is over £120 per reel. Our price only £20.00 for 100m reel. Ref: 20P21 or 1 of each for £35.00. Ref: 35P2. Makes absolutely superb speaker cable!

NEW PIR SENSORS. Infra red movement sensors will switch up to 500w mains. UK made. 12 month manufacturers warranty, 15-20m range with a 0-10mm timer, adjustable wall bracket. Only £20.00. Ref: 20P24.

MITSUBISHI 3 1/2" DISC DRIVES. Brand new drives, 1 1/2 height double sided, double density warranted. Our price £60.00. Ref: 60P5.

10 MEMORY PUSHBUTTON TELEPHONES. These are customer returns and 'sold as seen'. They are complete and may need slight attention. Price £6.00. Ref: 6P16 or 2 for £10.00. Ref: 10P77. BT approved.

NON-MEMORY PUSHBUTTON TELEPHONES. Same condition as above with radial £3.00. Our ref: 3P79. BT approved.

SPECTRUM PRINTER INTERFACE. Add a centronics interface to your Spectrum complete with printer cable for only £4.00. Our ref: 4P52.

SPECTRUM SOUND BOX. Add sound to your Spectrum with this device. Just plug in. Complete with speaker, volume control and nicely boxed. A snip at only £4.00. Our ref: 4P52.

BBC JOYSTICK INTERFACE. Converts a BBC joystick port to an Atari type port. Price £2.00. Our ref: 2P261.

TELEPHONE EXTENSION LEAD. 5mm phone extension lead with plug on one end, socket on the other. While. Price £3.00. Our ref: 3P70 or 10 leads for only £19.00. Ref: 19P2.

LCD DISPLAY. 4 1/2" digits supplied with connection data £3.00. Ref: 3P77 or 5 for £10. Ref: 10P78.

CROSS OVER NETWORK. 8 Ohm 3 way for tweeter midrange and woofer nicely cases with connections marked. Only £2.00. Our ref: 2P255 or 10 for £15.00. Ref: 15P32.

REVERSING LIGHT ALARM. Fits to car reversing light and sounds when reversing. Only £2.00. Our ref: 2P248.

BASE STATION MICROPHONE. Top quality uni-directional electret condenser mic 600 impedance sensitivity 16-18KHz - 68db built in chime complete with mic stand bracket. £15.00. Ref: 15P28.

MICROPHONE STAND. Very heavy chromed mic stand, magnetic base 4" high. £3.00 if ordered with above mic. Our ref: 3P80.

SOLAR POWERED NICAD CHARGER. A Nicad AA battery charger. Charges 4 batteries in 8 hours. Price £6.00. Our ref: 6P3.

HIGH RESOLUTION MONITOR. 9in black and white, uses Philips tube M24/306W. Made up in a lacquered frame and has open sides. Made for use with OPD computer but suitable for most others. Brand new. £20.00. Our ref: 20P26.

MAINS 15 WATT SOLDERING IRON. Price £3.00. Our ref: 3P65.

SOLDERING IRON STAND. Price £3.00. Our ref: 3P66.

SHARP PLOTTER PRINTER. New 4 colour printer originally intended for Sharp computers but may be adaptable for other machines. Complete with pens, paper etc. Price £16.00. Our ref: 16P3.

CENTRONICS ADAPTER KIT for above plotter printer converts it to Centronics compatible. Price is £4.00. Ref: 4P57.

CAR IONIZER UNIT. Improve the air in your car, clears smoke and helps prevent fatigue. Case req. Price £12.00. Our ref: 12P8.

NEW FM BUG KIT. New design with PCB embedded coil 9v operation. Priced at £5.00. Our ref: 5P158.

NEW PANEL METERS 500A. Movement with different scales that are brought into view with a lever. Price only £3.00. Our ref: 3P81.

STROBE LIGHTS. Fit a standard edison screw light fitting 240V 40 min. flash rate available in yellow, blue, green and red. Complete with socket. Price £10 each. Ref: 10P80 (state colour required).

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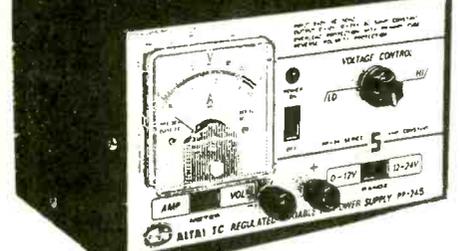
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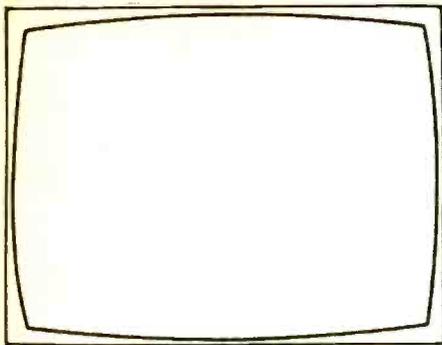
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TELEVISION

The Cost of Service Provision

EDITOR

John A. Reddihough

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COVER PHOTO

This month's cover photograph shows Television Ted with a Ferguson TX10 chassis – see article on page 608.

CORRECTION

The mode switch in the Panasonic D1 deck (see page 518 last month) should be fitted when in the eject, not the stop mode, i.e. no tape in the machine. The notch in the body of the switch will then line up with the notch in the arm.

HELD OVER

Due to shortage of space and production difficulties with this issue we have had to hold over several items we had planned to include. In particular, the letters section will be resumed next month. Keep writing in!

The TV and video business is no bed of roses these days whatever the role you play – manufacturer, dealer or service provider. Despite the fact that the products being offered to the public are increasingly sophisticated, are clearly found to be highly desirable and receive heavy use, the traditional battlefield situation of cut-throat competition and discounting keeps retail prices low. Excessively low we would say, the result being painfully thin profit margins. If even the Dixons of this world find it harder and harder to turn in a respectable profit, what hope is there for the smaller concern? The difficult economic situation shows no sign of any improvement in the short or medium term and dealers, be they large or small, in independent or multiple, are feeling the squeeze as never before. In addition to the squeeze on the spending power of potential customers, businesses are being assailed from all quarters. The burdens faced include rate increases on their premises, demands for higher wages from staff, and in many cases higher overheads in terms of rent, energy prices and insurance.

Some small measure of comfort has come from a general trend, led by manufacturers – with one or two notable exceptions – towards higher prices for TV and video products. This profit increase is very welcome. Not as a get-rich factor but, in many cases, as a survival lifeline. Consumer electronic equipment is increasingly cheap in real terms, but this is neither realised nor appreciated by most customers and users, whose demands and expectations seem to grow by the month.

It may well be that the present situation is providing a boost for the service side of the industry, in that owners of faulty equipment may in borderline cases opt for repair rather than replacement, especially where poll tax demands and increased mortgage payments must take precedence. On the other hand the low cost of new products means that repairs are expected to be done at minimal expense. We could, increasingly, face a throw-away situation, though the public will doubtless expect to be able to get something done about more complex equipment when it ails.

Users have come to expect low prices and a high degree of reliability. They no longer expect equipment to go wrong and get frustrated and annoyed when it does. Unlike a car or plumbing system that most householders understand to some extent, the operation of a TV set, VCR or camcorder is generally a complete mystery to its owner. While this can be useful to the repairer in that people don't dabble much or query diagnoses or repair methods, it does mean that users tend to lump fault symptoms together, especially in bounce situations. While an owner would not associate brake problems with a recent job on the radiator, the situation is quite different if the sound fails in a VCR just after a new tuner or reel idler has been fitted: with no conception of the complexity of their gear, many owners put any malfunction down to a loose wire or blown fuse – and expect a repair bill that reflects this view.

In comparison with the price of new products the cost of providing service is rising steeply. This is now coming into sharp focus as dealers are forced to examine every aspect of their operations in the current economic climate. When the sales and service sides of the business are run separately the running costs, profit margin and efficiency of each are easy to see. In the more traditional establishment where the service department is integrated with the sales operation it's difficult to separate the accounting. Inefficiency, poor management and wastage of resources can go unnoticed for a long time – sometimes until it's too late and the business founders or has to undergo painful surgery.

Provision of service during the guarantee period, whether for the standard one year or the extended schemes even now being promoted by some setmakers, can be a significant drain on a dealer's resources. The guarantee principle is fine, and now that some of the virtually unworkable clauses of the new consumer protection act have been removed it will, when passed, be useful in defining the benefits, extent and standards expected. The provision and implementation of a guarantee is not the basic problem even though the retailer almost invariably loses out on the deal in terms of manufacturers' reimbursements. The problem lies with the customers, almost all of whom have a total misconception about what the guarantee does and doesn't cover. It gives the purchaser a remedy in the event of defective materials and/or faulty workmanship, and nothing else. But most of what's presented for free-of-charge service under guarantee doesn't contain defective materials or suffer from faulty workmanship – indeed these account for a relatively small proportion of call outs and product returns. The rest are due to poor signals, dirty heads, breakages and other misuse, twiddling and finger trouble, incompatibility, failure of the user to understand the equipment or the instruction book, lightning strikes and power surges and so on. The list is a long and weary one and for these – and batteries, styli etc. – manufacturers will correctly not entertain a claim.

If they are to survive, dealers need to be as tough and exacting themselves and make a fair charge for these things. Consumers cannot have cheap prices and free service. It's a difficult situation, but this will have to happen unless the profit margin at the time of sale increases sufficiently to cover such a featherbedding service. This seems very unlikely in the foreseeable future.

Trees and UHF Reception

Part 2

Bill Wright

In this concluding instalment I'll give some practical examples to illustrate some of the techniques previously outlined and to show the peculiar things the aerial man sometimes has to do when faced with his arch-enemy the tree.

The Solitary Oak

It was a lovely summer's afternoon. The call was in a small village I'd never visited before. While driving into the village I noted that the Emley Moor transmitter's massive concrete tower could be clearly seen, about five miles away. No reception problems here I thought cheerfully. The picturesque cottage contained a quaint old lady and a far from quaint up-market TV set. It said "bad text" on the job card, and this was certainly true. The ordinary pictures were terrible as well, especially ITV. There was no snow but a lot of ghosting and there were rapid signal-level fluctuations. Colour came and went. A meter reading at the bottom of the downland swung about wildly – by about 20dB. From the front of the row of cottages it seemed inexplicable: the chimney-mounted aerial looked all right.

From the roof the problem was obvious. A solitary oak stood impassively in the middle of the immense lawn of a mansion whose grounds occupied the land behind the cottages. That old lady's roof was the only one in the village from which Emley Moor couldn't be seen, and there was nowhere on the cottage that wasn't behind the spectacular old tree.

I had the usual unsatisfactory exchange with the old lady about why it hadn't happened before – she was convinced that the new TV set was faulty – then suggested that we approach either neighbour to seek permission for the aerial to be mounted on an adjacent roof. Unfortunately she wasn't on speaking terms with either of them – apparently some unpleasantness about a delinquent cat about twenty years ago was to blame – so that was out. Inadvertently, the mansion owner's gardener saved the situation. To make room for his sit-on lawnmower the tree's lower branches had been removed to a height of about two metres. This gave a clear view of the transmitter from under the mass of foliage – provided you were round the back of the cottage on your hands and knees!

After some experimentation an aerial was fixed to the back wall. Its height was quite critical – it had to be between half and one metre above the concrete path. Fortunately the path was a dead end, and eventually a couple of posts and a rail were installed to fence off the aerial. This installation proved to be completely reliable. The signal strength provided was a constant 23dB/mV. Not quite the theoretical line-of-sight figure, but enough to call for the use of an attenuator.

Problems with a Communal System

One of my jobs is to service the communal aerial systems used at a large estate of flats arranged in blocks of twenty four. Most of the blocks have clear line-of-

sight to the transmitter. The three that haven't are, paradoxically, on higher ground than the rest of the estate. They are on the lower slopes of a hill that's topped by a dense plantation of mixed trees. These trees form the boundary of a large estate and go back quite a long way.

One summer quite a few years ago the tenants of the middle block started to complain. It transpired that they had suffered from slightly impaired reception during the two previous summers. Now it was really bad. I seem to recall that BBC-2 dropped out most severely. Up on the roof it was clear that the trees had grown sufficiently in recent years to obscure the transmitter. When the flats had been built in the mid-Sixties the trees had been nowhere near tall enough to cause problems. As is often the case with a plantation, the tops of the trees presented a fairly regular horizontal line that had moved upwards inexorably as the years passed.

Feeding any sort of communal system from a tree-screened aerial is really bad news. The amplifiers get indigestion, the tenants get high blood pressure and the aerial contractor gets aching legs. It's imperative to find an unscreened location or an alternative transmitter.

The aerial was in the middle of the roof. While walking along the ridge tiles with a test aerial and meter I found a spot where there was still line-of-sight: a narrow fire-break in the trees produced a V in the otherwise straight horizon, and at just one spot on the roof this lined up with the transmitter. There were no funnies. The meter showed correct line-of-sight signal levels on all channels, and within the clear area there were no signal variations. Luckily there was a convenient gable, so an aerial was fixed there pronto. Fifty metres of best-quality Joe Loss – sorry, low-loss – cable took the signal back to the amplifier and the result was magic.

After three more summers the magic wore off. Because of the usual incompetent Housing Association bureaucracy the tenants had been left with really bad reception all summer. This was the year when Channel 4 test transmissions started, and for some reason the new signal was present at the amplifier with sufficient strength to cause cross-modulation. At first I thought that this was the full extent of the problem and wondered why I'd left the amplifier within a few dBs of cross-modulation three years previously.

The tenants were having a right old moan and I was glad to get up the ladder away from all the indignation. On the roof I could see no sign of the V that had been my salvation previously. The fire break had not been maintained – I couldn't even see where it had been. The trees were now much higher. I wondered whether they were bamboo. There was nowhere on that roof with line-of-sight. So I experimented with alternative transmitters. The only possibility gave less than brilliant signal levels however and carried the wrong ITV region – a serious disadvantage with a communal system. It was just possible to obtain line-of-sight with the aerial on a tall mast, but there was nowhere suitable for such an installation and in any case I was reluctant to present the Housing Association with a large bill when the problem

would return after a few more years.

The next block along was behind the trees, but because of the lie of the land the transmitter was visible well above them. It wasn't such an expensive job to fit an aerial on that block and get the signal back to the problem block via 150m of CT125. A catenary wire carried the cable between the buildings and a repeater amplifier was used.

Guess what happened next! Yes, that's right. Two years later the tenants of both blocks were up in arms. This time the trees were so high that the living rooms on the ground floor were dark even in sunny weather and what's more the TV pictures had gone funny again. Wearily climbing on to the roof I found that I couldn't even see the transmitter.

For a while it seemed that the owners of the trees could be persuaded to reduce the height of that part of the plantation because of the daylight problem, but it came to nothing. Right I thought, that's it! I'll cure it once and for all! Four blocks away the transmitter could be seen clearly right down to the bottom of the mast. There were no trees below the line-of-sight, just ploughed fields. The building was on low ground and the forest loomed above, well to one side. I felt that it was an evil but impotent presence.

By now the Housing Association was well aware of the problem. It was unhappy, but was prepared to pay. Trunk cables were installed, linking all the nearby blocks. We were carrying out a schedule of system renovations during this period and ended up with seven blocks fed from one aerial and head-end. The system was well designed and carefully installed. It should have gone on for ever.

It worked perfectly for years. Until last summer in fact, when ITV became rather snowy. A refracted signal from a clump of trees near the main plantation was to blame for this. It was reducing the ITV signal levels by 15dB. Not enough to make the picture snowy when fed straight into a TV set as there was still 8dB/mV, but unacceptable for a largish system. A signal going through the head-end and repeaters at 15dB below its fellows gets noisy. There was a bit of ghosting as well.

There was nowhere on any of those large roofs, and I tried them all, where correct signal levels could be obtained. This effect is very variable with time of course, so channel equalisers were not the answer. I could get things fairly well at certain locations, but there was nowhere that I felt confident about. I suppose I could have fitted channelised preamplifiers with a.g.c. and hoped for the best. In the event I moved the aerial to a location where all the channels were within 7dB of each other and added signals from the remote transmitter with the wrong ITV programmes. The tenants were all given a leaflet to show to their TV engineers. It explained the problem and suggested that all eight signals should be tuned in. Signal levels from the local transmitter were set at the amplifier as if they were normal line-of-sight. They could on occasions go a bit snowy if they wanted to, but they couldn't cause cross-modulation. This ploy seems to have worked well so far.

Aerials on Trees

It's not all that unusual to have to fit an aerial on a tree – this is about the only occasion when a tree will help the aerial man. A tree-top installation is often the only practical way of obtaining line-of-sight over an obstruction.

Needless to say the obstruction is usually the other trees.

In this particular case the customer lived in a bungalow with dense, close woodland that prevented reliable reception from the only possible transmitter. Over the years I'd moved the aerial from one place to another on the roof, always with an unsatisfactory and short-lived improvement. The only garden sloped downwards from the bungalow on the side away from the transmitter, so the roof was the obvious place for the aerial – except that there was one really tall tree at the bottom of the garden. Although the tree's base was on very low ground, observation from a distance showed that its top was definitely line-of-sight. Over the years I kept trying to persuade the customer to let me put an aerial on top of the tree, but he was worried about what he called the aesthetic aspect. I would ask him which he looked at most, the top of the tree or the TV picture. Finally his wife made his see sense. I don't like climbing trees, but a man's gotta do what a man's gotta do.

It was a pig of a job. It was raining on the day and the only access to the tree was down the steep, muddy lawn. I'll draw a veil over the hazards of working with a chain saw at the top of such a large tree. A few branches were removed so that the tree didn't obscure the aerial. The downlead was routed from the base of the tree along a fence to the garage, then overhead to the bungalow. I fitted an amplifier about half way along the cable run and a distribution amplifier in the loft to feed five outlets. There have been no further reception problems.

As long as care is taken to remove obstructing branches, the movement of a tree in the wind has surprisingly little effect on reception from an aerial it supports.

The Upside Down Aerial

A local relay is not the complete answer to poor reception in a particular neighbourhood. In this case the prominent feature of the town was its castle. It stands on a rocky outcrop whose lower slopes are wooded. The appropriately named Low Road skirts the castle grounds. There are hills surrounding the area, except in the direction of a high-powered transmitter 30km away.

Reception directly behind the castle is awful. A low-powered relay transmitter was finally provided but was a great disappointment. It serves only about a quarter of the houses that need it, transmitting a highly-directional beam to one small area. When the BBC and the IBA plan these things they drive around the area in a Range Rover with a log-periodic aerial on a telescopic mast. An afternoon of this is the full extent of their research. They haven't a hope of discovering all the nooks and crannies where reception is bad. If they asked all the local riggers to mark the bad reception on a large-scale map they would learn far more at less cost. The excuse given for installing these highly-directional, under-powered relays is that anything better might cause co-channel interference outside the area. But in a lot of cases, including this one, the excuse is invalid since the transmitter is screened all round by high ground.

One particular customer had terrible reception through the trees that surround the castle. He'd tolerated it for several years on the promise of this eagerly-awaited relay. When it came into operation I was unable to get more than -12dB/mV from it at the site, and that was with severe ghosting. The transmitter was only

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about 700m away, but the transmitting aerial pointed in the wrong direction. Reception of a sort was possible by directing the aerial at the castle and receiving the reflection, but this signal wasn't good enough to use.

Having established that the new relay was a washout I started looking towards the main transmitter. The trees are very close and very dense. After some time I found one point on the roof where the signal levels reached the dizzy heights of 0dB/mV. This is 20dB below the line-of-sight figure so it wasn't good, but it was much better than the levels of the signals coming from the existing aerial – one channel was at -27dB/mV. The relevant point in space was at the base of the chimney. High ridge tiles made it impossible to fit a lashing wire low down, while the brickwork was in such poor condition that a wall bracket would have been unsafe. I installed a chimney lashing kit with the mast protruding downwards, then fitted the aerial at the bottom of the mast, just above roof level. Because a long downlead had to be used a low-gain masthead amplifier was fitted – with some misgivings about the possibility of cross-modulation in winter. This greatly improved the reception. I warned the customer that this improvement might be short-lived, but in fact the installation has proved to be fairly reliable and no further work has been required.

Customer Relations

If there's no alternative to obtaining reception through dense foliage the aerial installer must make plain to the customer the limitations of what can be achieved. There is no guarantee of reliable reception under these circumstances: if you offer a guarantee, even if only by implication or by the omission of a disclaimer, you are making a rod for your own back. You must honour the normal warranty on materials and workmanship of course – this is a legal requirement and a good tradesman will do this automatically. But you can't be held responsible for any tricks that trees might pull. In other words you are responsible for the aerial but not for any variation of the incoming signals at a later date.

It's all too easy to be held responsible for things that are beyond your control. The result can be a lot of hassle. Explain the problem to your customer fully. People often assume that they should be able to get perfect reception no matter where they choose to live. You must dispel this illusion. Give the customer an honest assessment of the chances of achieving reliable reception and explain the ground rules *before* you install the aerial. If you can see a wildly expensive solution that would be absolutely cast iron, such as a remote aerial and a 500m downlead, let the customer know about it. If he rejects the idea in favour of a cheaper solution you've transferred a large part of the responsibility to him.

If you find yourself with a customer who cannot accept this limitation of your responsibility and insists on an unconditional guarantee you must decline the job. Cut your losses and leave him to the mercy of the local cowboys. As you drive past the house over the next few years you'll have the amusement and satisfaction of seeing a quick succession of jerry-rigged aerials appear on the roof, probably ending up with a hopeless wideband DIY special. Remember that if a person lives in a place where TV reception is unpredictable it is, initially, his problem. It becomes yours only with your prior agreement, which must be on your terms.

Long Distance Television

Roger Bunney

March produced summer-like weather in the UK, with long hours of sunshine and temperatures rising into the mid-60s Fahrenheit. By early April temperatures were plunging to below freezing point. Less remarkable were the DX-TV conditions, which provided minimal cheer during the month. By the time these lines are read the Sporadic E season should have started. Let's hope it will be a good one. The following is an "ionospheric" log, reception being SpE unless otherwise indicated.

- 5/3/90 Iran ch. E2 test card at 1055 via F2.
- 6/3/90 TVE (Spain) ch. E2.
- 14/3/90 Unidentified programming on ch. E2 via F2.
- 16/3/90 TVE E2.
- 18/3/90 An Arabic ch. E2 station received at 0920 via F2.
- 20/3/90 NRK (Norway) E2; DR (Denmark) E3; SVT (Sweden) E2; RUV (Iceland) E4. TSS (USSR) R1 and ch. E2 Arabic script were received via F2.
- 27/3/90 CST (Czechoslovakia) R1.
- 28/3/90 ARD (West Germany) E2.
- 30/3/90 TVE E2.

Auroral activity was mainly reported from Scotland. An evening opening on the 13th produced ch. E2/R1 signals and RTE (Ireland) ch. IB. There was nightly activity over the 18-24th and further activity in the evening of the 28th.

There were several periods of tropospheric enhancement over most of the UK, the result of high-pressure systems and the delightful weather. Band III/u.h.f. signals from France and West Germany, also the low countries, were received over much of the UK on the 7th. For those in the south west TVE (Spain) lifted out of the noise on chs. E9 and E37. Five days later another event occurred with similar reception and the bonus of Switzerland chs. E6, 7 and 34 – a cheering sight. There was a spell of intense tropospheric reception on the 16-18th. West and East German signals were received (DFF chs. E11, E12 and E34), Danish TV1 and TV2 signals

were seen extensively and, from a greater distance. Swedish SVT-1 and -2 stations were noted on chs. E6/43 and E24/33 respectively. TVE was present in the south west on chs. E8/9/31. Conditions deteriorated on the 17th but peaked up on the 18th with in addition to the previously noted signals Switzerland chs. E6/7/31/34 and ORF (Austria) chs. E5/24. The final tropospheric opening occurred on the 26th, with an even wider range of signals including NRK (Norway) E10/11, SVT E6/9/30 and DR E5/8/30/37.

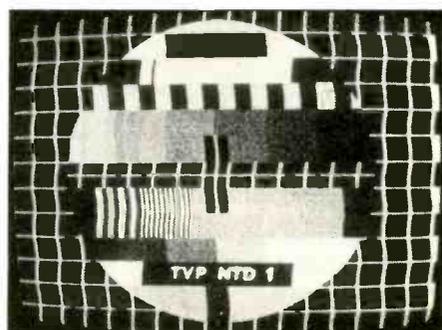
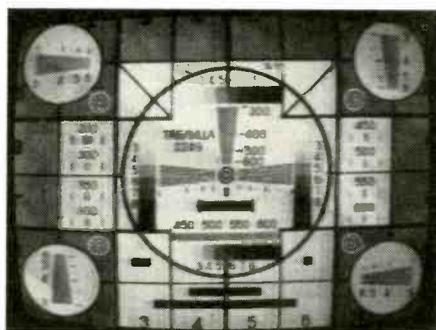
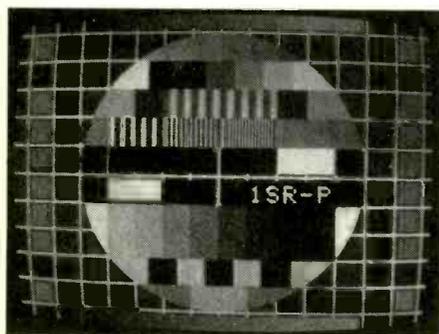
There was random daily MS (meteor scatter) reception throughout the month. Bill Cotterill at Tipton achieves regular, sustained MS reception from across Europe on a daily basis. There's a lot to be seen if you've the time and the patience.

My thanks to Peter Schubert (Rainham), Bill Cotterill (Tipton), Simon Hamer (Powys), Ian Menzies (Aberdeen) and Roger Fussell (Torpoint) for sending in reports.

Peter has recently returned from a four week holiday around the world via Hong Kong, Australia, New Zealand and the USA. He maintains that UK TV is the best in the world. He noted that there were two Chinese- and two English-language channels in Hong Kong, all with many commercials. Brisbane and Melbourne each have five channels, three commercial, one ABC (government) and one ethnic. New Zealand has three channels, two run by the NZBC and the commercial TV3, all carrying advertisements and with many UK and US programmes mixed in with the local content. Peter's US hotel TV carried 12 channels, a mixture of cable and satellite material plus local services. Programmes are spoilt by the intrusion of advertisements – Peter was not impressed with American TV.

Robert Copeman and Anthony Mann have both written in recently to report on reception in Australia. F2 reception seems to have been better down under. Robert's log includes several days with intense F2 signals, including low-v.h.f. band mobile transmitters and Radio Beijing harmonics (30.3 and 34.1MHz are favourites). Anthony heard US pagers at up to 43MHz on the 8th and 17th, with weak backscatter F2 in early March.

Bill Cotterill is experiencing serious difficulties in Band I. A local computer produces the usual raster – a central dark square with light border – and Bill comments that large figures appear in the square. On certain days radiation occurs for ten hours. The problem jams much of Band I. More recently a pirate f.m. transmitter operating at Smethick near Birmingham has been jamming ch. R2. Down here in south Hampshire we get



All the photographs above show reception by David Glenday in Arbroath during the 1989 SpE season. Left: The new Czechoslovakian test pattern. Centre: The USSR 0249 monoscope test pattern. Right: The Polish version of the PM5544 test pattern – note the dark background and absence of side panels.

problems with computers, 49MHz baby alarms and kids' walkie-talkies, the latter being sold for as little as £5 a pair.

Satellite TV News

Galavision over PanAmSat (PAS-1) at 45°W varies in signal strength and frequency. Both 525/NTSC and 625/PAL signals have been noted.

Canal Plus has bid for Filmnet, whose profits have been falling. Meanwhile Filmnet is considering the use of a different scrambling system. The Cable Authority has banned RTL+ from UK cable systems.

Due to the failure of the INSAT IC/ID craft India is to use twelve transponders on Arabsat B which is now at 26°E to improve its coverage of India. Currently only 50 per cent of Arabsat's capacity is being used.

The Japanese BS3a satellite is due up later this year. Japan Satellite Broadcasting (JSB) is to use one channel and NHK two.

Despite efforts to get German broadcasters to use Kopernikus (DFS-1) and the later DFS-2, Astra seems to be attracting most operators. Teleclub, which is likely to be bought by Canal Plus and relaunched as "Premiere", is being carried by Astra 1A. Tele-5, Discovery and TRT Turkey are considering whether to opt for Astra 1B.

RTL-V is considering a change of encryption standard. Superchannel is hoping to obtain a downlink on the second generation Eutelsat craft due to be launched later this year.

SpE Prospects

You may be feeling that with the trend for European TV transmissions to move from Band I to Band III/u.h.f. and the increasing interference at 49/50MHz there is less likelihood of SpE reception in the UK. There are still many Band I transmitters in Italy, Africa and the Middle East however, so there's the opportunity for the vigilant to get some quite dramatic catches. Accurate listings of these transmitters are rare, but information from Gosta van der Linden and the Benelux DX Club enables us to publish the following lists as a guide for the coming SpE season.

Italian Private Stations

<i>Service/channel</i>	<i>Transmitter location</i>
Telemarket/E2	Monte Penice, Lombardia
Tele Ercolano/E2	Naples, Campania
Telemellina/IA	Pavia, Lombardia
Quarta Rete TV/IA	Torino, Piemonte
Audiovision/IA	Milano
Telefriuli/IA	Udine, Friuli
Tele-Uno/IA	Tarvisio, Friuli
Tele Valle Aosta (TVA)/IA	Sarre, Aosta
Canala A/IA	—
Telesettelaghi S.r.l./IA	Varese, Lombardia
Canala Crema/IA	Milano
VideoMusic/IA	Castelvecchio Pascoli, Lombardia
Telebari/IB	Bari, Puglia
Telelibera/IB	Perugia, Umbria
Tele Trieste MIA/IB	Trieste, Venezia Giulia
Teleradio San Marco/IB	Cosenza, Calabria
TO Sardegna/IB	Sassari, Sardinia
Teleor/IB	Oristano, Sardinia
TVS Quattro Mori/IB	Cagliari, Sardinia
Telelibera/IC	Perugia, Umbria
Radio TV Atri/IC	Atri, Abruzzo
Rete 7 Piemonte/IC	Torino, Piemonte

African Band I Transmitters

Dumyat	ERTU-2	E2	0.9kW	Egypt
Freetown	SLT	E2	1kW	Sierra Leone
Gwelo	ZBC	E2	17.6kW	Zimbabwe
Kabwe	TZ	E2	0.8kW	Zambia
Kissi	GBC	E2	15kW	Ghana
Kisumi	VOK	E2	15kW	Kenya
Malabo	TNE	E2	1kW	Equatorial Guinea
Mahe	RTS	E2	1kW	Seychelles
Abafon	NTA	E3	15kW	Nigeria (Ibadan region)
Bulajewo	ZBC	E3	3kW	Zimbabwe
Jamasi	GBC	E3	15kW	Ghana
Jaradi	NTA	E3	15kW	Nigeria (Sokoto region)
Lusaka	TZ	E3	0.8kW	Zambia
Monga	TZ	E3	0.5kW	Zambia
Solwezi	TZ	E3	75W	Zambia
Izana	RTVE	E3	350kW	Canary Islands
Ajancote	GBC	E4	15kW	Ghana
Big Bend	STBC	E4	0.5kW	Swaziland
Dumyat	ERTU-1	E4	0.9kW	Egypt
Harare	ZBC	E4	20kW	Zimbabwe
Ibadan	NTA	E4	15kW	Nigeria (Ibadan region)
Jaji	NTA	E4	15kW	Nigeria (Kaduna region)
Kitwe	TZ	E4	40kW	Zambia
Malherbes	MBC	E4	15kW	Mauritius
Nairobi	VOK	E4	30kW	Kenya
Scaba	STBC	E4	10W	Swaziland
Laayoune	RTM	E4	240kW	Morocco
Remada	RTT	E4	40kW	Tunisia

Big Bend and Scaba have vertical polarisation, the rest horizontal.

Middle Eastern Band I Transmitters

Fih	TL-1	E2	1.1kW	Lebanon
Beit-Mery	TL-3	E2	1kW	Lebanon
Jounieh	TL-2	E2	1kW	Lebanon
Dubai	DRCTV	E2	240kW	UAE
Iran	IRIB	E2	—	Iran
Homs	ORTAS-2	E2	—	Syria
Jounieh	LBC	E2a	200W	Lebanon
Abou K'mal	ORTAS-1	E3	200kW	Syria
Nabi-Saleh	ORTAS-1	E3	100kW	Syria
Swaileh/Amman	JTV-1	E3	104kW	Jordan
Bagisli	TRT-1	E3	2.5kW	Turkey
Shiraz	IRIB	E3	20kW	Iran
Dharan	Ch.3TV	E3	5kW	Saudi Arabia
Habshan	UAETS-1	E3	5kW	UAE
Maasser el Chouf	TL-2	E4	60kW	Lebanon
Hassakeh	ORTAS-1	E4	200kW	Syria
Salkhad	ORTAS-1	E4	640W	Syria
Haddar	ORTAS-1	E4	200W	Syria
Istanbul	UT	E4	500W	Turkey
Hamedan	IRIB	E4	108kW	Iran
Shah Nakhjeer	IRIB	E4	200kW	Iran
Al-Ainah	YTV	E4	400W	Yemen
Isa Town	BT	E4	120kW	Bahrain

Fih has vertical polarisation. Where known all the rest have horizontal polarisation.

News Items

Spain: Antenna-3 has proved unpopular with viewers and a considerable investment is to be made in programme/news improvement. Tele-5 is more popular. Canal Plus Espana has delayed opening until the Autumn. Canal Sur (Andalusia) has been fined for

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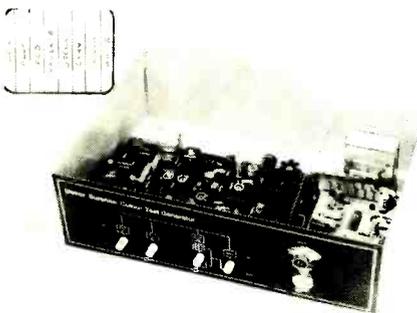


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TELEVISION

● DE LUXE COMPONENT TESTER

Many scopes incorporate a component tester. This enables you to check a component by looking at the waveform produced when a test a.c. waveform is applied to it. A simple component tester design for use with an oscilloscope was published in our June 1984 issue and proved to be very popular. Such a device can make the servicing of complex equipment relatively simple, since it's often quicker to use it to check every component on a PCB rather than to spend time tracing through the circuitry and checking likely items. The de luxe component/signature tester presented next month, designed by David Botto, is easy to build and simple to use. It has many extra features. Diodes, zener diodes, transistors, thyristors, i.c.s, LEDs, VCR end sensors, capacitors, resistors, mains transformers and loudspeakers can all be tested. In-circuit and continuity checks can be carried out. Signature touting? Well, any network/circuit section will produce a distinctive pattern or signature: once you know what to expect in equipment commonly dealt with you can make simple spot checks. The tester is particularly helpful for identifying unmarked surface-mounted and other components and can be used with almost any scope.

● SERVICING THE FERGUSON FV30B's PSU

Many video engineers treat this VCR with suspicion because of its switch-mode power supply. It's not a difficult circuit to sort out however. A look at its operation and guidance on fault finding.

● CD PLAYER SERVICING

The next instalment in Joe Cieszynski's series deals with the power supply arrangements used in CD players.

● TEST REPORT

Nick Beer on the EV4061 vectorscope and waveform monitor from Electronic Visuals.

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HA11244	165p	TD311V	165p	STR7217	640p	2SB75	750p	PAN NV333 FF-REW IDLER	170p
HA12002	280p	TC41010	90p	STR7308	565p	2SB929	255p	HRD 110/120 CARRIAGE	2350p
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HA13403	550p	TD41029	280p	STR441	460p	2SC380	20p		
KA2101	165p	TD41047	360p	STR451	470p	2SC506	395p		
LA1207	245p	TD41170S	100p	STR455	660p	2SC998	305p		
LA1260	300p	TD41412	100p	STR456A	665p	2SC1018	145p		
LA1352	145p	TD41908A	95p	STR1096	400p	2SC1172	145p		
LA1365	110p	TD42002	110p	STR4090	625p	2SC1185	100p		
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LA5527	140p	TD43590	320p	AC141	35p	2SC1730	38p		
LM301	25p	TD43653	365p	AC142	35p	2SC1942	180p		
LM339	35p	TD44100	325p	AC120	30p	2SC3655	55p		
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LM3915	240p	TD43590	320p	BD135	25p	2SC655	55p		
LB1405	225p	UPC324C	70p	BD124	110p	2SC792	380p		
LB1416	225p	UPC571H	190p	BD238	32p	2SC819	370p		
MS143P	285p	UPC1001H	200p	BF240	12p	2SC836	140p		
MS186AP	325p	UPC1161C	140p	BF259	70p	2SC845	240p		
MS214	135p	UPC1178C	105p	BU126	68p	2SC849	225p		
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breach of copyright. Early March saw the opening of Telecino Madrid. Algeciras TV closed in late 1989 but has since been seen on ch. E48 with the callsign Canal Cuatro TV. The director of Algeciras TV previously intimated that if the Spanish authorities wouldn't let him transmit he would approach the authorities in Gibraltar. Spanish telecommunications authorities are still seeking the source of Canal Cuatro TV!

Portugal: With the privatisation/commercialisation of TV additional channels are being made available. There's a suggestion that the authorities will require half the programming to be in Portuguese and ten per cent locally produced. A fourth channel is being considered though there are potential interference problems with Spanish and Moroccan transmitters.

West Germany: The satellite programme PRO7 is being transmitted over the ch. 46 Hamburg and Bremen outlets. Tele-5 was previously carried by the Hamburg transmitter: RTL+ is carried outside the PRO7 hours.

Eastern Europe: Relaxation is taking place in Hungary. There have already been 32 applications for franchises, seven for Budapest city, four seeking more national coverage and two hoping for coverage extending into Austria. Most are commercial though some are political/community orientated. Italian TV magnate Silvio Berlusconi is seeking interests in both Hungary and Poland.

In Yugoslavia the first and second network feeds from TV Zagreb are to carry regular stereo sound using a system similar to the German one, i.e. with two subcarriers spaced from the main vision carrier. TV Ljubljana is now using teletext of the UK type. Zagreb has also opted for this standard.

New transmitters

The following transmitter openings have been reported to us by the BDXC, all in Denmark. Vendsyssel/Mosbjerg ch. E56H (relays Nordjylland); Kollund ch. E31V (relays Sydjylland); Kobenhavn Vest ch. E31H (main Sydjylland transmitter); Helsingor ch. E40V and Kalundborg ch. E56V both relaying Sjaelland. H = horizontal and V = vertical polarisation.

Letter

VINTAGE RADIO

In reply to David Tilley's letter in the March issue, may I suggest an economic modification for valve replacement in the DAC90A and similar Bush receivers? This is to substitute a B9A valveholder for the B8A used with the UL41 output valve and rewire it so that a UL84 can be fitted. The connections are easy to transfer and no component value changes are required. Audibly the circuit behaves as previously, despite the fact that the preferred diode load is some $2k\Omega$ "out", but the wallet takes a great rest. I should add that I've received suitable admonishment from Chas E. Miller in his *Radiophile* magazine because this modification "destroys the historical authenticity".

The UL84 and UL41, as well as the UCH41 and UF41, can be obtained from Colmor Electronics, Goldhawk Road, Shepherd's Bush, London W6 or East Cornwall Components (Marco Trading), Wem, Salop.

David Porter,
Ludlow, Shropshire.

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ANOTHER SHAMBLES

Only a few thousand receivers were available for the start of the BSB services on April 29th. These naturally went to those involved with the BSB Launch Club. Everyone knows what the problem has been – the time taken to develop and get into manufacture the decoding chips required. What is a bit of a mystery is why BSB didn't take this into account. It's a fact of life in the chip industry that new devices take a couple of years to get into production.

To take full advantage of the MAC transmissions the signals should be decoded and fed to the TV set/monitor in RGB form. What about recording? Syntronix (St. Matthews House, Brick Row, Darley Abbey, Derby NDE3 1DO – 0332 553 024) has announced an interface unit that enables the RGB outputs from a BSB decoder to be recorded by an S-VHS or Hi8 VCR.

NICAM RECEPTION

A receiver for Nicam stereo sound has been introduced by Sachs Nicam (GB) Ltd. (Suite 4, Belmont Lodge, London Road, Stanmore, Middx HA7 4NG – 081 420 6311) to sell at under £200. The receiver, Model AD9000, receives an aerial input and provides an output to drive a hi-fi system, hi-fi stereo VCR or a stereo-equipped TV set. Since it also provides a video output users can record sound and vision together.

Nicam transmissions from the IBA's Mendip and Winter Hill transmitters and their relays start on May 25th.

SATELLITE ROUND-UP

Sky Television has announced that after just two months of the scrambled Sky Movies service there were some 450,000 subscribers, with substantial orders for decoders outstanding. Sky claims that it now has an audience of four million in some 1,364,000 homes – this figure includes those with satellite TV installations and those who receive the services on cable.

Some strange new aerial designs were to be seen at the Olympia Cable and Satellite 90 Exhibition held in early April. Tabstrong's diamond-shaped DoubleVision dish is designed for reception of the BSB and Astra transmissions. Each side of the dish is 63cm long, one third of the dish being angled to receive BSB while the other two thirds are directed at Astra. Two LNBS are mounted on a common arm. The US firm MicroBeam showed conical aeriels with the LNBS mounted at the back. The front diameter is 23.5cm for BSB, 34.5cm for Astra.

An integrated receiver-decoder for Sky Television reception should be available from Ferguson in August for about £350. As with Ferguson's current Sky receiver units it will be produced by Pace Microtechnology Ltd. Pace intend to market similar units and also to supply for other brands.

A new version of the Satfinder installation meter has been introduced by Longreach Marketing Ltd. (Riverside Business Park, Lower Bristol Road, Bath BA2 3DW – 0225 444 894). New features include a variable voltage output – 10/15/20V. This enables the meter to be used with a Cambridge dish, which has a unique 10V

drive, with normal systems on 15V and BSB equipment with 20V. Marconi LNBS can be tested by using the 15 and 20V drives. The unit will take normal or rechargeable batteries and can be used in line with the receiver. There's an accurate analogue meter and an audio pitch tuning system. The price remains at £120 plus VAT.

The new launch date for the Astra 1B satellite is December 1st.

ORION DISTRIBUTION

CPC plc (186-200 North Road, Preston, Lancs PR1 1YP – 0772 555 034) has been appointed official distributor for Orion branded TV and video products throughout the UK. This gives CPC the sole UK spares distribution rights for Orion Electric Ltd. branded TV and video equipment.

SMD SOLDERING AID

Raychem Ltd. (Edison Road, Dorcan, Swindon SN3 5JA – 0793 528 171) has introduced SolderQuick which has been specifically designed for working with surface-mounted components. It consists of a presoldered tape which is laid on the board beneath the component to be soldered. Flux and reflow are then applied, leaving individual joints without bridging. We hope to publish a report on this product shortly – seems that it could be a great help with this tricky operation.

THE IEEIE

The Institution of Electrical and Electronics Incorporated Engineers and the Society of Electronic and Radio Technicians have amalgamated to form The Institution of Electronics and Electrical Incorporated Engineers, a professional Institution for Incorporated Engineers and Engineering Technicians in the electronic and electrical fields. Members of the new Institution use the initials MIEIE, AMIEIE etc. as appropriate. The previous bodies were both formed in 1965. Address of the new Institution is Savoy Hill House, Savoy Hill, London WC2R 0BS – 071 836 3357).

CATALOGUES

A new 160-page catalogue is available for £1.50 from Cricklewood Electronics Ltd., 40 Cricklewood Broadway, London NW2 3ET (081 452 0161). It comes with discount vouchers to the value of £8 against component orders (£2 per £30 order).

The full East Cornwall Components catalogue is available for £1 from ECC at 119 High Street, Wem, Shrewsbury SY4 5TT. The discount tickets that accompanied the supplement included with our March issue continue to be valid.

VIDEO NEWS

JVC has launched a modular portable S-VHS-C system in Japan, comprising a "palm-sized" VCR with hi-fi sound, a camera with 360,000-pixel 0.5in. CCD imager, a 3in. LCD monitor with speaker, a TV tuner, a small power unit and a deck holder. The components are designed to be slotted together in various combinations. Price in Japan is the equivalent of about £990. To date there has been no notification of a European launch.

A standard, interchangeable lens system, called the VL Mount System, has been developed by Canon, Hitachi, Matsushita and Sony to enable camcorders to be used with different lenses. The system is based on digital technology devised by Canon. It allows the

autofocus and auto-iris systems to work normally by using a microcomputer for communication between the main camera unit and the lens. The system can be used with $\frac{2}{3}$ in. and $\frac{1}{2}$ in. CCD cameras.

A flat, binocular-style 8mm camcorder, Model VMES88, is to be launched in the UK by Sanyo later this year, at an expected price of around £1,000. New technology is used in the exposure and auto-focus systems to improve the results obtained under various conditions. The aim of the new shape is ease of use, with the controls all mounted on top.

Hitachi's new Model VMC1 camcorder at around £800

has a full range of facilities (two speeds, a multi-image generator for titling and graphics superimposition, trick play modes etc.) despite weighing only 970g (excluding battery and tape). A unique twist-grip facility makes it easy to operate and the four heads are of the amorphous type as used in professional equipment.

Panasonic Communications and Systems has developed an erasable video disc recorder. The discs hold half an hour of video material per side and can be used up to a million times. The system is intended for broadcast applications and is at present restricted to NTSC operation.

Books

Newnes Guide to Satellite TV by D.J. Stephenson, B.A., I.Eng., F.S.E.R.T., published by Heinemann Newnes, Halley Court, Jordan Hill, Oxford OX2 8EJ at £14.95.

Getting acquainted with satellite TV is something that can no longer be put off as the number of dishes attached to houses and flats continues to grow. Callouts to satellite TV installations will soon be a common feature of field servicing while receivers are appearing on the service bench in increasing numbers.

For those who have yet to take the plunge this book can be recommended. It takes you through all you need to know in an easy-to-follow manner. The book can also be recommended to those who already have some experience of satellite TV, since it contains much practical reference material – and who doesn't need to refer back to basics from time to time to check on something not fully appreciated before?

Mathematics have been kept to the minimum – just what ought to be there in order to be able to work out dish alignment etc. Dishes and headends are covered in detail, with the emphasis on the types being sold in the High Street now. Installation is dealt with at some length – in fact four chapters are devoted to this. You probably won't need to follow all this through, but it was wise to ensure that subjects such as multi-satellite installations are included.

The book concludes with a useful chapter on the repair of satellite TV equipment, with some practical circuitry discussed. This should form a good basis for tackling the sorts of problems likely to arise.

The emphasis throughout is on practical matters – even to the extent of including a note on whether or not to paint a dish! This makes it a worthwhile publication to add to your data sources. One subject about which little is said is scrambling/unscrambling. But there's not much you can do about something that goes on in the deepest recesses of a specialised chip. Derek Stephenson is a practising video/satellite TV engineer and will be known to many readers for his useful articles on satellite TV topics in this magazine. There's a special pre-publication offer – see the advertisement on page 639.

Stereo Sound for Television by Francis Rumsey, published by Focal Press, Westbury House, Bury Street, Guildford GU2 5BH at £12.95.

It took a long time for the great advantages of stereo sound to be added to TV broadcasting. At present stereo

is gradually being added to the UK transmission network and an increasing number of receivers are being fitted with stereo decoders – some 110,000 sets incorporating NICAM decoders were produced in the UK last year. This book covers all aspects of stereo sound from the physiological factors through to microphone and studio techniques then transmission systems. It does so in a succinct manner, without anything essential being left out. I suspect that the main interest for service technicians will be the section on NICAM. This and the various other transmission systems are given adequate treatment. A worthwhile book for those interested in this aspect of TV.

Video Recording and Playback Systems, 500 Questions and Answers, by K. Shipman, published by Dickson Price Publishers Ltd., Hawthorn House, Bowdell Lane, Brookland, Kent TN29 9RW at £5.95.

The aim of this book is to help those preparing for the City and Guilds 224 Part 3 Video Recording and Playback examination. It should be a useful aid since the questions are written in the style of the examination papers and cover just about everything you're likely to be asked, while the answers have been prepared in the general style that examiners expect. The author points out that ability to compose brief answers is important to success in an examination since it avoids waste of valuable time. His guidance should be helpful indeed for City and Guilds students.

Newnes Radio and Electronics Engineer's Pocket Book, compiled by Keith Brindley. 18th edition, £9.95.

Newnes Computer Engineer's Pocket Book, compiled by Michael Tolley. 2nd edition, £9.95.

Both published by Heinemann Newnes, Halley Court, Jordan Hill, Oxford OX2 8EJ.

The Radio and Electronics Engineer's Pocket Book has been substantially increased in size over the years. This latest edition has 325 pages packed with useful data and information. You can refer to all manner of things from DBS allocations to standard operational amplifier circuits. The 74 and 4000 series data and pin connections are helpful to have to hand and just about every frequency allocation is included. Plus the usual formulae and tables.

There are increasing occasions when the video/TV engineer finds that he has to get involved with computer matters now that the technologies overlap in so many places. The Computer Engineer's Pocket Book will provide the answer to most of the things you are likely to need to look up. Digital chips are again covered and there's much helpful information on microprocessors. Various standards, connectors etc. are all there.

Servicing the Ferguson TX100 Chassis

J. LeJeune

The Ferguson TX100 chassis, following in the footsteps of its predecessors the TX9 and TX10, exploited the advanced techniques of its day. The asynchronous chopper power supply provides full mains isolation and for the first time in a Ferguson chassis auto-greyscale correction was featured. Now, in its turn, the TX100 has been superseded.

Sets fitted with the TX100 chassis started to be introduced in the autumn of 1984. There were great expectations of the chassis and these were not misplaced. It's good tempered and reasonably reliable, apart from an early spate of power supply and line output transistor failures – I'll deal with this subject in full. One fact to bear in mind is that the chassis was designed to be able to drive a very wide range of tubes – 90° and 110° types, both "standard" and FST versions, with three neck sizes and several scan coil configurations. This involves a number of subtle but important component value differences in the timebases. When component replacements are required in these areas, make sure that you fit the correct type.

In common with most other chassis, the more basic the model the less troublesome it is. Many of the troubles with the TX100 stem from the high sensitivity of its remote control system. Minor irritations with the mechanical programme selector switches and the occasional field timebase fault tended to make those not committed to Ferguson products suspicious. There is however little to dislike about the TX100.

Power Supply Faults

We'll begin with the power supply. There are several common faults here. Fortunately they can be recognised and eliminated easily. The faults all result in the no results symptom and begin with the mains on/off switch.

In models with remote control the mains switch has a third pair of contacts that make momentarily when the switch is operated. These contacts provide a system reset for the remote-control circuits so that the receiver comes on with all the analogue controls normalised and the programme selector at No. 1. If the contacts fail to close momentarily the receiver will immediately go into standby and the remote-control unit will have to be used to switch it on. If the switch fails with the contacts permanently closed the receiver will power up but the channel-stepping buttons on the front panel won't change upwards and the remote-control system will operate only partially. Changing the switch is the obvious cure. The replacement will restore normal working though some switches, because of their mechanical tolerances, won't respond to on/off "stabbers": the switch should always be operated deliberately and pushed fully home.

Further problems occur in the chopper control circuit – they are commonly found in other manufacturers' models that use the TDA4600 series chip (a TDA4600-2 here, IC7). Fig. 1 shows the relevant circuitry. The chopper transistor TR6 is current limited by the action of the components connected to pin 4 of IC7. C118 charges

from the rectified mains supply via R115. While TR6 is conducting, pin 4 of IC7 is open-circuit, allowing C118 to charge. When the control circuit switches TR6 off, pin 4 of IC7 goes low and C118 is discharged. Thus a sawtooth waveform is developed at pin 4. The amplitude of this sawtooth waveform depends on the length of time during which TR6 is conductive. To prevent TR6 passing excessive current the control circuit checks on when the amplitude rises to 4V. The time C118 takes to charge depends on the value of R115, and in early TX100 sets this resistor gave trouble – as it did in the TX9 chassis (PC1044 board). R115 has to withstand the 350V or so produced by the mains rectifier, so a standard 250V working type will not do as a replacement. A 500V, metal-glaze type is required and is available from Ferguson.

Another critical resistor is R114, whose value was standardised at 0.39Ω for all models. We've had earlier models in the workshop with this resistor having gone high in value. This reduces TR6's base drive, the result being destruction of TR6. A word should be said on the trail of destruction that accompanies failure of TR6. It usually goes short-circuit collector-to-base. D13 then has 350V at its cathode and disintegrates. R121 burns up, and current flows via C117 into pins 7 and 8 of IC7. C117 frequently survives this treatment, but IC7 rarely does.

The recommended replacement for TR6 is a T9063V, which is a selected BU508A. It's wise to replace the spring retaining clip and the grey thermopad at the same time. A kit for the job is available from Ferguson. These comments apply equally to the line output transistor TR10, which we'll come to in a moment. In 110° sets D28, which is connected in series with the 119V h.t. supply to the line output stage, is a common offender, either going very leaky or short-circuit. In the leaky condition the diode exhibits an excellent leakage resistance/temperature characteristic!

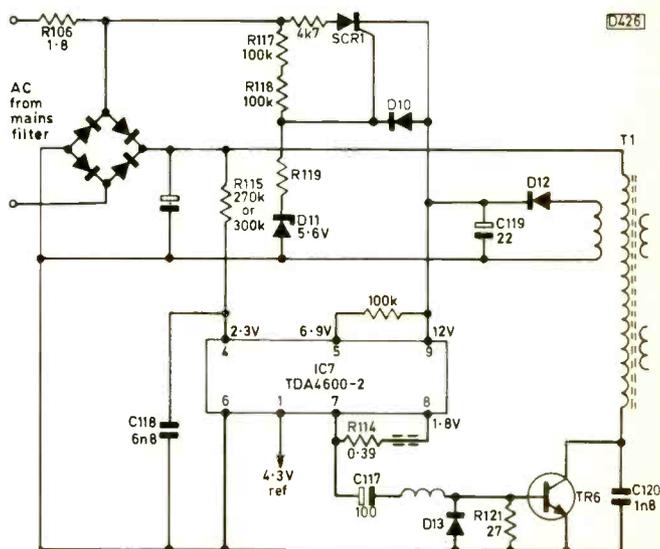


Fig. 1: Part of the chopper circuit, showing the items that can give trouble.

Before leaving the power supply it's useful to consider what happens should the line output transistor TR10 for example fail, placing a short-circuit across the 119V h.t. line. The contacts of relay RL1, which is controlled by TR9, switch the 119V supply on/off. When there's a short-circuit across the h.t. line the protection system within IC7 automatically shuts the power supply down. As TR9 is then no longer powered, the relay's contacts open, thus removing the short-circuit. The power supply senses that the short-circuit has been removed and starts up again. The cycle is repeated and with a non-remote control set you can hear the relay's contacts chattering. With remote-control sets the power supply drops into the standby mode at switch-on. Disconnecting PL18 will get the relay chattering if there's a short-circuit across the 119V rail.

Failure of the power supply to start up should direct attention to R117 and R118 in thyristor SCR1's gate circuit. These are both 100k Ω , but occasionally one of them may go high-resistance as a result of which there's insufficient current for SCR1 to switch on. SCR1 provides a start-up supply for IC7.

Line Scan Troubles

Failure of the line output transistor TR10 was a common occurrence in early TX100 sets. A couple of modifications ensure that it doesn't recur. Fig. 2 shows the relevant circuitry. Note the change in the supply to the timebase generator chip IC4, at pin 16: C75 is changed to 22 μ F while R78 becomes 1k Ω and is connected to pin 3 of the 15V regulator IC9. TR10 should preferably be type T6071V with 90° tubes and type T9063V with 110° tubes. These transistors are both selections from the BU508A family.

The line driver transistor TR8 occasionally fails, though this isn't an everyday happening. In this event it's worth checking C127, C141, D34 and the output from IC9. If a scope is to hand check TR8's base and collector waveforms to see if the transistor is operating with full drive. TR8 should be replaced using another BC372 or a recommended equivalent.

Field Scan Failures

Failure of the field driver/output chip IC6 is fairly rare. Two types are in use. The TDA3652 is usually found but in sets with an A51-590X or A51-427X conventional 20in. tube a TDA3651 is fitted. They are not interchangeable and the rule is to replace with the same type.

Field cramp at the bottom, foldover and sometimes loss of height occur when C99 (100 μ F) has gone low in value or D4 is leaky. Go for the capacitor first – sometimes you can see that electrolyte has leaked on to the PCB.

Low-level Stages

The tuner, i.f., luminance/chrominance processing, low-level sound and sync/timebase generator (pin 10 of IC4) circuitry is fed from a nominal 12V line. This is derived from a 17V supply via a three-terminal regulator (IC8) which is rated at 1A. Failure of this regulator has been encountered occasionally, generally after a thunderstorm which has done further damage to the chassis though the device can fail for no apparent reason.

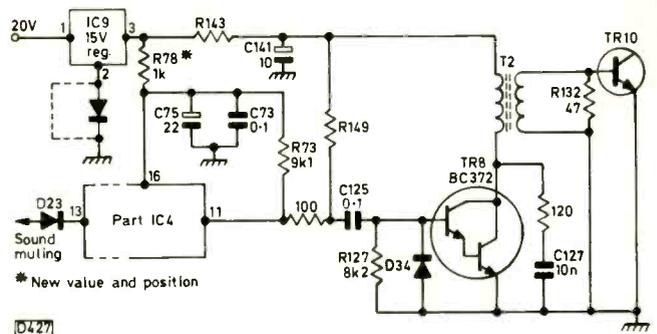


Fig. 2: The line driver circuit, showing modifications to IC4's supply at pin 16. The value of R143 depends on the tube type. R149 is 1k Ω or omitted depending on tube. D34 is omitted when R149 is not present.

Some models display heavy chroma patterning on areas of saturated colour. This is due to subcarrier leakage and can be traced to L6. If adjustment doesn't cure the problem you can get a replacement type – with this C27 must also be changed, from 22pF to 27pF.

The Sync and TB Generator Chip

Complete loss of sync occurs when C63 (150pF) goes short-circuit, removing the video feed to the sync/timebase generator chip IC4. A one-ended line hold control (RV9) turned out to be due to a damaged track though R70 could also be the cause. IC4 itself rarely seems to cause trouble. Note the previously mentioned modifications to prevent destruction of the line output transistor TR10 at switch-on, particularly in cold weather. When R78 is changed from 18k Ω to 1k Ω it must be connected to the 15V supply, not the 119V line.

Sound Muting

IC4 contains a circuit that detects the presence of the video: its output at pin 13 goes low to mute the sound in the absence of video and sync. In a set with no picture and sound it's sometimes useful to check for the presence of sound before you dismantle half the tuner and i.f. strip. This can be done by unsoldering one end of D23: the mute line then goes high, enabling the sound chip IC5.

The Colour Decoder Chip

A TDA3562A colour decoder chip is used (IC3). It also performs the brightness, contrast and saturation control operations, auto-greyscale correction, and contains the RGB video switches that provide changeover

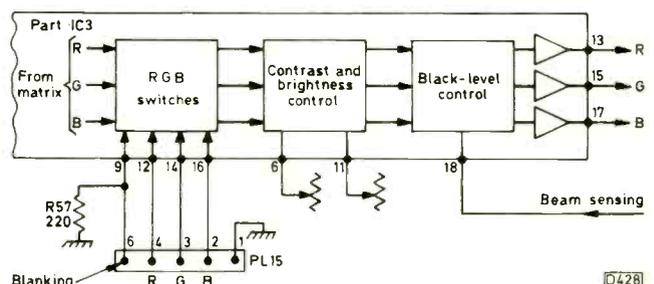


Fig. 3: Inputs to the video switches in IC3. 1.5V at pin 9 of IC3 (pin 6 of PL15) changes the switches over.

from decoded off-air or external (via the scart socket) signals to teletext RGB signals. Switching control is applied to pin 9 of the chip: there is access to this at pin 6 of PL15, see Fig. 3. Application of 1.5V from a torch cell to this point changes the video switches over and could be a useful way of isolating the source of any video disturbance. IC3 is very reliable and provides long service. It can however be destroyed by a c.r.t. flashover.

The CRT Base Panel

The RGB output stages are on the c.r.t. base panel. There are two main problems here. The first relates to the three 1kΩ resistors R604, R608 and R612 which link the RGB channels to the single beam sensing line that provides feedback to the TDA3562A chip. They tend to go high in value. The result is a flood of colour depending on which resistor has changed value. It can give the impression that the c.r.t. has failed.

The other problem occurs mainly with 59cm FS tubes. It shows up as random spurious operation of the remote-control system. The cause is corona discharge in the spark gaps formed in the tube base socket. Homes with coal fires and/or occupants who smoke tend to experience this trouble. The best remedy is to replace the c.r.t. base socket, install central heating and give up smoking!

Versions of the TX100

A problem with the TX100 is that there are eight or nine different versions of the chassis. When remote control and teletext are taken into account as well, the permutations become pretty complex. Some later models incorporate fastext and in this case a microcomputer chip is used to operate the remote-control system – the whole system is on one PCB. Table 1 lists the various models and PCB numbers. Where retrofit teletext is available the kit number is included in the teletext column. Some models incorporate baseband stereo sound for VCR use. There are punchings in the basic chassis for the German Zwei-Ton system, but this is not used in the UK. Some models are equipped with TACS control PCBs, enabling up-down buttons to be used instead of rotary or slider controls. The TACs board is included in the remote-control column.

If you are tempted to try to convert a 90° chassis to 110° or vice versa be warned that this is very difficult. It will take three or four hours and a lot of adrenalin.

Remote Control Problems

Excessive sensitivity of the remote control input circuit to induced interference from the mains lead and from high-voltage corona can be reduced, on non-teletext models that use the PC1564-311 panel, by connecting an underboard bonding strap of heavy-gauge wire, suitably insulated, between pin 1 of the SAA5012 chip IC2001 and the earthy end of the clock oscillator timing components C2007 and C2008. Screening the mains lead where it passes by the remote control PCB is a help. So is removing the mains lead from the bundle of cables from the chassis to the controls and routing it away from the rest. A "power cleaner", like those used with computers, can also be tried, but watch out for earth-leakage trips in rural areas – they may not like the current in the earth line!

Table 1: Models fitted with the TX100 Chassis.

Model	Chassis	RC PCB	Teletext
20A1	PC1150-014	—	—
20A2	PC1150-014	PC1863-303	—
20A3	PC1150-014	PC1515-357	PC1539-304
20C3	PC1150-014	PC1564-311	PC1539-304
20G1	PC1150-014	PC1564-321*	—
20G2	PC1150-014	PC1564-311	—
20G3	PC1150-014	PC1564-311	PC1539-304
20H1	PC1150-014	PC1223-001*	—
20H2	PC1150-014	PC1223-002	—
20H3	PC1150-014	PC1223-002	PC1228-001
22B1	PC1150-111	—	—
22B2	PC1150-111	PC1548-302	—
22B3	PC1150-111	PC1515-357	PC1539-304
22B4	PC1150-111	PC1536-307	PC1539-304
22D1	PC1150-111 (30AX) PC1150-121 (Bonded-yoke CRT)	—	—
22D2	PC1150-111 or -121	PC1564-311	—
22D3	PC1150-111 or -121	PC1564-311	PC1539-304
22G1	PC1150-111 or -121	PC1564-321*	—
22G2	PC1150-111 or -121	PC1564-311	—
22G3	PC1150-111 or -121	PC1564-311	PC1539-304
22H1	PC1150-111 or -121	PC1223-001*	—
22H2	PC1150-111 or -121	PC1223-002	—
22H3	PC1150-111 or -121	PC1223-002	PC1228-001
26D1	PC1150-111	—	—
26D2	PC1150-111	PC1564-311	—
26D3	PC1150-111	PC1564-311	PC1539-304
26G2	PC1150-111	PC1564-311	—
26G3	PC1150-111	PC1564-311	PC1539-304
51A0	PC1150-731 (A51JAR) PC1150-751 (A51EAL)	PC1564-311	—
51A2	PC1150-731 or -751	PC1544-311	—
51A3	PC1150-731 or -751	PC1544-311	PC1539-304
51A4	PC1150-731 or -751	PC1544-311	PC1539-304
51A5	PC1150-731	PC1544-331	PC1539-304
51A8	PC1150-731	PC1564-311	TA171 kit
51G2	PC1150-731 or -751	PC1637-003	—
51G3	PC1150-731 or -751	PC1637-001	—
51H4	PC1150-731 or -751	PC1637-001	—
51H5	PC1150-731 or -751	PC1637-001	—
59B2	PC1150-841	PC1544-311	TA174 kit
59B3	PC1150-841	PC1544-311	PC1539-304
59B5	PC1150-831	PC1544-331	PC1539-304
59B8	PC1150-131	PC1564-311	TA171 kit
59D2	PC1150-841	PC1544-311	TA174 kit
59D3	PC1150-841	PC1544-311	PC1539-304
59G2	PC1150-731 or -751	PC1637-003	—
59G3	PC1150-731 or -751	PC1637-001	—
59H4	PC1150-831	PC1637-001	—
59H5	PC1150-831	PC1637-001	—
59J7	PC1150-131	PC1223-102	PC1228-001
66B2	PC1150-861	PC1544-311	TA174 kit
66B3	PC1150-861	PC1544-311	PC1539-304
66B5	PC1150-861	PC1644-331	PC1539-304
66B8	PC1150-161	PC1564-311	TA171 kit
66H4	PC1150-861	PC1637-001	—
66H5	PC1150-861	PC1637-001	—

* Non-remote TACS panel.

Sunlight can decrease the sensitivity of the receiving diodes by swamping them with vast amounts of infra-red radiation. Careful positioning of the receiver may be necessary and a tip here is to slide the infra-red assembly

slightly back down the moulding that holds it. This decreases the "window" and can help, but it also narrows the angle from which the receiver can be controlled by the handset.

Remote Control Servicing

There are seven different types of remote-control PCB. Of these the PC1564-311 is the most common. Faults in this area usually involve the SAA5012 chip IC2001 or the M293B1 chip IC2007. The SAA5012 produces a variety of faults that can be logically traced back to it, notably total disability of the remote-control system. An oscilloscope can be used to check this. Apply the probe to pin 22 first to see if there's an output from the IR receiver module. Next check for 5V at pins 23 and 24 and for the clock oscillator waveform at pins 18 and 19. If this waveform is absent and there's nothing obviously wrong with the resonator and its associated components, the chip has probably retired. Other problems with IC2001 include failure to switch in and out of standby due to absence of a flip-flop output at pin 6 and failure to select any even-numbered channels due to the absence of an output at pin 3, which carries the least significant bit of the programme number address.

The M293B1 tuning chip contains a non-volatile memory. Thunderstorms and c.r.t. flashovers very often attack this part of the chip, the result being that memory is lost and programmed-in channels cannot be retrieved. Check for the oscillator waveform at pins 13 and 14, for 5V at pin 12, and the status of the programme-address pins 3, 4, 5 and 6. Pin 3 is the least significant bit, and programme one is binary 0000.

Tuning drift with this module can occur through internal leakage in IC2007, but before you consign this chip to the little heap already on the bench it's worth checking IC2006, TR2018 and C2020. Suspect TR2017 and its associated components if the module won't memorise tuning data – this circuit supplies 25V for the memory during its read and write cycles.

The remote-control receiver is very sensitive and can be affected by corona from high voltages in the c.r.t. system and from mains-borne spikes between either side of the mains and earth. If the symptoms are wild, abandoned channel-changing and variations in volume, colour and brightness, look for these causes. I've known a faulty mains switch on the receiver to be the cause, but more commonly the trouble is due to a loose connection to the tube's external coating or mains-borne spikes. In the latter case try removing the incoming mains lead from the bundle and routing it well away from the remote-control PCB. In severe cases I've fitted a screened mains cable from the mains plug to the receiver's on/off switch, but this is expensive and difficult to obtain nowadays.

There are two three-terminal regulators on the PC1564-311 panel, IC2002 and IC2003, both type 7805. The former supplies the IR receiver preamplifier and IC2001 while the latter feeds the memory and display areas. They should be checked in the event of malfunctions.

Teletext

In the past setmakers have not encouraged teletext decoder servicing, possibly due to the delicate and expensive semiconductor devices they use and partly due

to the assumption that engineers are unfamiliar with digital technology. Fortunately very little appears to go wrong with teletext decoder modules and, given a little thought, most faults are fairly obvious.

There are some adjustments on the teletext panel and a summary of their functions may be useful – but the temptation to go twiddling must be resisted. Trimmer CV1031 adjusts the resonance of the clock oscillator's 6MHz crystal. The clock oscillator provides the decoder's timing signals, and is set by calling up a mixed picture and text display from the remote-control handset. When CV1031 has been set correctly the text and TV displays should be synchronised. L1031 is part of the resonant circuit used to recover the transmitted clock signal that precedes each row of text data. This clock oscillator is a shock-excited type, similar to the colour subcarrier regenerator circuit used in elderly Rank colour sets. The tuning of L1031 gives either text or gibberish. If you have a frequency counter it can be set for 6.9375MHz.

The setting of RV1031 should not be altered unless there's a field sync problem with "after-hours" text operation. The teletext display normally depends on the transmitted signal for line and field sync. Should the transmitter fail or simply close down at the end of the day's broadcasting text will normally be lost. The decoder used in these sets substitutes its own sync pulses when the transmitted signal ceases, RV1031 being provided to adjust the width of the substitute field sync pulse.

Finally RV1032 is the text contrast adjustment. Set it to give clean areas of saturated colour without colour drift due to overheating of the c.r.t.'s shadowmask. Teletext is notorious for showing up this failure in current c.r.t. technology: judicious adjustment of RV1032 will avoid its appearance.

Further Points

The TX100 has proved to be a very good workhorse for 90° and 110° models. We've covered most of the common problems and some less common ones in the previous notes. One or two further points are perhaps worth making. We've already mentioned failure of the line output transistor. The transformer also fails on occasion. When either of these items has to be replaced the line driver transistor TR8 is not above suspicion. A check is to measure its base voltage over a period of about a quarter of an hour. The reading should remain steady at 0.8V. In the event of no green/blue/red check whether the relevant bias/feedback resistor R601/605/609 (100kΩ) has gone open-circuit.

Retubing

The chassis has a lot of life in it beyond that of its tube. It's worth replacing the tube therefore when this becomes necessary. When fitting a reprocessed tube there's one small pitfall you can encounter. Very often the beam current balance between the three guns leaves much to be desired, and this can result in the auto-greyscale system doing a few somersaults! If this occurs, try to get access to a c.r.t. analyser such as the B-K unit that can balance the emissions of the guns. Also note the effect of the first anode preset: when fitting a fresh tube it will pay to experiment with the setting of this control (part of the line output transformer) slightly.

An Efficient Linear Power Supply

Keith Cummins

The switch-mode (chopper) power supply is now well known and has virtually taken over in TV sets. Although complex, it has the advantages of efficiency and good regulation.

Earlier solid-state TV receivers all used linear power supplies which were in many cases very inefficient. It just so happened that an old B and O monochrome receiver, used in our guest bedroom, developed hum problems recently. While poking around in a hurry I succeeded in blowing up its power supply. The circuit consisted of a half-wave mains rectifier and capacitor followed by two series regulator transistors with a large shunt ballast resistor. This lot ran across the upper rear of the chassis. The rectified mains voltage was around 290V while the h.t. supply was at 175V, with a current consumption of 330mA. A quick sum, $290 - 175 = 115 \times 0.33$, revealed that about 38W was being dissipated by the regulator alone, not taking into account the 9W surge limiter resistor in series with the rectifier. It seems safe to reckon that about 45W was going up in heat from this circuitry. No wonder the back got hot!

Having the old dead set on my hands my initial reaction was to dump it in the skip, but on further reflection I wondered whether it might be possible to design a more efficient power supply. Three factors had to be taken into account:

- (1) The circuit would have to be built using cheap, easy-to-get components.
- (2) To justify the effort the power saving needed to be significant.
- (3) The performance and stability had to be at least equal to that of the original circuit. Though it had been horribly inefficient, it had worked well. This article describes a substitute circuit which reduces the total power consumption by 23W.

Circuit Concept

Fig. 1 shows the starting point that led to the development of the new circuit. It outlines an arrangement consisting of a mains transformer followed by a rectifier circuit and then a series regulator. This has the advantage that the mains voltage is stepped down to a more manageable level before being rectified. The voltage difference between the regulator's input and output is thereby reduced, with the dissipation being reduced pro rata. Remember that all the regulator has to do is to cope with the a.c. ripple voltage across the reservoir capacitor.

Now it's obvious that we don't want to use a special transformer. Apart from being bulky – and there wasn't much room in the set – it would radiate a field and also contravene factor (1) mentioned above. The problem



Fig. 1: Initial thoughts on increasing efficiency.

would be solved by using an alternative method, one that met our criteria, to reduce the voltage developed across the reservoir capacitor.

The answer lies in the use of a thyristor. Now I recall the dreadful problems we had with some of the early thyristor power supply circuits in the Seventies. You could get pumping and skip-cycling as a result of the attempt to achieve regulation by using simple feedback to control the thyristor's triggering point. In the present design this problem is avoided by employing the thyristor as a voltage-dropping rectifier, without regulation. Its triggering point is suitably set, past the positive peak of the mains cycle, so that the voltage developed across the reservoir capacitor is no greater than it needs to be to provide the following series regulator with sufficient headroom.

Regulator Headroom

How do we define this "headroom", i.e. the voltage difference between the regulator's input and output? The d.c. voltage developed across the reservoir capacitor has a ripple voltage superimposed on it. It's essential that the regulator can still operate correctly at the lowest excursion of the ripple. In this circuit the headroom is 25V and the ripple 30V. Before you look too surprised I should point out that the ripple is $\pm 15V$, so the lowest voltage across the regulator will be $25 - 15 = 10V$ while the highest voltage will be $25 + 15 = 40V$. The circuit can cope with this.

Two adjustments are provided, output voltage and headroom. The latter is adjusted for minimum dissipation consistent with correct operation.

Circuit Description

Fig. 2 shows the full circuit. The 240V a.c. mains input is applied to the L and N input lines directly. R1 is the first enemy of efficiency we come to. Its use is unavoidable however since it's necessary to limit the inrush current through Thy1 when it first triggers to charge the reservoir capacitor C3. Reduce the value of R1 too much and I can guarantee a blow-up as soon as you switch on.

The circuit falls into two parts, first the thyristor rectifier and its trigger and secondly the regulator section. We'll consider the thyristor triggering first.

The incoming mains a.c. waveform via R1 is integrated by R2 and C1 to remove spikes and noise and introduce a small phase lag. A large, variable phase lag is then introduced by R3, RV1 and C2. Thus the voltage across C2 is still rising after the incoming sinewave has passed its positive peak. When the voltage across C2 reaches approximately 34V, diac D1 switches on. As a result current flows via R4 and the primary winding of T1 to discharge C2. R4 is included to provide current limiting. The voltage that appears across T1's secondary winding fires Thy1, which conducts to charge the reservoir capacitor C3. At this point the mains waveform is falling. Once the voltage at the anode of Thy1 falls

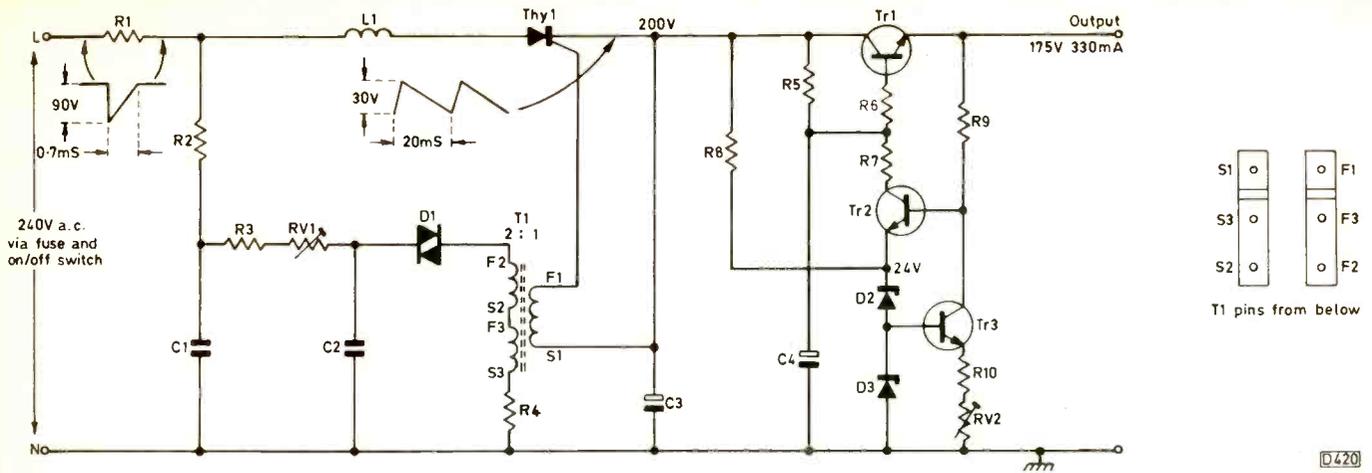


Fig. 2: The final circuit, with thyristor rectifier and series regulator.

below the d.c. level across C3 the thyristor is reverse biased and cannot conduct again until the next positive-going trigger pulse arrives.

RV1 enables the thyristor's triggering point to be adjusted, thereby setting the mean voltage developed across C3. This is the headroom adjustment for the regulator. L1 is included to slow the thyristor's switch-on current rise time, thus reducing interference radiation. The use of the trigger transformer T1 provides a more reliable and consistent triggering performance than a simple RC coupling network would.

At one point I considered using a bridge rectifier ahead of the thyristor, with a view to providing symmetrical mains loading, twice the number of thyristor firings and half the ripple voltage. Unfortunately this apparently good idea has snags. The trigger circuit becomes more complicated, and if the thyristor goes short-circuit C3 charges to nearly the full peak mains voltage. The regulator's headroom thus becomes enormous, along

with the dissipation, and Tr1 then goes short-circuit. To avoid calamity under these conditions a crowbar circuit would be necessary. Using the circuit as shown, if Thy1 goes short-circuit the fuse simply blows. Which fuse? I hear you ask – the one already fitted in the receiver, ahead of this circuit, of course!

Now we come to the regulator bit. Tr1 is the series element. Its base is biased by R5 and decoupled by C4. This RC network provides basic smoothing of the output irrespective of the rest of the circuit. R6 is included to prevent parasitic oscillation. Because of R5 and the relatively high impedance of Tr1's base compared with the load impedance, C4 does not have to be of very large value to provide adequate smoothing. In fact if the value of C4 is too large the following situation will arise. At switch on C3 charges rapidly, and if the base of Tr1 doesn't follow quickly enough Tr1's collector-base breakover voltage will be exceeded, leading to failure of Tr1.

To achieve regulation, Tr1 is controlled by Tr2 and Tr3. The function of Tr3 is not immediately obvious, but it's very important. The circuit works by reducing the voltage at the base of Tr1, via R7, to obtain the correct output voltage. Tr2 is simply an error detector/amplifier. Its base senses the regulator's output, via R9, while its emitter is held at 24V by the zener diodes D2 and D3 which are biased on by R8.

RV2 in Tr3's emitter circuit sets the output voltage. The base of this transistor is biased at a constant 12V from the junction of the two zener diodes. Adjusting RV2 sets the current flowing through Tr3 and also R9, thus determining the working point of Tr2. The important point here is that Tr3 forms a constant-current stage: once its collector current has been set by RV2 the current can't change. Therefore any change in the output voltage at the emitter of Tr1 will not change the current flowing through Tr3: the entire current change occurs via the base of Tr2, which is just what we want for efficient voltage control. In other words, the use of a constant-current stage avoids the feedback attenuation that occurs when the error detector stage is driven by a simple potentiometer circuit.

Dissipation

The circuit's power dissipation works out as follows. First R1. The voltage waveform across this resistor is shown in Fig. 2. The peak voltage is 90V, but the

Components List

Resistors:

R1 6.8Ω, 15W
R2 47k, 0.5W
R3 47k, 0.5W
R4 22Ω, 0.3W
R5 2.2k, 0.5W
R6 100Ω, 0.3W
R7 4.7k, 0.5W
R8 120k, 1W
R9 47k, 1W
R10 2.2k, 0.3W
All 10%

Presets

RV1 47k
RV2 4.7k

Inductors:

L1 100μH, lowest resistance possible
T1 2:1 pulse transformer. RS 196-375

Miscellaneous: Veroboard, heatsinks, nuts and bolts, etc.

Capacitors:

C1 22nF, 400V, 10%
C2 220nF, 100V, 10%
C3 400μF, 400V electro
C4 22μF, 400V electro

Semiconductor devices:

D1 BR100
D2 12V, 500mW
D3 12V, 500mW
Thy1 BT106
Tr1 TIP47
Tr2 MJE340
Tr3 BC107

waveform is triangular. Thus the mean is half the peak voltage. Current flows for 0.7msec every 20msec, i.e. each full cycle of the 50Hz mains frequency, so the duty cycle is 0.7msec in $20 - 0.7 = 19.3$ msec. The dissipation in R1 is:

$$(V_{pk}/2)^2/R1 \times \text{duty cycle, i.e.}$$

$$(90/2)^2/6.8 \times 0.7/19.3 = 10.8W.$$

Secondly Tr1. In this case the dissipation is simply the current, 330mA, multiplied by the headroom voltage, i.e. $0.33 \times 25 = 8.25W$.

These two main areas add up to approximately 19W. Allowing 3W sundry dissipation elsewhere in the other bits, we can say that a total of about 22W is not far out. This is much better than the 45W of the original circuit.

Tr1, a 40W device, is quite happy provided 7°C/W of heatsinking is provided. Although it probably wasn't necessary, I provided small heatsinks for Thy1 and Tr2.

The whole circuit, with the exception of R1 (hot) and C3 (large), was built up on a piece of Veroboard.

Setting Up

To avoid excessive dissipation, a little care over setting up is necessary. I recommend the following procedure. Set RV1 to maximum resistance and RV2 to minimum resistance. Load the power supply with a dummy load as appropriate. Connect the mains supply and advance the setting of RV1 until the required output plus headroom voltage is measured across C3. Adjust RV2 for the correct output voltage, then readjust RV1 for the correct headroom. The headroom can be set higher where severe mains voltage drops may occur, but the dissipation in Tr1 will be greater than with a normal mains voltage variation.

If you install the power supply in a receiver, keep it away from signal circuits to avoid interference from the thyristor triggering.

Philips' Satellite TV Production

George Cole

On April 10th Philips flew a handful of UK journalists to Le Mans, France to attend a press conference on MAC and high-definition television (HDTV). Le Mans is famed for its 24-hour motor race and was thus a fitting location, since Europe is in an HDTV race with Japan.

Also attending the conference were representatives of British Satellite Broadcasting (BSB), including its head Anthony Simmonds-Gooding. The launch of the BSB services was on April 29th, but few sets were available at the time, even for demonstration purposes. There is apparently a six-week delivery for receiving equipment. It's hoped that this will fall to three weeks by the end of June.

BSB Receivers

Philips' aim to produce 250,000 BSB receivers by the end of the year. The company says that several thousand were delivered by the time the service started and that production is now running at 8,000 units a day. The receiver, Model STU902, is compatible with future developments of the MAC system, i.e. wide-screen pictures and HDTV. Remote control is used for all functions, with an on-screen display system. There are ten presets which are preprogrammed in the factory. The Eurocypher conditional access system is incorporated for BSB's scrambled transmissions. Connections include a scart socket with composite video and RGB outputs, terrestrial TV r.f. connectors, satellite aerial input, external access control module output and, interestingly,

a data output for audience survey purposes! The sound is digital. Dimensions are 80 × 420 × 250mm and the weight is 2.2kg.

BSB says that a system should cost around £360 with a dish aerial, £370 with a Squarial.

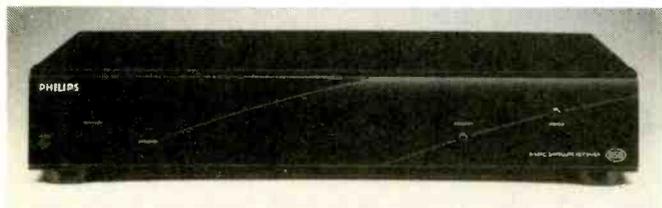
Production

The Philips plant is also producing D2-MAC decoders for the Continental markets and expects to have produced a million MAC receivers by the end of the year. We were taken on a brief tour of the factory which employs 1,250 people, 900 of whom are involved in production. I was told that the manufacture of BSB receivers turned out to be harder than had been expected: there are over 600 components.

Politics

The major conference speech was given by Peter Groenenboom, managing director of Philips Consumer Electronics and Video Display Products. He maintained that MAC was the way for Europe to go and said that the HDTV battle wasn't just about television but also about its impact on industry, computers and telecommunications. A 1,250 club has been formed to promote the HD-MAC system. Its members include an assortment of European public and private companies and broadcasting organisations.

Nevertheless one has the feeling that many companies are hedging their bets. Most of the West German satellite TV broadcasters have opted for PAL, despite their original intention to use D2-MAC. Philips is a leading advocate of MAC but is also involved in the PAL Plus project that aims to produce enhanced versions of PAL, including wide-screen pictures. And one part of the factory we were not shown was the section with the production lines for Videocrypt decoders, which Philips manufactures for Sky TV's PAL with scrambling system.



The Philips Model STU902 D-MAC BSB receiver.



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The Sony Video Walkman

Mick Dutton

The Sony Video Walkman combines an LCD colour TV receiver and a Video-8 tape unit. It's designed to be truly portable and is of approximately the same size as the early Philips portable audio cassette recorders – for those of you who can remember that far back! Picture size is 3in. diagonal. The built-in tuner covers the u.h.f. and v.h.f. bands. When tuning, a cursor is displayed on the screen: its colour is grey or red depending on whether the u.h.f. or v.h.f. bands are being tuned. As there are no station presets the band has to be swept to change channel. This is no hardship. The telescopic aerial provided is surprisingly sensitive. Sound can be switched from 6MHz to 5.5MHz operation. A built-in speaker is provided but hardly does justice to the sound circuitry, so the use of headphones is recommended.

The ni-cad battery clips to the back and provides a playing time of about forty minutes. Alternatively the double-life battery Sony supply for camcorder use can be fitted. A standard U-type 8mm video deck is used. The drum has two heads, which means no third head to give good-quality pause. For those who want to record a programme away from home a built-in one-event, 24-hour timer is incorporated. The machine will switch itself off, should you fall asleep while watching a film, by using the built-in sleep timer facility.

There's an input to enable a camera to be connected and powered. The video and audio input facilities provided make the Walkman ideal for use as a camera or camcorder monitor. In addition video and audio outputs are available, enabling the machine to be used for dubbing or to drive an external monitor.

The Electronics

The same Sony chip set used in the V88 camera is employed. The CXA120A is a sophisticated input selector that caters for camera, line-in, playback or tuner signals. All inputs have a.g.c. and there's provision for character mixing. Luminance and chrominance signal processing is undertaken by a CXA1200. This chip does most of the work. As the signals pass to and from peripheral circuitry via various pins fault tracing in this area shouldn't be too difficult. The CXL1502M chip contains a comb filter for luminance/chrominance signal separation. In the playback mode a CXA1202A provides preamplification of the signals coming from the heads. In the record mode it provides signal mixing. Automatic track following signals are fed in at pin 46, and there's automatic switching to provide the correct bias for the type of tape being used.

A CXP80116 is used for system control and servo operation. The pin labelling should be recognisable. Pin 68, drum reverse, is interesting. It's used to make the drum shake backwards and forwards should dew be detected. This prevents tape sticking. Automatic track following is carried out within IC101 (CXP80116) and IC202 (CXA1204). IC306 (CX20115A) processes the drum PG and FG pulses to make them suitable for application to IC101.

A conventional chopper power supply is used. There's

also a d.c./a.c. converter to provide the supply for the fluorescent tubes at the back of the LCD panel.

The LC Display

The liquid-crystal display, which was developed by Sharp, is of the twisted-nematic type. Fig. 1 shows the idea. Each liquid-crystal cell (pixel) consists of a polarising plate at each side with the liquid-crystal material in between, the combination acting as a light filter. Only light of one polarity can pass through the input polarising plate. The output plate is oppositely polarised. Alignment of the liquid-crystal molecules depends on the voltage applied across the device. Light passing through the liquid-crystal material has its polarity twisted: when the twisting action matches the polarisation of the two polarising plates there is maximum light transmission. Since the liquid-crystal molecule alignment depends on the applied voltage, a video waveform will alter the brightness of the output.

The applied voltage must be a.c. If d.c. is applied electrolysis will occur within the cell, causing the output to drop. High temperatures and exposure to ultra-violet light should also be avoided.

Since a video waveform is by nature d.c., the video signals (RGB) are inverted line by line to give the signals an a.c. component. This is illustrated in Fig. 2. IC902 (4053BF), called the invert switch, carries out the required inversion.

Colour is obtained by placing a colour filter in front of

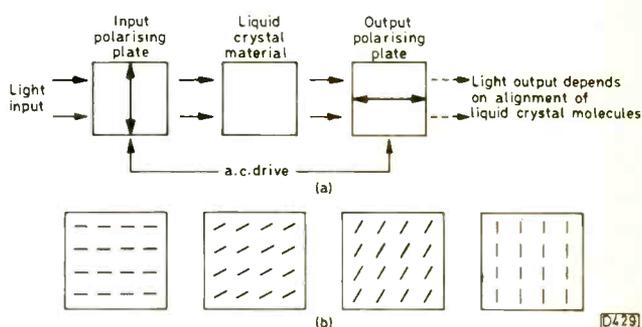


Fig. 1: The liquid-crystal cell. (a) Principle of operation, (b) light twisting action of the liquid crystal material.

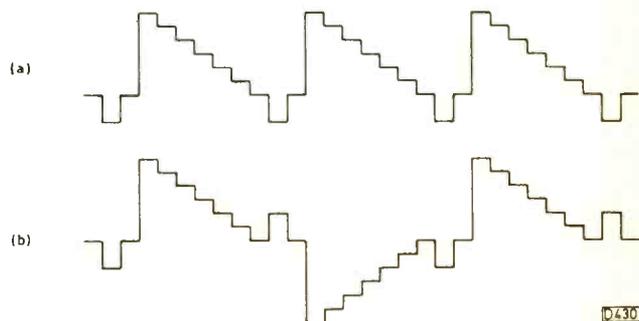


Fig. 2: Initial video waveform (a), shown at (b) after switching to provide an a.c. component.

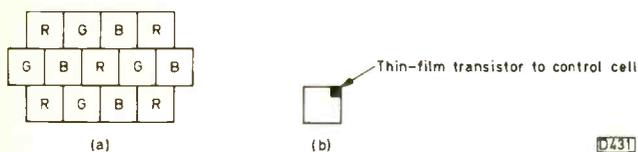


Fig. 3: Colour filter arrangement (a), position of the matrixed cell-drive transistor (b).

the display in brick-wall style, see Fig. 3. The drive is applied to a matrix of thin-film transistors, one for each cell/pixel. X and Y shift registers apply row and column drive in similar fashion to a CCD imager. An LCD can

be viewed only from a critical angle which is also dependent on the applied voltage.

Since a liquid-crystal display acts as a filter and doesn't produce any light a source of back-lighting is required. In the GV-8E this is provided by two fluorescent tubes with a diffuser assembly. The voltage across the tubes is approximately 80V and should be treated with respect.

The LCD drive panel is at the rear of the display and incorporates facilities for the insertion of characters and tuning cursor lines. The display has 92,160 pixels, each 0.161 × 0.19mm, arranged in 384 columns and 240 rows. Screen size is 61.8 × 45.6mm.

If an individual pixel fails, going dark, the result is not very noticeable. A pixel that fails giving maximum light output can be disconcerting with dark scenes.

Acknowledgement

The Video Walkman costs around £800 and is not a toy. My thanks to Henry of Sony UK for his excellent instruction on the Walkman.

TEST CASE

330

Each month we provide an interesting case of TV/video servicing to exercise your ingenuity. These are not trick questions but are based on actual practical faults.

Why is it that the biggest and heaviest TV sets seem to be the ones that have to be taken back to the workshop for repair? Philbert, our man-on-wheels, had struggled briefly with a top of the picture foldover problem before he decided to hump all 26 inches of a Ferguson 37371 into the van and back to base.

Philbert's efforts had been confined to banging the PCB with a screwdriver and twiddling the field linearity control RV773. The workshop experts banged the PCB some more and also twiddled RV773 and the other presets, to no more avail than Philbert. They then changed the TDA3652 field output chip – the set is fitted with the PC1560/1561 version of the TX10 chassis. Still the top of the picture remained folded over. Maybe the 26V supply was low? It measured 25.8V.

Resident Workshop Sage was next consulted on the matter. His firm diagnosis was that there was something amiss with the flyback generator section of the field output stage. Most of it's in the chip that had already been replaced, but sage pointed to the two external components D771 and C776 which act as a voltage doubler to boost the field output stage's supply during the flyback period. So far as he was concerned these two items were highly suspect.

So much for theory. In practice replacement of these two components had no effect on the fault symptom. RT – for it was he who wielded the soldering iron – watched glumly as the folded-over picture once more dawned on the screen. Sage was again consulted. Still convinced that the flyback generator was responsible, he advised a check to ensure that there were no 20msec dents in the

26V supply, then to check that the supply was in fact being doubled, or thereabouts, at pin 6 of the TDA3652 chip during each flyback period. RT got his scope sweeping at field rate and hooked it to the 26V line. There was a field-rate ripple, but its amplitude was very small, certainly not enough to cause this symptom. The waveform at pin 6 of the chip was more revealing. Its peak-to-peak amplitude was only about 13V instead of the expected 22V or so. With the scope d.c. coupled and the probe's earthing clip connected to chassis the amplitude of the flyback pulse was seen to be far short of the specified 48V.

RT had a theory of his own. He'd read that the field coils present a resistive load during the scan and an inductive one during the flyback. What if there was something wrong with the yoke or its circuit? Wouldn't this damp the flyback? Short-circuit turns in the yoke or the field output transformer in old valved sets very often caused top foldover confirmed Television Ted. It's not easy to replace the scanning yoke in this set, so RT decided to check associated items first. In went a new scan coupling capacitor C775, then substitutes for R772 and C774 which are connected in parallel with each other across the scan coils. The Christmas tree on the underside of the PCB was growing, and a replacement for R776, the 1.2Ω yoke-current sampling resistor, was next added to the bristling assortment of bits and pieces there.

The yoke circuit was all right of course. The field output chip and the supply line were also o.k. Amongst what little was left, the culprit was found soon afterwards and another ring was drawn around something on the workshop circuit diagram. What was it?

ANSWER TO TEST CASE 329 – page 551 last month –

The system control arrangements in the Fisher FVH-P905, the subject of last month's test case, are no different from those used in other VCRs. When the problem is reversion to stop after tape loading, the vital points to check are that the threading is being completed, that the load-end switch (in this case the mode

switch) is doing its job, that the reels are turning and that pulses from the reel sensor are reaching the syscon (irrelevant in this particular case as the loading motor reversal was immediate), and finally that the SW25/head flipflop pulses are reaching the system microcomputer control chip to tell it that the head drum is spinning.

It was this last check that the technician failed to carry out. The head drum was rotating, and PG pulses were being fed to the servo section and there processed to produce the SW25 squarewave. This waveform was being passed to the microcomputer chip, but was getting

lost in the gungey mess of corrosion that was present at pin 42. So far as the chip is concerned the SW25 pulses have a high source impedance, coming as they do via the 100k Ω resistor R5041. The electrical leakage due to the corrosion was removing the pulses at the pin itself.

Someone had spilt something into the machine, and that was the prime cause of the trouble. There are two lessons to be learnt here. First, exhaust all syscon input possibilities when checking out deck failure faults. Secondly, make a physical examination of the boards and mechanics in anything that develops a fault!

TV Fault Finding

Reports from Roger Burchett, Alfred Damp, J.S. Ruwala, Nick Beer, Hugh MacMullen, Alan Shaw and Ian Bowden

Rediffusion Mk 4 Chassis

These sets are now flooding the ex-rental market. A good few of them come off Granada maintenance contracts. The only troubles I've had in the past have been failure of the BU208A line output transistor and dry-joints on the chopper transformer – the latter often cause the former. You may also find that 4R2 (470 Ω) in the start-up circuit has sprung open.

A new fault is beginning to appear however. 4C16 (3,300pF) becomes dry-jointed at its bottom end with the result that the BU326A chopper transistor eventually fails and the mains fuse blows. When confronted with this situation check the BD433 chopper driver transistor 4TR2 which is sometimes leaky. If you miss this point and switch on after fitting a new chopper transistor the following will be destroyed: 4TR3 (BU326A), 4TR2 (BD433), 4TR1 (BC368), 4R22 (470 Ω), 4R23 (5-6 Ω), 4R26 (100 Ω), 4D15 (BA157) and 4IC1 (TDA1060). You will also be treated to a good bang and smoke. Guess how I found this out?! Going back to 4C16, this capacitor along with 4R32 and 4D18 form a snubber circuit across the chopper transistor, controlling the rate of voltage rise when it switches off.

R.B.

Saisho CT141/Matsui 1420

A stock fault that's beginning to appear on these very popular portables is that R503 (82k Ω) goes high or open-circuit. As a result the power regulator (Q501, 2SC3158) fails to start up.

R.B.

Loewe Art 55, Studio 70 etc

We had three of the these sets, all brand new and all of them displaying the same symptom. The fault was first brought to our attention by a customer who complained about poor colour. Careful examination of the picture revealed that the chrominance and luminance information didn't register exactly – there was in fact a gap of about an eighth of an inch to the left of any item displayed on the screen. This gap seemed to show up predominantly on reds and blues but affected all colours. The effect looked like a luminance delay line fault, but this digital chassis doesn't have a luminance delay line.

We looked through the service sheet and found a Y delay adjustment. The set was put into the service mode via the remote control handset and this adjustment was called up. The value attributed to it was 052. When we took this figure as high as it would go, via the handset, the

luminance and chrominance information were brought into coincidence. The two other sets were then found to be the same, a similar adjustment putting the displays right.

A.D.

Ferguson TX100 Chassis

This was a JVC set fitted with the TX100 chassis. It was "dead" with only 56V on the h.t. line, though the 12V and 20V supplies were all right. This proved that the power supply was working. There was no short-circuit across the h.t. line and the line output transistor and h.t. rectifier were both o.k. We next checked the h.t. reservoir capacitor C121 which turned out to be open-circuit, a replacement restoring normal operation.

The line driver transistor in this chassis is a BC372 Darlington device. I've found that a TIP110 works very well in this position.

J.S.R.

Grundig 8636

The customer complained of a bright line in the centre of the screen. I assumed that this was field collapse, but when the set was switched on the picture was there, though with incorrect linearity and a bright line in the centre. Replacing the vertical module made no difference. The field output transistors and their supply were o.k., the culprit being C468 (15 μ F, 25V).

J.S.R.

Sony KV1412

This set took about twenty-thirty minutes to start up when it was cold. Once it was on the picture was perfect. With the help of a hairdryer and freezer we established that the fault was in the power supply, around the UPC1394C chip. Replacing the chip made no difference and we then found that R602 had increased in value to 5M Ω . Fitting a replacement cured the trouble.

J.S.R.

Salora 1H6 – Ipsalo 1

A field engineer brought this set in. He'd replaced the line output transistor to get it going and was somewhat put out to find that the new transistor got exceedingly hot exceedingly quickly. Since the set worked perfectly in every other respect the obvious thing to do was to check the line drive waveform. This was fine at the primary of the line driver transformer but at the secondary the

second negative-going spike was missing. So this was what was upsetting the line output transistor! We've known a chipped core in the driver transformer cause such problems but the transformer was o.k. this time. After much fruitless checking, during thirty second periods to avoid destruction of the line output transistor, I decided to check with Salora technical. Their suggestion was to replace several capacitors in the driver and output stages – CB526, CB527, CB528, CB529, CB530, CB535 and CB542. When we did this the set worked fine. **N.B.**

Samsung CI338Z

One of our field engineers had brought this set from a local hotel where it was one of many being rented. It was completely dead and the usual problem of an open-circuit mains fuse (uprate to 1A) was not the reason. In fact the mains transformer, a very hefty affair, had an open-circuit primary winding. When the replacement arrived it was fitted along with a new μ PD1986C chip in the handset – this device had also been faulty. We were rewarded with a standby light but the set wouldn't come on when the power/standby switch beside the channel/volume switches was pressed. Operation of each of these switches should drive the appropriate pin of IC003 (μ PD1987C) high. This system was working. To power the set pin 6 should go high, switching on a transistor to earth the lower end of a relay coil. There was no output from pin 6. The chip's 12V supply was present and there was an input from the 455kHz crystal. We heated the chip gently with a hairdryer and this brought it to life. A replacement restored normal results at all temperatures. **N.B.**

Salora 21M80/7

The fault with this set was that the width would increase after about an hour's use. The job card said gradually but our field engineer said suddenly, which turned out to be the case. When the fault occurred the width was equal to the maximum setting (setting YO) of the width control on the alignment menu – it's a digital chassis. This adjustment had no effect when the fault was present, though a check on the pulse-width modulated drive from pin 28 of the DPU, IC3501, proved that the system worked up to this point. This drive translates to a d.c. shift at the base of transistor TB528, which is one half of a long-tailed pair. There was no shift at the emitter however, due to a faulty BF422 transistor. **N.B.**

Decca/Tatung 140 Chassis

This set wouldn't switch on from standby. Because there were none of the usual problems on the main PCB I powered the set directly from the mains supply, bypassing the remote control circuitry. The set then worked, so we had a remote control fault. The best bet was the SAA1351 chip, and when this was replaced normal operation was restored. On previous occasions I've had the tripler upset this chip, so I disconnected it before testing. When I reconnected it the SAA1351 was affected, so a new tripler had to be fitted as well. **N.B.**

Toshiba 159X4Y

This multi-standard portable came into the workshop with little or no sound. It appeared as if it needed a

6MHz filter, but being a multi-standard set the sound i.f. differences were catered for. It's a difficult set to service as the lead lengths are short, but we soon discovered that quite a long length of print had burnt off. Toshiba was unable to supply a manual but came up with one for the 159R4R which is similar but without the multi-standard facilities. A close examination showed that there was no 12V supply to the sound i.f. and AV panel. This has to be unsoldered to examine it. When a link was connected across the burnt print to connect the 12V supply the 2 Ω , 1W fusible resistor R448 went open-circuit. There was a short between the 12V line and chassis, the cause being D404 and D405 which were both short-circuit. Why hadn't the fusible resistor blown in the first case? I fitted two new diodes and replaced R448 with a 2 Ω , 0.25W fusible resistor, then reassembled and tested the set. **H.MacM.**

Philips CTX-E Chassis

A recurring fault with these popular sets is a dry-joint at pin 12 of the line output transformer. The result is no timebase operation. As a matter of course now when one of these sets passes through the workshop we resolder all the line output and chopper transformer connections using high melting point solder.

One of these sets came in with no picture but with the e.h.t. and focus supplies present. We found that R3585 (2.2 Ω) was open-circuit, though there was no sign of any discolouration. **H.MacM.**

Matsui 1480

No sound or raster on this very common set was easy to track down as there was no line drive. Eventually, after changing the line chip, we noticed that there was a sticky film on the nearby print. Cleaning this brought the set to immediate life – and a sigh of relief. **H.MacM.**

Philips NC3-CR

This set worked quite well but had horizontal striations over the screen. It turned out that C2413 (100 μ F, 400V) was completely open-circuit. I suspect that we shall see more of this due to the proximity of the chopper heatsink. **H.MacM.**

Ferguson SRA1

If the receiver is dead or stuck on standby check for dry-joints on the mains transformer. For a dead receiver with no 18V line check whether R145 (1 Ω) is open-circuit, possibly due to an accidental short-circuiting of the single feed cable between the receiver and the LNB. **A.S.**

Ferguson TX85 Chassis

This set had apparently gone off with a bang during a thunder storm. The 800mA mains fuse had blown, the chopper transistor TR6 was short-circuit and the control chip IC4 (TEA2018) had an internal short between pin 6 and chassis. After replacing these components the set failed to start – a quiet pulsing could be heard coming from the power supply. The cause of this was the 15V supply rectifier D13 (RGP30) which was short-circuit. **I.B.**

Attenuator Design Program

John T. Beaumont

An attenuator is a passive circuit used to introduce a fixed power loss between the source and a load while matching the input and output impedances. Although the input and output impedances of an attenuator should be the same, the computer program provided in this article can be used to design attenuator networks for use where the source and load impedances are unequal with minimum loss.

As the menu (see Fig. 1) shows, the program can be used to calculate the resistor values for either T or pi attenuator networks, which can be of either symmetrical or unsymmetrical configuration.

Attenuators are useful for carrying out receiver measurements, especially when a signal generator to be used for the purpose has a limited output attenuation range. Fig. 2 shows a typical switched attenuator which can be designed using the program. Although the value of 75Ω has been chosen as the source and load impedance any value within reason can be selected - the computer will print an error message on the screen should the input and output impedance ratios be excessive. The circuit shown in Fig. 2 gives switched attenuation values between 0dB and 31dB. Additional sections can be added if required and should be in the sequence 32dB and 64dB respectively.

When sections are connected in cascade it's important that the output impedance of one network matches the input impedance of the following one. The choice of

network, T or pi, enables the best selection of preferred resistor values to be chosen. Table 1 shows a list of preferred resistor values. By using this list the computed resistor values can be modified slightly to enable standard values to be used.

The switches can be standard wafer-type slide switches and the resistors of the carbon-film type. Build the circuit in a narrow aluminium box with coaxial sockets at each end to act as input and output connectors.

Figs. 3-6 show each of the network options as they appear on the screen.

The program has been written for use with the BBC Micro. Since BASIC has been used it should be possible to convert the program for use with other types of computer. The DEFPROC routines can be replaced with GOSUB and if necessary the calculations can be performed without the graphics.

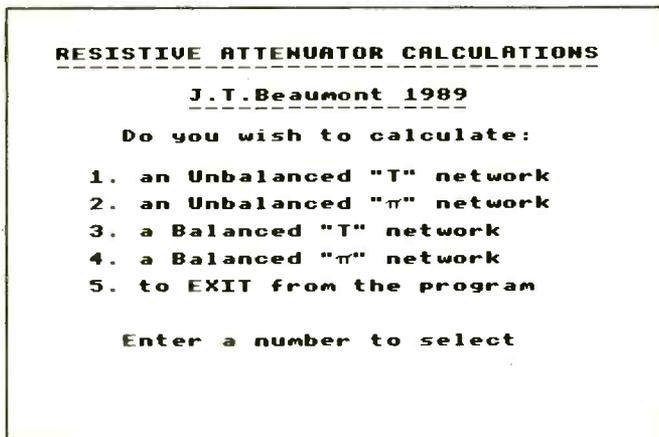


Fig. 1: Attenuator design program menu.

E24	E12	E6
10	10	10
11	-	-
12	12	-
13	-	-
15	15	15
16	-	-
18	18	-
20	-	-
22	22	22
24	-	-
27	27	-
30	-	-
33	33	33
36	-	-
39	39	-
43	-	-
47	47	47
51	-	-
56	56	-
62	-	-
68	68	68
75	-	-
82	82	-
91	-	-

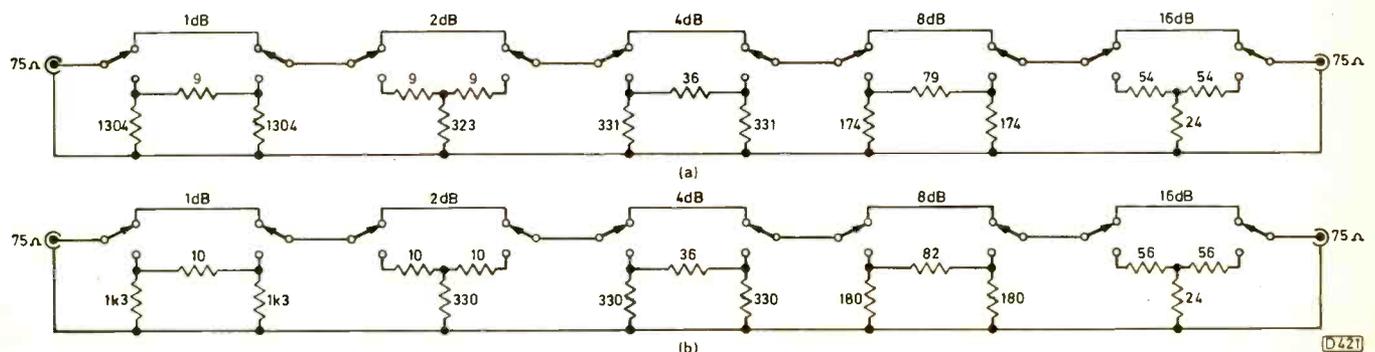


Fig. 2: Switched attenuator for 0-31dB. (a) Calculated resistor values. (b) Modified for preferred values.

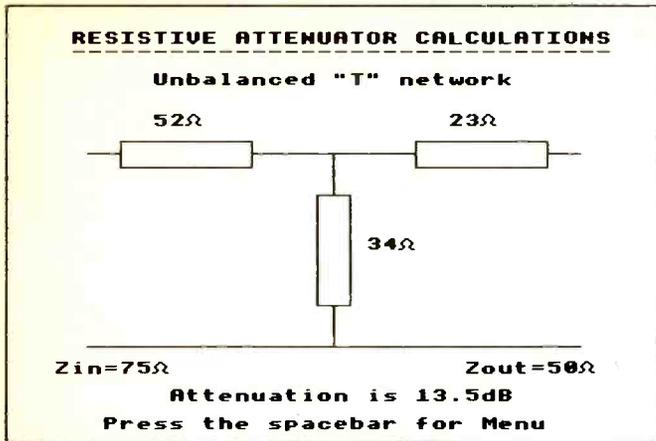


Fig. 3: Unbalanced T attenuator example.

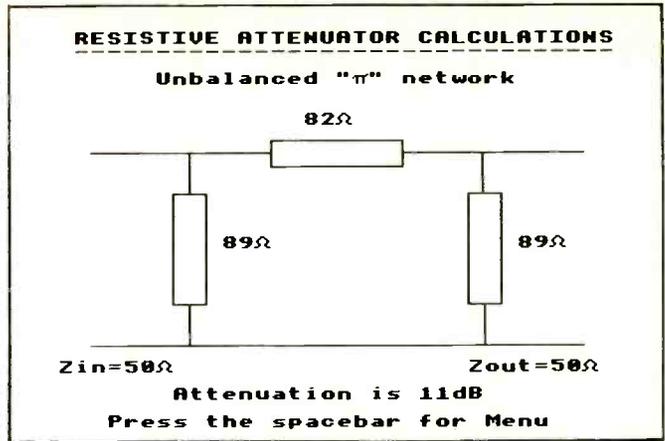


Fig. 4: Unbalanced pi attenuator example.

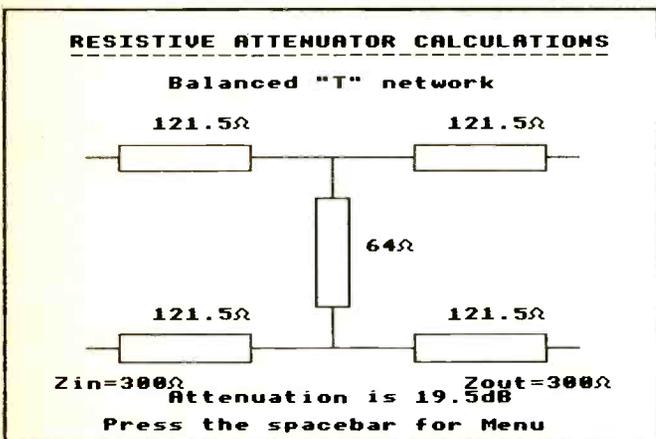


Fig. 5: Balanced T attenuator example.

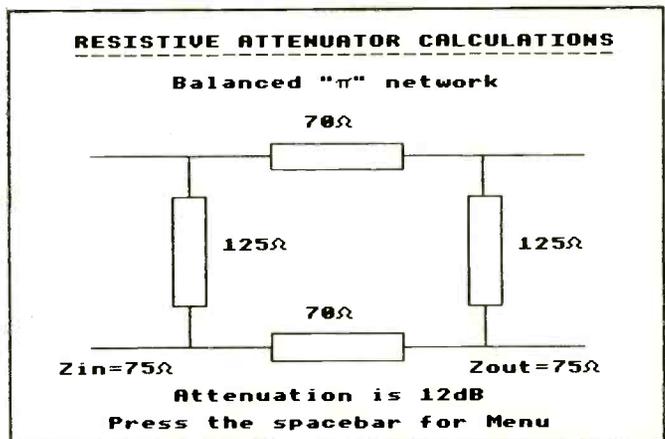


Fig. 6: Balanced pi attenuator example.

```

10 REM *****
20 REM * ATTENUATORS *
30 REM * (c) J.T.Beaumont 1989 *
40 REM *****
50 MODE4
60 REM The OHMS symbol
70 VDU23,225,24,36,66,66,36,36,195,0
80 REM The Pi symbol
90 VDU23,226,0,1,126,164,36,36,36,0
100 REM Remove flashing cursor
110 VDU23:8202:0:0:0:
120 REM White print on Blue screen
130 VDU19,0,4,0,0,0
140 PRINT TAB(3,3);"RESISTIVE ATTENUATOR CALCULATIONS"
150 PRINT TAB(3,4);"-----"
160 PRINT TAB(11,6);"J.T.Beaumont 1989"
170 PRINT TAB(11,7);"-----"
180 PRINT TAB(7,9);"Do you wish to calculate:"
190 PRINT TAB(5,12);"1. an Unbalanced ""T"" network"
200 PRINT TAB(5,14);"2. an Unbalanced ""π"";CHR$(226);"" n
" network"
210 PRINT TAB(5,16);"3. a Balanced ""T"" network"
220 PRINT TAB(5,18);"4. a Balanced ""π"";CHR$(226);"" n
etwork"
230 PRINT TAB(5,20);"5. to EXIT from the program"
240 PRINT TAB(7,24);"Enter a number to select"
250 PROC_Border
260 A$=GET$
270 IF A$<"1" OR A$>"5" THEN GOTO 260
280 IF A$="5" THEN CLS:PRINT TAB(9,7);"Bye":END
290 CLS
300 PRINT TAB(4,2);"RESISTIVE ATTENUATOR CALCULATIONS"
310 PRINT TAB(4,3);"-----"
320 IF A$="1" PRINT TAB(9,5);"Unbalanced ""T"" network
"
330 IF A$="2" PRINT TAB(9,5);"Unbalanced ""π"";CHR$(226)
:""" network"
340 IF A$="3" PRINT TAB(10,5);"Balanced ""T"" network"
350 IF A$="4" PRINT TAB(10,5);"Balanced ""π"";CHR$(226);
"""" network"
360 PRINTTAB(5,10);"Enter input Impedance ";
370 INPUT Zin
380 PRINTTAB(5,12);"Enter output Impedance ";
390 INPUT Zout
400 PRINTTAB(5,14);"Enter Attenuation required Db ";
410 INPUT Db
420 LET D=Db/20
430 IF A$="3" LET H=27 ELSE LET H=26
440 PRINT TAB(0,10);SPC(40)

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450 PRINT TAB(0,12);SPC(40)
460 PRINT TAB(0,14);SPC(40)
470 LET Q=10^(D)
480 LET T=Q^2-(Zin/Zout)
490 LET S=Q^2+(Zin/Zout)
500 IF A$="1" OR A$="3" THEN PROC_T_net
510 IF A$="2" OR A$="4" THEN PROC_Pi_net
520 PRINT TAB(3,H);"Zin=";Zin;CHR$(225);TAB(28,H);"Zou
t=";Zout;CHR$(225)
530 PRINT TAB(10,28);"Attenuation is ";Db;"dB"
540 IF A$="6" THEN PROC_Error
550 PROC_Border
560 PRINT TAB(6,30);"Press the spacebar for Menu"
570 A$=GET$
580 IF A$=" " THEN RUN
590 GOTO 570
600 END
610 DEF PROC_Border
620 MOVE0,0:DRAW1279,0:DRAW1279,1023:DRAW0,1023:DRAW0,
0
630 ENDPROC
640 DEF PROC_Pi_net
650 MOVE512,640:DRAW512,702:DRAW768,702
660 DRAW768,640:DRAW512,640
670 IF A$="4" THEN MOVE512,192:DRAW512,256:DRAW768,256
680 IF A$="4" THEN DRAW768,192:DRAW512,192
690 MOVE320,320:DRAW320,576:DRAW384,576
700 DRAW384,320:DRAW320,320
710 MOVE896,320:DRAW896,576:DRAW960,576
720 DRAW960,320:DRAW896,320
730 MOVE160,672:DRAW512,672:MOVE768,672:DRAW1120,672
740 MOVE160,224:DRAW512,224:MOVE768,224:DRAW1120,224
750 IF A$="2" THEN MOVE160,224:DRAW1120,224
760 MOVE352,224:DRAW352,320:MOVE352,576:DRAW352,672
770 MOVE928,224:DRAW928,320:MOVE928,576:DRAW928,672
780 LET R6=1/(1/Zout*2*Q/T)
790 LET R4=1/(1/Zin*S/T-1/R6)
800 LET R5=1/(1/Zout*S/T-1/R6)
810 LET R4=INT(R4+0.5):IF R4<0.5 LET A$="6"
820 LET R5=INT(R5+0.5):IF R5<0.5 LET A$="6"
830 LET R6=INT(R6+0.5):IF R6<0.5 LET A$="6"
840 IF A$="2" PRINT TAB(13,17);R4;CHR$(225);TAB(31,17)
;R5;CHR$(225);TAB(18,8);R6;CHR$(225)
850 IF A$="4" PRINT TAB(13,17);R4;CHR$(225);TAB(31,17)
;R5;CHR$(225);TAB(18,8);R6/2;CHR$(225);TAB(18,22);R6/2;C
HR$(225)
860 ENDPROC
870 DEF PROC_T_net
880 MOVE224,640:DRAW224,702:DRAW480,702

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```

890 DRAW480,640:DRAW224,640
900 IF A$="3" THEN MOVE224,192:DRAW224,256:DRAW224,256
910 IF A$="3" THEN DRAW480,256:DRAW480,192:DRAW224,192
920 MOVE608,320:DRAW608,576:DRAW672,576
930 DRAW672,320:DRAW608,320
940 MOVE800,640:DRAW800,702:DRAW1056,702
950 DRAW1056,640:DRAW800,640
960 IF A$="3" THEN MOVE800,192:DRAW800,256:DRAW1056,25

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```

1050 LET R1=Zin*S/T-R3
1060 LET R2=Zout*S/T-R3
1070 LET R1=INT(R1+0.5):IF R1<0.5 LET A$="6"
1080 LET R2=INT(R2+0.5):IF R2<0.5 LET A$="6"
1090 LET R3=INT(R3+0.5):IF R3<0.5 LET A$="6"
1100 IF A$="1" PRINT TAB(9,8);R1;CHR$(225);TAB(27,8);R2
:CHR$(225);TAB(22,17);R3;CHR$(225)
1110 IF A$="3" PRINT TAB(9,8);R1/2;CHR$(225);TAB(27,8);
R2/2;CHR$(225);TAB(22,17);R3;CHR$(225);TAB(9,22);R1/2;CH
R$(225);TAB(27,22);R2/2;CHR$(225)
1120 ENDPROC
1130 DEF PROC_Error
1140 CLS:PRINT TAB(2,12);"The Impedance Ratio is excess
ive"
1150 PRINT TAB(2,14);"You will have to put two attenuat
ors"
1160 PRINT TAB(2,16);"in series."
1170 ENDPROC

```

6

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970 IF A$="3" THEN DRAW1056,192:DRAW800,192
980 MOVE160,672:DRAW224,672:MOVE480,672:DRAW800,672
990 MOVE1056,672:DRAW1120,672
1000 MOVE160,224:DRAW224,224:MOVE480,224:DRAW800,224
1010 IF A$="1" THEN MOVE160,224:DRAW1120,224
1020 MOVE1056,224:DRAW1120,224
1030 MOVE640,224:DRAW640,320:MOVE640,576:DRAW640,672
1040 LET R3=Zin*2*Q/T

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CD Player Casebook

Reports from Mike Leach and Philip Blundell, AMIEE

Philips CD150

The problem with this machine was intermittent sound: both channels went off at the same time though the time display kept going. The mute line didn't go low as you might have expected, but the right and left data (DRCF, DLCF) disappeared. When the preceding stage (CIM) was checked we found that the data flag (UNEC) was unreliable. It went high when the sound went off. A new SAA7020 ERCO chip cured the problem. P.B.

Pioneer PDZ-72T

This machine wouldn't read the TOC. The disc rotated and a waveform was available at the r.f. test point but the waveform was extremely erratic and misshapen. During the attempted TOC reading the laser would chatter and the machine would eventually go into the stop mode.

I noticed that the feed motor didn't move the laser assembly to the table of contents after focus had been achieved. We tried going through the setting up procedure, but the fault remained. I was about to condemn the laser assembly when I decided to try the diffraction grating adjustment procedure. The machine then started to work. After going through the rest of the adjustments it performed perfectly. Hopefully it'll stay that way.

Normally I go for the grating adjustment only when all else has failed. Usually, like this one, when I suspect the laser anyway and the customer has agreed to pay. I've found from experience that a player which has been tweaked (offsets etc.) can usually be set up by following the manufacturer's instructions. But if the grating adjustment has been got at as well you've a big task in front of you to get the machine to work correctly. Grating can be very difficult to set up, and you have to be pretty sure in your own mind that the rest of the player is in order before attempting it. M.L.

Sanyo CP17

The problem here was that the disc tray didn't open. R691 (10Ω) in the tray drive circuit was open: it's in the 9V supply to the drive chip and provides protection should the drive chip become stressed.

The loading mechanism hadn't quite lowered the disc clamp when the fault originally occurred. To be on the safe side we changed the loading motor as well as the LB1645N drive chip 1C691. The machine then operated normally. M.L.

Philips CD304

Although this player had been dropped no physical damage was apparent. The complaint was of very bad distortion on both channels. An inspection of the decoder and servo boards showed that all the through-earth connections had previously been resoldered. I decided to resolder them just in case, since distortion with these machines is generally due to bad earth connections on the decoder board. Most of the connections I checked bubbled, indicating poor earthing.

After carrying out this resoldering operation I ran up the machine and discovered a multitude of problems – in fact a different problem appeared each time the machine was switched on. Sometimes the whole display would be lit brightly; sometimes there would be no display at all; occasionally only one segment would light; the drawer would open and close by itself; and so it went on. The slightest movement of the servo board would briefly rectify the fault, so I checked all my soldering. Everything appeared to be in order. Power supply next, but this was o.k. Then the front panel. All connections were o.k., so were the connections from the decoder to the servo board. Throw manual in the air and retreat to the pub.

Some time later I started again from scratch. The +2 (5V) supply from the servo board to the control/display board turned out to be intermittent. So I linked across. Still no go, even with this 5V supply now permanent. It comes from plug 27 on the servo board, and I discovered that four out of the five connections here were intermittently open-circuit. The wires had been crimped too tightly during manufacture, so I cut the plug off and soldered the connections to the board directly.

At last the machine worked properly. Two of the poor connections were data lines to the front panel, which would account for the odd symptoms. But there was still distorted sound. This turned out to be due to a poor earth connection on the decoder board – to be precise the earth connection between C2513 (22μF) and crystal 1504. After cleaning the lens and setting up the laser power the player worked perfectly. M.L.

Pioneer PDZ-72T

There was no light output from the laser assembly, the result being that the disc failed to rotate. When the laser had been replaced and the machine set up the TOC was read in the normal way. Pioneer supply these lasers for only £27 plus VAT. Other manufacturers please note! M.L.



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1580H	2.70	25C1678	1.20	AN2140	2.40	BC207	0.16	BOXS46	0.31	BU126	1.10	HA1196	7.43	MC130P	1.30	SAS560T	0.42	STR1986	11.20	TBA970	3.60	TD4440	1.95
1585R	3.20	25C1741	1.25	AN224	5.09	BC212B	0.29	BOXS2A	2.09	BU137	6.53	HA13001	1.73	MC1350P	0.48	SAS570T	5.42	STR4090	8.01	TBA990	1.98	TD4440	4.15
17052	4.50	25C1810	1.70	AN236	1.33	BC213L	0.10	BOXS3A	1.96	BU205	1.15	HA1306	2.26	MC1351P	1.25	SAS570S	1.95	STR440	6.18	TC2A770	2.15	TD4500	4.70
17053	5.51	25C1815	2.00	AN240P	0.98	BU214	0.10	BOXS4	1.21	BU206	1.27	HA13402	7.06	MC1352P	1.40	SAS580	2.85	STR451	6.18	TC2A780S	1.05	TD4600	1.75
17074	9.30	25C1826	0.67	AN241	1.71	BC225	0.10	BOYS1	1.18	BU207	1.18	HA13342	2.65	MC1353P	1.55	SAS580B	1.33	STR454	8.16	TC2A820A	2.16	TD4610	3.40
17089	3.45	25C1829	2.25	AN245	5.04	BC227	0.10	BOYS2	0.29	BU208	1.12	HA13365	1.48	MC1354P	1.48	SAS580C	1.48	STR455	8.16	TC2A820B	2.16	TD4620	3.75
17127	2.50	25C1875	1.80	AN253	1.80	BC230	0.10	BOYS3	0.46	BU209	1.06	HA13369	2.28	MC1355P	1.48	SAS580D	1.48	STR456	8.16	TC2A820C	2.16	TD4630	3.75
17376	1.50	25C1893	3.02	AN250	1.80	BC232B	0.08	BF118	0.08	BU210	1.06	HA13367	2.75	MC14493P	2.15	SAS670	1.33	STR454	5.52	TC2A820	2.16	TD4650	14.20
1N4001	0.04	25C1906	0.98	AN272	7.92	BC239B	0.25	BF121	0.25	BU209A	1.12	HA1368	1.95	MC14494P	2.15	SAS670	1.33	STR620	6.96	TC2A830	2.24	TD4570	2.25
1N4002	0.06	25C1921	1.37	AN295	7.63	BC239A	0.31	BF123	0.13	BU209	1.75	HA1368B	1.95	MC14508A	3.75	SAS670	1.61	TG05V	7.98	TC2A840	2.24	TD4570S	2.25
1N4003	0.06	25C1923	0.30	AN301	2.45	BC251A	0.50	BF127	0.13	BU226	2.95	HA1370	3.71	MC14510B	3.75	SAS700	1.33	TG05V	7.98	TC2A850	3.05	TD4810	3.92
1N4004	0.05	25C1929	2.25	AN302	3.08	BC230	0.35	BF127	0.29	BU206	0.99	HA1374	1.80	MC14528B	1.95	SAS700	1.33	TG05V	7.98	TC2A860	3.05	TD4810B	3.70
1N4005	0.05	25C1958	1.98	AN315	2.46	BC230	0.35	BF153	0.58	BU405	1.24	AA117	9.5	MC1712	1.98	SAD2006	1.70	TG04V	0.97	TC2A870	2.25	TD4933	3.15
1N4007	0.07	25C1957	0.95	AN316	4.95	BC303	0.48	BF157	0.33	BU407	0.54	HA1388	2.05	MC7742P	3.49	SG264A	4.48	TG04V	1.45	TC2A880S	2.38	TD1013	7.24
1N4148	0.03	25C1953	1.93	AN318	7.16	BC304	0.06	BF158	0.18	BU412	5.29	HA1389	2.28	MC7742P	3.49	SG264A	4.48	TG04V	1.45	TC2A890S	2.38	TD1014	3.00
1N4448	0.05	25C1962	1.30	AN320	5.47	BC308A	0.17	BF159	0.18	BU426A	1.67	HA1392	2.22	MC7742P	3.49	SG264A	4.48	TG04V	1.45	TC2A900S	2.38	TD1015	3.00
1N4501	0.11	25C1969	1.83	AN321	2.25	BC308	0.17	BF160	0.17	BU500	1.53	HA1397	2.75	ME6002	0.26	SI125H	2.90	TG03V	1.25	TC2A910	1.65	TD1025P	0.93
1N4502	0.13	25C1983	0.51	AN322	6.78	BC311A	0.13	BF167	0.13	BU308A	1.50	HA1398	1.50	MC14511B	2.15	SG584P	1.95	TG03V	1.25	TC2A920	1.65	TD1025P	0.93
1N4503	0.11	25C1986	1.55	AN337	5.37	BC327	0.09	BF173	0.34	BU536	1.55	HA1398	2.75	ME6102	0.28	SI125H	2.90	TG03V	1.25	TC2A930	1.65	TD1025P	0.93
1N5404	0.10	25C2009	0.34	AN340P	1.53	BC328	0.11	BF177	0.55	BU608	1.65	HA1406	2.07	ME6102	0.28	SI125H	2.90	TG03V	1.25	TC2A940	1.65	TD1025P	0.93
1N5408	0.14	25C2028	2.33	AN355	1.65	BC337	0.09	BF178	0.40	BU705	2.50	HA1452	0.85	ME6101	0.75	SK2E2104	2.62	TG03V	1.25	TC2A950	1.65	TD1025P	0.93
1N5414	0.05	25C2029	2.11	AN362	1.50	BC338	0.12	BF179	0.36	BU806	1.03	HD14538	2.07	KA12501	0.35	SK4E4F106	0.85	TG03V	1.25	TC2A960	1.65	TD1025P	0.93
151565	0.11	25C2063	0.99	AN370	3.95	BC368	0.19	BF180	0.36	BU907	1.40	HD38702	4.2	KA12501	0.35	SK4E4F106	0.85	TG03V	1.25	TC2A970	1.65	TD1025P	0.93
151566	0.10	25C2078	3.39	AN371	3.43	BC368	0.19	BF180	0.36	BU907	1.40	HD38702	4.2	KA12501	0.35	SK4E4F106	0.85	TG03V	1.25	TC2A980	1.65	TD1025P	0.93
15201	1.50	25C2173	1.54	AN372	4.50	BC371	0.48	BF182	0.34	BU904	1.66	HD38702	4.2	KA12501	0.35	SK4E4F106	0.85	TG03V	1.25	TC2A990	1.65	TD1025P	0.93
2N2213A	0.37	25C2095	1.65	AN322	4.42	BC454	0.36	BF183	0.39	BU834	0.39	HD38805A	14.08	MJE3055	1.25	SK4E4F202	0.96	TG03V	1.25	TC2A100A	1.65	TD1025P	0.93
2N3053	0.35	25C2091	1.30	AN520	4.40	BC460	0.42	BF184	0.43	BU835	0.69	HD4801A05	14.07	MJE340	0.48	SK4E5F100	1.36	TG03V	1.25	TC2A101A	1.14	TD1025P	0.93
2N3054	0.99	25C2141	2.44	AN5610	7.43	BC461	0.47	BF185	0.39	BF185	0.39	H131010	14.60	MJE320	0.49	SK5170	2.15	TG04V	1.45	TC2A102A	1.14	TD1025P	0.93
2N3055	0.66	25C2142	0.87	AN5612	2.20	BC462	0.51	BF194	0.14	BY127	0.13	H131010	14.60	MJE320	0.49	SK5170	2.15	TG04V	1.45	TC2A103A	1.14	TD1025P	0.93
2N3042	1.16	25C2276	0.99	AN613	4.20	BC463	0.51	BF194	0.14	BY127	0.13	H131010	14.60	MJE320	0.49	SK5170	2.15	TG04V	1.45	TC2A104A	1.14	TD1025P	0.93
2N3032	1.20	25C2223	1.28	AN630	3.95	BC478	0.32	BF196	0.17	BY164	0.44	HM6231	9.50	ML237B	1.95	SL414	3.69	TG06A	4.20	TC2A105B	2.42	TD1025P	0.93
2N3103	0.18	25C2236	1.69	AN501N	1.66	BC479	0.17	BF197	0.24	BY176	0.93	HM6232	7.20	ML238	5.65	SL432A	3.44	TA7027	4.80	TC2A106S	2.95	TD1025P	0.93
2N3105	0.15	25C2278	1.14	AN6250	1.75	BC552	0.28	BF198	0.17	BY179	1.42	HM6233	5.69	ML923	3.10	SL429	2.48	TA7050	1.74	TC2A107S	1.70	TD1025P	0.93
2N3106	0.14	25C2314	0.87	AN6300	4.40	BC546	0.28	BF199	0.17	BY182	1.05	HM7103	4.65	ML926	3.10	SL431	2.13	TA7051	1.74	TC2A108S	1.70	TD1025P	0.93
2N3107	0.16	25C2335+Kit	0.90	AN6310	5.54	BC547	0.54	BF200	0.37	BY187	0.77	HM7032	4.60	ML929	3.10	SL430	2.13	TA7052	1.74	TC2A109S	1.70	TD1025P	0.93
2N3111	0.11	25C2351	1.26	AN6340	5.82	BC548	0.28	BF218	0.28	BY188	0.77	HM7032	4.60	ML929	3.10	SL430	2.13	TA7052	1.74	TC2A110S	1.70	TD1025P	0.93
2N3112	0.11	25C2352	1.65	AN6341	5.82	BC549	0.28	BF218	0.28	BY188	0.77	HM7032	4.60	ML929	3.10	SL430	2.13	TA7052	1.74	TC2A111S	1.70	TD1025P	0.93
2N3172	1.55	25C2570	1.85	AN663	16.00	BC550	0.10	BF227	0.65	BY207	1.22	HT407	13.25	MM5389N	2.01	SL318A	0.97	TA7059	3.13	TC2A112S	1.60	TD1025P	0.93
2N3173	1.95	25C2571	1.60	AN6631	1.95	BC556	0.11	BF240	0.19	BY208	1.15	HT408	10.65	MM5387AAN	6.20	SL186E1A0	0.82	TA7070P	1.83	TC2A113S	1.60	TD1025P	0.93
2N3189	0.40	25C2575	0.75	AN6551	0.50	BC557	0.50	BF241	0.10	BY210	1.17	KAZ2101	1.80	MM5481N	6.93	SL186E2AN	2.57	TA7072P	2.57	TC2A114S	1.60	TD1025P	0.93
2N3223	1.17	25C2671	6.91	AN6552	0.68	BC558	0.10	BF242	0.10	BY212	1.17	KAZ2101	1.80	MM5481N	6.93	SL186E2AN	2.57	TA7072P	2.57	TC2A115S	1.60	TD1025P	0.93
2N3234	0.15	25C268A	1.85	AN6610	1.15	BC559	0.10	BF243	0.10	BY212	1.17	KAZ2101	1.80	MM5481N	6.93	SL186E2AN	2.57	TA7072P	2.57	TC2A116S	1.60	TD1025P	0.93
2N3238	0.62	25C2683	6.50	AN7111	1.25	BC562C	0.14	BF246A	2.52	BY223	1.25	L200CV	1.69	MM1435VX	8.81	SN29716N	3.66	TA7089P	3.10	TC2A1190	2.27	TD1025P	0.93
2N4101	1.33	25C337	1.40	AN7115	2.52	BC635	0.34	BF255	0.20	BY224-600	2.60	LA1201	0.75	MP1192	1.95	SN29715N	6.04	TA7092P	3.94	TC2A1190S	2.27	TD1025P	0.93
2N4240	1.55	25C373	1.16	AN7145	2.00	BC636	0.20	BF256	0.52	BY226	0.15	LA1210	1.56	MP2794	4.00	SN29722	11.95	TA7093P	3.99	TC2A120S	1.51	TD1025P	0.93
2N4444	1.66	25C383	1.33	AN7146	3.90	BC637	0.24	BF257	0.34	BY227	0.20	LA1230	1.18	MP2812	5.07	SN29723AN	8.77	TA7093P	3.99	TC2A121S	1.51	TD1025P	0.93
2N5293	0.50	25C388	1.27	AN7151	2.37	BC638	0.15	BF258	0.33	BY228	0.60	LA1230	1.18	MP2812	5.07	SN29723AN	8.77	TA7093P	3.99	TC2A122S	1.51	TD1025P	0.93
2N5294	0.50	25C389	1.81	AN7156	3.37	BC640	0.24	BF259	0.34	BY230-1000	1.20	LA1237N	2.05	MP2812	5.07	SN29723AN	8.77	TA7093P	3.99	TC2A123S	1.51	TD1025P	0.93
2N5295	0.50	25C390	1.81	AN7156	3.37	BC640	0.24	BF259	0.34	BY230-1000	1.20	LA1237N	2.05	MP2812	5.07	SN29723AN	8.77	TA7093P	3.99	TC2A124S	1.51	TD1025P	0.93
2N5297	0.50	25C458	0.34	AN7218	0.80	BD115	0.36	BF263	0.57	BY229-600	1.20	LA1363	1.05	MP2812	5.07	SN29723AN	8.77	TA7093P	3.99	TC2A125S	1.51	TD1025P	0.93
2N5298	0.61	25C495	0.92	AN7223	4.55	BD116	0.70	BF271	0.34	BY296-600	1.23	LA1365J	1.46	MP2812	5.07	SN29723AN	8.77	TA7093P	3.99	TC2A126S	1.51	TD1025P	0.93
2N6190	1.58	25C151A	1.80	AN707	7.72	BD124	1.31</																

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Machine Nos.: 4000H 4001H 4002H
Head Part Nos.: 5458282 5458413 5458415 5458992
Machine Nos.: 4001H 4004H

VHS I

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Machine Nos.: VT3000
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Machine Nos.: VT4000 VT4200 VT5000 VT5500
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VHS A

VHS H

Head Part Nos.: 5458282 5458413 5458415 5458992
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VR3943 VR3963 VR3993 VR3975 VR3985 VR3986 VR3983

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Machine No.: VC581/2/3 651 681/2/3/5 659 699
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Machine No.: VTC5350 VTC5500
Head Part Nos.: 1430762 T02000
Machine No.: VTC9300 VTC9455 VTC9500
Head Part Nos.: 143072 T02100
Machine No.: VTC9300P5 VTC9350

SONY
Head Part Nos.: A6762 044A, 044B, 054A, 147A
Machine No.: SL3000, 8000, 8080, SLT 6Me, 7, 7E, 7ME
Head Part Nos.: A6762 012A, 038A, 055A, 129A
Machine No.: SLSW, 5000 5100 SLC5, C6, C7
Head Part Nos.: A6762 072A, 122A, 136A, 139A, 213A
Machine No.: SL20, C30, C33, C40, C44
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Machine No.	Description	Price
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VID4	01X0-018-729 Take up idler T3V00/PU49280	7.96
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VID6	01X0-033-454 Roller Assy. (cass. Housing) T3V23/PU49042	4.50
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VID8	01X0-040-017 Reel motor assembly 3V29/30/PU51381V	27.95
VID9	01X0-065-009 Capston motor 3V35/36/38/39/PU55371V	20.92
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VID12	V6413663 GEC 4000/Hitachi VT33 f/l rewind arm	2.10
VID13	V6861471 GEC 4001/2/Hitachi 93/9500 f/l rewind arm	2.07
VID14	V6861482 GEC 4001/2/Hitachi 93/9500 play idler assy.	4.20
VID15	V6886971 GEC 4004/Hitachi VT33 f/l rewind arm	1.80
VID16	V2423461 ET541 Tuner Unit	13.50

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VID18	VXP0344 Idler NV7000/7200	0.85
VID19	VXZ0078 Tension Band NV7000	2.85
VID20	VXP0521 Idler NV370	1.65
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VID25	1430662T01201 Reel drive pulley VTC 5000	5.49
VID26	PR2758 Pinch roller VTC5000/5150	2.95
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VID30	RMOTV1008 Reel motor VC9700	16.14
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VID33	NIDL0004 Idler wheel VC2300	3.50

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3 V 35/36	DBK150	£1.25
3 V 38/39	DBK150	£1.25
3 V 42/43/44	VID7540	£1.95
3 V 45/48/54	VID7540	£1.95
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VBS 7600	DBK105	£1.15
VBS 7000	DBK105	£1.15
VBS 9000	DBK10	£1.76
FVHP 420	VID7532	£1.99

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V 4001 H	DBK129	£1.10
V 4002 H	DBK129	£1.10
V 4100 H	DBK128	£1.95

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VT 8500	DBK144	£0.68
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VTC 6000	VID7807	£1.19
VTC 5300	DBK105	£1.15
VTC 5400	DBK105	£1.15
VTC 5500	DBK106	£1.95
VTC 6500	VID7533	£1.00
VTC 8300	DBK104	£3.12
VTC 8350	DBK145	£1.70
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VCR Clinic

*Reports from Philip Blundell, AMIEE,
John C. Priest, Jim Littler, Nick Beer,
Stephen Leatherbarrow, Jeff Herbert
and Ian Bowden*

Philips VR6462

There was no reel motor rotation in play, though fast forward and rewind were all right. Comparisons with another machine (as usual there were no voltages on this section of the circuit) revealed that the supply to pin 2 of the drive chip was missing. It should be 7.5V in play and comes via the BAX18 diode D6147 which was open-circuit. In the fast-wind modes the supply comes via D6146.

P.B.

Philips VR6182

If you get wow on sound, before reaching for the manual check the condition of the capstan drive belt. Rotate the motor by hand while looking at the motor pulley: you'll probably see the belt moving up and down the pulley because it's warped.

P.B.

Sharp VC9300

There was no modulator output from this machine. The video/TV LED lit but the modulator's 12V supply was missing. Supply switching is carried out by transistor Q803 on the mechacon board. It was open-circuit base-to-emitter.

P.B.

Sharp VC381H

This may seem to be obvious, but for an intermittent blank raster in the play or E-E mode check that the test pattern switch on the modulator isn't dirty.

P.B.

Philips VR6462

Intermittently one side of the cassette lift didn't go down as the cassette was taken in. Lever 209 had been bent when the idler had been changed at some time in the past. As a result it didn't locate in the tray very well. Something to bear in mind next time you change one.

P.B.

Saisho VR1100/1200/1600

A common fault with these machines is no movement of the tape after threading up in the play mode. Just to the right of the capstan/pressure roller there's a guide pin (limiter post) that should move in an arc away from and to the right of the capstan during the threading-up process. In the fault condition it doesn't move and wedges the pressure roller so that it can't rotate. This limiter post is in its turn controlled by a white nylon lever that's pivoted at its centre, has a fork at one end that engages with the limiter post and at the other end has a steel pin that projects down through a slot in the deck to be operated by the mecha-slide.

This lever splits where the pin is pressed in, as a result of which the pin falls out into the bottom of the cabinet. If you can find it the pin can in an emergency be got back into place by using Araldite. It's best however to fit a new lever, which is available from CPC at Preston under part number MA850A600039. The replacement lever has a slightly enlarged boss to hold the steel pin. This is a

more secure arrangement – certainly I've had no callbacks after fitting this lever.

Replacement can be carried out by removing the cabinet top cover and then the limiter post assembly (one self-locking nut on the pivot). The white nylon lever can then be removed from its pivot after freeing the securing clip. Reassemble in the reverse order, not forgetting the limiter post's return spring and a touch of sealing paint on the locking nut. About a quarter of an hour when you've done it once or twice.

J.C.P.

Philips VR6367

The call-out complaint was "no picture". On site we found that all functions worked, the loop-through and E-E signals were fine, but on playback only a locked black raster was displayed. Sound was also absent. After making some basic voltage checks the machine was taken back to the workshop where we found that recordings made on it played back well on another machine but that playback of its own or other recordings just produced the black raster.

Attention was turned to the P310 signal panel. The voltages around IC7351 (TDA3730) and transistors 7305/6/7 were correct. A good f.m. waveform was present at the output from the head amplifier and was traced through to pin 19 of IC7351. Demodulated video was present at pin 24 and was traced through to pin 5 of module 1006 on the noise reduction and dropout compensation panel. There was no output at pin 2 however. The Philips manual doesn't describe this module at component level: it has two chips and a 13.3MHz crystal amongst other things. To confirm that the fault was in this module a 68 μ F electrolytic was used to bridge across pins 2 and 5 (positive end to pin 2). This produced playback sound and vision, of degraded quality due to loss of any compensation but surprisingly good in the circumstances. Similar steps were made on the module itself to try to localise the fault to component level, but apart from confirming that the 13.3MHz crystal was working we couldn't with certainty pinpoint the cause of the fault to either chip. These chips (TL8704P and TA7741P) are not listed by any of the wholesalers we use and a check via Philips' MOVIES showed that they were both over £12 with VAT. Since the customer was getting impatient we decided to order the complete module, at £26.35 plus VAT. This restored normal operation. I've hung on to the old module however and when I've a little time to spare and another of these machines to hand I'll investigate further and let you know the outcome.

J.C.P.

Ferguson 3V35/JVC HRD120

This VCR drifted off tune on BBC-1 only. My first thought was to put BBC-1 on another button and see if this drifted too. It did. The tuning voltage is obtained from a voltage doubler circuit which according to the circuit should produce some 45V at TP6. Ferguson told me that the voltage here should be a bit higher than this but if it gets very high, say 70V, all the components in

the voltage doubler circuit should be changed – D14, D15, C21, C22, C23, C24, C25 and R13. I did this and the machine was o.k. for about four weeks. Then it came back again.

This time I decided to change the HZT33-02 33V stabiliser D10. The machine seems to have worked all right ever since, but I would still recommend that anyone experiencing tuning faults with these machines should look at that doubler circuit. It had gone haywire in this particular machine and no particular component could be blamed. **J.L.**

Matsui VX820

A dead machine with not even any clock operation should lead to a check on the 12V regulator transistor Q02. You'll often find that it's short-circuit base-to-emitter. You may also find that the 13V zener diode in its emitter circuit is faulty. Q02 is associated with IC01, the main power supply chip at the rear centre of the main base panel. During normal use a lot of heat is generated here, which no doubt contributes to the failure of Q02. We use a BD131 as a replacement. **S.L.**

Matsui VX880

The problem with this machine was low E-E and playback luminance – the chrominance and sound were not affected. PF01, a coil which couples the signal to the r.f. modulator, was faulty. When it was dismantled we found that it was full of green gunge. The machine has a history of spillages and the results are beginning to show up. **S.L.**

Sharp VC8300

The customer's complaint was that there was no carriage operation and the T2.5A fuse on the power panel was open-circuit. When we replaced the fuse and loaded a cassette the machine very slowly laced up before blowing the fuse again. The loading motor proved to be the cause. Amongst other things it had also damaged the STA401 loading motor drive chip I805. **S.L.**

Panasonic NV7200

This ex-rental machine had been put aside by a junior engineer. The complaint was that it cut out after a couple of seconds in play. At first glance the symptoms on the card suggested that the large loading belt was worn, but on test the machine laced and ran before cutting out. It also cut out in the rewind and fast forward modes. A loss of reel pulses then? Yes indeed. I've had the magnetic base of the supply table fail in these machines and while beginning to check for this I found the cause of the problem – the spool securing circlip was weak and the spool had risen above the brake. Thus the base was too far away from the sensor to be able to produce good pulses. Those not familiar with these machines should note that the pulses come from the supply instead of, more usually, the take-up reel. **N.B.**

Panasonic NV-M5

I thought that this was going to be an easy one – there was no EVF picture. The usual cause is a noisy brightness control potentiometer. This time the control

was completely noise-free however, and when it was turned most of the way up a dim, defocused picture appeared. Low c.r.t. voltages were then suspected, but none of any interest are given on the circuit diagram. The focus supply was found to be 170V. Obviously low, but how low? A check on Panasonic's Bristol technical line produced some guidance. Though they hadn't any additional information on the M5's EVF they had some readings for the MC10. This suggested that the line output transformer was defective, but a new one made no difference. The fault was eventually traced to rectifier D803 which had gone high-resistance. When a replacement was fitted the voltage at its cathode was 440V and the picture was restored. All relevant readings were taken and noted on the circuit for future reference. But the c.r.t. was on the poor side and I decided to replace it. It was the second EVF c.r.t. with a burn image in one week. The other was in a Sony CCD-V8AF that was used as a surveillance camera! **N.B.**

Panasonic NV-G40

We were sure that fast flutter on the playback sound would be a mechanical problem, due to the capstan shaft or bearing. It turned out to be an electrical problem with the motor stator unit however, part no. VEK2944. Note that the capstan motor is not supplied complete, you have to order the various component parts to change the whole motor. **J.H.**

Samsung VI611/Logic VR950

No playback chroma was traced to the coupling capacitor C3103 (0.01 μ F) being leaky. While searching for the cause of this fault someone had changed just about everything else in the colour section. **J.H.**

NEC N9015K

The problems with this machine were poor playback and f.m. inversion (black streaking) on record, similar to what you get with a badly worn head or incorrect adjustment of the head resonance controls. The cause however was that C75 in the head amplifier section on the main signal PCB had gone open-circuit. It's a 1 μ F, 50V capacitor and when we removed it from the board the telltale white powdery deposit was visible around its leads. **J.H.**

Panasonic NV-L28

This machine failed to produce any digital functions. If picture-in-picture was selected, followed by the swap function, in the playback mode the machine would toggle between tape playback and E-E but without the inset screen. We removed the digital box and its covers and made checks around the digital microcomputer IC9007 but couldn't find anything wrong. We then noticed a couple of VCO/phase comparator chips, IC9003 and IC9004 (type MN6790), which are controlled by the microcomputer chip. They both receive line-frequency inputs which are used to lock an internal 21.4MHz VCO. A divided-by-two output derived from this oscillator appears at pin 8. When a digital function is selected, pins 9 and 7 are taken low. This should switch on the oscillators. The output from IC9003 was fine, but only 5V appeared at pin 8 of IC9004. Replacing this chip restored full operation. **I.B.**

Servicing Compact Disc Players

Part 16: Player Mechanisms

Joe Cieszynski

It's fair to say that with CD players mechanical faults are generally the easiest ones to deal with. This is in stark contrast to the situation with VCR servicing. VCR mechanisms are considerably more complex, and to make matters worse the construction of some models is such that servicing can be something of a nightmare. Certainly anyone with experience of VCR or even audio compact cassette recorder servicing should find CD player mechanisms a light relief.

There are basically four sections of a CD mechanism. These are the disc drawer, the disc clamp, the disc drive and the optical assembly transport. The drawer and clamp actions can be combined as a single operation by using multi-function motors and cams, and in an increasing number of players the optical assembly sled is driven by the same motor as the drawer. Fortunately this doesn't result in excessive complication.

Having noted that a CD player's mechanism is relatively simple, we'll consider the sorts of problems likely to be encountered in the normal course of servicing.

The Drawer

First the drawer and clamp arrangement. The drawer, or tray, is designed to take the disc into the player and then drop it down on to the turntable. Once the disc has been deposited on the turntable the disc clamp arm engages, holding the disc in position. In the majority of budget players this mechanism is very simple: a motor retracts the drawer, after which the disc and clamp arm are made to drop. Fig. 1 shows a typical example.

The most common complaint with a mechanism of this type is that the drawer has jammed. Perhaps the reason for this complaint being so common is that the drawer comes in for the bulk of customer abuse and misuse – not all players take kindly to having the drawer manually operated, especially at great speed! Fortunately most of the faults in this area are obvious, i.e. broken runners, broken dropping or clamping mechanisms, worn loading racks or gears, smashed fronts, etc. It's not uncommon to come across a player where the drawer has separated from the rest of the unit. With faults of this type your mechanical engineering skills and ingenuity may be tested, but most problems can be put right quite quickly so long as spare parts are available.

One problem you might encounter with this type of mechanism is that discs are damaged by a scratch that forms a complete circle around the music track area. The scratch would seem to occur because the feet in the disc tray haven't dropped down far enough. Thus when the disc spins up to speed marks are scoured on its surface. It should still be possible to play the music tracks up to the scratch, but as the data beneath the scratch will have been lost there will be no focus and tracking servo references here. Remember also that the error correction system can deal with a continuous dropout period of only up to 48 consecutive frames, representing a track length of around 8.7mm. A scratch that runs around the

disc will far exceed this.

When you come across this fault your natural conclusion might well be that the feet should drop down farther, and this may be the case. There's another common cause of this symptom however: the height of the turntable could be set too low. This has been the case in a number of players I've encountered. The height is normally set at a specific level which is given in the manual – see for example Fig. 2. Make sure that this level is correct. It's not good practice to lift the turntable an extra 1mm for good measure. This can introduce clamp action problems as a result of which the disc seizes, preventing the run-up. I've also come across players that won't play certain discs because the turntable height is incorrect. The cause of this symptom is that some discs aren't completely flat: if the turntable is set too low these discs catch on the feet.

Clamp Arm Problems

Problems can also occur with the clamp arm (Fig. 3). The arm's purpose is to hold the disc firmly and centrally on the turntable. To allow free movement of the disc the clamp grip must be free to spin with it. There are different types of grip mechanism, basically either nylon/plastic or magnetic. The nylon/plastic type usually consists of a disc assembly that's lubricated with silicone to permit smooth running. The magnetic grip is far more effective, being less prone to slip. In this case the turntable is made of ferrous metal so that the ring magnet on the grip clamps on to it firmly, trapping the disc in between.

In certain models the clamp grip has become such a problem area that modifications have been introduced by the relevant manufacturer. Generally however the grip is not a major cause of trouble. If you do encounter a player with a disc spinning problem it's worth checking the clamp mechanism.

Other Loading/clamping Systems

There are other methods of loading and clamping the disc so we'll take a brief look at these.

Some of the more sophisticated players use two motors in the loading mechanism, one to operate the draw and the other to perform the disc drop and clamping action. Many Sony players use this method, the clamp arm being referred to as the "chucking arm" – hence the second motor is known as the chucking motor.

Front-loading CD players are now very popular, especially in portable ghetto-blaster equipment. In this case the disc tray opens in very much the same way as a compact cassette lid. No motor is needed: the disc is simply dropped into the tray and as the tray is closed the disc locates on the turntable. The clamp is usually magnetic and is built into the tray, the clamp action being performed as the tray is closed.

When servicing a front-loading player note that the optical assembly is accessible to the user. So one of your

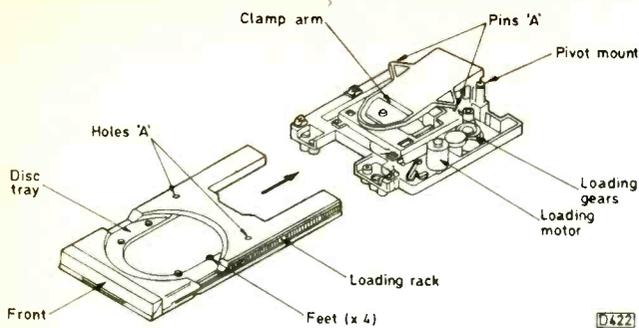


Fig. 1: A common type of drawer/clamp arm assembly. Once the drawer has closed a spring forces the rear of the clamp arm upwards, pivoting the front downwards. As this occurs the two pins marked A drop through the holes marked A and the four rubber feet on which the disc rests are pressed down, allowing the disc to fall on to the turntable.

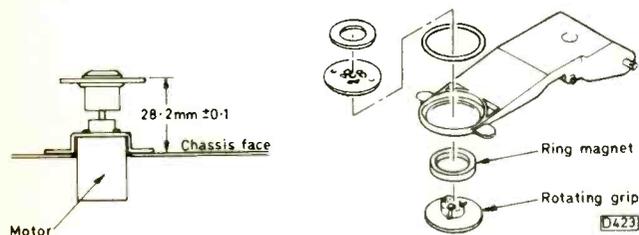


Fig. 2 (left): Typical disc turntable height adjustment, in this case for the Sanyo Model CP667.

Fig. 3 (right): Exploded view of the clamp arm used in the Sony Model CDP35. The ring magnet is attached to the turntable. As a result the disc is secured tightly between the turntable and the rotating grip.

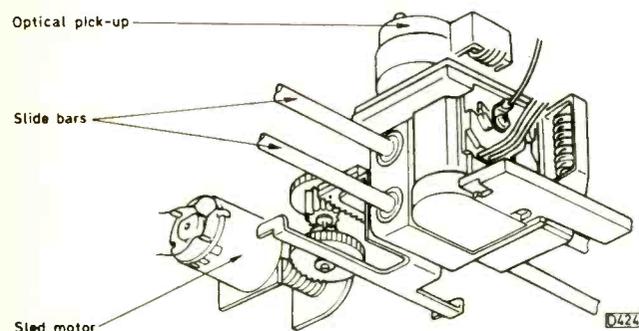


Fig. 4: Typical optical sled assembly, showing the slide bars, gears and drive motor. In some cases the motor may be coupled to the gears via a belt.

first checks should be that the lens is clean and that the two-axis device can still move freely in all directions. This is easy to do: switch off the power and move the optical lens gently both from side to side and in and out. There should be a slight resistance, but the lens should always return to its central position without sticking. This test is similar to checking a loudspeaker cone for sticking, but it's not one hundred per cent reliable. Bear in mind that if the deck uses a radial arm assembly – in which case it's more than likely to be of Philips origin – the optical lens will move only in and out, there being no sideways motion. For further information on the two-axis device see Part 2 in this series (page 410, April 1989).

It's also necessary to remember the safety aspect when servicing a front loader. Since the customer is able to view the laser directly, manufacturers generally design the player so that the laser doesn't light until the tray is

closed. This is not always convenient from a servicing point of view – for example when checking the laser's output power, observing the focus search, etc. you may have to override the tray-closed identification switch to turn on the laser. Make sure that you remove the override after servicing, otherwise you could find yourself faced with a large liability claim. It's one thing to forget to remove the insulation tape from a VCR's end sensors, quite another to leave an active laser pointing out through the clear front of a disc tray. Just think what could happen if a child snapped off the disc tray while the laser was still emitting.

The Disc Motor

The disc motor can seize up, and it's not unknown for a disc motor to run slow. This may not always be obvious. If the player has a service mode a check that can be made quickly is to move the optical assembly to the outer edge of the disc, where the speed of rotation is slowest. You may well find that the player can operate at this point, the defective motor being able to reach a speed of just over 200 r.p.m. but not able to reach the 500 r.p.m. required at the inner edge (start) of the disc.

Other disc speed faults were outlined in Part 12 (February 1990) when we looked at the PLL servo in detail.

The Sled Assembly

Fig. 4 shows a typical sled assembly. Operation of the sled was discussed in Part 11 (January 1990).

Players that use a sled and drive motor to transport the optical assembly can experience problems when the sled mechanism sticks. The usual cause is a build up of dirt and grease on the slide bar. Other causes are sticking gears, worn belts or other defects in the drive mechanism.

There are several types of sticking. A single spot of grease could make the player stick at a certain time after the start of play, while a general coating of grease can cause random sticking or may seize the sled completely. The usual cure is to clean, polish and relubricate the slide bars, using a silicone lubricant sparingly. Some people advocate leaving the slide bars clean of lubricant because dust can adhere to it. Personally I've not had any comebacks with machines to which I've applied lubricant. Perhaps other engineers may care to comment on this point?

A seized sled can result in damage to the sled motor drive transistors or chip. If you find that these components are defective it's worth checking the sled mechanism before applying power.

In some players the sled assembly has only one slide bar, the other side of the assembly being supported by rubber mounts. It's possible for the mounts to weaken so that the sled sags, the result being that the beam doesn't strike the disc at 90°. Since the spot at the reflective surface will be elliptical the result will be incorrect focusing and possibly tracking. The only permanent cure is replacement of the rubber mounts – if they are available as a spare part. If the optical assembly has a tangential adjustment it's possible to use this to provide compensation for a slight sag. The amount of sag I'm talking about is very small, which makes this a difficult fault to diagnose unless you are familiar with the player in question. Clues are intermittent or permanent loss of

data output with the focus servo tricky if not impossible to set up.

The alternative to the sled assembly is the Philips' radial tracking arm. This mechanism is reliable. If you do suspect that an arm is sticking you can check by switching off the power and moving the arm very gently across its arc of travel. There should be no friction at any point.

Deck Sensors

Deck sensors usually take the form of leaf switches or optocouplers. They keep the system control microcomputer informed about the state of the mechanism. The computer needs to know whether the drawer is open or closed, whether or not a disc has been inserted, when the clamping action has been completed, and the position of the optical sled or radial arm.

A player that suffers from strange mechanical faults may simply have a dirty or broken leaf switch. It's worthwhile checking the switches before going too deeply into the control circuitry.

Optocouplers are often used as disc-inserted detectors. There are two modes of operation. One is for the disc to break the light path when inserted. This is very simple to override for servicing purposes – a piece of insulating tape in the light path will suffice. The other method is to place the optocoupler LED and the detector in close parallel: when a disc is inserted the light from the LED is reflected back to the detector. There are ways in which this can be overridden for servicing. Perhaps the simplest is to tape a piece of silver foil over the sensor.

Belts

Like audio and video cassette recorders CD players suffer from worn or stretched belts, especially when they are over three years old. Where belts are employed they usually drive such things as the disc drawer, the clamp arm and sled. Peculiar faults that may initially appear to be due to the electronic control system very often turn out to be caused by a slipping belt that fails to operate a deck sensor correctly. This will come as no surprise to those familiar with VCRs.

Optical Assembly Adjustments

Some optical assemblies have grating and tangential adjustments. If these are incorrectly set the result will be intermittent or no player operation. The problem is that these symptoms are identical to those present when the focus or tracking servo is misadjusted or faulty. The link is obvious: when the optical assembly is not correctly set up the feedback to the servo is incorrect. Whether you check the optical assembly or the servos first will depend largely on your experience of the model concerned. My aim here is simply to warn you not to overlook these mechanical adjustments. Refer to Part 3 (page 522, May 1989) for information on methods of setting up the grating and tangential adjustments.

Multiplay Machines

A natural development with the CD player is the multiplay version in which a cartridge containing say half a dozen discs can be inserted and the player programmed either to play each disc in turn or alternatively to play a

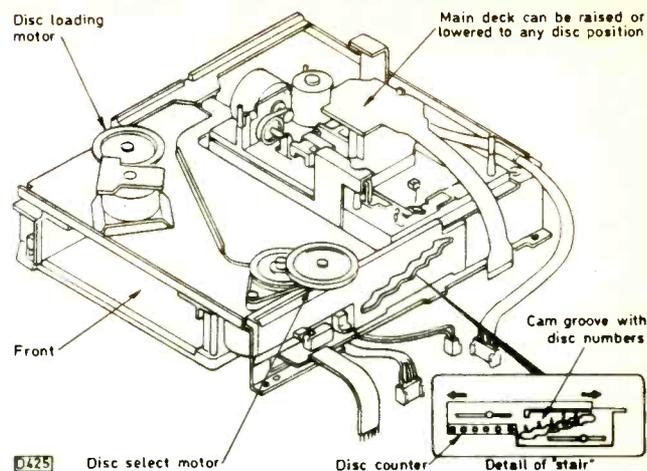


Fig. 5: the multiplay mechanism used in the Pioneer Model PDM60 and similar machines.

selection of tracks from different discs. Mechanical servicing is obviously more complex and is reminiscent of the autochangers of days gone by.

Let's assume that the player has a six-disc cartridge. The required disc is extracted and placed on the turntable. Because the discs are stacked on top of each other in the cartridge the player's deck assembly has to move up and down until the turntable is aligned with the required disc. The machine then plays the disc and returns it to the cartridge. This operation is controlled by the microcomputer chip and sensors are included to detect the deck's vertical position, the number of discs in the cartridge, whether or not a disc is loaded, and whether a multiple- or single-disc cartridge has been inserted. Additional motors are needed to move the deck and to load/unload the discs.

Fig. 5 shows a typical multiplay mechanism in which the disc select motor alters the vertical position of the main deck. The disc counter on the right-hand side consists of a series of holes that move past an optocoupler as the disc select motor operates. Its output keeps the microcomputer chip informed about the deck's position. There are two stepped cam grooves, one on each side of the player. A cam slides along these grooves as the select motor operates, altering the elevation of the main deck.

A further evolution of the multiplay CD principle is used in modern juke-boxes. These employ a standard single-play mechanism that's fitted into a custom-designed carousel. The control hardware and software are likewise custom designed to work with the music selection keypad, the carousel and of course the coin-operated on/off switch.

Personal CD

Faults experienced with personal CD players are much the same as with any other CD player, though the circuitry may be a little more complex. The main difficulty from the servicing point of view arises because of the small physical size of these players. I wouldn't recommend tackling them until you are familiar with standard CD players. In fact the small financial return makes it best to leave these players to appointed dealers who have the necessary experience, technical back-up and spares sources.

A Visit to Willow Vale Electronics

Nick Beer

The problems associated with the provision of spares, and the various ways in which different firms and manufacturers go about it, have received a fair amount of attention in the magazine in recent times. To gain some insight I decided to take a look, from the inside, at the operation of an independent spares wholesaler from whom we regularly obtain parts.

Virtually everyone engaged in the domestic brown goods servicing field knows of Willow Vale Electronics as a supplier of general components, spares, test equipment and service aids. The firm is now the sole distributor in the UK for Grundig and Sharp, and is an authorised distributor for many brands including Ferguson, GEC and Philips. It was founded some twenty six years ago and continues to expand. Under the Double D banner for example finished goods are now marketed from a base in Bournemouth. But as WVE the firm concentrates on and specialises in the supply of spares. As part of its expansion, and with the aim of providing an improved service, a second branch was opened in Manchester some five years ago. Since then this branch has increased its operations fourfold. More recently the acquisition of two smaller companies has led to a branch being opened in Nottingham.

My plan was to pay a visit on a typical working day and see things in action. The day got off to a particularly enjoyable start when I was flown to the company's head office at Reading in its now famous helicopter GBWVE. You may well have seen it in action at various Sharp events. As usual it was piloted by the firm's managing director Peter Bartlett – who is even better known in the industry than his helicopter!

The Sales Office

And so to work. First stop was the sales office where the phones never stopped ringing. Around 800 orders a day are dealt with, the majority of which come via the order hotline 0734 876 444. Some orders are sent in by fax. In addition to orders there are continual queries about price and availability, part numbers, etc., so the phones are kept busy.

Few of the orders are as straightforward as they should be. The problem is that people like you and me ring up without all the necessary information. No part number or order code for example, maybe no account number or no idea of what's actually wanted. These problems can be sorted out on the phone but this delays the ordering process considerably, ups your phone bill and creates delays for other people wanting to order. So the moral is to be prepared. Have your company name, address and account number ready, and wherever possible quote the WVE order codes or manufacturer's part numbers. Know your quantities, but keep an open mind about this as you may well be offered a quantity discount or alternative proposition that may be particularly attractive.

If you don't have all the required information the telephonist may have to do some computer checks or refer you to one of the in-house technical departments.

If you don't know your account number for example the telephonist can find this by company name or, should you not know under which name your company is registered at WVE, by listing all the dealers and their account numbers in your area. When a part is ordered by description, if the telephonist cannot identify the part, order code or part number from the list on the screen you will have to be referred to the appropriate technical department. There are separate ones for Sharp, Philips, GEC/Ferguson and Grundig/general problems.

Technical Departments

The people in the technical departments know their jobs and yours – they are former engineers. Stan, the Grundig and general queries man, sits in the sales office amidst piles of lists and queries. While I was talking to him he was constantly answering outside calls and internal ones from people with problems. Thanks to his apparently photographic memory for Grundig part numbers and model/chassis links he was able to answer many queries off the top of his head. An example of the cross-check system used to sort out queries was the case where a customer wanted a tripler for a particular Grundig colour set that was not listed. Stan soon found that it was shown under the chassis number, CUC120. After sorting out the order he added the model number to the computer classification so that in future access would be available under either the chassis or model number.

Not surprisingly perhaps the Philips department upstairs had the biggest pile of queries. A MOVIES terminal was in regular use here. The problem seems to be that Philips use a rather ambiguous method of parts description, though I was told that this is improving. But when mechanical parts are all either knob, lever or bracket things can be confusing!

The COPS Viewdata System

An alternative to telephone ordering is to use the WVE computer ordering parts system (COPS). If you have a viewdata terminal that gives access via the Istel network to Sony or Panasonic spares, or to the Philips MOVIE system, all you need is a COPS password. To get one contact Dave Allen at Reading with your account number. Over 1,400 passwords had been issued by the time of my visit, covering some fifteen per cent of account holders.

The benefits of ordering spares by viewdata will be discussed in a separate article. Since it helps both the dealer and supplier, WVE and others are encouraging people to use this system. WVE offers priority dispatch, within ninety minutes of order receipt, and also provides generous discounts and special offers to COPS users. With all COPS orders over £10 there are no extra charges. If you don't already have one, WVE offers rental and HP terms for new terminals which, if you have passwords, you can also use with other suppliers' systems.

The COPS system also helps if you don't have part numbers, as you can call up a list of parts for a given model or give a description and get the order code and part number. The system is being developed to make available technical advice pages, to enable adverts to be placed free of charge, and to provide a facility to leave messages for all departments in the company. Account status and suchlike can also be checked. You can choose which branch to order from and see the stock levels at each branch. The price and availability of any part can be checked. You can also check your back orders and add or cancel items.

Once a clear order has been received, something that as you can see is not always as simple as it may seem from our end, the computer used for processing orders provides a plain white picking slip – the one you receive in your parcel. The picking slips go to the stores where, in order of priority, they are allocated to the pickers. Priority is given to orders for Securicor A delivery and those arriving via COPS. The picking slip tells the picker the bin number for each item required, but this job is not wholly robot like. Since each bin contains a number of different items the picker has to ensure that the correct one is taken from each bin. When the order is complete the picker places it in a tray ready for packing. At this point it's married up with the copy invoices that also come in your parcel. Prior to packing the order is checked. Thus most errors are detected. But the sheer quantities of goods involved and the fallibility of human nature means that inevitably a very small number of errors get through. The 800 or so orders a day are collected by Royal Mail or Securicor for dispatch to WVE's 8,000 account holders. Under the Grundig, Philips and Sharp distribution agreement WVE also has to supply, at retail prices, members of the public who have difficulty in obtaining spares from dealers. You can imagine some of the problems that occur here. Thus some of the parcels are sent off to customers paying CWO or by credit card.

Without the use of computers the job of stock control would be horrendous. Replacement stock is ordered automatically when the level has fallen to a certain threshold. When an item is out of stock you can be told the situation – on order for example, anticipated date for delivery, etc.

WVE makes extensive use of computers in all departments. This is the key to achieving a decent profit margin. But heavy reliance on computers would be disastrous in the event of a failure, while specially tailored programs can be horrifyingly expensive. So WVE has its own in-house programmers. The man who designed the COPS system, Dave Allen, is in fact also the Sharp queries man!

Catalogues

Over the years WVE has received a fair amount of stick over the irregularity and quality of its catalogues. In fact this is often given as the reason for not quoting order

codes. A new catalogue system, which would seem to be the answer to these problems, is currently being introduced. Representatives supply a loose-leaf binder and regular packs of pages for insertion. To date the packs cover Sharp, Philips, Grundig and Ferguson VCR spares. As the sheets include exploded views, part numbers, descriptions and order codes they amount to more than just a catalogue – in fact they can often be used as a substitute service manual. This system provides for easy updating. See your representative for details.

We've all tended to complain about catalogues at some time or another. My visit to WVE brought home to me what's involved. Just think of how many parts there are in a single VCR, how many of these are the same as in another model, and so on. Sitting with Peter Bartlett for a while watching him use an extremely powerful computer to compile the mechanical parts list for just one Sharp VCR helped me to appreciate why catalogues take some time to produce.

COPS in Action

Towards the end of my visit we retreated to the office and watched the COPS terminals in action. There are now ten of them. Though the idea is to speed up spares ordering, it's clear that many users are still unfamiliar with the system. As you watch there are long pauses while the user is asked for his account number and the parts numbers. One thing that WVE would like to get across is the importance of typing "Q#" to leave the system. Ringing off without doing this blocks the modem for future incoming calls. The staff have to spot this and reset the modem – something that cannot be guaranteed during the 24 hours a day when COPS is available.

One complaint about the COPS system is that a direct line to Reading is used instead of the local call type arrangement with the Istel network used by Panasonic, Sony and others. Thus phone calls cost more. The system has advantages over a spoken call however. The fact that it can be used after 6 p.m. at the cheap rate is also not insignificant. Certainly on my visit the terminals were all busy well after six.

Conclusions

In conclusion, the idea of the visit was to see the problems of spares supply from the other side. I hope that this report will help to make life easier for everyone. Don't forget to be prepared with all the required information before you ring direct or use COPS. We need to get this right because an ever increasing proportion of spares has to be specifically ordered instead of being drawn from our own stocks, and if the current pattern of manufacturers handing over the provision of spares to specialist firms like WVE continues we will be relying on them more and more.

My thanks to the staff of WVE for an interesting day, particularly to Peter Bartlett, Bryan Tuckfield and Mike Eltherington who organised the trip.

Published on approximately the 22nd of each month by IPC Magazines Limited, King's Reach Tower, Stamford Street, London SE1 9LS. Filmsetting by Trutape Setting Systems, 220-228 Northdown Road, Margate, Kent. Printed in England by The Riverside Press Ltd., St Ives plc. Sole Agents for Australia and New Zealand – Gordon and Gotch (A/sia) Ltd.; South Africa – Central News Agency Ltd. Subscriptions: Inland £20, overseas (surface mail) £24 per annum, payable to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH. "Television" is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed of by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to currency exchange fluctuations and VAT, and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever. ISSN 0032-647X.

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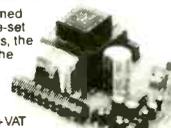
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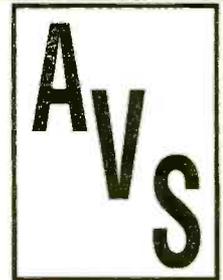
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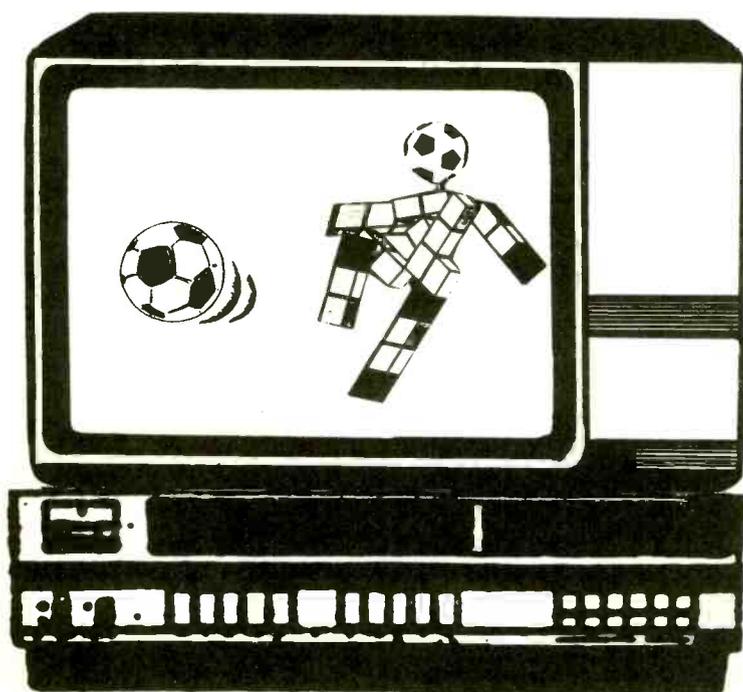
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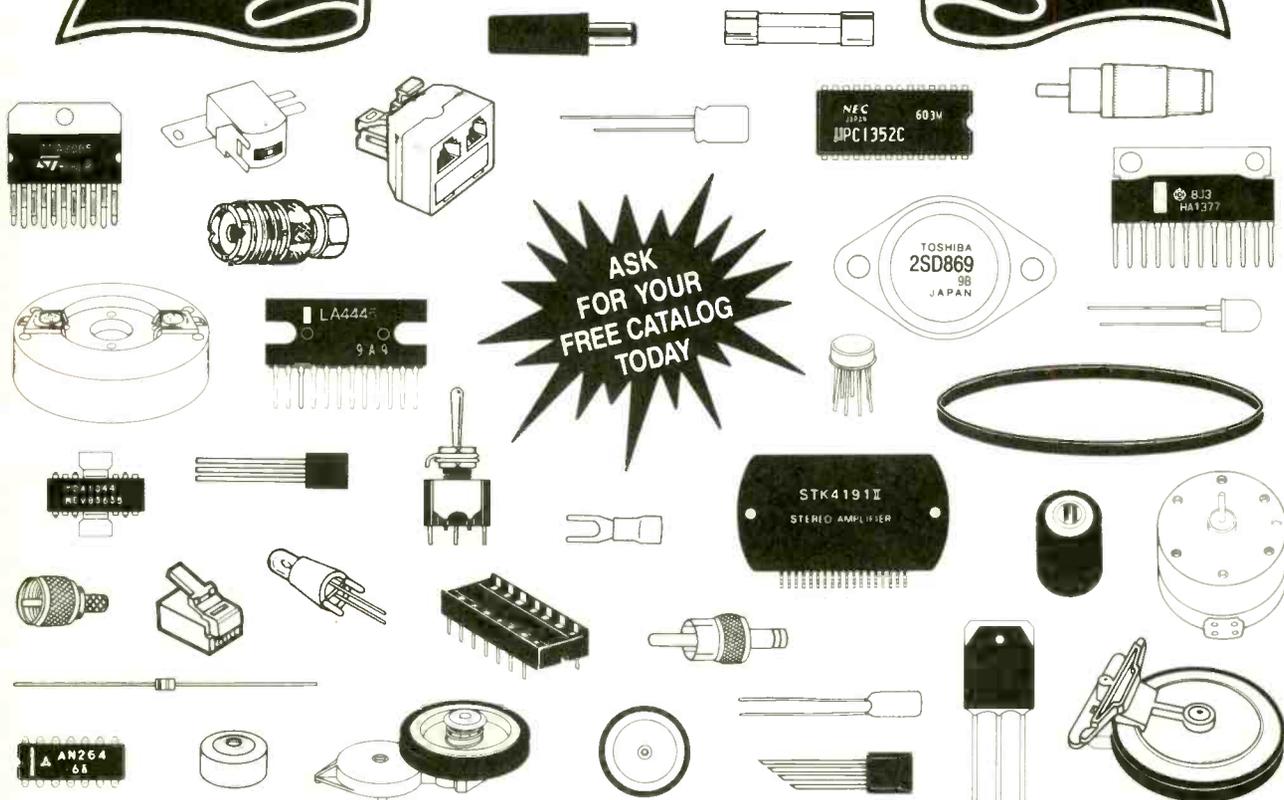
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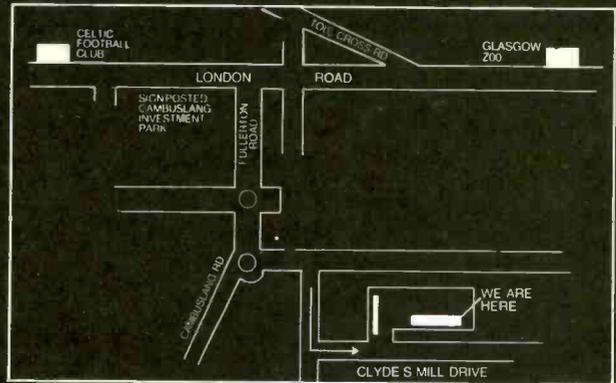
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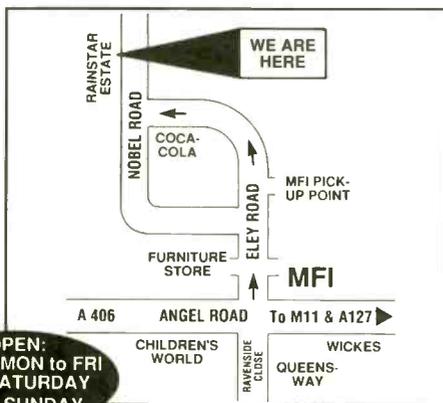
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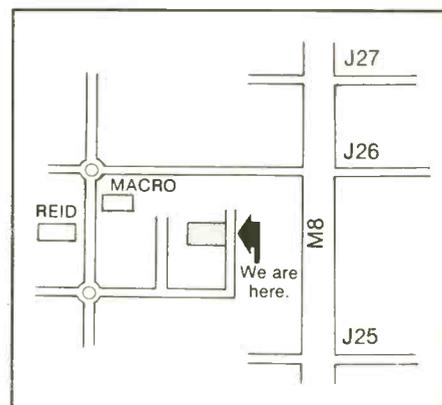


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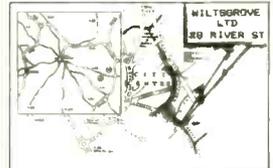
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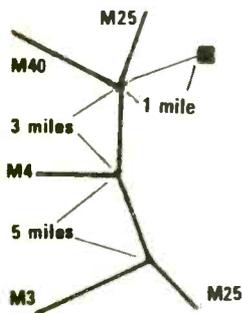
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Ferguson 3V23	10.00
Ferguson 3V31	5.00
Sharp 9500H	10.00
Sanyo VHR330	10.00
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Ace Assemblies Sony C9	15.00
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Sanyo VTC9300 Modulators	6.00
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Hitachi 5500 Reel Motor	4.00
Hitachi 5500 Capstan Motor	10.00
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Nat Pan NV333 Loading Gear	3.00
Nat Pan NV333 Supply Roller	1.50
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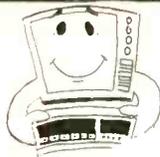
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If you keep back issues of *Television* then read on. The Fast Fix fault card filing systems list the symptoms of either television faults or Videorecorder, camcorder and camera faults found in *Television Magazine* under *TV Fault Filing, VCR Clinic and Service Bureau* from 1981-1989 inclusive. Each card file contains thousands of faults which are collated and indexed under manufacturers name and then chassis or model. An example is a Philips K30 with a blank raster, look on p744/Aug '88. The Fast Fix card files will provide you with a speedy means of locating faults published in this magazine saving you time and money. Ready boxed, quick to use and easily updatable. Fast Fix could pay for itself with just one successful repair. **Fast Fix Television £35.00 inclusive.**

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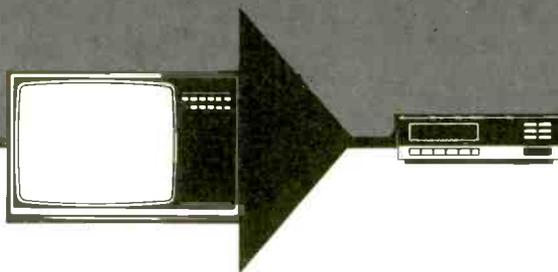
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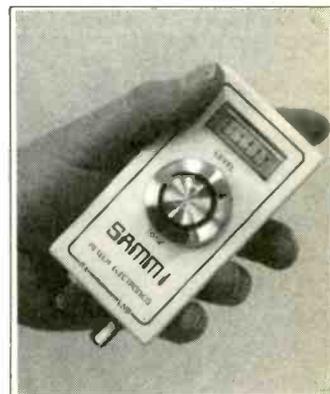
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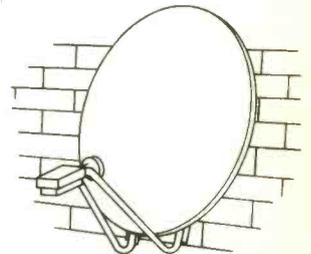
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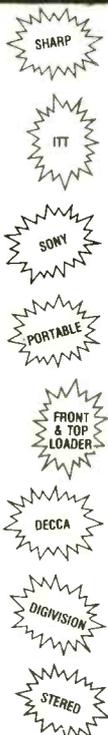
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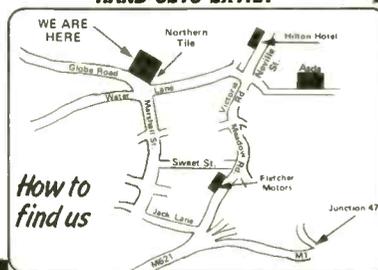
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BT18124	£1.00	BT18124	£1.00
BT18224	£1.00	BT18224	£1.00
BT19224	£1.00	BT19224	£1.00
CA270AE	50p	CA270AE	50p
CA270CW	50p	CA270CW	50p
CA270IC	50p	CA270IC	50p
CA270RE	50p	CA270RE	50p
CA1310	50p	CA1310	50p
CA3046	50p	CA3046	50p
CA30K50	50p	CA30K50	50p
CA30K90	50p	CA30K90	50p
CA3123	40p	CA3123	40p
CA3146	£1.00	CA3146	£1.00
CA3189	40p	CA3189	40p
CA3189B	£2.00	CA3189B	£2.00
CA3403	£2.00	CA3403	£2.00
CA3455BE	£4.00	CA3455BE	£4.00
DM7492	50p	DM7492	50p
HA1124A	50p	HA1124A	50p
HA1196	40p	HA1196	40p
HA1370	£2.00	HA1370	£2.00
HA1377	£3.00	HA1377	£3.00
HA1423	£1.00	HA1423	£1.00
HA1440	25p	HA1440	25p
HA1484	£3.00	HA1484	£3.00
HA1485 Ant	£1.00	HA1485 Ant	£1.00
HA1745S	50p	HA1745S	50p
HA1800	50p	HA1800	50p
HA1818B	25p	HA1818B	25p
HA1819A	50p	HA1819A	50p
HA1905BP	20p	HA1905BP	20p
HA1928	20p	HA1928	20p
HD3894C	£1.00	HD3894C	£1.00
K5731D 1001012	£1.00	K5731D 1001012	£1.00
LA3220	50p	LA3220	50p
LA4102	£1.00	LA4102	£1.00
LA7830	£2.00	LA7830	£2.00
LA7831	£2.00	LA7831	£2.00
LM1111N	£1.00	LM1111N	£1.00
LM1017P	25p	LM1017P	25p
LM1021	£5.00	LM1021	£5.00
M913	£2.00	M913	£2.00
MH24-SAA	£2.00	MH24-SAA	£2.00
M125-SAA	£3.00	M125-SAA	£3.00
MS40A-84RS	£3.00	MS40A-84RS	£3.00
MC470P	£1.00	MC470P	£1.00
MC1307	75p	MC1307	75p
MC1312	£1.00	MC1312	£1.00
MC1330 GN76530	£1	MC1330 GN76530	£1
MC1349	50p	MC1349	50p
MC1352	£1.00	MC1352	£1.00
MC1358	£1.00	MC1358	£1.00
MC1496	£1.00	MC1496	£1.00
MC14002	15p	MC14002	15p
MC14013	25p	MC14013	25p
MC14016	25p	MC14016	25p
MC14069	30p	MC14069	30p
MC14514	50p	MC14514	50p
MC1748	80p	MC1748	80p
ME144956	£1.00	ME144956	£1.00
MI-231	£2.50	MI-231	£2.50
MI-T0416	£2.00	MI-T0416	£2.00
MI-232	£1.00	MI-232	£1.00
MI-237B	£1.00	MI-237B	£1.00
MI-238B	£2.00	MI-238B	£2.00
MI-239	£4.00	MI-239	£4.00

Thyristors	
Philips Kinc OT121	50p
IRH4A	30p
BT151/501	20p
BT106 Plastic	30p
BT106 Metal	30p
BT19	£1.00
BT210	£1.00
BRC443	75p
G11 Thyristor	60p
Decel-3810	60p
OT12	£1.00
OT13	£1.00
OT14	£1.00
OT15	£1.00
OT16	£1.00
OT17	£1.00
OT18	£1.00
OT19	£1.00
OT20	£1.00
OT21	£1.00
OT22	£1.00
OT23	£1.00
OT24	£1.00
OT25	£1.00
OT26	£1.00
OT27	£1.00
OT28	£1.00
OT29	£1.00
OT30	£1.00
OT31	£1.00
OT32	£1.00
OT33	£1.00
OT34	£1.00
OT35	£1.00
OT36	£1.00
OT37	£1.00
OT38	£1.00
OT39	£1.00
OT40	£1.00

TV Crystals	
4MHz	50p each
4.433619	£1.00
6MHz	£2.00
8.867238	£2.00
10.736353	£2.00
11.159100	£2.00
Large or small	50p each
Antistatic Isolating	10p
Disc Type Heat	10p

MLA26	£1.00	TBA625	50p	TDA2575A	£1.00
MA8840B-C	£2.00	TBA651	£2.00	TDA2576	£1.00
MA1840 P-D170	£2.00	TBA673	£1.00	TDA2578A	£2.00
MA1841 P1011	£3.00	TBA750	£1.50	TDA2579A	£2.00
MA1842 PCY35	£2.00	TBA781	£1.50	TDA2581	£2.00
MA1842P-Q105	£2.00	TBA810	50p	TDA2591	£1.00
MA18440P	£2.00	TBA810AP	60p	TDA2593	£3.00
MA18440XX	£2.00	TBA810S	60p	TDA2595	£3.00
MA18481B	£3.00	TBA820M	25p	TDA2600	£5.75
MA1250BJC	30p	TBA920	£1.50	TDA2611A	£1.00
MMS387	£1.00	TBA930Q	£1.50	TDA2611AQ	£1.00
MMS611	£1.00	TBA990Q	£1.00	TDA3651	£1.00
MMS840	£3.00	TB147CA326895	£2.00	TDA3652	£2.50
PCD8571P	£3.00	TMS1943 N2L	£3.00	TDA3653	£4.00
K35 Philips Receiver IC	£3.00	TMS9981	£4.00	TDA3660	£2.00
MA1250BJC	£3.00	TMS9981	£4.00	TDA3690	£1.00
M491B1B1	£5.00	TMS9981	£4.00	TDA3693	£1.00
MS40A-84	£5.00	TMS9981	£4.00	TDA3697	£1.00
MS40A-84	£5.00	TMS9981	£4.00	TDA3704	£3.00
MS40A-84	£5.00	TMS9981	£4.00	TDA3823	£2.00
MS40A-84	£5.00	TMS9981	£4.00	TDA3829	£1.00
MS40A-84	£5.00	TMS9981	£4.00	TDA3900	£1.00
MS40A-84	£5.00	TMS9981	£4.00	TDA3908	£1.00
MS40A-84	£5.00	TMS9981	£4.00	TDA3910	£1.00
MS40A-84	£5.00	TMS9981	£4.00	TDA3910B	£1.00
MS40A-84	£5.00	TMS9981	£4.00	TDA3915	£1.00
MS40A-84	£5.00	TMS9981	£4.00	TDA3915A	£2.75
MS40A-84	£5.00	TMS9981	£4.00	TDA3915B	£3.00
MS40A-84	£5.00	TMS9981	£4.00	TDA3915C	£3.00
MS40A-84	£5.00	TMS9981	£4.00	TDA3915D	£3.00
MS40A-84	£5.00	TMS9981	£4.00	TDA3915E	