

APRIL 1990

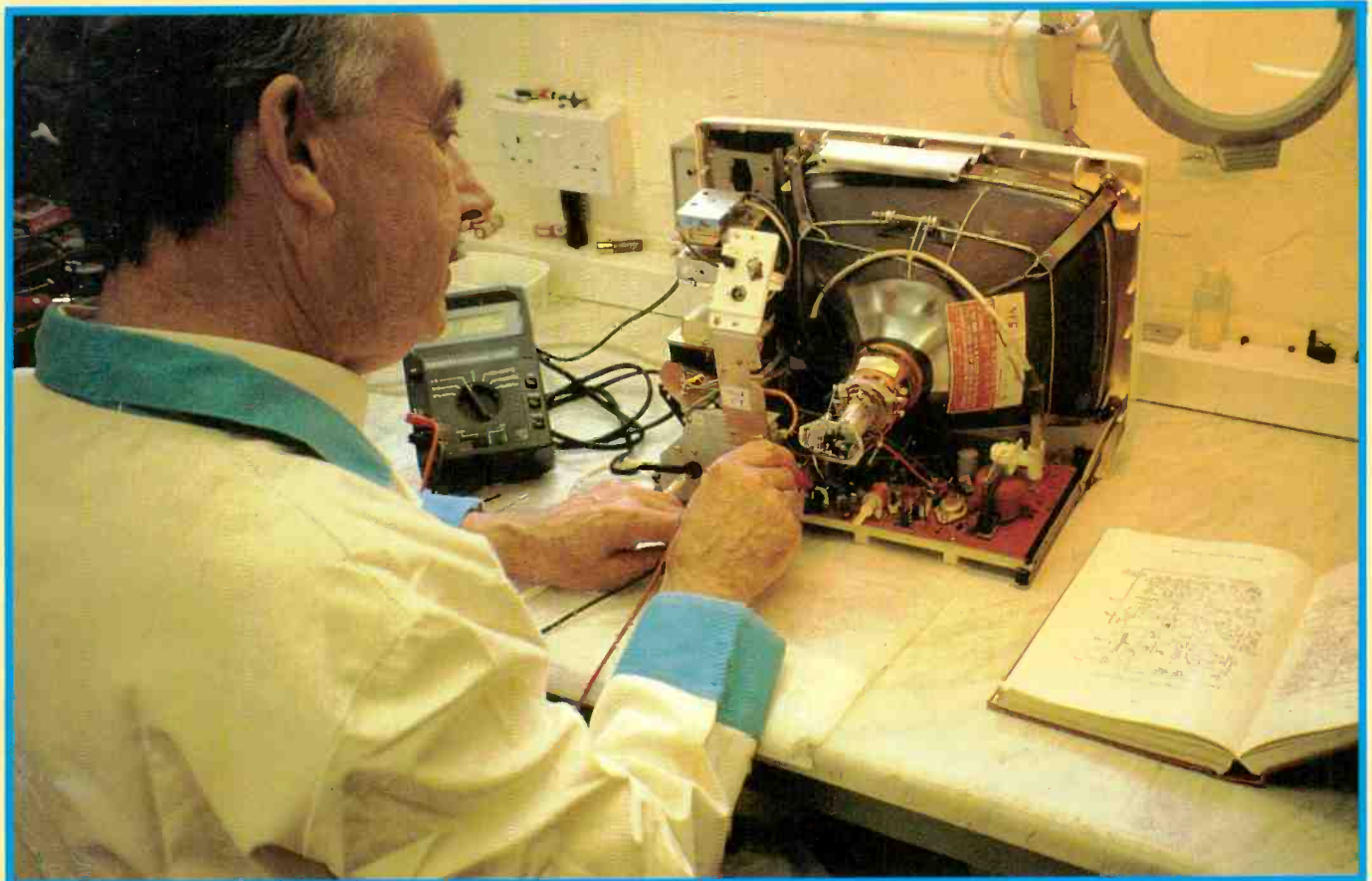
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TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

**FREE TV/VCR SPARES GUIDE
PLUS 32-PAGE CATALOGUE**

(East Cornwall Components)



**Servicing Monochrome Portables
Compact Disc Formats • DX-TV
Fault Finding on CCD Imagers
VCR Clinic • TV Fault Finding
Servicing CD Player Servos**



ONE The "Universal" Remote FOR ALL

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Now, replace all your separate remotes with one remote that does it all!

One For All is an intelligent pre-programmable handset which can operate ANY TV or VCR, or any other home entertainment appliance for that matter, including cable and satellite systems and audio kit, up to 13 in total.

One For All is despatched already pre-programmed – all you have to do to set it for your own appliances is to press 4 keys followed by a 3-digit code for each one. Once set, all the normal features of the original remote control are there ready for you to use – teletext, stereo, brightness control for television . . . skew, polarization, east/west controls for satellites . . . counter, clock set, slow motion for VCR . . .

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But if you are a technical superstar, One For All can become as smart as you are . . .

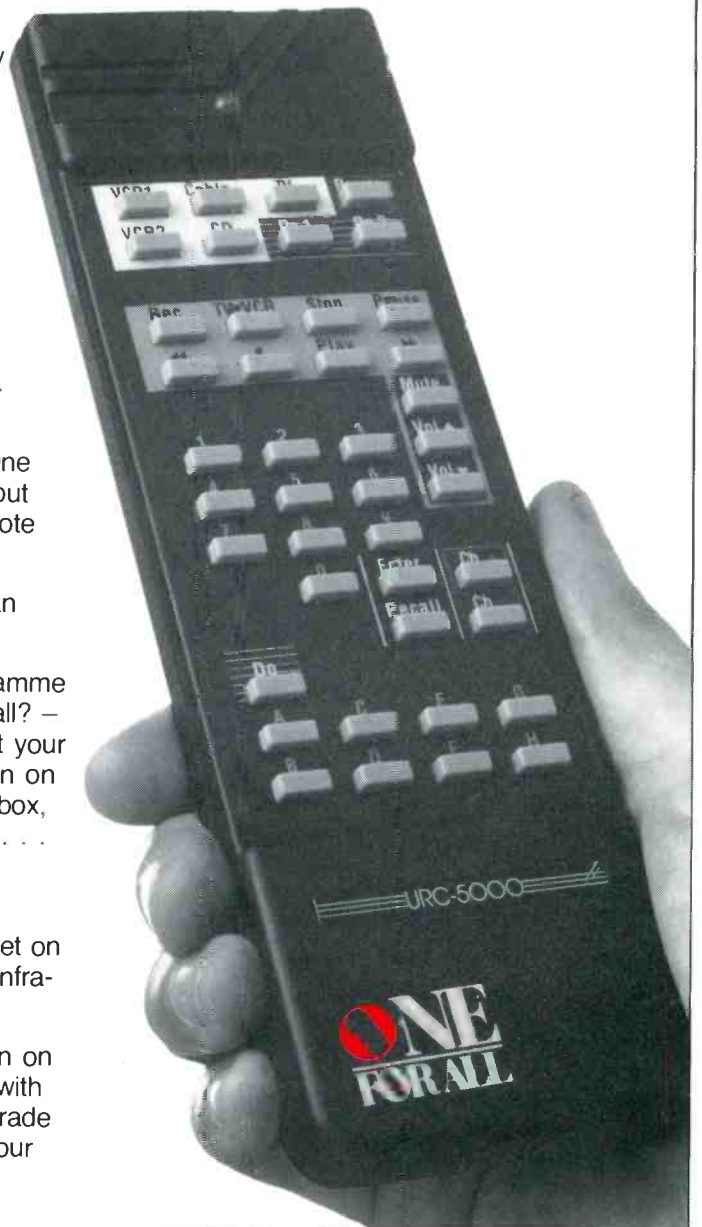
you want to programme a sequence so that pressing one key will do them all? – no problem. You can programme One For All to suit your own requirements, for example you may want to turn on the TV, switch to satellite channel, turn on satellite box, change channel to sky movies, move dish to Astra . . . You can set your One For All to transmit all these instructions at the press of a single key.

There is virtually no limit to the sequences you can set on "One For All", and virtually no limit to the type of infra-red controlled appliances it can operate.

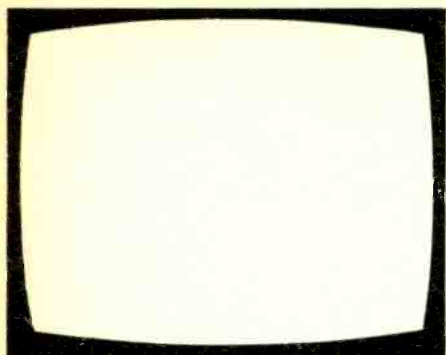
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Please send more information on "One For All" to:
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All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", King's Reach Tower, Stamford Street, 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

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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

- 437 Leader**
- 438 Teletopics**
News, comment and developments.
- 439 Things Ain't So Good** *Les Lawry-Johns*
No change in the property situation but the sets keep coming along.
- 440 CD Player Casebook**
Fault reports from Mike Leach and Ian Bowden.
- 443 Two Days in the Life of . . .** *Kevin D. Davies*
The problems involved in installing a video jukebox – and what the governor did to it afterwards.
- 444 Servicing Monochrome Portables** *David Botto*
Despite the low price of new sets it's still possible to make a profit out of servicing monochrome portables – provided you go about it the right way. Advice on charging, customer liaison and speedy fault-finding on the sets themselves.
- 445 Next Month in Television**
- 448 Letters**
- 450 Compact Disc Formats** *George Cole*
From LaserVision to the CD-ROM, taking in the basic CD system, CD Graphics, CD Video and CD Interactive. System specifications and details of the discs and players.
- 456 VCR Clinic**
Reports from Philip Blundell, Eng. Tech., Eugene Trundle, Alfred Damp, Ian Bowden, Stephen Leatherbarrow and Chris Avis.
- 458 Long-distance Television** *Roger Bunney*
DX conditions and reception and news from abroad. Plus a review of the PR Technology decoder for unscrambling the Filmnet Satellite TV transmissions.
- 461 Servicing Compact Disc Players, Part 14** *Joe Cieszynski*
Setting up procedures and fault finding in the focus and tracking servo sections of a player, with an explanation of what the various controls do.
- 466 TV Fault Finding**
Reports from Philip Blundell, Eng. Tech., Eugene Trundle, Chris Plaice, Nick Beer, J.K. Potts, Mick Dutton, J.C. Priest and Chris Avis.
- 468 Fault Finding on Image Sensors** *Steve Beeching, T.Eng.*
The imager's supplies and drive signals and how to diagnose faults from the symptoms displayed.
- 470 The Room at the Back** *J. LeJeune*
More on the brilliant work carried out in Sid's service department . . .
- 471 Test Case 328**

OUR NEXT ISSUE DATED MAY WILL
BE PUBLISHED ON APRIL 18

AA119	9p	BD245	50p	BFX29	20p	S2800	52p	2N5321	60p	78GUC1	215p	AN-7178	290p	LA-1130	150p	M-5151B	225p	STK-4021	425p	TA-7207	150p	TDA-1524	350p
AA132	9p	BD264	50p	BFX84	20p	S2800M	52p	2N5366	25p	78GUC1	190p	AY-1016	270p	LA-1150	150p	M-5151B	225p	STK-4025	600p	TA-7208	145p	TDA-1541	1600p
AA137	40p	BD265	45p	BFX85	20p	S2800M	52p	2N5401	12p	78GUC1	190p	AY-1270	270p	LA-1185	150p	M-5151B	225p	STK-4026	800p	TA-7209	150p	TDA-1670A	300p
AA125	25p	BD269	45p	BFX87	15p	T2800	52p	2N5488	12p	VALVES		AY-1390	450p	LA-1201	75p	M-5151B	200p	STK-4028	620p	TA-7210	260p	TDA-1701	320p
AA126	25p	BD269	45p	BFX88	15p	T2800M	52p	2N5496	8p	DAF96	60p	AY-3810	450p	LA-1210	140p	M-5151B	240p	STK-4036	600p	TA-7211	145p	TDA-1700A	300p
AA127	21p	BD278	50p	BFX89	60p	TIP29A	22p	2N6107	40p	DF36	50p	AY-3812	400p	LA-1230	130p	M-5151B	240p	STK-4044	1100p	TA-7222	120p	TDA-1870A	300p
AA128	21p	BD311	100p	BFY18	40p	TIP29C	22p	2N6254	110p	DL92	50p	BA-301	65p	LA-1231	210p	M-5151B	240p	STK-4046	1100p	TA-7223	120p	TDA-1872A	450p
AA141	30p	BD312	100p	BFY50	140p	TIP30	25p	2N6292	40p	DY87	60p	BA-311	80p	LA-1364	200p	M-5151B	240p	STK-4048	1280p	TA-7225	300p	TDA-1904	120p
AA142K	30p	BD314	100p	BFY51	140p	TIP30C	30p	2N6334	120p	DY802	75p	BA-333	80p	LA-1368	220p	M-5151B	240p	STK-4101	650p	TA-7227	190p	TDA-1908A	100p
AA176	22p	BD315	150p	BFY56	25p	TIP31A	24p	2N6403	160p	EABC80	60p	BA-340	150p	LA-1385	170p	M-5151B	240p	STK-4111	950p	TA-7229	300p	TDA-1940	280p
AA187	21p	BD316	150p	BFY64	25p	TIP32A	24p	2N6413	65p	EB01	44p	BA-401	60p	LA-1460	220p	M-5151B	240p	STK-4112	950p	TA-7230	170p	TDA-1941	300p
AA187K	21p	BD318	150p	BFY90	45p	TIP32C	28p			EBF80	45p	BA-402	60p	LA-2000	150p	M-5151B	240p	STK-4122	650p	TA-7232	250p	TDA-1950	280p
AA188	21p	BD331	150p	BLV49	85p	TIP33	28p			ECB82	80p	BA-514	150p	LA-2100	190p	M-5151B	240p	STK-4131	680p	TA-7233	600p	TDA-2002	80p
AA188K	21p	BD332	150p	BR100	43p	TIP33C	60p			ECB83	80p	BA-516	150p	LA-2101	160p	M-5151B	240p	STK-4141	650p	TA-7234	400p	TDA-2003	100p
AA189	48p	BD362	80p	BR101	43p	TIP34C	60p			ECB85	80p	BA-524	240p	LA-3201	80p	M-5151B	240p	STK-4151	680p	TA-7235	200p	TDA-2004	130p
AA191	48p	BD370	30p	BR303	85p	TIP35C	65p	AA119	9p	ECH81	100p	BA-526	220p	LA-3210	65p	M-5151B	240p	STK-4152	950p	TA-7242	290p	TDA-2006	120p
AD142	100p	BD371	30p	BR309	55p	TIP36C	65p	AY1100	40p	ECH82	100p	BA-527	95p	LA-3220	100p	M-5151B	240p	STK-4162	950p	TA-7243	350p	TDA-2008	175p
AD161	35p	BD433	28p	BRV49	38p	TIP41C	25p	BY126	6p	ECL82	80p	BA-534	290p	LA-3301	110p	M-5151B	240p	STK-4171	1000p	TA-7267	290p	TDA-2009	200p
AD162	35p	BD434	28p	BRV56	33p	TIP42A	25p	BY127	8p	ECL84	70p	BA-536	180p	LA-3350	110p	M-5151B	240p	STK-4181	820p	TA-7269	850p	TDA-2010	200p
AF124	50p	BD436	31p	BSX20	15p	TIP42C	25p	BY133	8p	ECL86	80p	BA-546	180p	LA-3361	100p	M-5151B	240p	STK-4191	1100p	TA-7270	250p	TDA-2020	140p
AF125	50p	BD437	31p	BSX26	18p	TIP47	40p	BY164	40p	ECL87	80p	BA-550	160p	LA-3401	100p	M-5151B	240p	STK-4201	1000p	TA-7271	200p	TDA-2030	120p
AF126	50p	BD438	31p	BSX28	18p	TIP48	40p	BY179	35p	ECL88	80p	BA-556	150p	LA-3403	180p	M-5151B	240p	STK-4202	1000p	TA-7272	260p	TDA-2038	900p
AF239	30p	BD438	30p	BT100A	70p	TIP49	45p	BY184	32p	EF85	65p	BA-558	380p	LA-4031	140p	M-5151B	240p	STK-4301	700p	TA-7273	350p	TDA-2040	200p
AF239	30p	BD438	30p	BT106	180p	TIP50	60p	BY196	20p	EF85	65p	BA-584	400p	LA-4032	140p	M-5151B	240p	STK-4311	800p	TA-7274	250p	TDA-2054M	120p
AS215	100p	BD441	40p	BT109	90p	TIP52	120p	BY207	11p	EF183	75p	BA-610	160p	LA-4100	85p	M-5151B	240p	STK-4352	700p	TA-7275	270p	TDA-2100	300p
AS217	100p	BD442	40p	BT119	100p	TIP53	120p	BY208	18p	EL34	25p	BA-630	160p	LA-4101	85p	M-5151B	240p	STK-4362	625p	TA-7282	260p	TDA-2170	400p
BA165	10p	BD520	60p	BT138	60p	TIP54	140p	BY210	22p	EL84	75p	BA-630	160p	LA-4102	120p	M-5151B	240p	STK-4372	600p	TA-7283	280p	TDA-2200	80p
BA143	10p	BD521	60p	BT146	99p	TIP56	140p	BY212	18p	EL85	75p	BA-640	160p	LA-4112	120p	M-5151B	240p	STK-4373	1000p	TA-7289	400p	TDA-2300	80p
BA154	6p	BD534	38p	BT149	99p	TIP106	65p	BY226	18p	EL85	75p	BA-403	220p	LA-4112	120p	M-5151B	240p	STK-4373	1000p	TA-7289	400p	TDA-2510	450p
BA157	12p	BD535	38p	BT179	140p	TIP107	65p	BY227	18p	EL85	75p	BA-403	220p	LA-4120	270p	M-5151B	240p	STK-4392	1180p	TA-7310	100p	TDA-2524	120p
BB106B	18p	BD536	38p	BU100A	110p	TIP110	47p	BY228	32p	EL86	75p	BA-5102	200p	LA-4125	200p	M-5151B	240p	STK-4803	820p	TA-7312	120p	TDA-2532	120p
BC107	8p	BD538	40p	BU104	100p	TIP112	40p	BY298	26p	EY87	45p	BA-5402	250p	LA-4135	250p	M-5151B	240p	STK-4833	920p	TA-7314	210p	TDA-2540	100p
BC108	8p	BD543	40p	BU108	100p	TIP115	45p	BY299	28p	EY87	45p	BA-5406	250p	LA-4137	180p	M-5151B	240p	STK-4843	865p	TA-7315	200p	TDA-2542	150p
BC109	8p	BD545	40p	BU109	100p	TIP116	45p	BY310	15p	EZ35	65p	BA-5408	220p	LA-4140	70p	M-5151B	240p	STK-4853	950p	TA-7317	240p	TDA-2543	300p
BC109C	8p	BD545	40p	BU110	110p	TIP120	43p	BY355/600	30p	EZ80	70p	BA-5408	220p	LA-4160	200p	M-5151B	240p	STK-4853	950p	TA-7317	240p	TDA-2543	300p
BC115	10p	BD649	50p	BU140	140p	TIP121	46p	BY70/500	32p	GZ34	200p	BA-6208	250p	LA-4182	190p	M-5151B	240p	STK-4893	1400p	TA-7328	200p	TDA-2556	300p
BC118	11p	BD651	50p	BU126	60p	TIP122	47p	BY70/800	36p	PC85	60p	BA-6209	320p	LA-4190	300p	M-5151B	240p	STK-4913	1220p	TA-7329	200p	TDA-2566	120p
BC140	20p	BD675	38p	BU180	150p	TIP127	45p	OA90	6p	PCF80	80p	BA-6305	300p	LA-4192	180p	M-5151B	240p	STK-5023	600p	TA-7332	250p	TDA-2575	100p
BC142	20p	BD678	38p	BU120	75p	TIP127	56p	OA91	6p	PCF200	135p	BA-640	220p	LA-4201	120p	M-5151B	240p	STK-5322	620p	TA-7343	250p	TDA-2578A	200p
BC147	40p	BD679	40p	BU205	70p	TIP130	30p	QA200	7p	PCF80	80p	BA-6411	250p	LA-4220	230p	M-5151B	240p	STK-5324	550p	TA-7357	400p	TDA-2579	250p
BC148	40p	BD680	40p	BU206	70p	TIP132	30p	QA201	7p	PCF80	80p	BA-6411	250p	LA-4260	230p	M-5151B	240p	STK-5325	550p	TA-7357	400p	TDA-2581	155p
BC149	8p	BD681	40p	BU206	70p	TIP132	30p	QA201	7p	PCF80	80p	BA-6411	250p	LA-4260	230p	M-5151B	240p	STK-5325	550p	TA-7357	400p	TDA-2581	155p
BC157	8p	BD682	40p	BU206	70p	TIP132	30p	QA201	7p	PCF80	80p	BA-6411	250p	LA-4260	230p	M-5151B	240p	STK-5325	550p	TA-7357	400p	TDA-2581	155p
BC159	8p	BD683	40p	BU206	70p	TIP132	30p	QA201	7p	PCF80	80p	BA-6411	250p	LA-4260	230p	M-5151B	240p	STK-5325	550p	TA-7357	400p	TDA-2581	155p
BC160	8p	BD684	40p	BU206	70p	TIP132	30p	QA201	7p	PCF80	80p	BA-6411	250p	LA-4260	230p	M-5151B	240p	STK-5325	550p	TA-7357	400p	TDA-2581	155p
BC171	10p	BD709	50p	BU209	140p	TIP149	90p	UA001	40p	PCH200	100p	BA-7004	200p	LA-4270	300p	M-5151B	240p	STK-5371	300p	TA-7607	270p	TDA-2582	160p
BC172	10p	BD711	50p	BU209	140p	TIP149	90p	UA001	40p	PCH200	100p	BA-7004	200p	LA-4270	300p	M-5151B	240p	STK-5371	300p	TA-7607	270p	TDA-2582	160p
BC177	14p	BD736	50p	BU312	120p	TIP150	90p	UA001	40p	PCH200	100p	BA-7004	200p	LA-4270	300p	M-5151B	240p	STK-5371	300p	TA-7607	270p	TDA-2582	160p
BC178	14p	BD737	50p	BU312	120p	TIP150	90p	UA001	40p	PCH200	100p	BA-7004	200p	LA-4270	300p	M-5151B	240p	STK-5371	300p	TA-7607	270p	TDA-2582	160p
BC182	7p	BD785	50p	BU325	55p	TIP159	90p	UA001	40p	PCH200	100p	BA-7004	200p	LA-4270	300p	M-5151B	240p	STK-5371	300p	TA-7607	270p	TDA-2582	160p
BC182L	7p	BD787	50p	BU325	55p	TIP159	90p	UA001	40p	PCH200	100p	BA-7004	200p	LA-4270	300p	M-5151B	240p	STK-5371	300p	TA-7607	270p	TDA-2582	160p
BC183	7p	BD789	50p	BU325	55p	TIP159	90p	UA001	40p	PCH200	100p	BA-7004	200p	LA-4270	300p	M-5151B	240p	STK-5371	300p	TA-7607	270p	TDA-2582	160p
BC183L	7p	BD789	50p	BU325	55p	TIP159	90p	UA001	40p	PCH200	100p	BA-7004	200p	LA-4270	300p	M-5151B	240p	STK-5371	300p	TA-7607	270p	TDA-2582	160p
BC184	7p	BD797	50p	BU407D	95p	TIS61	42p	UA001	40p	PCH200	100p	BA-7004	200p	LA-4270									

LINEAR IC'S

TEA-1002 650p	25A-979 85p	25C-1114 415p	25C-2278A 60p	25C-3179 160p	25D-789 80p	25D-1608 210p	25D-1941 500p
TLO-61 40p	25A-980 30p	25C-1115 380p	25C-2279 25p	25C-3181 240p	25D-792 400p	25D-1609 100p	25D-1984 150p
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TLO-72 55p	25A-1008 120p	25C-1162 35p	25C-2282 60p	25C-3225 100p	25D-811 450p	25D-1651 270p	25J-57 45p
TLO-74 80p	25A-1010 225p	25C-1164 60p	25C-2283 30p	25C-3244 80p	25D-819 400p	25D-1663 450p	25K-19 45p
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TLO-82 40p	25A-1012 100p	25C-1195 210p	25C-2290 25p	25C-3261 500p	25D-822 400p	25D-1667 120p	25K-58 100p
TLO-83 67p	25A-1013 30p	25C-1212 120p	25C-2298 120p	25C-3263 350p	25D-826 100p	25D-1668 120p	25K-68 100p
TLO-84 80p	25A-1016 40p	25C-1213 50p	25C-2299 80p	25C-3264 510p	25D-836 150p	25D-1677 300p	25K-134 415p
ULN-2002 70p	25A-1018 100p	25C-1214 40p	25C-2271 60p	25C-3277 280p	25D-836A 200p	25D-1739 450p	25K-135 415p
ULN-2003 69p	25A-1019 100p	25C-1215 60p	25C-2274 40p	25C-3280 300p	25D-837 80p	25D-1815 100p	25K-147 45p
ULN-2004 69p	25A-1069 150p	25C-1216 200p	25C-2275 50p	25C-3281 300p	25D-838 400p	25D-1825 120p	25K-196 150p
ULN-2008 170p	25A-1076 280p	25C-1275 75p	25C-2278 120p	25C-3293 85p	25D-841 160p	25D-1843 100p	25K-197 140p
ULN-2803 130p	25A-1084 100p	25C-1278 110p	25C-2291 1800p	25C-3298 120p	25D-844 200p	25D-1846 350p	25K-312 750p
ULN-2804 170p	25A-1091 100p	25C-1279 30p	25C-2291 125p	25C-3299 120p	25D-845 250p	25D-1884 300p	25K-323 130p
ULN-2805 130p	25A-1094 190p	25C-1306 90p	25C-2295 60p	25C-3303 170p	25D-850 260p	25D-1910 280p	25K-88 70p
ULN-2806 130p	25A-1102 180p	25C-1308 350p	25C-2298 120p	25C-3306 200p	25D-856 80p		
ULN-2807 130p	25A-1105 120p	25C-1317 25p	25C-2301 500p	25C-3316 280p	25D-858 250p		
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ULN-2809 130p	25A-1111 120p	25C-1327 20p	25C-2320 120p	25C-3331 40p	25D-864 200p		
ULN-2810 130p	25A-1112 120p	25C-1328 40p	25C-2324 120p	25C-3335 90p	25D-866 120p		
ULN-2811 130p	25A-1113 70p	25C-1329 80p	25C-2324 120p	25C-3356 120p	25D-868 450p		
ULN-2812 130p	25A-1114 80p	25C-1342 120p	25C-2331 150p	25C-3358 80p	25D-870 400p		
ULN-2813 130p	25A-1117 120p	25C-1345 60p	25C-2331 150p	25C-3378 120p	25D-871 450p		
ULN-2814 130p	25A-1121 200p	25C-1358 350p	25C-2333 200p	25C-3383 80p	25D-879 60p		
ULN-2815 130p	25A-1123 200p	25C-1359 60p	25C-2334 240p	25C-3400 40p	25D-880 20p		
ULN-2816 130p	25A-1124 80p	25C-1363 35p	25C-2334 240p	25C-3402 50p	25D-882 80p		
ULN-2817 130p	25A-1125 120p	25C-1384 35p	25C-2337 60p	25C-3416 80p	25D-892A 100p		
ULN-2818 130p	25A-1126 120p	25C-1390 55p	25C-2353 120p	25C-3417 100p	25D-894 120p		
ULN-2819 130p	25A-1127 120p	25C-1395 80p	25C-2360 120p	25C-3419 120p	25D-895 100p		
ULN-2820 130p	25A-1128 120p	25C-1398 70p	25C-2361 150p	25C-3420 120p	25D-896 200p		
ULN-2821 130p	25A-1129 120p	25C-1403 500p	25C-2362 50p	25C-3422 110p	25D-890 400p		
ULN-2822 130p	25A-1130 120p	25C-1404 500p	25C-2369 100p	25C-3425 110p	25D-891 400p		
ULN-2823 130p	25A-1131 120p	25C-1413 240p	25C-2373 210p	25C-3459 250p	25D-917 300p		
ULN-2824 130p	25A-1132 120p	25C-1419 150p	25C-2389 45p	25C-3460 300p	25D-921 320p		
ULN-2825 130p	25A-1133 120p	25C-1424 150p	25C-2407 110p	25C-3461 400p	25D-923 300p		
ULN-2826 130p	25A-1134 120p	25C-1446 100p	25C-2408 120p	25C-3466 350p	25D-948 120p		
ULN-2827 130p	25A-1135 120p	25C-1448 100p	25C-2412 100p	25C-3467 70p	25D-950 300p		
ULN-2828 130p	25A-1136 120p	25C-1449 120p	25C-2413 50p	25C-3468 70p	25D-951 300p		
ULN-2829 130p	25A-1137 120p	25C-1450 200p	25C-2458 40p	25C-3502 120p	25D-952 300p		
ULN-2830 130p	25A-1138 120p	25C-1452 100p	25C-2463 120p	25C-3502 120p	25D-957A 50p		
ULN-2831 130p	25A-1139 120p	25C-1453 320p	25C-2470 65p	25C-3503 90p	25D-958 60p		
ULN-2832 130p	25A-1140 120p	25C-1473 70p	25C-2481 120p	25C-3504 120p	25D-959 100p		
ULN-2833 130p	25A-1141 350p	25C-1474 125p	25C-2482 40p	25C-3505 120p	25D-961 100p		
ULN-2834 130p	25A-1142 120p	25C-1475 60p	25C-2483 120p	25C-3506 120p	25D-973 60p		
ULN-2835 130p	25A-1143 120p	25C-1505 80p	25C-2484 240p	25C-3508 170p	25D-973A 60p		
ULN-2836 130p	25A-1144 120p	25C-1507 140p	25C-2510 80p	25C-3595 220p	25D-985 120p		
ULN-2837 130p	25A-1145 120p	25C-1508 140p	25C-2511 60p	25C-3608 120p	25D-986 120p		
ULN-2838 130p	25A-1146 120p	25C-1514 65p	25C-2527 300p	25C-3613 130p	25D-1012 200p		
ULN-2839 130p	25A-1147 120p	25C-1515 65p	25C-2545 55p	25C-3636 280p	25D-1021 120p		
ULN-2840 130p	25A-1148 120p	25C-1520 120p	25C-2547 65p	25C-3657 400p	25D-1022 400p		
ULN-2841 130p	25A-1149 120p	25C-1521 120p	25C-2550 70p	25C-3668 120p	25D-1024 130p		
ULN-2842 130p	25A-1150 120p	25C-1541 110p	25C-2551 70p	25C-3675 160p	25D-1025 130p		
ULN-2843 130p	25A-1151 120p	25C-1545 120p	25C-2552 150p	25C-3678 280p	25D-1046 200p		
ULN-2844 130p	25A-1152 120p	25C-1546 120p	25C-2553 200p	25C-3679 200p	25D-1051 130p		
ULN-2845 130p	25A-1153 120p	25C-1547 140p	25C-2555 150p	25C-3717 120p	25D-1060 130p		
ULN-2846 130p	25A-1154 120p	25C-1548 140p	25C-2556 150p	25C-3717 120p	25D-1061 130p		
ULN-2847 130p	25A-1155 120p	25C-1549 140p	25C-2557 150p	25C-3719 150p	25D-1071 450p		
ULN-2848 130p	25A-1156 120p	25C-1550 80p	25C-2558 200p	25C-3746 120p	25D-1073 350p		
ULN-2849 130p	25A-1157 120p	25C-1551 60p	25C-2559 200p	25C-3747 120p	25D-1074 350p		
ULN-2850 130p	25A-1158 120p	25C-1552 60p	25C-2560 200p	25C-3748 120p	25D-1075 350p		
ULN-2851 130p	25A-1159 120p	25C-1553 60p	25C-2561 200p	25C-3749 75p	25D-1076 350p		
ULN-2852 130p	25A-1160 120p	25C-1554 60p	25C-2562 200p	25C-3750 120p	25D-1078 520p		
ULN-2853 130p	25A-1161 120p	25C-1555 60p	25C-2563 200p	25C-3751 120p	25D-1079 520p		
ULN-2854 130p	25A-1162 120p	25C-1556 60p	25C-2564 200p	25C-3752 120p	25D-1081 520p		
ULN-2855 130p	25A-1163 120p	25C-1557 60p	25C-2565 200p	25C-3753 120p	25D-1082 520p		
ULN-2856 130p	25A-1164 120p	25C-1558 60p	25C-2566 200p	25C-3754 120p	25D-1083 520p		
ULN-2857 130p	25A-1165 120p	25C-1559 60p	25C-2567 200p	25C-3755 120p	25D-1084 520p		
ULN-2858 130p	25A-1166 120p	25C-1560 60p	25C-2568 200p	25C-3756 120p	25D-1085 520p		
ULN-2859 130p	25A-1167 120p	25C-1561 60p	25C-2569 200p	25C-3757 120p	25D-1086 520p		
ULN-2860 130p	25A-1168 120p	25C-1562 60p	25C-2570 200p	25C-3758 120p	25D-1087 520p		
ULN-2861 130p	25A-1169 120p	25C-1563 60p	25C-2571 200p	25C-3759 120p	25D-1088 520p		
ULN-2862 130p	25A-1170 500p	25C-1564 60p	25C-2572 200p	25C-3760 120p	25D-1089 520p		
ULN-2863 130p	25A-1171 500p	25C-1565 60p	25C-2573 200p	25C-3761 120p	25D-1090 520p		
ULN-2864 130p	25A-1172 500p	25C-1566 60p	25C-2574 200p	25C-3762 120p	25D-1091 520p		
ULN-2865 130p	25A-1173 500p	25C-1567 60p	25C-2575 200p	25C-3763 120p	25D-1092 520p		
ULN-2866 130p	25A-1174 500p	25C-1568 60p	25C-2576 200p	25C-3764 120p	25D-1093 520p		
ULN-2867 130p	25A-1175 500p	25C-1569 60p	25C-2577 200p	25C-3765 120p	25D-1094 520p		
ULN-2868 130p	25A-1176 500p	25C-1570 60p	25C-2578 200p	25C-3766 120p	25D-1095 520p		
ULN-2869 130p	25A-1177 500p	25C-1571 60p	25C-2579 200p	25C-3767 120p	25D-1096 520p		
ULN-2870 130p	25A-1178 500p	25C-1572 60p	25C-2580 200p	25C-3768 120p	25D-1097 520p		
ULN-2871 130p	25A-1179 500p	25C-1573 60p	25C-2581 200p	25C-3769 120p	25D-1098 520p		
ULN-2872 130p	25A-1180 500p	25C-1574 60p	25C-2582 200p	25C-3770 120p	25D-1099 520p		
ULN-2873 130p	25A-1181 500p	25C-1575 60p	25C-2583 200p	25C-3771 120p	25D-1100 520p		
ULN-2874 130p	25A-1182 500p	25C-1576 60p	25C-2584 200p	25C-3772 120p	25D-1101 520p		
ULN-2875 130p	25A-1183 500p	25C-1577 60p	25C-2585 200p	25C-3773 120p	25D-1102 520p		
ULN-2876 130p	25A-1184 500p	25C-1578 60p	25C-2586 200p	25C-3774 120p	25D-1103 520p		
ULN-2877 130p	25A-1185 500p	25C-1579 60p	25C-2587 200p	25C-3775 120p	25D-1104 520p		
ULN-2878 130p	25A-1186 500p	25C-1580 60p	25C-2588 200p	25C-3776 120p	25D-1105 520p		
ULN-2879 130p	25A-1187 500p	25C-1581 60p	25C-2589 200p	25C-3777 120p	25D-1106 520p		
ULN-2880 130p	25A-1188 500p	25C-1582 60p	25C-2590 200p	25C-3778 120p	25D-1107 520p		
ULN-2881 130p	25A-1189 500p	25C-1583 60p	25C-2591 200p	25C-3779 120p	2		

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AKAI
VS9300, VS9500, VS9700, 3V16, 3V22, 3V23 150p
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VCR5200 360p
VCR7000 360p

FERGUSON
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3V29-30, 3V31-32 280p
3V35-36, 3V38-39, 3V42-43, 3V44-45, 3V48, 3V53, 3V54-55, 3V56-57, 3V58-59, 3V64-65, FV10-11, FV12-14 280p

HITACHI
VT11, VT33 280p
VT61-62, VT63-64, VT65, VT86-88, 280p
VT110-122, VT120-128, VT130-135, VT138-150, VT168, -220, VT5000, VT8000, VT9300, VT9500 280p

JVC
HR3300, HR3330, HR3360, HR3660, HR4100, HR7700, HR7720, HR7730, HR7860, HR7610, HR7650, HR7655 280p
HRD110, HRD111, HRD120, HRD121, HRD140, HRD150, HRD160, HRD225, HRD455, HRD565, HRD725 280p

MITSUBISHI
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NATIONAL
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PHILIPS
VR6460 280p

SANYO
VHR1100, VHR1300, VHR1500, VHR2300, VHR3000 360p
VTC5000, VTC5150, VTC5600, VTC9300, VTCM10, VTCM20 280p

SHARP
VC381, VC386, VC2300, VC3300, VC7300, VC7700, VC8300, VC9100, VC9300, VC9500, VC9700, VC387, VC481, VC482, VC483, VC486, VC496, VC581 360p
VC582, VC583, VC585, VC651, VC681, VC685, VC750, VC780, VC781, VC785, VC787 360p
VC793, VCT72 360p

SONY
SLC5, SLC6, SLC7 360p
SLC9, SLC20, SLC24, SLC30, SLC33, SLC44, SLH100 360p
SLF1, SLF11, SLF25, SLF30, SLF60, SLF100 360p

PHILIPS
VR-6460 170p

SANYO
VTC-5000 75p
VTC-5300 100p
VTC-5500 95p
VTC-9300 220p

SHARP
VC-381/383/386 125p
VC-6300 150p
VC-7300/7700/7750 150p
VC-9300 150p
VC-8381, VC-9100 125p
VC-9300, VC-9500 135p

SONY
SL-C5, SL-C6 140p
SC-C7 140p
SC-C9 165p
SL-8000-8080 200p

TOSHIBA
V-55/57 85p
V-5250/5280 230p
V-5470 210p
V-5475 160p
V-7540 160p
V-8600 150p
V-9600 85p

AKAI
VP-7100 160p
VS-1 150p
VS-2EG 100p
VS-4 120p
VS-5EG 100p
VS-9300 160p
VS-9500 155p
VS-9700 160p
VS-9800 155p

AMSTRAD
TVR-1-2-3 210p
VCR-4600 & Mk 2 210p
VCR-4700 210p
VCR-5200 210p
VCR-7000 80p

FERGUSON
3292, 3V00, 3V01 150p
3V16, 3V22, 3V23 65p
3V29/30 120p
3V31/32 85p
3V35/36 80p
3V38-39 80p
3V42/43 65p
3V44/45 65p
3V45/54 65p
3V55 65p

FISHER
VBS-7000 245p
VBS-9000 120p

HITACHI
VT-11, VT-33 100p
VT-5000 120p
VT-5500 130p
VT-8000 60p
VT-8500 60p
VT-9300 50p
VT-9500 50p
VT-9700 60p

JVC
HR-3300, HR-3330, HR-3360, HR-3660, HR-4100, HR-7700, HR-7720, HR-7730, HR-7860, HR-7610, HR-7650, HR-7655 150p
HRD110, HRD111, HRD120, HRD121, HRD140, HRD150, HRD160, HRD225, HRD455, HRD565, HRD725 180p
HR-4100 180p
HR-7200 70p
HR-7600 80p
HR-7610 95p
HR-7650 75p
HR-7655 90p
HR-7700 77p
HRD-110, HRD-111, HRD-120, HRD-225, HRD-250, HRD-455, HRD-565, HRD-566, HRD-725, HRD-755 100p

MITSUBISHI
HS-200 200p

NATIONAL
NV-300 160p
NV-333 135p
NV-377 100p
NV-2000 150p
NV-3000 160p
NV-7000 95p
NV-7200 90p
NV-8600 160p

PHILIPS
VR-6460 170p

SANYO
VTC-5000 75p
VTC-5300 100p
VTC-5500 95p
VTC-9300 220p

SHARP
VC-381/383/386 125p
VC-6300 150p
VC-7300/7700/7750 150p
VC-9300 150p
VC-8381, VC-9100 125p
VC-9300, VC-9500 135p

SONY
SL-C5, SL-C6 140p
SC-C7 140p
SC-C9 165p
SL-8000-8080 200p

TOSHIBA
V-55/57 85p
V-5250/5280 230p
V-5470 210p
V-5475 160p
V-7540 160p
V-8600 150p
V-9600 85p

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VCR-7000 & JVC

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PU-45979
CAPSTAN MOTOR 1950p
PU-55371V
DRUM MOTOR 1950p
PU-46414
REEL MOTOR 2650p
PU-51381V

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74LS SERIES HIGH SPEED CMOS
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74ALS SERIES LOW POWER SCHOTTKY T.T.L.
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 BOOKS AND MANUALS ARE ZERO V.A.T. Goods are despatched on the day we receive your order. If for any reason we are out of stock we will try to inform you as quickly as possible. We try our best to give a speedy, fair and efficient service. V.A.T. invoice on request. Give us a ring - we'll give you service. Please ask if what you need is not listed - we will try to help. Prices are subject to change without notice. In some cases we may have to supply an equivalent. We need expiry dates for credit card orders. MINIMUM ORDER £5 or handling charge will be made.

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BELT KITS	no of belts
VK1 AKAI VS9300/9500/9000	
JVC HR3300/3320/3330/3360	
TCE 8903/3V00/3V16/3V22	7 2.40
VK2 NAT. PAN. NV7000B/7200B	5 1.45
VK3 SONY SLC57	6 2.25
VK4 SONY SL8000/8500/8600	6 3.60
VK5 SONY SL3000UB	7 2.10
VK6 NAT. PAN. NV3000B	6 1.99
VK7 SANYO 9300P	4 2.75
VK8 NAT. PAN. NV2000B	6 1.73
VK9 NAT. PAN. NV8600B/8610/V011	7 1.50
VK10 TOSHIBA V8600	6 1.45
VK13 SANYO VT6500M	2 1.50
VK14 SANYO VT6500	5 1.85
VK15 JVC HR7650/3V31	3 2.00
VK16 HITACHI 5000	1 1.90
VK17 SHARP 8300	6 1.76
VK18 SHARP 9300	5 1.47
VK19 HITACHI VT18000/8300/8500	3 1.05
VK20 HITACHI VT11 33	6 1.50
VK21 HITACHI 9500	3 1.12
VK22 SONY SLC6	6 1.90
VK23 SANYO 5500	3 1.05
VK24 NAT. PAN. NV3000/NV333	6 1.55
VK25 TOSHIBA V7540	5 1.90
VK26 JVC/HR 7700/3V23	2 2.96
VK27 THORN 3V29	4 1.75
VK28 AMSTRAD 7000	3 1.45
VK38 AMSTRAD 4500/9000	3 2.25
VK39 AMSTRAD 4600/5200	2 2.95
VK29 NAT. PAN. NU777	4 1.80
VK30 SONY T9	6 2.20
VK31 TOSHIBA 9600	4 1.85
VK32 SANYO 1100/1300/1500	4 0.75
VK33 FERGUSON 3V25-36	1 1.20
VK34 FERGUSON 3V42/3-4-5-8	0 0.90
VK35 FISHER FVHP170-716-722	1 1.20
VK36 PANASONIC NV370-430	1 1.20
VK37 HITACHI 9300	0 0.85

VIDEO LAMPS	
NAT. PAN. VHS BULB (ALSO SHARP)	1.30
GENERAL PURPOSE VHS BULB	0.50
3V23 WITH PLUG	1.59
3V29 WITH PLUG	1.59
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AMSTRAD 4500/4600/5200/9000	1.80
HITACHI 9300/9500	0.65

FEW ONLY 3HSS	
Hitachi 15.00	
VT4000/4200	
5000/5500	
VIDEO HEADS	

FEW ONLY ANTEX	
AUTO REPAIR SOLDERING KIT	
£4.00 + VAT	

REMOTE CONTROL HANDSETS	
AMSTRAD	
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C.T.V. 1409 - MD1409221	15.00
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V.C.R. 7000 - MD150583	10.00
V.C.R. 9000 - MD150578	10.00

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BC107	0.20
BC141	0.30
BC142	0.30
BC158	0.16
BC212	0.10
BD131	0.33
BD243	0.85
BD244	0.85
BD839	0.96
BD707	1.50
BF757	0.54
BF758	0.54
BR103	0.83
BR303	1.45
BU208A	0.95
BU208D	0.20
BU208/02	2.10
BU326A	0.85
BU426	1.60
BU500	2.50
BU508A	3.20
BU508D	2.77
BU508AF	2.50
BUT11	2.20
BUT11AF	3.00
BOW81A	3.84
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TP42C	0.59
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2SC1307	3.00
2SC1172Y	5.50
2SC3156	2.46
2SD1398	2.46

WE WELCOME ORDERS FROM SCHOOLS, COLLEGES AND GOVERNMENT INSTITUTIONS ON OFFICIAL REQUISITION.

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VHS CAPSTAN MOTOR	25.50
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SHARP REEL MOTOR	19.50



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VID7903	NV333 13.09
VID7906	NV370 9.73
VID7904	NV777 8.33
VID7905	NV730 8.61
VID7909	NV688 8.61
VID7909 Ferguson	3V29 17.85
VID7918	3V35 19.95
VID7919	3V42 24.00
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VID7921	3V58 15.61
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VID7923 Sharp	VC381 12.25
VID7908 Amstrad	Clutch Kit 4.50

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TEST	£3.36

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JUST SOME OF OUR RANGE	
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Lashing Kit	2.30
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Coax Cables	0.18
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Y Splitter	0.85
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Traveller	11.50
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AKAI BV327815	4.87
AMSTRAD 7000	2.20
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FISHER 42040300/400	4.50
FERG 3292 F/F	1.46
FERG 3V00 TAKEUP	1.46
FERG 3V00 TAKEUP late	4.95
FERG 3V16 TAKEUP	4.95
FERG 3V16 TAKEUP late	5.85
FERG 3V22 TAKEUP	4.95
FERG 3V22 TAKEUP late	5.85
FERG 3V29 TAKEUP CL	2.08
FERG 3V29 TAKEUP SPL	2.13
FERG 3V29 TAKEUP IOL	1.44
HITACHI 6414221	2.90
HITACHI 6413663	2.68
HITACHI 6861471	5.04
HITACHI 6861482	0.70
HITACHI 6345173	5.02
HITACHI 6886971	0.40
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NAT PAN VXP041	3.20
NAT PAN VXP040	1.10
NAT PAN VXP034	1.08
NAT PAN VXP031	1.22
NAT PAN VXP052	1.28
NAT PAN VXP043	4.08
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SANYO 5000 RLR ASSY	5.10
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SHARP 006	2.20
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SDNY SLC57 3000	1.27

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4 BUTTON IR8876	15.00
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F14R 12 BUTTON FFD09156	13.81
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I.T.T.	25.00
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G11 TXT U.S. 31 BUTTON	29.42
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DO YOU KNOW THAT WE STILL SELL TRIPLERS LOFTY PUSH BUTTON SWITCHES SERVICES AIDS MANUALS SECURITY EQUIP AERIALS BATTERIES LEADS DIODES POTENTIOMETERS SATELLITE EQUIP AND MUCH MORE? ASK!!
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incl. DISH/LNB RECEIVER	199.00
RG59 CABLE 100M	19.95
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4 CORE POLAR CABLE	10.50
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F LNB CONN	0.45
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COMPASS	6.00
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ONLY	2.50
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6502	4.00
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6526 COMMODORE	8.50
6561 COMMODORE	7.74
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8701 COMMODORE	5.46
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901225 CHA ROM. COMM.	8.71
901226 BAS ROM. COMM.	0.07
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ZTX213	0.17
ZTX314	0.24
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ZTX650-1	0.27
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VCC240	6.15
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LA7800	3.75
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1 MONTH ONLY SKC E80 Video Tape	£20 for 10 - VAT

GOLD PLATED PHONO PLUGS	
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THE FOLLOWING TV REMOTES ARE EXACT REPLACEMENTS FOR THORN SETS AND COVER A WIDE RANGE OF CHASSIS INC. TX910 96100. PLEASE STATE MODEL NO. OF SET OR ORIGINAL HAND SET NO.	

BY127 0.05p	
PHANTOM 240	41.25
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HAMEG OSCILLOSCOPES

HAMEG are Europe's top selling DUAL TRACE OSCILLOSCOPES. Select from four superb models. All, with the exception of the HM 1005, incorporates a useful COMPONENT TESTER. Size - all models - 285mm x 145mm x 380mm. Clear display 8 x 10cm. Mains supply: 110/125/220/240V AC 50/60Hz. All supplied with 2 PROBES, a COMPREHENSIVE MANUAL and a 2 YEAR WARRANTY.

HM203-6 20MHz STANDARD



- SPECIFICATION**
- * 2 Channels
 - * Bandwidth: DC-20MHz
 - * Sens: Ch1, Ch2, 2mV/cm
 - * Timebase: 0.2s-20ns/cm
 - * Triggering: DC-40MHz
 - * Active TV-Sync-Separator
 - * Variable hold-off
 - * Trigger LED indicator
 - * Calibrator: 1KHz Square wave
 - * Component tester
 - * Plus many features

Price £314.00 + £47.10 V.A.T.

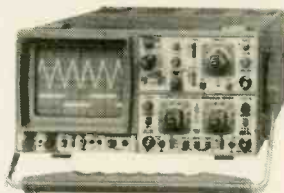
FREE Securicor Delivery

SPECIFICATION

- * 2 Channels
- * Bandwidth: DC-60MHz
- * Sens: Ch1, Ch2, 1mV/cm
- * Timebase: 2.5s-5ns/cm
- * Triggering: DC-80MHz
- * Active TV-Sync-Separator
- * After delay trigger
- * Sweep delay * Delay line
- * Trigger LED indicator
- * Calibrator: 1KHz & 1MHz Sq. Wave
- * Component tester
- * Plus many more superb features

Price £575.00 + £86.25 V.A.T.

HM604 60MHz UNIVERSAL



FREE Securicor Delivery

HM1005 100MHz UNIVERSAL



3 CHANNELS-UP TO 6 TRACES

- SPECIFICATION**
- * 3 Channels
 - * Bandwidth: DC-100MHz
 - * Sens: Ch1, Ch2, Ch3, 1mV/cm
 - * Timebase A: 2.5s-5ns/cm
 - * Timebase B: 0.2s-5ns/cm
 - * Triggering: DC-130MHz
 - * After delay trigger * Delay line
 - * Trigger LED indicator
 - * Overscan LED indicator
 - * Active TV-Sync-Separator
 - * Calibrator: 1KHz & 1MHz Sq. Wave
 - * Plus many more excellent features

Price £726.00 + £108.90 V.A.T.

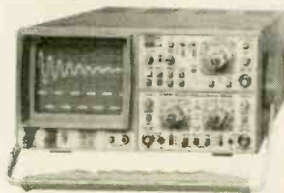
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SPECIFICATION

- * Digital Storage
- * Analogue real time (Same as 203-6)
- * Bandwidth: DC-20MHz
- * Sens: Ch1, Ch2, 2mV/cm
- * Timebase Analogue: 0.2s-20ns/cm
- * Timebase Digital: 5s-2µs/cm
- * Triggering DC-40MHz
- * Active TV-Sync-Separator
- * Max sampling rate: 2x5MHz
- * Memory: 2x1024x8 Bit
- * Dot joiner
- * Printer/plotter output
- * Component tester
- * Plus many more useful features

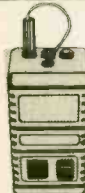
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HM205-2 20MHz DIGITAL STORAGE



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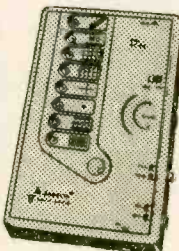
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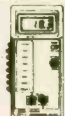
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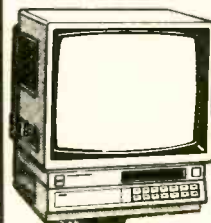
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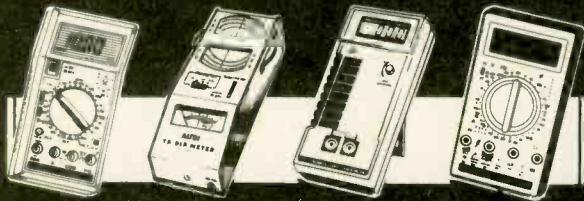


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		HA1421	1.25	TA7193P	4.50	ITT CVC20	8.50	BD131	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		HA1430	2.95	TA7205AP	1.40	ITT CVC25/30/32	8.50	BD132	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		LA1201	1.25	TA7222P	1.85	ITT CVC25/30/32	8.50	BD133	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		LA1230	2.95	TA7272	2.95	ITT CVC25/30/32	8.50	BD134	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		LA1365	2.45	TA7277	3.25	ITT CVC25/30/32	8.50	BD135	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		LA4440	0.70	TBA120AS	1.00	ITT CVC25/30/32	8.50	BD136	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		LA4455	2.45	TBA120U	1.00	ITT CVC25/30/32	8.50	BD137	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		LA4460	2.45	TBA120U	1.00	ITT CVC25/30/32	8.50	BD138	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		LA4461	2.45	TBA120U	1.00	ITT CVC25/30/32	8.50	BD139	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		LA7800	1.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD140	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		LA7801	2.90	TBA120U	1.00	ITT CVC25/30/32	8.50	BD141	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		M29381	6.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD142	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		MCI3002	3.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD143	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		MCI4497P	4.50	TBA120U	1.00	ITT CVC25/30/32	8.50	BD144	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA11250	3.85	TBA120U	1.00	ITT CVC25/30/32	8.50	BD145	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1250	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD146	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1251	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD147	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1252	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD148	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1253	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD149	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1254	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD150	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1255	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD151	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1256	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD152	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1257	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD153	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1258	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD154	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1259	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD155	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1260	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD156	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1261	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD157	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1262	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD158	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1263	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD159	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1264	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD160	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1265	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD161	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1266	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD162	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1267	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD163	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1268	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD164	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1269	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD165	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1270	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD166	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1271	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD167	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1272	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD168	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1273	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD169	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1274	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD170	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1275	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD171	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1276	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD172	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1277	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD173	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50
		SA1278	4.95	TBA120U	1.00	ITT CVC25/30/32	8.50	BD174	50	19054V	3.50	19054V	3.50	19054V	3.50	19054V	3.50	19054V			

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| M625 Logic Probe/Pulsar | £14.74 | 2030ET 27 Range 10A AC/DC. Cap. Hfe Temp. Buzz | £29.30 |
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- 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 so 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 pattress.
- 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 uF non-polarised block capacitors, pcb mounting.

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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. 12P17.

TOASTERS. 2 slice toasters - may need slight attention. Only £3.00 each. Ref. 3PB4.

PERSONAL STEREOs. Again customer returns but complete and with stereo headphones a bargain at only £3.00 each. Our ref. 3PB3.

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 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. BD683.

POWERFUL IONISER

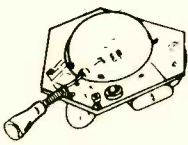
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REAL POWER CAR SPEAKERS. Stereo pair output 100w each. 4-Ohm impedance and consisting of 6 1/2" woofer, 2" mid range and 1" tweeter. Each set in a compact purpose built shelf mounting unit. Ideal to work with the amplifier described above. Price per pair £29.95. 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 shelf mounting unit. Price per pair: £27.95. 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. Our ref: 11P3. 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. Black and white 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 Free Delivery. Order ref: 25P10.

14" COLOUR MONITOR made by the American Display Tek company. Uses high resolution tube made by the famous Japanese Toshiba company. Beautifully made unit intended for console mounting, but top and sides adequately covered by plated metal panels. Full technical spec. on its way to us. We have a limited number of these. All brand new still in maker's cartons. Price: £89 each plus £6 insured carriage. Order ref: 89P1/1.

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

BUSH RADIO MIDI SPEAKERS. Stereo pair. BASS reflex system, using a full range 4in driver of 40ohms 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 Chinn. This is 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 £59.50, reference 60P2. Both are brand new. Insured delivery £3 on each or both.



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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.

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BASE STATION MICROPHONE. Top quality uni-directional electret condenser mic 600r 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. 4 Nicad AA battery charger. Charges 4 batteries in 8 hours. Price £6.00. Our ref: 6P3.

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

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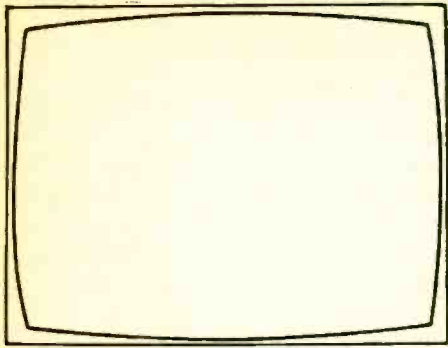
NEW PANEL METERS 500A. Movement with different scales that are brought into view with a lever. Price only £3.00. Ref: 3P81.

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 (stale colour required).

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METAL PROJECT BOX. Ideal for battery charger, power supply etc. Sprayed grey size 8" x 4" x 4 1/2". Louvered for ventilation. Price £3.00. Ref: 3P75.



TELEVISION

40 Years On

This issue marks our fortieth anniversary, the first issue of the current series having appeared, as *Practical Television*, in April 1950. I say "in the current series" because *Practical Television* had appeared previously – in fact I have three issues labelled Vol. 1, No. 1! The earliest appeared in 1934, when the magazine managed to run for fifteen months. That was in the era of mechanical TV, with Baird's 30-line system, of course. It's amazing that the magazine lasted so long, since actual broadcasting was minimal. Subsequently *Practical Television* appeared as a supplement to its then sister magazine *Practical Wireless*. By early 1950 however interest in television was beginning to increase considerably – and paper rationing had ended on March 1st, making it easier to get a "new" publication going.

That "first" issue in 1950 was a great success, and clearly reflected public interest in the new medium – the BBC had restarted TV broadcasting in June 1946, from Alexandra Palace, and the second transmitter, at Sutton Coldfield, had opened in December 1949. F.J. Camm, who founded and was the first editor of *Practical Television*, had a great feel for publishing opportunities, having started a number of magazines in his time. Back in 1950 television was still something to wonder at. Very few people had sets. In fact regular radio broadcasting was less than thirty years old. It is indeed surprising that TV followed on so soon, and reflects the remarkable achievements of those who pioneered electronic TV. The cost of a radio receiver was appreciable then, while a TV set was beyond the reach of most potential viewers even if they lived in an area served by a transmitter. Not at all like now, when radio sets have become throw-away items, and TV sets are things that people buy without a second thought – video equipment too for that matter.

Writing in the April 1950 issue F.J.C. commented that "television today is as good as any home cinematograph, but finality has not been reached. There are still the problems of colour television, shown to be practical by Baird, and of stereoscopic television, also known to be possible and by means of which we may view a three-dimensional picture." We had to wait seventeen years for the start of the colour service. We're still waiting for stereoscopic TV! Colour became feasible once RCA had come up with a compatible system, in the late Forties. Stereo adds great complexity and is not compatible even with the wide bandwidths made possible by the use of the satellite TV bands. For the foreseeable future, we shall have to content ourselves with higher definition and wide-screen displays.

There are many things that were not apparent back in early 1950. The transistor had been invented but was still a laboratory curiosity. There was no hint of the fact that circuitry would become entirely solid-state, with chips that include transistors by the hundred making all sorts of digital techniques possible. Valves ruled and looked likely to go on doing so indefinitely. Home audio recording had not yet appeared, let alone domestic video recording – or professional video recording for that matter. As for satellite TV, it was still felt that it would be impossible to get into space against the earth's pull!

Your present editor remembers F.J.C., having joined George Newnes Ltd. in early 1952. Though not in Camm's part of the company, my association with the Newnes *Radio and Television Servicing* books meant that I was a frequent visitor to the *Practical Television* office just along the corridor. While F.J.C. ran the show the work of editing both *Practical Wireless* and *Practical Television* was done by Bill Delaney. When I knew him he had just one young assistant, Barry. They had to work hard to get those two magazines out.

In its early days *Practical Television* was aimed at the man in the street with a technical interest. Knowledge of television soon became general however, and the ranks of those prepared to build TV receivers from ex-wartime radar equipment soon waned as sets became cheaper and cheaper. *Practical Television* was in difficulties by the mid-Sixties. It's likely that the coming of colour in 1967, when we all had to relearn our TV theory, revived it. Since then there's been a constant stream of technical developments to sustain interest. Incidentally the "Practical" was dropped in October 1970, as part of a move to tidy things up and concentrate more on the needs of the thousands who look after the country's TV and video equipment.

It's hard today to think back to the time when PCBs were still to come and everything depended on valves, with their great heat dissipation. Have we passed, in more recent times, through a golden age of TV, as a letter on a later page suggests, only to return to more mediocre standards? Certainly the delta-gun colour tube was capable of producing superb pictures, better than those generally available today. TV sound has always been good, though seldom given the chance. Now the vision side is enhanced by picture-in-picture, on-screen graphics and so on while on the sound side we are gradually getting Nicam stereo transmissions. There is great potential yet in current technology, and it will be interesting to watch the course of developments.

Spares Guide

UK readers will find the 1990 edition of our TV/VCR Spares Guide included in this issue. In view of their growing importance we have this time included several CD brands/suppliers and satellite TV equipment distributors. Note that on May 6th the 01 London telephone numbers will become either 071 (inner London) or 081 (outer London area). We will provide a further note on this next month.

EDITOR

John A. Reddihough

Please note that the telephone numbers below are for contact with the advertisement departments only. Editorial enquiries should be sent to the editor at the address given on page 425.

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CLEANING CLOTH

The free sample cleaning cloth supplied with last month's issue was a Walkisoft Industrial Wipe. It was supplied by and is available from SEME Ltd. For full details see note on page 455.

CORRECTION

AKD's telephone number was shown incorrectly on page 279 of the February issue. The correct no. is 0438 351 710.

YEAR PLANNER

Readers can obtain a corrected Year Planner by applying direct to Celtel Ltd., PO Box 135, Basingstoke, Hants RG25 2HZ. See advertisement on inside of front cover.

Teletopics

SATELLITE TV ROUND-UP

The official starting date for BSB's satellite TV services is on April 29th, though some cable TV networks will be distributing the five channels to their subscribers from March 25th. The reason for this phased start-up is the lack of receiving equipment to date. STC has been added to the list of aerial suppliers, having been given an initial order for 50,000 Squarials to be delivered by the end of June. The STC Squarials, which are 38cm square, are slightly smaller than those being supplied by Matsushita. They are 2cm deep and use phased-array technology. A production line capable of producing 10,000 of the aerials a week is being set up at STC's Paignton plant.

Sky Television's move to scrambling with the Movie Channel seems to have been a success, with some fifty per cent of Sky's viewers taking out a subscription. This is a higher percentage than was expected and could bring Sky £30m or more a year. It will help reduce Sky's losses, which have been running at £2m a week.

A small, high-tech UK company, Zeta Services Ltd., Harden Park, Alderley Edge, Cheshire SK9 7QN (telephone 0625 583 850), has designed a compact satellite TV receiver module - it's about the size of a pack of twenty cigarettes - for inclusion in a TV set or VCR. While the main aim seems to be to get manufacturers to include the module in their equipment during production, there is also the possibility of fitting it retrospectively. The module makes use of the spare tuning capacity built into most modern TV sets and VCRs. Many can tune to up to 99 channels. The module appears to take care of tuning and demodulation, but not decoding. It includes connections for a Videocrypt decoder for Sky Movies. Comprehensive patent applications have been taken out. One advantage of the module is that it will enable a VCR to provide viewing on one satellite TV channel while another one is being recorded, something that's not possible with the current generation of set-top satellite TV receivers.

Four major media and communications companies, NBC Television, News Corporation, Hughes Communications and Cablevision, have announced plans to start a DBS service that would make over a hundred TV channels available to viewers across the USA. It would use the Hughes HS601 high-power satellite, said to be the world's most powerful commercial space-based transmitter. The service would be known as Sky Cable, being a pay-TV venture. It would cost about \$1bn to set up and could be in operation by the end of 1993. One advantage for the US broadcasting and cable companies would be a sharing of programming and distribution costs. Viewers in many areas would get much improved reception, and there's the possibility of transmitting both standard and HD-TV signals, with digital quality sound.

TRANSMITTER NEWS

The IBA has commenced the second phase of its major transmitter re-engineering project. Thirteen transmitters up to twenty years old are to be replaced by all solid-state equipment supplied by Varian TVT Ltd. of Cambridge under a £6m contract. The transmitters concerned are at Hannington, Oxford, Rowridge,

Waltham, Stockland Hill, Tacolneston, Craigkelly, Heathfield, Sudbury, Dover, Belmont, Redruth and Selkirk. The new transmitters are ready for the Nicam stereo sound service which is being introduced progressively throughout the UK.

Nicam test transmissions are being radiated by the Wenvoe BBC-1 transmitter and its relays daily between 9.30 and 17.45. The sound on the two Nicam channels is not in stereo to ensure that there are no problems with Nicam VCRs that use the Nicam signal when available as their preferred sound source.

The government has rejected a proposal by the IBA that it should provide £20m to set up the Channel 5 transmitter network. Under the plan the eventual Channel 5 franchisee would have refunded the money. The government felt that although the plan might hasten setting up the service it would pre-empt possible options. The Channel 5 franchise will not be awarded until 1992 and it appears likely that the service will not be available until late 1993 or 1994.

1989 TRADE BALANCE

The BREMA figures for 1989 show that exports of colour TV receivers exceeded imports by £58m. In 1988 there was a deficit of £12.3m. The VCR deficit of £49.3m was well down on 1988's £95m. CTV exports totalled £301.3m, imports £243.3m. The gain was in larger-screen sets, a £40.5m deficit being recorded in smaller-screen sets.

VIDEO NEWS

JVC has launched the first VHS/VHS-C compatible VCR in Japan, Model HR-SC1000. The machine has a multi-loading system that accepts both full-size VHS and VHS-C cassettes. This is made possible by using a multi-formation tray that accepts both cassette sizes. Other features include S-VHS picture quality, hi-fi sound and a newly developed video stabiliser to eliminate vertical jitter during playback. A new switching noise compensator (SNC) is claimed to eliminate switching noise at the bottom of the screen. The price in Japan will be the equivalent of around £800. No European launch date has been announced so far.

Hitachi has released an S-VHS-C camcorder, Model VM-S83, that includes a flexible exposure arrangement called the "professional programmed AE system". Users can select from seven modes, including full auto and full manual. The five semi-automatic modes are P, Ps, Po, S and D. In the P mode the iris and 13-speed shutter are adjusted automatically but white balance and focus are operated manually. Ps is an action programme in which the shutter is biased towards the higher speed. Po is a depth programme in which the aperture is biased towards the higher f numbers to maximise the depth of field. S is a shutter priority mode in which the user selects the shutter speed and the aperture is set automatically. The D mode works the other way round. Also included are a nega-posit converter and four-page digital superimposer, hi-fi sound, long-play, index marking etc. The half-inch CCD imager has 470,000 pixels and works down to 5 lux. The suggested price is £1,300.

Matsushita has launched an S-VHS-C camcorder, Model NV-MV-1, in Japan. An ultra-compact mechanism with new tape loading and drive arrangements is used. This along with a four-layer PCB results in a very compact model that weighs 1kg. The price is the equivalent of about £700. No details of a European launch have been announced.

Sony has launched its first S-VHS VCR in Japan. Model SLV-R7 is priced at the equivalent of £800 and a European launch is expected later this year. Features include an on-screen display and a digital timebase corrector (TBC) to reduce jitter. Sony's CCDF380 8mm camcorder has been released in the UK with a suggested price of £799. A key feature is the auto-lock panel that covers the less used facilities and puts the camcorder in the automatic mode. This offers pick up, point and shoot filming. The CCDF380 weighs 1.2kg.

Hitachi has launched the Lapwatch Model VTLC50 in the UK at a suggested price of £1,300. It combines a VHS VCR with a 5in. TV set with LCD screen and has PAL/SECAM capability – it will also play NTSC tapes.

IN BRIEF

If you hurry you've just time to attend The Video Show, which is being held on March 23rd-25th at the Westminster Exhibition Centre (Horticultural Halls), Vincent Square, London SW1. This consumer video show is organised by *What Video* and *Camcorder User* magazines. The first morning is a free trade preview, public admission being from 12 noon.

The Vintage Wireless Company Ltd., Tudor House, Cossham Street, Mangotsfield, Bristol BS17 3EN has published a new "wanted list" for 1990. It's a 28-page listing of stock required for resale. The Saturday retail showroom has been reopened – callers are welcome from 10 a.m. to 3 p.m.

Things Ain't So Good

Les Lawry-Johns

They're certainly not. The shop still hasn't sold and not many jobs are coming in. Those that do take me ten times longer to sort out than they used to do.

Take the set I collected the other day. I'd looked at it before but it had refused to go wrong. I was then told that the bottom of the picture came up after several hours. To about half way. I took it down to the shop and spent several hours trying to find the cause of this. It appeared to be a TX90, but there were some differences in the field output stage. Eventually I changed the transistors and diodes. The diodes shorted and I found an open-circuit resistor in the feed to the output stage. Its value appeared to be 12Ω, but when I fitted a replacement of this value the diodes again shorted. The lower transistor also appeared to have been damaged. So in went more components, including a 22Ω resistor this time. The field scan now opened up, but with bottom compression. This was overcome by altering the value of a couple of resistors – there's no linearity control. If all this puzzles you, the name on the front was Logic instead of Ferguson. The main panel was mounted flat in the middle, not upended on the left-hand side as with Ferguson sets.

Someone then phoned to say that his GEC colour receiver was smelling. I thought that this might be due to the tripler, so I asked him to bring it down to the shop. When the set arrived I switched it on and the smell came up. On sniffing around I found that its source was the upper left-side mains fuse. You could see that its black cover had been melting. So I unplugged the set and

removed the cover of the fuse. The fuse came out as well of course. It was blackened and had obviously been damaged by poor contact. The fuseholder was cleaned and the contacts tightened, then a new fuse was fitted. It no longer smelt and the job was finished. I told the owner that he wouldn't get the smell again and he departed in high spirits.

I was subsequently asked to repair a Grundig set and agreed to have a look as I knew the owner. He brought it in and told me that there was no sound or picture at all. So I removed the rear cover and started to check the line output stage etc. As this appeared to be in order I spent some time checking around the tuner. Nothing seemed to be wrong so I turned to the front of the set and twiddled the control knobs. The screen lit up, with dots, and the sound hissed. I tuned the buttons down to our transmitter and got a faint picture with sound. The results were the same when the aerial was disconnected. An examination of the aerial socket showed that it had seen better times. When a new one was fitted the picture looked as good as new and the sound was perfect. I launched into a fever of abuse but the owner maintained that the screen hadn't lit up and that there had been nothing at all from the speaker. Oh well, we can't all be perfect, can we?!

A Philips G11 I was called to did funny things after a few minutes. So I took it down to the shop where I had it working on the bench for a couple of hours. As it wouldn't do anything wrong I had to take it back to the owner. She phoned later to say the fault had reappeared, so I had to repeat the procedure.

This time it did do funny things when I had it on the bench. After about an hour the bottom of the picture came up, with a white line indicating compression – about half way up, actually. I tapped around the field output stage gently, and this immediately restored full scan. So I had to wait for the fault to put in another appearance – it couldn't be made to occur by disturbance. Eventually the bottom came up again and this time I was gentler, disturbing things with my fingers. It was only when I gently rocked the TDA2600 field output chip's heatsink that the fault cleared. So out it came and the socket was thoroughly cleaned and sprayed. Then back went the chip, the clip and the heatsink. I gather that the fault hasn't occurred since.

The same owner then brought a Philips KT3 along. She said that it had been working well until one day when it had started to click at switch on. I removed the rear cover and disconnected the tripler from the line output transformer. The sound then came on and there was plenty of life from the transformer. Assuming that the tripler was responsible for the trouble, I removed it and fitted my last one. You can imagine my annoyance when the set tripped just as it had done previously. I had checked for discharge from the e.h.t. cap and there hadn't seemed to be any. Nevertheless I removed the cap and carefully cleaned the area around it. The set then came on and didn't click. I cursed myself for being too quick to accuse the tripler. How can I carry on when I'm so stupid?

That's the problem you see. Something wrong with my head. Probably what should have happened twenty years hence. It started about three years ago. When I went to the doctor about it he said he thought it might be my heart. It wasn't, so I can only assume it's something to do with ageing. The trouble is that it's getting worse as time goes by. What with that and the shop, things are bad.

CD Player Casebook

Reports from Ian Bowden
and Mike Leach

Technics SL-XP2

The symptom was described as intermittent "static" noise which was worse on some tracks than others and affected both channels. When the fault eventually occurred in the workshop it was immediately diagnosed as being digital noise. An order was therefore put in for the RAM chip, the most likely cause. When the new chip was fitted however the fault was still present. It was only when the noise put in an appearance for a short time in the pause mode that we were able to pinpoint the faulty component. There was an output from pin 12 of the digital filter chip IC301 though none was going in as it was muted by the digital signal processor. A replacement filter i.c. cured the fault. **I.B.**

Meridian CD101

The problem with this Philips based player was poor left channel and no right channel sound. The left channel sound was extremely distorted. Extensive work had been carried out in the past on the DA converter section, so I started at the beginning.

The player uses TDA1540 DA converter chips. In a good working machine there should be a -18V supply at pin 11 of both the TDA1540s. As this supply was present the next step was to scope pin 1 (digital input) of both chips. The waveforms here were completely different, leading me to suspect the SAA7030 digital filter chip. Replacing this restored normal results. **M.L.**

Goodmans GCD550

The complaint with this machine was that it was very slow at finding tracks. It was installed under the stairs behind the bar in a local eating house, which is where I attended to it - the landlord didn't want to move it. The first thing I noticed was greasy marks on the front control panel. The player read the TOC all right and played track one o.k. But it wouldn't find tracks 7, 8, 9 or 10. A quick glance at the disc revealed all - there was a huge, greasy thumb print! I cleaned all the discs for the landlord and explained the situation. He was happy with this.

Several weeks later the player appeared in the workshop with the same complaint. This time the discs were clean but a hazy film could be seen on the laser lens. Everything was all right after cleaning the lens.

Incidentally we also frequently have to service this chap's microwave cooker, but that's another story! **M.L.**

Philips CD150/Saisho CDX100

This machine wore the Saisho label. The customer reported that it cut out and went into error during play. I suspected the laser but ran it up just in case. It played for about twenty minutes then the sound went off and a jumbled mess appeared in the display. The functions had all locked up - not even the open/close button operated. After switching the mains supply off and on again the machine ran up and read the TOC correctly. I selected play and everything was o.k. for about ten minutes.

Then the machine locked up again with a faulty display. So I whipped the top off and changed the MAB8441-T018 control/display microcomputer chip, which is mounted on the front panel. That cured the fault. **M.L.**

Philips CD160

Isn't it always the same? No matter how many different components and chips you keep in stock you always need the one you haven't got! One of these machines came in recently with the complaint that the left-channel sound was very distorted. I dived in, not thinking or looking at the circuit, and changed the TDA1541 DAC chip. I keep one or two of these in stock as they've given trouble before. Not this time however. In this case the fault was due to the SAA7220P digital filter chip. So I ordered two of them with the idea that I'd have one ready next time round. But it doesn't work that way, does it? I've a drawer full of odd chips for various TV and video applications, and it looks as though none of them will ever be used. I hope the boss isn't reading this . . . **M.L.**

Philips CD104

This one had been sitting on the shelf for some months, supposedly in working order. When we ran it up the tracking was very unstable and occasionally the disc wouldn't rotate for TOC readout. It was while the machine was in this no-go condition that I realised the turntable motor was stiff. Off came the bottom bearing and, after cleaning it, I applied a small amount of light oil. After reassembly a slight adjustment was made to the turntable height. The machine then ran perfectly. **M.L.**

Philips CD160

This player had been well and truly got at. The original fault was no operation as the tray didn't open. It was repaired by a nearby firm at King's Lynn and returned to the customer Sam with a note that read "laser required, approximate cost £125". Poor old Sam was devastated. He complained that the machine had worked all right until the tray had jammed, so why did it want a new laser?

The upshot was that it came to us. I stripped it down and could see that the tray control transistors on the front panel had been changed. Although the tray now worked there was still a burnt 1Ω resistor which I changed for good measure. I switched on and inserted a disc. It spun like fury - I thought the machine was going to take off! A check with the laser power meter confirmed that there was no light, but I wasn't convinced about this. When the servo/preamplifier board was removed I could see that extensive soldering had been carried out around the TDA5708 focus signal processor chip. In addition the flexi PCB which plugs into this board was loose and was fitted at an odd angle. Resoldering the components associated with the chip and replugging the flexi PCB cured the problem. Not exactly a £125 job! **M.L.**

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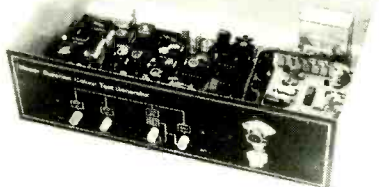
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Two days in the life of . . .

Kevin D. Davies

We read lots in the magazine about the servicing of conventional domestic video/TV equipment. The problems that some of us face are less usual, to say the least. I'm the senior service engineer of Haverfordwest Coin Machines, Pembrokeshire, having come into this fascinating industry as a fruit machine designer in 1970. In those days components used to move – relays, mechanical timers and so on. If a fuse had blown the quickest way to find the fault was to replace the fuse with a screwdriver, switch on and observe where the smoke came from! How things have changed! So you think you have real problems dealing with tricky faults on the bench? Read on . . .

The Video Jukebox

One day recently was largely devoted to the installation of a video jukebox, with a Thomson overhead projector and a 100in. screen, at a club fifteen miles from base. For those of you not conversant with this relatively new innovation, it consists of the following items. First a unit that holds two modified VHS VCRs and sometimes a six-disc CD player. This lives in a cellar, cupboard or any other convenient place. It's linked to a wallbox (the bit you put your money in) in a bar via a multicore cable, to the projector via a video cable, to the speakers via a two-core cable and to a volume control via a separate multicore cable.

I won't go into the problems of hole drilling, cable running, projector and screen mounting etc., except to say that Murphy's Law plays a large role with this sort of thing. Suffice it to say that after linking all the components together in the presence of an ever increasing audience of expectant – and by this time quite tipsy, some of them having been on the beer since 11 a.m. – onlookers we came to the grand switch-on. Time 2 p.m.

Everything worked apart from one niggling little fault – the projector's convergence. Now those of you who've made an attempt to reconverge a Thomson projector may or may not find the next bit funny. Since the projector was suspended from a 20ft high ceiling, we had to resort to using a large table upon which we perched a step-ladder. When the projector's lower cover is removed you find row upon row of convergence potentiometers, along with a plastic sheet telling you what each one does. Mercy upon mercy! The procedure is reasonably straightforward, but can you imagine doing it atop that ladder, trimming tool in one hand, while a drunkard carrying a tray of full pints walks into the table beneath just as you are attempting to get the red verticals on to the blue and green ones?

Once the convergence had been completed, to the best of my ability or that my nerves could stand in the circumstances, it was time to select a video track. I won't go into the finer details of how the system works. Basically, there are two identical VHS tapes coded so that when one VCR is playing the other VCR looks for the next track. This means that there is very little delay between one track finishing and the next one starting.

The track selected appeared on the screen, to shouts and applause, with bad tracking errors. "Adjust the

tracking control" I hear you say. Yes indeed. Only one little problem. The VCRs are two rooms away from the screen, not sitting conveniently on or under the screen as with you people! This is where Father Christmas came in handy. A couple of years ago he kindly gave me a Casio 2in. colour TV set. With the aid of a lead and a plug correct tracking was restored.

So there we have it. 5 p.m.: system up and running. Time to depart.

Next Day

Next day there was a phone call. Video jukebox installed yesterday doesn't work. As Les would say, "oh dear!"

Arrive at site to be confronted with more wires hanging from the projector and more in the room with the VCRs than I'd installed. These wires are brown in colour and look like TV aerial cable. By jove, they are aerial cable!

"Where are the BNC plugs I soldered on to the black leads to the VCRs and the projector?" I asked the club owner's son.

"Ah!" he replied. "Daddy cut them off last night. Mummy told him not to. Would you like a cup of tea?"

"What's all this new cable?" I asked, "and please can I have my plugs back?"

To cut a long story short, Daddy had removed the BNC plugs and replaced them with TV aerial plugs. He'd then tried to plug them into the projector which had no place for them. So he'd given up. Apparently word had got around that he had this big screen in his club, so they'd all turned up to watch the snooker!

Having restored the set-up to its original design, I made up a lead for him to link his own VCR to the projector when the customers want to watch Rugby matches etc. But he has to make do with the sound from his own TV set as I was not going to get involved with linking his VCR to the jukebox's audio amplifier – it has external switching via a circuit board between each VCR.

The second call that day was to a video game which had been visited by another "engineer" the day before. All that base would tell me was that it "didn't work".

When I switched on I found that the monitor was healthy enough. But there were no voltages to the game boards. Closer inspection of the power supply showed that an 0.25A fuse had been replaced with a 25A one (the good old days?!). The machine was promptly loaded into the car, a radio call was made to base for a replacement game and it was back to base for me – no more calls at present.

A couple of days previously I'd been working on a monitor fault in the workshop. Having been side-tracked, I left a note on this machine so that it wouldn't be sent out by mistake. This note said "no sync". On route to our stores, I had to call in at the office. The boss's son was on the phone. As I walked in his face lit up. "I'm trying to get hold of someone to order a new sync for that faulty monitor" he announced.

Oh dear! But it's all true, I tell you!

Servicing Monochrome Portables

David Botto

Besides being a first-rate technician the successful TV/VCR engineer must be a good businessman. When you consider that a brand new 12in. mains/battery monochrome portable can be bought for as little as £60 including VAT, you cannot afford to spend more than about an hour at most on repairing one.

It's helpful to have the service manual to hand, but for certain makes service information and/or circuit diagrams may not be easy to obtain. Don't be put off by this however. The circuitry in most monochrome portables is quite straightforward, most of them using similar arrangements.

Many of the faults that occur are of the "stock" variety. The majority relate to the power supply. In my experience few TV shops and even fewer multiple stores seem to want to repair monochrome portables. This works to your advantage. You'll be surprised at the number of people who will bring monochrome portables along once they get to know that you're willing to repair them. Many of these folk will be new customers who will buy new TVs and other profit-making items from you.

Power Supply Circuitry

Nearly all monochrome portables have a power supply consisting of a mains transformer, a full-wave rectifier and a series voltage regulator circuit. We'll start by taking a look at a couple of typical examples.

Fig. 1 shows the circuit used in the popular Thorn 1590/1591 chassis (Ferguson, Ultra, Marconiphone etc. models). The mains transformer T1 has a centre-tapped secondary winding that feeds the two rectifier diodes W7/8. These develop about 17V across the reservoir capacitor C85, the connection between the rectifiers and the capacitor being made via the battery/mains switch and fuse F2. The 17V supply is fed to the emitter of the series regulator transistor VT21. The 10Ω, 5W resistor (R99) connected in parallel with VT21 is included to share the dissipation and provide a start-up current feed. VT21's base is connected to the junction of R100 and the collector of VT22, which provides the control action. R104 in its base circuit is used to set up the 11.6V stabilised output at the collector of VT21. VT22 senses voltage changes at its emitter, across R102 which is connected in series with zener diode W17 across the stabilised 11.6V rail. The voltage across W17 remains constant, any variation appearing across R102.

When the current drawn by the set decreases, the 11.6V line voltage will tend to rise. This rise will be detected at the emitter of VT22 which, being an npn device, will pass less current. The resultant voltage rise at VT22's collector reduces the conduction of VT21, a pnp device, restoring the correct conditions at its collector. A rise in the current drawn by the set will produce the opposite sequence of events.

Many sets use the type of circuit just described. Fig. 2 shows the slightly different arrangement used in the later Thorn 1790 series chassis. Here the series regulator transistor TR3 is driven by the differential amplifier pair TR4/5. TR4's base voltage is held constant by zener

diode D3. In this circuit voltage changes are sensed at the base of TR5. Say the set draws extra current. The 11V rail voltage will tend to fall, reducing the voltage at TR5's base. TR5's conduction decreases, reducing the current flowing through R20. Consequently the voltage across R20, i.e. at the emitter of TR4, falls. Since TR4 is an npn device whose base voltage is held constant by D3 its conduction will increase. TR3's drive is thus increased, the action restoring the correct output at its collector.

There are several variations on this theme. Some Hitachi sets for example use a KC582C chip to sense the l.t. line voltage and drive the series regulator transistor, while the voltage error detector circuit in the Philips/Pye TX chassis senses the voltage across the line output stage derived 26V boost rail instead of the 10.8V output from the series regulator transistor. Bridge rectifiers are much more common than the two-diode circuits shown in Figs. 1 and 2.

Making Repairs Pay

You can make money repairing monochrome portables provided you go about things the right way. It's best to make a fixed minimum charge for the repair of any monochrome portable, plus parts and VAT of course. If the set can't be put right for this sum it's beyond economic repair. What if the receiver has been well and truly got at by someone with a big pair of hands? In this case it will pay you to politely refuse the job.

My view is that £18 is a fair rate for this fixed charge. But you must decide on your particular charge in accordance with your overheads. Tell your customers your terms of business before starting on the repair. You'll also find that most people will happily bring their

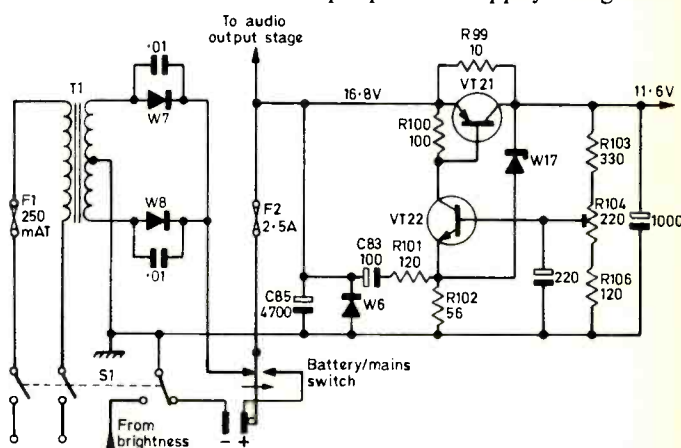


Fig. 1: The power supply circuit used in the Thorn 1590/1591 series chassis. Series regulator circuits of the type shown here are very common in monochrome portables. Diode W6 will conduct in the event of the battery connections being reversed: F2 will then blow, protecting the rest of the circuitry. Several modifications were introduced in later production sets. The network C83/R101, later deleted, provides hum cancellation by injecting hum at the emitter of VT22.

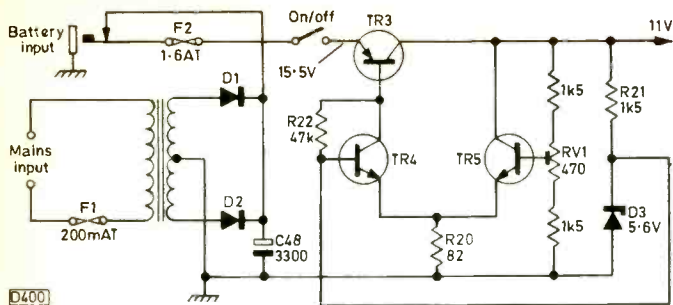


Fig. 2: Power supply circuit used in the Thorn 1790 series chassis, with a differential amplifier to control the series regulator transistor TR3. In this circuit current flowing via the emitter-base junction of TR3, R22 and D3 provides a start-up feed.

portables to your shop when you explain that this will save them money.

Contact the customer before going ahead with the repair should expensive parts be needed. Incidentally this method eliminates the customer who "doesn't mind going up a pound" (or even two pounds!) for the repair. The aim of this advice on the business side of repairs is to help you to get a fair and honest return for your work.

The First Check

Since monochrome portables are often roughly treated the first thing to check is the cabinet. If it's cracked or has a piece missing the set could be unsafe to use. Replacement cabinets, if obtainable at all, are usually so expensive that such a repair is uneconomic. Unless you have a replacement case to hand, don't be tempted to repair a set with an unsafe cabinet. Someone could receive a severe shock or even lose their life.

Dead Set

If the set is dead, begin by checking the power supply. First test the fuse in the mains plug. Make sure that its rating is correct: 2A is about right for most sets, but some unknown person may have fitted a 13A type.

When you remove the cabinet you will usually find two, sometimes three, fuses in the power supply section. The mains fuse is commonly rated at 200-315mA. Check that it has not been replaced with an incorrectly rated type.

The fuse between the mains rectifier and the series regulator transistor is likely to be a 1.6 or 2A quick-blow type. If it looks black it may be because someone has happily connected a 12V d.c. battery supply to the set the wrong way round. If you are fortunate, replacing the fuse may restore the set to working order.

After checking the fuses, the next thing to do is to ensure that the c.r.t.'s heater is intact. It's senseless to spend time repairing circuitry only to find that the tube has an open-circuit heater. If the tube has failed, check price and availability before going further. It's then best to quote a price to the customer before proceeding with the work.

If, after checking and replacing fuses as necessary, you find that the regulated l.t. line, which is usually about 11V, is missing or very low, check the regulator transistor. It's a good idea to check the line output transistor at the same time. If the regulator transistor is o.k., measure the unregulated d.c. supply to the regulator transistor – it should usually be 15-18V.

next month in

TELEVISION

● SERVICING THE PANASONIC D1 VIDEO DECK

The D1 deck mechanism was used in a wide range of Panasonic VCRs released over a period of years, including the NV230, NV430, NV810, NV870, NV-G7, NV-G10, NV-G12 and NV-G18. This series covers machines from a basic model with wired remote control through to a group of dual-speed models with hi-fi sound. Nick Beer covers the operation of the mechanism, part replacement and adjustments and provides a faults list that also gives common electronic faults on particular models.

● INTERCARRIER SOUND CONVERTER

The different sound-vision signal spacing used in system I (UK) and system B/G (most of Western Europe) has often caused problems. Conversion from one standard to the other involves changing several items – and what if you want to be able to receive both kinds of signal? Multi-standard receivers generally use parallel tuned circuits, but this arrangement is not easy to implement with an existing single-standard set. J. LeJeune's solution is to use a simple mixer stage to convert a 5.5MHz input to 6MHz. The design is not critical and the components used are widely available. By selection of the appropriate input ceramic filter 4.5MHz, 5.5MHz or 6.5MHz intercarrier sound signals can be converted to 6MHz.

● TRANSFERRING FILM AND PRINTS TO VIDEOTAPE

Ivor Nathan discusses ways of transferring prints and cine film material to videotape for easier storage and presentation and describes a simple home system that gives excellent results.

● CD PLAYER FAULT LOCATION

The next instalment in Joe Cieszynski's series provides flow charts to enable logical fault-finding procedures to be established and outlines ways of dealing with various basic fault conditions.

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The a.c. rectifier diodes that produce this unregulated supply often fail. In most monochrome portables there's a small mains transformer whose secondary winding feeds the diodes. Sometimes the transformer's primary winding goes open-circuit. As a safety precaution, check that there is no short or leakage between the primary winding and chassis.

When the unregulated voltage is o.k. but the 11V line is low or non-existent it pays to make a quick check on all the transistors and diodes in the regulator circuit. As I've said in past articles, the best and fastest way of doing this is to use a component tester. The fault could be in the line output stage, see later. Make sure that the voltage adjustment preset is working properly. These controls sometimes receive brutal treatment, as a result of which the slider arm doesn't contact the resistor element properly. Where an i.c. is used to control the regulator transistor's base current and you suspect that it has failed, check its price and availability before spending more time on the set.

Hum

If there's a picture and sound but there are nasty hum bars floating up and down the picture it's likely that one or more of the mains rectifier diodes is leaky or open-circuit – the picture size is often reduced as well. This is especially so when the diodes are all in one block. Use separate diodes if the original unit is unobtainable.

A leaky series regulator transistor can also cause severe hum bars, as can failure of the large mains rectifier reservoir capacitor – 2,200 and 3,300 μ F are common values for this component.

Setting up the LT Line

Set up the regulated l.t. line to the specified voltage using an accurate digital multimeter. If you don't have a manual or any indication of the correct figure, set the voltage to 11.6V and check the picture size.

The Line Timebase

Fig. 3 shows the line oscillator, driver and output stage circuitry used in the Thorn 1690/1691 series chassis. It's typical of that found in many sets, including those of Far Eastern origin. The fault tracing procedure we'll outline applies to most monochrome portables.

When the 11.3V regulated supply is correct but the line timebase is dead, measure the voltage at the collector of the line output transistor VT17. This will establish whether the circuitry is intact up to this point. Next connect your oscilloscope (10:1 probe) to the collector of transistor VT15 to check that the line oscillator is working. The waveform should be as shown in Fig. 4(a). In some sets turning the oscillator coil adjustment a long way off will kill oscillation. This sometimes happens when the oscillator frequency adjustment is available at the rear of the set. If you are fortunate, readjustment may be all that's necessary. Check whether the core is cracked or one of the fine wires from the windings of the line oscillator coil (L12) has broken off.

The next scope check to make is at the collector of the driver transistor VT16. Fig. 4(b) shows the waveform to expect. If it's missing, check the transistor, the continuity of the line driver transformer's primary winding (T3) and the feed resistors R90 and R142. Finally check the

waveform at the base of the line output transistor VT17, see Fig. 4(c).

Don't spend time searching for obscure faults in the line timebase circuitry. Instead check all the transistors and diodes with a component tester.

This method of checking the operation of the line timebase applies to all models of whatever make. Note that in some sets the line oscillator is incorporated with other circuitry in an i.c.

A fault in the line output stage will often load the power supply with the result that the regulated l.t. supply voltage is low or absent. A short-circuit line output transistor will impose a heavy load, as will a line output transformer with shorted turns or a defective e.h.t. rectifier. The latter is often a separate stick type but is also often incorporated within the line output transformer's encapsulation. If the line output transformer is getting warm, there could be shorted turns or a faulty internal e.h.t. rectifier. In either case a replacement transformer is called for. In other cases where you suspect the line output transformer, make sure that any rectifier diodes it feeds and their reservoir capacitors are o.k. In the circuit shown in Fig. 3 W15 and C95 provide a 95V supply for the video output transistor, the brightness control network and the tube's first anode and focus electrodes. With many tubes a separate, higher voltage is required for the first anode. This will also be derived from the line output transformer.

Thorn line output transformers are usually easy to obtain and economical. With some makes however you'll need to check the price and availability before going any further with the repair.

Line Sync Faults

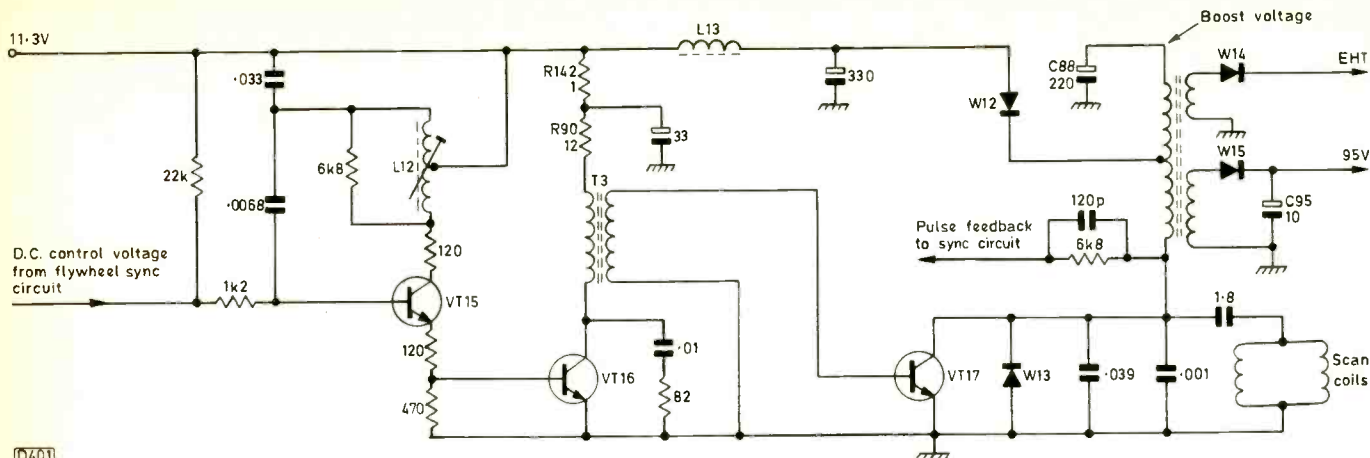
Line sync faults can be due to several causes. The circuitry involved may be in i.c. or discrete component form. In the former case the chip and any electrolytic capacitors associated with the line sync/oscillator part of the circuit are suspect, also the pulse feedback resistor connected to the line output transformer. With discrete component circuitry the items to check are the flywheel sync diodes, associated capacitors including small electrolytics that may have dried out, and resistors that tend to go high in value. Check high-value resistors first. Also the sync separator transistor of course.

Field Timebase Faults

If the fault is no field scan you can't afford to spend time on making exhaustive checks through the circuitry. When the set uses discrete component circuitry the usual cause of this fault is failure of one of the field output transistors and/or a resistor connected in series with them. If necessary check all the transistors and diodes in the field timebase circuit with a component tester. In some models the field timebase circuitry is in i.c. form. If the external components are in order you've no alternative to changing the i.c. For linearity problems, check the electrolytics in the field driver and output stages.

No or Poor Picture

Good sound and a raster but no or a poor picture is often due to failure of the video output transistor or an associated small electrolytic capacitor drying out. The contrast control should also be checked in case it's dirty



0401

Fig. 3: The line oscillator, driver and output stages in the Thorn 1690 series chassis.

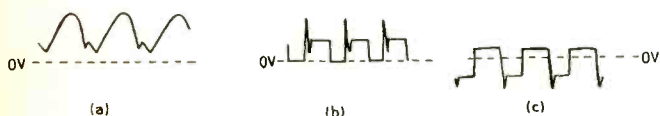


Fig. 4: Key waveforms in the line timebase circuitry, (a) at the collector of the line oscillator transistor, (b) at the collector of the line driver transistor and (c) at the base of the line output transistor.

or open-circuit. On older models check the a.g.c. transistor and the setting of the associated preset.

Signal Troubles

The audio circuitry may again be in i.c. or discrete component form. In the former case check the supply to the i.c. then if necessary the i.c., but note that faulty contacts in an earphone socket are a common cause of trouble. Small electrolytics can dry out, causing weak or distorted sound. Driver and output transistors are the most common cause of trouble with discrete component circuitry. Connection to the loudspeaker is usually via a high-value electrolytic which could have failed. Speaker troubles are not uncommon.

The i.f. strip tends to be reliable. With older sets the usual cause of problems is faulty transistors.

A faulty tuner can be responsible for a dusty picture. Some tuners can be repaired but the best policy is to replace the unit. Check price and availability, then contact the customer. Before you condemn the tuner ensure that its 11V supply is present and that, with electronic tuning, the tuning voltage is there. Also that it varies when different channels are selected. When a set repeatedly drifts off tune the tuning voltage stabiliser is suspect.

Many monochrome portables have a simple loop aerial at the back. In some areas vastly improved performance can be obtained by using a set-top aerial. You can sell portable set-top aerials at around £5-6 each. Keep a stock of them and offer one to every person whose set comes in for repair. This makes for increased customer satisfaction, and of course more profit for you. You can obtain such aerials from PV Tubes, 104 Abbey Street, Accrington, Lancs and from other firms that advertise in *Television*.

PCB Faults

Breaks in the PCB print are common and cause various mysterious symptoms. It's worth examining the

print carefully through a magnifying glass. This takes only minutes and can save you a lot of time.

Obscure Faults

What if the fault is obscure and difficult to find? There was a time when I would never give up on any set no matter how long the repair took. But you're in business to show a profit. Rather than spend hours on a fault, tell the customer that the set has an obscure, hard-to-find fault and is beyond economic repair.

Incidentally, obscure faults are often due to liquid having been spilt into the set through the cabinet vents – water from flower vases and beer are favourites. The set is then definitely a write-off. Even if you do manage to get it working, almost certainly a series of further faults will arise in the near future and you'll get the blame for them.

Replacement Transistors

The two ECA Semiconductor Reference books available from Willow Vale Electronics and other spares stockists are a good investment for those repairing monochrome TV sets (or any piece of electronic equipment). They cover an extensive range of diodes, transistors, thyristors and i.c.s. The reason for this is that it's not always easy to obtain the original transistor types for some monochrome portables – especially those from the East European block or the Far East. And you can't afford the time to go chasing round looking for them. With the ECA books as a reference you'll almost always find something suitable in your spares stock or something that's readily available.

When replacing the series regulator transistor in the power supply by all means fit, if you can, the original type of transistor. Otherwise, as a very general rule, a TIP41C can usually be used as a replacement for an npn regulator and a TIP42C as a replacement for a pnp regulator.

Presentation

After completion of the repair it pays to spend five minutes polishing the cabinet and cleaning the c.r.t. face. This pleases the customer and shows that you take pride in what you do. It can also lead to further work through recommendation.

Letters

CABINET DESIGN

I'm sure that I speak not only for myself, other engineers and dealers but also for the majority of our trade's more elderly customers when I suggest that it's time some consideration was given to their needs in the design of CTVs, VCRs and audio equipment. Designers and stylists should back off from their current preoccupation with "Hi Tech" design. Of the goods on offer at the moment, 95 per cent are in black or charcoal grey cases with tiny control panels set low down on the cabinet front, often behind fragile plastic doors whose hinges give up after a short time, and are frequently obscured by being mounted under the overhang of a c.r.t. mask. The marking and lettering of these controls are difficult to make out, being red, grey, brown etc. on the cabinet's black or dark grey base colour. In addition the design of most TV and VCR stands puts the set at a low level with the VCR almost on the floor. For these reasons elderly people whose eyesight is poor and who cannot get down on their knees or bend easily find it almost impossible to operate "modern" equipment.

Remote control is little better as the tiny buttons are anathema to arthritic fingers, and again the lettering and legends on the controls are frequently difficult to make out. The current fashion to have the majority of the analogue controls adjustable only from the handset is also confusing to older people, especially as so many different methods are used by manufacturers to set and store these control levels. A great many unnecessary service calls are generated by customers who press a couple of wrong buttons, lose the correct operating levels and are unable to correct things without help. User instructions leave much to be desired, and at the cheaper end of the market are often enough not original printing but photocopied sheets. Service calls made for this purpose can't always be charged for. This is not only for goodwill reasons but also out of consideration for the feelings of customers who are afraid of being considered non-compos mentis if they admit to being unable to operate commonly available equipment.

I also long for the return of decent wooden cabinets which fit in with traditional decor. It shouldn't be necessary to have to go out and buy an additional – and expensive – cabinet to house one's newest purchase simply because you cannot get something that will look right amongst the rest of your furnishings. We don't all hanker to live in the control room of a starship! Apart from aesthetic considerations, plastic cabinets are basically flawed. Their acoustic properties leave much to be desired, and the squeaks and cracks emitted by some sets during warm-up have to be heard to be believed. I've lost count of the number of sets of all makes with which I've had to glue acoustic deadening material inside and rubber packing at the joints to try to get rid of these unwanted noises and improve the poor acoustic performance when the customer has had his third changeover and is screaming for his money back.

Incidentally what on earth is the purpose of providing a set with Nicam sound then piping it out through two little tinny speakers clipped inside a flimsy plastic cabinet and both rear-loaded with the same airspace – the inside of the cabinet – without any attempt to provide acoustic

separation? I've had to stand and listen on more than one occasion while an irate customer demonstrated that his new Hi-Tech CTV with monitor style cabinet, stereo sound and remote control looks and sounds a lot worse than the six-year old set he was going to relegate to the kitchen.

An increasing proportion of the population is elderly. They control a great deal of the present-day purchasing power, have some degree of good taste, and their hearing – although not always at its best – has not been devastated by years of ghetto-blasters and personal stereos. It's time that the industry paid some attention to their needs, got away from current fashion and reintroduced a bit of traditionalism. There's also a great demand for a very basic, simple-to-operate VCR with a single-event timer, large well-labelled push-buttons and preferably a sloping control panel that can be seen and operated from above. Something like the old Hitachi VT11E or VT63, or the Philips VR6462.

Come on designers, pull your corporate fingers out and give the public what it wants for a change.

*John C. Priest,
Blackpool, Lancs.*

PHILIPS 2A CHASSIS

You could possibly be correct with your suggestions in connection with the Philips 2A chassis suffering from the lace-curtain effect (Service Bureau, February 1990), but in my experience this fault has usually been intermittent, flexing the teletext PCB clearing it for a couple of days. For a lasting cure remove IC7770's socket and solder the chip directly to the PCB.

*Philip Blundell, Eng. Tech.,
Great Barr, Birmingham.*

POOR SERVICE DATA

I am writing to complain about the growing tendency for some manufacturers and spares suppliers to send photocopied service information, at an exorbitant price, when a service manual is requested. In many cases these photocopies are of poor quality and are virtually unreadable, especially the board and component layouts.

Surely it's not too much to ask for a decent service manual to be provided at a fair price? Some manufacturers, for example Akai, provide a full manual at a reasonable price.

*J. S. Davies,
Blackpool, Lancs.*

TORQUE MEASUREMENT

A reader has sent me some comments on the units of torque measurement used in my article on back tension (January). He states that torque is the measurement of the product of force and distance, not the quotient of force by distance. The latter is suggested by the use of g/cm. The more suitable abbreviation is g-cm, where g is assumed to be grams force. Strictly speaking it is not a measurement of force and a better unit would be the kilodyne or Newton. These are not widely appreciated outside the laboratory however, so it would seem to be best to stick to g-cm. My thanks to Mr. Robinson.

Readers in Southern Ireland might like to know that the complete range of Konig test cassettes, including the

back-tension cassette reviewed in the January issue, is available from O'Doherty Electronics Ltd., 92A St. Clare's Avenue, Harold's Cross, Dublin 6W. A brochure is available on request.

Nick Beer,
Bideford, Devon.

SATELLITE TV IS GREEN!

I wonder why such businesslike people as Murdoch and Sugar haven't done more to promote the greenness of satellite TV? The terrestrial TV transmitter for this area runs at a cool 100kW. It calls for the use of fossil and nuclear fuel and needs umpteen back-up relays to cover a radius of twenty miles! The pictures are sometimes watchable... Astra 1A can cover much of Europe using the equivalent power of a domestic electric light bulb, with the supply provided by solar power. The picture quality is excellent except when the house is snowed under!

David C. J. Tilley,
Tiverton, Devon.

HINTS AND TIPS

Erratic operation of the ramp generator in the Thorn 9800 chassis can be cured by replacing the 25V error amplifier and 25V stabiliser circuits with a 7824 voltage regulator chip fed from the line output stage derived 48V supply via a suitable series resistor.

Here's a simple colour-bar program for the Amstrad CPC464:

- 10 MODE 0: BORDER 13
- 20 INK 1,2,6: INK 2,2,4: INK 3,2,0: INK 4,1,8: INK 5,8:
- INK 6,6: INK 7,2: INK 8,0
- 30 FOR A = 80 TO 640 STEP 0
- 40 ORIGIN 0, 0, A-79, A, 400, 0: CLG A/80
- 50 NEXT A
- 60 GOTO 60

K. J. Treeby,
Plymouth, Devon.

FOR DISPOSAL

I have for disposal free a dual-standard Ultra Model 6624 in working order. Circuit and plans are available. As the set is in a large cabinet it will have to be collected.
W. Milne, 20 Graham Road,
Wimbledon, London SW19 3SR.

I have for disposal a large quantity of valves, from 1940 onwards, some boxed and some loose. Also an Avo valve characteristic meter and manual (bench type with sloping front), a Channel 405-line pattern generator, a 9in. working GEC Model 2147 in Bakelite case and Trader service sheets approximately 900-1,800.

H. Keighley, 117 Bradford Road,
Riddlesden, Keighley, Yorks BD20 5JH.
Telephone 0535 603 012.

HELP WANTED

The problem I've had with the Amstrad VCR4600 is that two white lines appear on playback, one a quarter of the way down the screen and the other a quarter of the way up. Replacing the lower drum assembly provides a cure but in view of the cost this doesn't seem to be

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AN302	250p	LA1364	200p	TCA3089	175p	BC337	07p
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AN318	440p	LA3161	135p	TDA1015	105p	BD238	32p
AN340P	220p	LA3210	60p	TDA1029	280p	BF240	12p
AN363	220p	LA3300	145p	TDA1044	280p	BF259	70p
AN610P	160p	LA3330	165p	TDA1060	210p	BU126	68p
AN629	310p	LA3375	275p	TDA1080	110p	BU208	68p
AN3310K	285p	LA4100	80p	TDA1905	105p	BU208A	70p
AN5010	450p	LA4108	280p	TDA1908A	95p	BU208A(UAP)	90p
AN5011	425p	LA4110	115p	TDA2002	75p	BU325A	75p
AN5071	120p	LA4140	65p	TDA2003	88p	BU407	55p
AN5256	385p	LA4177	265p	TDA2004	110p	BU500	105p
AN5265	250p	LA4183	135p	TDA2005	110p	MJE340	25p
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AN5732	155p	LA4204	125p	TDA2007	100p	MJE521	35p
AN5733	185p	LA4205	145p	TDA2022	70p	2N3055	38p
AN5510	288p	LA4420	130p	TDA2030A	115p	2N3073	110p
AN5512	290p	LA4445	215p	TDA2541	140p	2SA350	60p
AN5615	400p	LA4611	165p	TDA2611	105p	2SA564	35p
AN5701	128p	LA4505	250p	TDA2600	625p	2SA738	95p
AN5732	155p	LA5511	300p	TDA2700	285p	2SA794	725p
AN5733	185p	LA5523	145p	TDA2822	70p		
AN5250N	115p	LM301	25p	TDA3500	600p	TP197	22p
AN3540	250p	LM339	35p	TDA3506	330p	TIP42C	23p
AN362	450p	LM308	72p	TDA3560	300p	UAE310	175p
AN3671	500p	LM319	160p	TDA3561	225p	SILVER SENSOR	INDOOR
AN5610	150p	LM389	125p	TDA4100	325p	AL	925p
AN5912	225p	LM133	65p	TDA4100	325p	UNIVERSAL FIG 8 MAINS LEAD	60p
AN7105	200p	LM390	38p	TD7231	130p	VIDEO BELT KITS ORDER ASS.	
AN7178	260p	LB1405	225p	UPC324C	70p	50 KITS and DISCOUNT 18% OFF	
AN7222	95p	LB1416	225p	UPC554C	150p	We also stock all types of IC's. Transistors. Video-Audio Belts. Pinch-rollers. Video liders. Idler Tyres and Radio and TV Valves	
AN7224	210p	M5106P	180p	UPC571H	190p	UNIVERSAL TRIPLER	480p
AN7410	230p	M5152L	115p	UPC571A	50p	9000 TRIPLER	880p
AN7421	250p	M5186AP	325p	UPC1171C	105p	3000 TRIPLER	815p
BA001	50p	M5218L	190p	UPC1197C	120p	FOAM CLEANER	110p
BA311	80p	M5012	700p	UPC1238	100p	SWITCH CLEANER	110p
BA313	55p	M51182L	250p	UPC1363C	210p	TX10 FOCUS UNIT	725p
BA328	85p	M51521L	290p	UPC2002	185p	PHILIPS GB TRIPLER	745p
BA333	92p	M54543L	285p	UPC4586C	90p	1500 B WORDOPPER	205p
BA343	95p	M63712	138p	UPC5580	400p	FREZER	100p
BA402	50p	MB3722	300p	STK0629	400p	SONY ON/OFF SWITCH	220p
BA656	140p	TA7061	100p	STK083	960p	Please phone us for types not listed. Please add 60p post & packing and then add 15% VAT to total. All items subject to availability, and prices can change without notice. Govt. colleges, schools & institutes orders accepted. All components are brand new. Best quotations given on large quantities.	
BA682	300p	TA7070	115p	STK435	500p	Export-Mail Order enquiries welcome. Access and Visa accepted.	
BA1330	150p	TA7119	130p	STK459	600p	J.J. COMPONENTS	
BA308	210p	TA7140	20p	STK2230	570p	63, THE CHASE, EDGWARE,	
BA3812L	425p	TA7145	400p	STK2250	910p	MIDDX. HA8 5DN, ENGLAND	
BA5115	300p	TA7176	225p	STK3041	580p	Tel: 01-952 4641. Fax: 01-952 4641	
BA6109	210p	TA7204	128p	STK3042	580p	CALLERS BY APPOINTMENT ONLY	
BA5219	315p	TA7214	260p	STK1070	135p		
HA1124	145p	TA7222	200p	STK1212	780p		
HA1125	140p	TA7229	285p	STK4121-2	780p		
HA1138	90p	TA7233	235p	STK4141-2	650p		
HA1196	150p	TA7280	320p	STK4191-2	950p		
HA1319	230p	TA7302	225p	STK4332	480p		
HA1361	90p	TA7318	190p	STK4352	650p		
HA1406	110p	TA7361	245p	STK7217	640p		
HA11251	210p	TA7401	350p	STK7308	565p		
HA11423	210p	TA7609	280p	STR441	460p		
HA11715	210p	TA7613	360p	STR451	470p		
HA12002	280p	TA7641	145p	STR455	650p		
HA13001	185p	TA7691	165p	STR4090	625p		
HA13403	550p	TA7769	280p	STR6020	480p		
				STR4090	590p		
				STR6041	690p		

SPECIAL OFFERS VIDEO HEADS

- JVC-FERGUSON-IT133H(V) . . . 375p
- PANASONIC 4H55(N) . . . 1000p
- JVC-HR140-150 . . . 2385p
- PANASONIC NV730-770 . . . 2800p
- PANASONIC NV600 (3Head) . . . 2200p
- PANASONIC NV366 (4Head Orig) . . . 3672p
- PANASONIC NV450 (3Head) . . . 2200p
- PANASONIC NV470-NVG10-G11 (3Head) . . . 2200p
- HITACHI VT11-VT14 . . . 1700p
- HITACHI VT5000-VT5500 . . . 1900p
- HITACHI VT8000-VT9500 . . . 1700p
- SONY C20-C30-C40 SLR . . . 1850p
- STR50103A410p IC41116 . . . 49p
- TD0841B 215p TDA2800 . . . 500p
- NBOACPU 100p ZSD1397 . . . 89p
- TDA2004 90p STK043 . . . 700p
- VOL REG 7805-7812-7815-7905-7912-7915-7918 . . . 25p
- BU208A (Min 10pcs) . . . 600p
- BU208A (Min 10pcs) . . . 650p
- RF Lead Male to Female . . . 60p
- RF Lead Male to Male . . . 58p
- AERIAL PLUGS METAL . . . 20p
- INDOOR TV AERIAL . . . 175p
- SILVER SENSOR . . . 925p
- UNIVERSAL FIG 8 MAINS LEAD . . . 60p
- VIDEO BELT KITS ORDER ASS. . . 205p
- 50 KITS and DISCOUNT 18% OFF . . . 100p

worthwhile. Extra drum earthing helps but is not a cure. Has anyone found a cost-effective cure? Also can anyone supply a clock panel complete for the VCR4600 Mk. II? It's not available from Amstrad. If you have one in a scrap machine and want to sell it, please phone me on 0296 21 070.

R. Dewis, 14 Eastfield Road,
Aylesbury, Bucks.

I desperately require a line output transformer for a 13in. Panasonic Model TC316GM, chassis no. PBX-M7A2. Brand new or a good second-hand one, all expenses willingly paid.

G. Wright, Kimberly Electronics,
Ludchurch, Narberth, Pems.
Telephone 083 483 280.

Can anyone supply me with a National Semiconductors LM373N chip?

H. E. Chamberlain, 70 Cromwell Road,
St. Judes, Plymouth PL4 9QP.

I am trying to obtain a handbook/manual for a Telequipment S42 or S42a scope. Even a simple circuit diagram would help. All expenses would be paid.

Terry Martini, 102 Samuel Lewis Trust Estate,
Dalston Lane, Hackney, London E8 1NP.

Can anyone supply a circuit diagram for the Polish Unitra 12in. solid-state monochrome portable NR OTV No. 156686?

R. Bailey, 51 Robin Gardens,
Waterlooville, Portsmouth, Hants PO8 9XF.

Compact Disc Formats

George Cole

The digital audio compact disc format is just one of a number of systems that put data on a 12cm (5in.) optical disc. Others include CD Graphics (CD-G), CD Video (CDV), CD interactive (CD-I) and CD Read Only Memory (CD-ROM). There are also some unofficial variants, and discs with erase/record capability are likely to be available before too long.

LaserVision

The compact disc is a direct spin-off from Philips' LaserVision technology, so we'll start by taking a brief look at this. Philips began research into optical disc technology in 1969, when the goal was to put an hour of colour video pictures with sound on to a 30cm (12in.) disc. The information was recorded on the disc in the form of a spiral track of microscopic pits and was read by a laser. At around the same time MCA in the US was engaged in similar work: the two companies decided to pool patents and research.

Philips gave the first public demonstration of what was then called the Video Long Play (VLP) system in September 1972. The VLP disc held thirty minutes of video information per side, with the video bandwidth limited to 3MHz and the chroma signal down-converted on to a 1MHz carrier. The discs rotated at a constant angular velocity (CAV) of 1,500 r.p.m., one frame being read out per revolution.

VLP was launched in the USA at the end of 1978, renamed LaserVision. The playing time was increased to an hour per side by running the disc at a constant linear velocity (CLV) – the rotational speed fell gradually from 1,500 r.p.m. at the inside to 570 r.p.m. at the outer edge of the disc (these are PAL specifications). This increased the pit density so that up to three frames (six fields) could be accommodated in the outer section of the track – see Fig. 1. The penalty with CLV is the loss of trick-play features such as still frame. So two types of LV discs were developed, "active play" CAV discs that could provide trick effects and had a maximum playback time of thirty-six minutes per side, and the long-play CLV discs which were used for films etc.

Picture quality was improved by using the composite (luminance plus chrominance) video signal to frequency modulate a 7.1MHz carrier. Two carriers at 684kHz and 1.066MHz provided stereo sound, again using f.m. During the recording process the audio signal was mixed with the f.m. video signal to produce a clipped waveform – see Fig. 2 – that contained the sound and vision in the form of pulse-width modulation (PWM). This signal was fed to a 100mW recording laser. It switched the laser on and off rapidly, as a result of which a pattern of pits was burnt on to the special glass master disc coated with photoresist. This glass master was used to make a stamper from which the discs were pressed.

The LV discs were made from polymethyl methacrylate (PMMA, or Perspex). Each disc consists of two sides that are glued together. An $0.04\mu\text{m}$ layer of reflective aluminium was then added, topped with a protective lacquer. The track length is 31km, the pits

being $0.4\mu\text{m}$ wide, $0.1\mu\text{m}$ deep and $0.5\text{--}1.5\mu\text{m}$ long. Track pitch is $1.6\mu\text{m}$. The length and spacing of the pits forming the track are determined by the pulse-width modulation, the video and audio signals being in analogue form. A helium-neon laser with an $0.63\mu\text{m}$ wavelength and an $0.9\mu\text{m}$ spot diameter is used to read the disc.

When the beam is over the flat spaces between pits, called "lands", most of the light is reflected back. When it strikes a pit two effects, known as multipath interference and beam diffraction, come into effect. The former relies on the fact that the pit depth is equal to a quarter of the beam's wavelength. Thus light reflected from a pit travels an extra half wavelength and is in opposite phase to light reflected from the flat surface. As a result, the light signals cancel. The second effect scatters the light outwards, reducing its intensity. The reflected light fluctuations are read by a photodiode array which converts them into an electrical signal.

LaserVision was an elegant system. But consumers are more interested in price and software availability than the technology. Thus although LV picture quality was much superior to the initial VCR formats the system never caught on commercially – because of the absence of recording facilities and a chronic lack of software. LV found a niche as an interactive video system for education and training however. The discs are known as

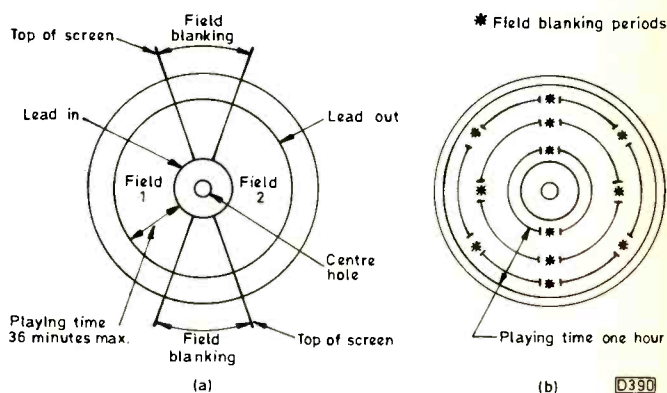


Fig. 1: Way in which the data is arranged (a) on a CAV active-play LaserVision disc and (b) on a CLV long-play LaserVision disc.

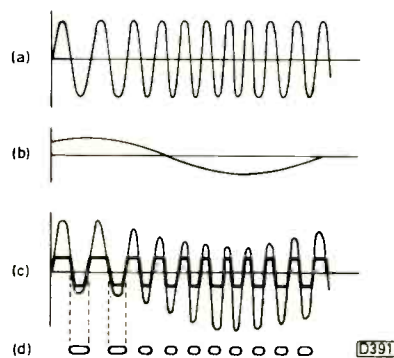


Fig. 2: Recording information on a LaserVision disc. (a) Vision f.m., (b) analogue sound, (c) sound and vision signals are added and clipped to produce (d) the bit pattern recorded on the disc.

LV-ROM and contain a mix of text, data, sound and pictures.

Basic CD

We'll next take a brief look at some of the features of the CD audio system. For a more detailed account you can refer back to earlier parts in Joe Cieszynski's Servicing Compact Disc Players series which began in the March 1989 issue.

The CD system was one of several systems proposed as a world standard for digital audio. In 1979 Philips demonstrated an 11cm digital disc with 14-bit signal encoding. The following year Philips joined forces with Sony, who had done much work on error correction techniques, the two firms proposing a 12cm disc with 16-bit encoding. The rest, as they say, is history. Over 50 million CD players have now been sold world wide and disc sales are running at several billion a year.

Although LV and CD share the same basic optical disc technology, there are important differences between them. CD is an all-digital system in which the pits and lands represent binary digits - zeros and ones. An aluminium-gallium-arsenide laser is used to scan CDs, the wavelength being 0.78µm. The discs have a 12cm diameter and are made of polycarbonate plastic instead of PMMA. And all CDs run at a constant linear velocity.

CD Graphics

A music CD holds up to 74 minutes of digitally-encoded sound, but there's no reason why other forms of data, say pictures or text, can't be stored. In fact a CD Graphics (CD-G) system that allows for storage of still pictures and text on an audio CD is written into the official CD Red Book standard.

Although the bits allocated to graphics comprise less than three per cent of the total data on a disc, some 1,500 images can be stored, or up to fifteen languages, on parallel tracks. They are stored in the following way. The data on an audio CD is arranged in groups of bits that are called frames (not to be confused with TV frames). Each frame consists of 588 bits, the frame rate being 7.35kHz. Fig. 3 shows the way in which a frame is arranged while Table 1 lists the contents. Parts 5, 6 and 7 of Joe Cieszynski's series (July, August, September 1989) provide a lot of information on CD frames. As we're not concerned with most of the bits here I'll simply outline their use.

- (1) The 24 frame sync bits are used for servo control in the player.
- (2) The subcode bits provide control information and graphics - we'll return to these in a minute.
- (3) The data bits are used for the audio information.
- (4) The error-correction bits are self-explanatory.
- (5) The margin (or merging) bits are inserted to prevent high d.c. components occurring in the signal - otherwise

Table 1: Contents of one CD frame

Purpose	Recorded bits
Frame sync	24
Subcode	1 × 14
Data	24 × 14
Error correction parity	8 × 14
Margin bits	34 × 3
Total	588

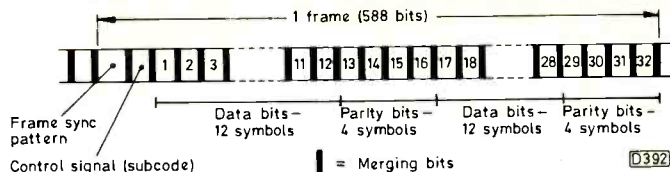


Fig. 3: Structure of the CD signal frames.

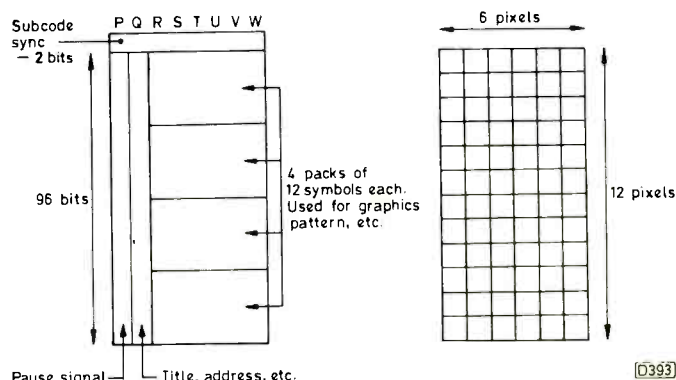


Fig. 4 (left): Structure of a block of CD subcode held in a RAM.

Fig. 5 (right): Structure of one font.

the player's tracking and frame synchronisation would be affected.

It's the subcode bits that concern us. They are arranged in the form of a 14-bit symbol, using 8-to-14 modulation (EFM). This form of modulation converts a block of eight bits to 14 bits and is again done to prevent the occurrence of high d.c. levels. In the player the 14 bits are converted back to eight (14-to-8 demodulation), these eight bits being referred to as P, Q, R, S, T, U, V and W. The P and Q bits are used for track identification, track time etc., while bits R-W are set aside for graphics.

The player holds the subcode bits from 98 consecutive frames in a RAM, forming eight 98-bit words that are known as a block - see Fig. 4. Seventy five blocks are formed each second (the 7,350 frame rate divided by 98 = 75). In practice the first two bits are used as the subcode sync signal, so that each subcode word has 96 usable bits. When the subcode sync signals have been removed from the block it's called a packet. A quarter of a packet is referred to as a pack, and each pack is read out at the rate of 3.3msec (1/75 sec divided by 4), which is used as a reference. The packs can be read out in parallel or serial form.

The graphics display consists of 288 × 192 pixels and looks like a teletext picture. It's divided into fonts, each consisting of 6 × 12 pixels (see Fig. 5). A full screen display has 50 × 18 fonts. Colours are produced in a 4-bit plane for each pixel: up to 16 colours can be selected from a palette of 4,096, i.e. there are 16 gradations of red, blue and green. The outside of the screen display is called the border and is in one colour.

It takes 2.5-10 seconds to draw each display. There's a facility that allows rows, columns or the whole display to be scrolled on or off the screen.

There's also provision for storing musical instrument digital interface (MIDI) codes that allow a user to control a bank of electronic instruments and play along with the music on the disc. A couple of years back a JVC engineer demonstrated this to me with a frenetic version of La bamba!



Fig. 6: Scanning electron microscope picture (magnification 2,500 times) showing the transition between the audio and video (smaller pits) sections of a 5in. CDV disc.

The CD-G discs are compatible with all CD players. Since the graphics are stored digitally there are none of the problems produced by different TV standards. An ordinary audio CD player simply ignores the R-W bits, playing the sound in the normal way. The CD-G player contains an extra graphics decoder chip. Such players have to be produced for the PAL and NTSC markets.

To date JVC has been making all the running with CD-G. Its first European CD-G player, Model XL-G512, was introduced last year in West Germany. A UK launch is likely this year.

CD Video

Depending on who you talk to, CD Video (CDV) is either CD with pictures or LaserVision with digital sound. The idea of merging digital audio with moving analogue pictures is not new. In fact early LaserVision prototypes had PCM audio output sockets. Laser Digital Discs (LDD) began to appear in NTSC markets in around 1984. These had analogue video plus analogue and digital sound tracks. Several years ago Pioneer began to market NTSC Combi players that could play LaserVision, LDD and conventional 12cm audio compact discs.

Philips formally announced specifications for the CDV format in March 1987, with a launch planned for that November. In fact the first CDV players finally

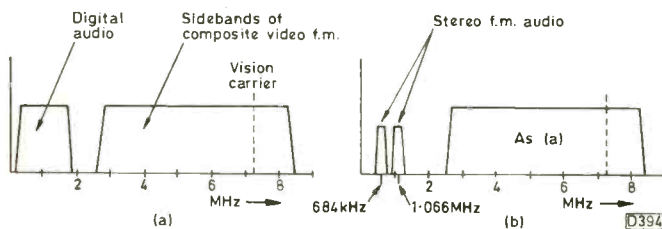


Fig. 7: Frequency spectra of (a) CDV signals and (b) LaserVision signals.

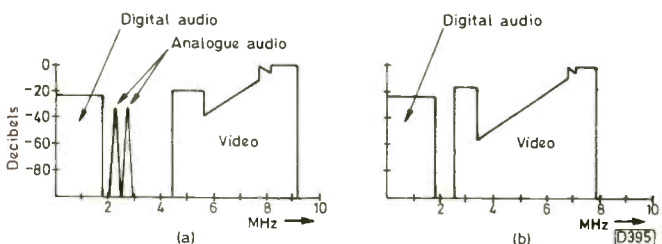


Fig. 8: Frequency spectra of (a) an NTSC CDV disc and (b) a PAL CDV disc.

appeared in September 1988. The reason for the delay was that both disc and player production proved to be far more difficult than expected.

Since CDV discs contain analogue video they are tied to world TV standards, i.e. the discs and players have to be for the NTSC or PAL areas. In the UK however Pioneer has released a CDV machine that enables NTSC discs to be played back via most types of PAL TV sets.

There are two types of CDV players, combi and clip. Combi players can handle the following types of disc:

- (1) The 8cm silver CD that stores twenty minutes of audio only.
- (2) The 12cm silver CD that stores up to 74 minutes of audio only.
- (3) The 12cm gold CDV disc that stores six minutes of analogue video with digital audio and a further twenty minutes of digital audio.
- (4) The 20cm extended-play CDV disc that stores twenty minutes of video with digital audio per side.
- (5) The 30cm long-play CDV disc that stores an hour of video with digital audio per side.
- (6) The 30cm LaserVision CAV disc that stores 36 minutes of analogue video and sound per side.
- (7) The 30cm LaserVision CLV disc that stores an hour of analogue video and sound per side.

Note that not all combi CDV players incorporate analogue audio circuitry, so some won't play the sound tracks of LaserVision discs. Some players don't provide the full trick-play features with CAV-type discs.

Clip players can handle only disc types (1), (2) and (3).

The 8 and 12cm discs are made of polycarbonate plastic while the larger discs are made of PMMA. Incidentally CDV discs are coated with silver instead of aluminium. This is not because of the recent scare stories about disintegrating CDs as a result of aluminium oxidation, but simply because silver improves production techniques.

CD and CDV discs have a table of contents (TOC) that tells the player what's on the disc. With 12cm discs the start and finish positions of the lead-in area are 20mm radius start and 23mm radius finish. The video lead-in is at 37.5mm, with the video start at 39mm. Fig. 6 shows the transition from the audio to the video section of the disc. With 20 and 30cm LV and CDV discs the lead-in start is at 53.5mm radius, the video information starting at 55mm.

A CD player reads the TOC and starts at track one, which is at the innermost part of the disc. The video portion of a 12cm CDV disc has the highest track number and is located at the outer part of the disc: it's played first however, unless the user instructs otherwise. When the video part has been played the laser returns to the start of the audio section and plays that. During audio playback the TV screen changes to a restful colour and displays the disc time and track information.

The signal spectra for LaserVision and CDV PAL discs are shown in Fig. 7. Both have composite video with frequency modulation but the CDV disc has digital sound while the LaserVision disc has two f.m. audio carriers.

Unfortunately for European LaserVision users it's not possible to put both analogue and digital sound tracks on a PAL CDV disc. Fig. 8 shows the frequency spectra for PAL and NTSC CDV discs. Not only is the video bandwidth wider for PAL but the nominal carrier frequency is lower, leaving room for only one type of sound signal. So the choice is either analogue or digital sound but not both. This is the reason why LDD discs

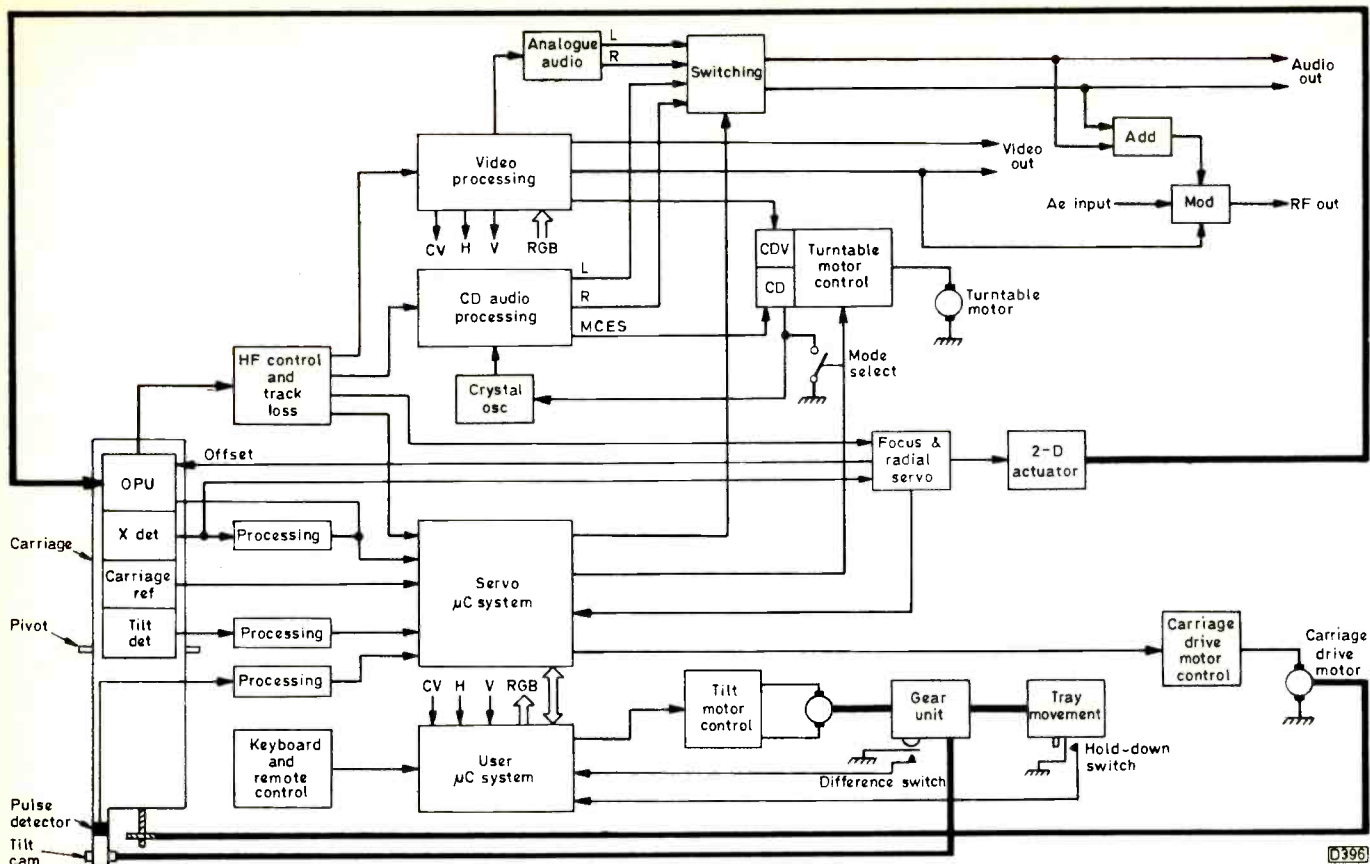


Fig. 9: Block diagram of a CDV player.

were launched in only NTSC markets. Owners of NTSC LaserVision players can play either LDD or CDV discs. European LaserVision owners can get only the pictures from a CDV disc. But most CDV combi players can handle LaserVision discs.

The CDV Player

The delay over the introduction of CDV is understandable when you consider what a combi CDV player has to be able to cope with:

- (1) Disc sizes ranging from 8 to 30cm.
- (2) Disc weights ranging from less than 20g to over 200g.
- (3) Disc speeds ranging from 200 to 2,250 r.p.m.
- (4) Discs that contain digital audio, or digital audio and analogue video, or analogue video and sound.
- (5) Either PAL or NTSC discs.
- (6) Warped or eccentric discs.

Let's consider disc size. Fig. 9 shows a block diagram for a CDV player. At the left-hand side you'll see a tilt detector. This has two roles, one of which is to identify the presence of a disc and its size. The detector consists of a single LED and a sensor that sits next to it. Both face upwards. A disc that's larger than 12cm will reflect light from the LED on to the sensor, but with a smaller disc there's no reflection. Since all large discs are video ones the player goes into the video mode. If there's no reflection the tilt detector moves to the start position for a 12cm disc and looks for a signal there.

The disc's contents can be found in one of two ways: by using the conventional TOC, or a special 24-bit Manchester code that's inserted in the video signal during the field blanking interval on lines 16, 17, 18, 330 and 331. CDV discs also contain a code to tell the player whether the video is PAL or NTSC. When an NTSC disc

is inserted a PAL player will display "NTSC": with a 12cm NTSC CDV disc inserted the player moves to the audio portion and plays that.

A CDV player can be simply hooked up to a TV set via an r.f. lead, but better results are obtained when the player is connected to a high-quality set with facilities to feed in composite video or RGB signals. Some of the latest CDV machines have Y/C terminals. The audio should be fed to a hi-fi system. If you take a look at the back of a CDV player you'll see that there are plenty of sockets! A CDV player can control the disc in several ways though some, such as still frame and slow motion, are available with only CAV discs. When a disc is inserted the player carries out the previously mentioned checks and displays the disc information on the TV screen. When the user has made his selection the player goes into action.

The carriage - see Fig. 9 - is pivoted at the centre and can be tilted through 4°. This gives a small amount of tilt correction for warped discs or larger discs suffering from edge droop. The optical pick-up unit (OPU) contains the laser and photodiode assembly. It moves in two planes, horizontal and vertical. Horizontal movement is referred to as radial tracking and has to be at right-angles to the track. The 2D actuator, X detector and tilt detector ensure that the laser tracks correctly and remains in focus.

When a disc is being played the digital audio is extracted, via a low-pass filter, and is then processed in the standard CD manner. The composite video signal is compared to a crystal reference for sync correction and is then demodulated into its RGB components. RGB text characters can be added for on-screen display information. The video can be taken off in RGB form, encoded as a composite video signal, or modulated on to a u.h.f.

carrier for sets that will accept an input only via the aerial socket.

CD Interactive

The next step after CD and CDV is CD-I. This is a consumer system that stores a mix of text, graphics, data, video and sound on a 12cm disc. The disc has a 650Mbyte capacity, which is equivalent to over a thousand floppy discs, 250,000 pages of typed text or, depending on their quality, 5-20,000 still video images. Interactive means that the user can control the way in which the data is presented. Graphics can be mixed with text or video with sound. One big advantage is that the CD-I system is completely digital, which means that the discs can be played on any CD-I machine. The format is being promoted by a number of companies, including Philips, Sony and Matusushita.

The CD-I standard, known as the Green Book, was presented by Philips and Sony in November 1988. The main features are as follows:

There are three resolution levels which, for a PAL monitor, are 384 × 280 pixels (normal), 768 × 280 pixels (double) and 768 × 560 pixels (high).

Four methods of picture encoding are used:

(1) Delta YUV (DYUV) is used for photographic images and motion video. Each picture uses 105kbytes, and 6,340 images can be stored on the disc.

(2) RGB 555 records the values for the red, green and blue pixel components. 555 relates to the fact that five bits are used for each colour. This means that each pixel can be one of 32,768 colours. Each RGB 555 image uses 210kbytes, and 3,170 images can be stored. RGB 555 images are used for elaborate moving graphics.

(3) CLUT 8. CLUT stands for colour look-up table. The 8 stands for 8-bit encoding, which allows 256 colours to be selected from a palette of 16 million. There are also CLUT 7 (128 colours) and CLUT 4 (16 colours) for use with double-resolution pictures. CLUT is used for simple graphics and cartoon images. Each CLUT image uses 105kbytes and 6,340 images can be stored.

(4) Run-length is a simple data compression algorithm that works by discarding the redundant bits, i.e. repetitive parts of a picture. This enables a 300kbyte image to be compressed to 5-10kbytes. Run-length is used with CLUT for cartoon animation images: the CD-I disc can store over an hour of cartoon animation and digital sound.

Unless otherwise indicated the figures quoted above apply with normal resolution pictures. CD-I also has effects such as cuts, wipes, dissolves etc.

Until recently CD-I motion pictures were restricted to full-screen cartoon animation or DYUV moving pictures occupying just thirteen per cent of the total screen area. Full-screen motion video seemed to be out of the

question due to CD-I's slow transfer rate (the speed at which the data comes off the disc). A single frame requires about 828kbytes of data when each pixel is 16-bit encoded. With the PAL frame rate of 25Hz a transfer rate of over 20Mbytes/sec would be required. But the CD-I's fastest transfer rate is 170kbytes/sec.

Last October however Philips, Sony and Matsushita announced an extension of the CD-I specification to incorporate full-motion video. It's made possible by using a data compression system called discrete cosine transform (DCT) which compresses the data by a factor of over 100:1, allowing up to 65 minutes of full-motion video with mid-fi sound to be stored on a disc. Picture quality is said to be between VHS and S-VHS standard.

CD-I offers four levels of sound quality. The highest is PCM digital audio, as used with CD audio discs. In practice however most CD-I discs will use a system called adaptive delta pulse code modulation (ADPCM). As Table 2 shows, ADPCM uses a lower sampling rate and lower quantisation. With PCM sound the bandwidth is 20kHz. ADPCM A's bandwidth is 17kHz, which is claimed to be equivalent to the sound quality obtained from a freshly-pressed vinyl record. In practice most people find it hard to distinguish between A sound and PCM. This mode is used for hi-fi music. ADPCM B's bandwidth is also 17kHz, but the use of 4-bit words reduces the quality to that of a good f.m. stereo radio broadcast. ADPCM C's sound has a bandwidth of 8.5kHz, equivalent to an a.m. radio transmission. This mode is used for speech, allowing more sound to be packed in for greater flexibility.

The sound channels are on parallel tracks, so that up to 16 different languages can be stored on a disc. A user could for example hop from an English to a French sound track at the touch of a button. Multiple channels can be played sequentially, and CD-I players have a buffer memory called a "sound map". This can hold several seconds of sound while the laser moves from the end of one audio channel to the beginning of the next.

CD-I discs look like ordinary CD audio discs. The data on them is organised into 75 sectors - don't confuse this with the sectors on a conventional floppy disc. A floppy disc runs at a constant angular velocity, so that the disc can be neatly divided into sectors of equal size. This makes it quick and easy to find data on a disc. The CD-I disc has a spiral track and runs at a constant linear velocity, so there has to be a different method of organising the sectors. They are in fact found by time and block number. Each minute on the disc is divided into seconds each of which has 75 blocks. The user selects what he wants using a pointer device like a mouse or IR remote control handset.

What's in each sector then? It's first necessary to point out that there are two kinds of data on a CD-I disc. The first is data whose errors can be concealed by interpola-

Table 2: CD-I sound levels

Level	Sampling rate	Quantisation	Channels	Playing time (hours)	Portion of disc used per channel
PCM	44.1kHz	16	One stereo	1	Whole disc
ADPCM A	37.8kHz	8	Two stereo or four mono	2.4	Half
ADPCM B	37.8kHz	4	Four stereo or eight mono	4.8	Quarter
ADPCM C	18.9kHz	4	Eight stereo or 16 mono	9.6	Eighth
				19.2	Sixteenth

tion and similar methods. This is called Form 2 data and includes audio and visual information. The second type, called Form 1, requires an extra level of error correction and is used for text and data. Since it uses more bits, a sector containing Form 1 data has less usable bits than one with Form 2 data.

Each sector is made up of 2,352 bytes which are used as follows:

- (1) 12 bytes are used for synchronisation.
- (2) 4 bytes are used for the header, which identifies the sector.
- (3) 8 bytes are used for the subheader, which identifies the type of data in the sector.
- (4) With Form 1 data there are 2,048 usable bytes (280 bytes are used for error detection and correction). With Form 2 data there are 2,328 usable bytes.

The disc's reading speed is 75 sectors per second, giving a Form 1 data transfer rate of 150kbytes/second compared with 170kbytes/second with Form 2 data. The different kinds of data (text, video, sound etc.) can be interleaved and read from the disc in real time.

Consumer CD-I players will be about the size of a VCR. They will be designed for hooking up to an existing TV set and hi-fi system and to play CD audio and CD-I discs.

Current CD-I players use a 68000 series microprocessor developed by Motorola to process and synchronise the various data coming off the disc. The player has a 1Mbyte RAM for storing data plus 8kbytes of non-volatile RAM that can be used to hold data which can be checked when the player is switched on again (the final moves in a game for example). The player's operating system is held in a ROM. With full-motion video, decompression chips will also be required.

The players will be controlled by a mouse, IR remote control handset or graphics tablet. Users will be able to link the CD-I player to various peripherals including a printer, keyboard and disc drive. Philips say there will also be add-on CD-I units for use with suitably equipped CD and CDV players.

CD-I will be aimed at the education, entertainment and information markets.

CD-ROM

The CD-ROM is used in business applications to hold vast quantities of data. Strictly speaking a CD-ROM isn't a storage device because the data can't be altered. CD-ROM was launched in 1985 and although Philips and Sony laid down basic specifications (known as the Yellow Book) they decided to leave it to the computer industry to sort out a way of indexing the data on a disc. The result was chaos, so manufacturers have adopted a standard formatting system known as the "High Sierra" or ISO 9660 (International Standards Organisation).

Unlike a CD-I player, CD-ROM drives are either stand alone units connected to a personal computer or are built into a computer. They cost around £500-£1,000. Most are used to store text and data, though the discs can also store other types of information such as vision and sound. An extension known as CD-ROM XA (extended architecture) uses CD-I sound and graphics.

There are four basic stages in CD-ROM production:

- (1) Data processing - collecting data from various sources. Some data, such as pictures, has to be digitised. The collected data is put on to a massive 1,200Mbyte hard disc.

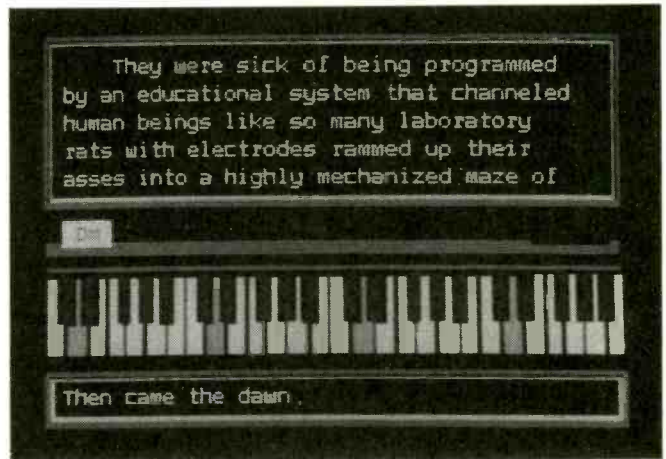
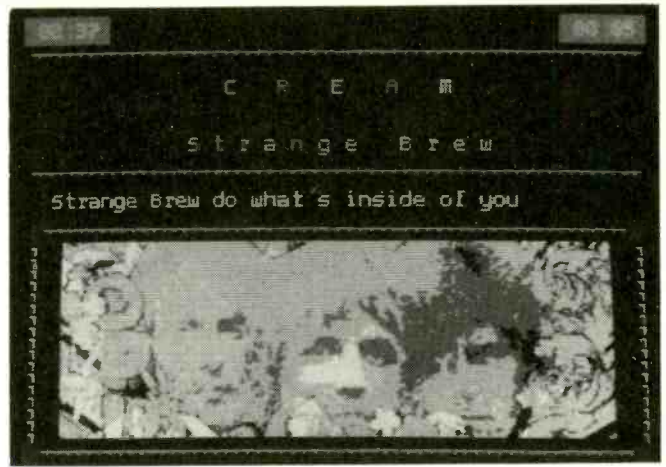


Fig. 10: Examples of CD graphics.

- (2) Premastering. This involves formatting the data to the ISO 9660 standard. The data is transferred to a premastering tape.

- (3) The mastering process, which is basically the same as that used for LV and CD discs, a laser writing the data on to a glass master. The master is used to make the metal stamper from which the discs are pressed.

In Conclusion

In a later article we'll explore the world of WORMs, CDV, CD-R, DVI, CD-E and CD4X.

My thanks to Takuro Bojo of JVC's audio division, Dave Wilson and Christine Taylor of Philips Du Pont Optical and Simon Turner of Philips Research for their help in the preparation of this article.

CLEANING CLOTH

The sample cleaning cloth supplied free with last month's issue was a Walkisoft Wipe. These cloths are available from SEME Ltd., Unit 2E, Saxby Road Industrial Estate, Leics LE13 1BS (telephone 066 465 392) at £7.25 + VAT for a pack of 125 in size 30 x 33cm.

The cloths have superior absorbancy (eight times own weight in water, six times own weight in oil), high wet strength and retention, smooth softness (no fluffing or scratching), very low lint, antistatic characteristics and are washable for reuse.

Our apologies to SEME for not providing details in last month's issue.

VCR Clinic

Reports from Philip Blundell, Eng. Tech., Eugene Trundle, Alfred Damp, Ian Bowden, Stephen Leatherbarrow and Chris Avis

Sony CCDV8AF

Many camcorder users complain of lens motor noise on the sound tracks they record, particularly during quiet passages when the audio auto-level control winds up the gain of the sound channel. In most cases little can be done about this short of buying and using an external microphone – we've changed motors on several different models with little or no improvement in the results obtained.

We've found however that the auto-focus drive motor wears in the Sony CCDV8AF, which is now three-four years old, and that fitting a replacement results in a marked decrease in sound-track rumble when the lens is on the move. **E.T.**

Sanyo VHR3300

This machine had fine E-E sound but instead of a picture there were swirling black-and-white patterns that looked as though they were caused by instability. This led us to investigate the vision i.f. section, but we found that a perfectly good composite video signal emerged from the demodulator. The trouble was caused by IC001 (LA7223) in the video circuit. The instruction entering this route switching chip was correct and the video signal was present at its input pin 7, but all that emerged from the output pin 1 was hash. **E.T.**

Alba VCR4000X

We didn't have a service manual for this machine, which was a great handicap in view of the fault – intermittent failure to play rented tapes in colour. The machine's own recordings played backed in colour correctly. The problem was solved by replacing the 4.43MHz crystal in the chroma section and setting up the VXO potentiometer R491. **E.T.**

Grundig VS180

There was an intermittent fault with this machine: when the fault was present the machine wouldn't carry out any deck function. It was very similar to the faulty cassette lamp syndrome with early makes and models. With a cassette in the machine however the stop button would act as an eject control.

The cause of this one was leakage in the CASS (eject) keyswitch. It was upsetting the keyscan system with the result that the action of the other switches was inhibited. Since the front surface of the faulty keyswitch was rather battered and the corresponding plastic "hinge" on the user's front-panel CASS key was in poor condition we replaced both items. **E.T.**

Mitsubishi HS302

"Reversed tape as sample" said a scribbled note on this machine. What could that mean? Examination of the cassette stuck to the machine's top cover showed that the ribbon was inside out. When we checked the machine's operation we found that the entry guide did not retract fully in the stop mode, so that when a cassette was inserted its ribbon caught the top of the guide and was

twisted round. The cause of the problem was an almost seized bearing at the pivot of the arm that drives the entry guide through the tape-loading process. It's below the head drum, on the left-hand side of the subdeck, and is difficult to get at. Penetrating oil and much toing and froing by hand finally freed it and enabled the spring to pull the guide to the fully-retracted position. **E.T.**

Toshiba V66/JVC HRD140

The deck used in this machine is similar to the one in a whole range of JVC-based machines – the HRD140, 3V43 etc. Sometimes tapes are damaged in the backwards search (review) mode. This is due to the tape buckling and bubbling between the capstan and pinch roller. The cause is an out of vertical guide arm, the one between the capstan and the TLL reel. It's better to replace this than to bend it – part no. PQ41384A. **E.T.**

Philips VR6660

When the test pattern was selected it couldn't be removed except by interrupting the mains supply. When playback of a cassette was tried the tape would thread then immediately unthread. The head drum rotated even in the stop mode. I started with this last point as it seemed to be the easiest one to deal with. As the /motor stop line (pin 25) didn't go low in the stop mode a new MAB8420C047 microcomputer chip was fitted. This cleared all the faults. Phew! **P.B.**

Grundig VS500

This machine blew the mains fuse because the BUZ90A chopper transistor was short-circuit. When d.c. checks were made to find out why we discovered that R1318 (300k Ω) was open-circuit. The f.e.t. and resistor were replaced, but the BUZ90A again failed at switch on. We had to fit a new TDA4650 control chip as well. **P.B.**

Philips VR6562/Pye DV543/Sharp VC750

A pair of these came in one day, both with the same fault. They would very intermittently go to stop a few seconds after play was selected. Sometimes the capstan didn't turn, other times the brake lever didn't move over so that the idler didn't contact the take-up reel and the tape spilt out. A new mecha state switch was tried but made no difference. In desperation I rang the nice man at Sharp. He suggested changing the cam gears, and he was right. I owe him a pint, maybe two . . . **P.B.**

Ferguson 3V24/JVC HR2200

The complaint with this machine was no picture. On examination I found that there was no drum rotation and, an added symptom, the VCR didn't enter the alarm mode. I decided to tackle the drum fault first. The cause of failure to rotate was that the drum stop signal wasn't being removed when play was selected. Tracing this brought me to IC4 on the audio/CPU board. When play

is selected pin 2 of IC4 should drop to 0V, removing the drum stop signal. But in this machine pin 2 fell to only 4V. The reason for this was eventually traced to leakage across the board to pin 2 of IC4, between two points where the print connection is taken through the board to the component side. Carefully cutting the print prior to the feed-through links and replacing it with a length of insulated wire restored normal results — including operation of the alarm mode when there's no drum rotation. **A.D.**

Panasonic NV180

This machine came in with a cassette inside and the tape still threaded. On applying power the drum motor ran fast and no functions were available. We found that the 5V supply at T1003 on the front system control/power panel was missing. There's a circuit protector connected to the collector of the 5V regulator transistor Q1001. It's not shown in the circuit diagram and had gone open-circuit. Replacing it restored all functions and allowed the tape to unthread correctly — saving a valuable wedding video. **A.D.**

Amstrad VCR4700/TVR2/TVR3

Tuning faults should lead to a check on the DAC output from the timer chip if the display indication in the tuning modes is incorrect. A variable mark-space ratio square-wave should be seen. If this is correct, follow it to pin 8 of the tuning voltage generator chip. This can and does fail, with no 0-30V output at pin 10. No DAC output is of course our old friend the 14DN233A timer chip. **S.L.**

Sentra GX8000

The customer's complaint was of difficulty in tuning channels B and D. I found that on these two channel positions only the tuning voltage wouldn't rise above 26V. There was a leak through selector G. After eliminating the isolating diodes I found that C407 had a 4k Ω leak. **S.L.**

B and O VHS82

The reported fault was that the machine wouldn't accept tapes. The front loading worked correctly when a cassette was inserted, but if any mechanical function was selected the capstan motor would kick anti-clockwise, clockwise, then anti-clockwise again, after which the cassette was automatically ejected. The reason for this behaviour was loss of tachometer pulses from the capstan, the cause being that C2206 (47 μ F) in the +11V supply to the tachometer amplifier circuit had gone short-circuit. No other damage had been caused as the supply comes from the 13V line via a 1k Ω resistor. **I.B.**

Panasonic NV-L28

This one had three reported faults. There was intermittent operation of the functions via remote control, the VTR power button mounted on the fold-down control panel didn't always work, and lastly the most significant symptom — when the control panel was in the upright position the tracking shifted off to one end of its range. All these problems were caused by one fault. The control matrix PCB is connected to the machine via a

flat, fifteen-way flexible lead that plugs into both the front PCB and the control PCB. The cause of the fault was a very small conductive strand which bridged between connections 14 and 15 of the FPC at the control panel end. As a result tracking minus ("Set Down" in the manual) was selected momentarily, or all the time with the control panel closed up. If any of these keys is held down no other key will be detected, including the VTR power switch, and it will also lock out the remote control input. **I.B.**

Samsung SI7220

The problem with this new machine was loss of E-E sound. It cleared when the bottom cover was removed, but could be made to come and go by slight pressure on the main panel. We soon found the cause. There was a 100 μ F capacitor mounted on the underside of the panel, a production modification. Its negative lead should be connected to chassis but bridged from where it was soldered to an adjacent land. This land is the audio feed from the tuner/input select area via pin 3 of connector CN401, and was thus shorting out the signal. **I.B.**

Logic VR950

The capstan servo was hunting and the tracking control had no effect. We traced the cause of the fault to the control, which was worn and open-circuit. Because of spares problems with these machines we used a standard horizontal 470k Ω preset, fitted with a suitable spindle that matched up with the front panel. This arrangement worked well. We then found the cause of the control's failure — a badly worn head drum that produced a poor, unstable picture and gave rise to an overworked tracking control. All was well after fitting a new drum from MCES. **C.A.**

Sharp VCA100HM

This machine accepted a cassette briefly then spat it out again. As one connection tag had broken off the top cassette sensing switch someone had soldered both leads together! The simple answer was a new switch. **C.A.**

Saisho VR1200HQ

This was a NICAM (Nasty Intruder Caused Absolute Mayhem) job. The original complaint was that the machine wouldn't accept a cassette. Its owner had accepted the kind repair offer of a friend at the local Electricity Board. When she retrieved it some time later it was completely dead.

A replacement 12V regulator transistor (Q2502) restored some life, but the machine still refused to accept cassettes. If a tape was wound in manually the start and fast-wind functions worked, but with no end-sensing operation. The left-hand PT361 sensor was open-circuit (the original fault?), but a replacement made no difference. The right-hand sensor is decoupled by a 10nF capacitor (C1012) which had been carefully replaced by a 4.7 Ω resistor! The correct component restored loading and end-sensing, but with no playback picture. Meterman had removed the head amplifier module and refitted it with the PCB edge connector misaligned. After correcting this we had a working machine, the owner had a large bill, and I suspect that her SWEB friend was about to receive a shock. **C.A.**

Long-distance Television

Roger Bunney

Reception during January was stark when compared with the multitude of signals we received during the closing months of 1989. Towards the end of the month the weather was far from settled, with severe winds. Several DXers lost their aerial masts completely and many poles were badly bent. Reception has generally matched the poor weather conditions. We'll start with the Sporadic E log:

- 5/1/90 TVP (Poland) ch. R1.
- 6/1/90 TVE (Spain) E2.
- 10/1/90 TVE E2, 3, 4.
- 11/1/90 TVE E2.
- 12/1/90 TVE E2, 3, 4; RTP (Portugal) E2, 3; CST (Czechoslovakia) R1.
- 14/1/90 TSS (USSR) R1.
- 15/1/90 Unidentified signals.
- 16/1/90 TVE E2, 3; SVT (Sweden) E3; RAI (Italy) IA; TVP R1, 2.
- 17/1/90 TSS R1.
- 18/1/90 +PTT (Switzerland) E2.
- 19/1/90 YLE (Finland) E3, 4.
- 21/1/90 TSS R1; YLE E3, 4; unidentified E2/R1 signal at lunchtime.
- 22/1/90 TVE E2, 3, 4.
- 26/1/90 TSS R1.

The Quadrantids meteor shower was less active than had been expected, though some activity was seen, particularly on the 3rd and 5th. The 3rd produced signal pings as high as Band III from Denmark, Sweden and Norway. Iain Menzies (Aberdeen) noted auroral activity during the first five days of the month. This was intense on the 5th, lasting through much of the night. Finland was identified during the opening on chs. E3 and 4. F2 layer propagation has unfortunately tailed off considerably, with reception on only five days. On the 7th there was an unidentified ch. E2/R1 signal at lunchtime – a 48.26MHz carrier produced programmes and commercials, the latter including a revolving star within a circle in the lower corner. Any ideas? Unidentified F2 signals on ch. E2 were received on the 12th, 17th, 18th and 30th at lunchtime.

Iain Menzies reports that a meteor scatter communica-

tions system for truckers is in operation in north America. A 1-2kW e.r.p. transmitter provides data at 43.92 and 49.595MHz for the Transtrack and Pegasus companies. Although MS has been used by the military for rapid burst data transmission, this is the first time I've come across it in commercial use. The Italian media magnate Silvio Berlusconi is involved with advertising on Hungarian and Polish TV, so you may receive glossy commercials on East European transmissions.

For DXers who can resolve teletext pages it's worth pointing out that the three Scandinavian countries are now exchanging pages in the 190 series, usually 192 onwards.

I've temporarily piggybacked a C band LNB on to a Ku band assembly here at Romsey and as a result have received some interesting satellite TV signals – from Libya, Nigeria, Niger and Saudi Arabia for example. The narrow beam used by Israel from Intelsat 1°W in Ku band was eventually seen, though at very low level, by using bandwidth filtering and local sync locking. Reception is not bad with a 1.5m dish. The inspiration to try this came from Ian Waller in Lincoln – he's also resolved the signals using a smallish dish.

My thanks to Simon Hamer (Powys), Iain Menzies (Aberdeen), Tim Anderson (St. Leonards), David Oliver (Birmingham), Roger Fussell (Torpoint) and Ryn Muntjewerff (Holland) for sending in reception reports.

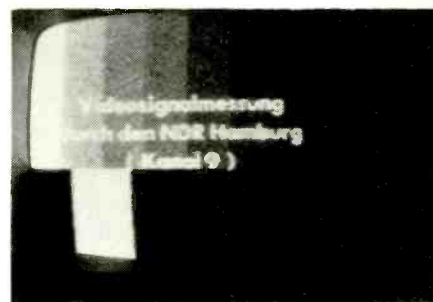
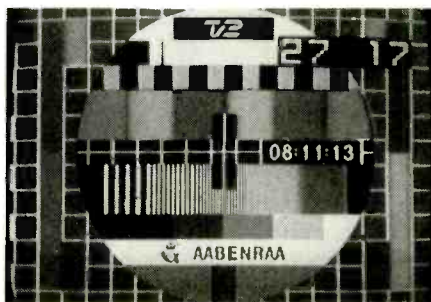
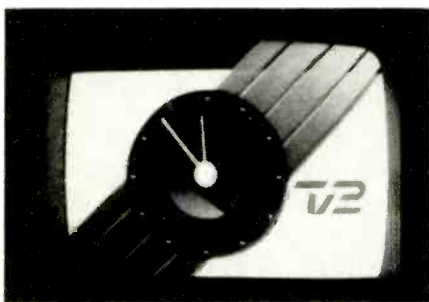
News Items

South Africa: BOP-TV (Bophuthatswana) hopes to become a national network. The Bophuthatswana TV authorities are seeking talks with the South African government.

Belgium: The transmitting mast at Anlier collapsed during the very high winds on January 25th, deleting the ch. E11 RTBF-1 and ch. E60 Tele 21 services.

Radio Amateurs: Swiss amateurs are to be allowed to operate in the 50-52MHz band during non-TV hours at up to 100W e.r.p. The position will be reviewed at the end of the year. Denmark has allowed operation in the 50-52MHz band on a 24-hour basis, at up to 500W. Permission includes the Faroe Islands. It's expected that Austria will soon allow operation in this band.

In the USA radio operator K2JIA (New Jersey) has applied to the FCC for the 50-54MHz amateur allocation to be withdrawn in favour of another f.m. radio band! K2JIA owns the medium-wave (a.m.) radio station WRNJ. The NAB and the FCC are unenthusiastic and it's felt that the proposal will not get much farther,



Left: The Danish TV2 network clock, received in Holland by Ryn Muntjewerff. Centre: A Danish TV2 test card received in Helsinki, Finland – Aabenraa ch. 27. Right: Test pattern received by Ryn Muntjewerff from NDR Hamburg ch. 9.

especially as no receivers for this unique band are available.

Argentina: Buenos Aires ch. 6 is expected to be on-air this summer. It's an unusual station, being 51 per cent owned by local authorities and 49 per cent owned privately.

Poland: A private station TV Echo is in operation in south west Poland, on ch. R28. Power is at present 200W but is expected to be increased to 1kW. The Wraclaw (Breslau) transmitter that opened on February 6th uses standard K PAL. PAL was chosen since most Polish receivers have PAL/SECAM capability and PAL eases transmission of programme material from Astra. The TVP-1 Siedlce ch. R1 transmitter has been closed down, being replaced by a ch. R52 outlet.

Spain: Tele-Murcia, also known as TELE 3, is now in operation, located near Alicante. The Expo 92 proceedings are to be transmitted in HD-TV form. Antenne 3 has started programme transmissions in Madrid and Barcelona.

Pakistan: A ch. E4 transmitter is in operation at Lak Pass, running at 8kW e.r.p.

Elektor Decoder Modification

The Matsushita encryption used by Filmnet has been changed in recent months. The system is based on inversion of complete TV fields, with some 32 sampling variations. Towards the end of last year alternate fields were being inverted: at the time of writing three in four fields are being inverted. Many of the decoders marketed last year can't cope with this change, though others can. The Filmnet decoder circuit published by *Elektor* last year is one that can't cope with the changed inversion rate, but several correspondents have sent details of modifications that enable it to do so. The three suggestions received are as follows - I've not tried them, so can't comment on their suitability.

(1) Connect a non-electrolytic 1 μ F capacitor in series with a 220 Ω resistor between pin 13 of IC3 and pin 10 of IC7.

(2) Connect a diode beneath the main PCB between pin 15 of IC9 and the junction of D4/P2, in the same direction as D4.

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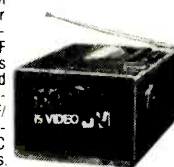


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(3) Locate part of IC denoted FF2 and add the components shown in Fig. 1.

My thanks to the unnamed sources of these modifications. It would seem fairly easy to carry out adjustment when Filmnet next changes the inverting frequency!

Satellite TV News

Yet another scrambling method, Pippacrypt, is in use. We understand that the video is inverted on alternate lines while the sound is transmitted in digital form during a 5 μ sec burst at the beginning of each line.

The SC Succ commercial TV channel transmitted via Intelsat 27.5°W hopes to offer up to sixty hours of entertainment weekly, with D-MAC encoding.

Astra's transponder 5 is to carry a Japanese channel during the Lifestyle/Children's Channel downtime, aimed at expatriate Japanese businessmen.

A new satellite TV distribution network, to be known as Helicon-STV, is being planned in the USSR. The 12GHz service will transmit regional programming and the CT1 and CT2 programmes to the fifteen republics. Each republic will have its own uplink site, using the

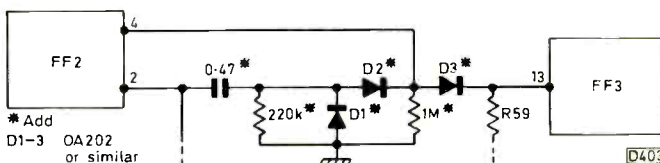


Fig. 1: Elektor Filmnet decoder modification, see text.

17.3-18.1GHz band. The satellites will be located at 23, 24, 44, 110 and 140°E.

A new type of dish aerial is being marketed by Philips in West Germany. In appearance it's similar to the usual offset dish but has a small subreflector on the LNB support arm. The LNB is mounted between the dish and the subreflector, aimed at the latter. It's claimed that the system increases efficiency from 60-70 per cent to 82 per cent, giving an extra 1-2dB gain.

Filmnet Decoder Review

Because of film copyright restrictions the Filmnet service via Astra is not officially available to UK viewers – Filmnet will not accept subscriptions from or offer decoders to UK residents. There's a similar situation with the Sky Movies channel not being available on the Continent. Both Filmnet and Sky Movies scramble the vision while leaving the audio in the clear. Sky has adopted Eurocrypt, which requires a smart card to unlock the decoding sequence. In theory no scrambling system is uncrackable, and there are rumours that Eurocrypt has already been cracked. Sky's system is very secure however, with updating every three months. It remains to be seen whether the pirates have in fact broken Eurocrypt. For more on the subject of scrambling, refer to *Satellite and Cable TV Scrambling and Descrambling* by Brent Gale and Frank Baylin, available from several technical book suppliers.

I was very interested to see the PR Technology Filmnet decoder Model FX-1001 on the satellite TV market, and was fortunate in obtaining a sample for on-site evaluation alongside another well-known decoder, the Filmview.

Picture quality was assessed using a large-screen TV receiver. I found that the picture produced by the Filmview decoder had adequate contrast and brightness but suffered from flicker. Two internal adjustments, for video gain and stability, are provided to optimise picture quality, but it proved impossible to obtain completely flicker-free images. Any horizontal white picture information at the bottom of the picture tended to exaggerate this flicker to the point of field jitter.

So to the FX-1001 decoder. As with the Filmview model the video input/output connections are via phono sockets. Connection is easy and cheap. There are two user controls at the rear, for brightness and contrast. When a Filmnet signal is passing through the decoder and its green LED indicates that the signal is being decoded, adjustment of the two rear controls results in a picture without flicker and with brightness and contrast levels similar to non-scrambled Astra transmissions. In short, the results are impressive.

The FX-1001 is housed in a black ABS case of some size – 226mm wide, 78mm high and 145mm deep. This is large, but PR Technology point out that it allows for upgrading to dual-system operation, i.e. Filmnet/Veronique, plus additional boards should Filmnet adopt sound scrambling. A Veronique board is under development and should be available by the time this report is published. The weight of the FX-1001 is around 1kg. There's no on/off switch, the mains-powered unit being controlled via the wall socket. A 1.8m mains lead is provided. A red LED indicates power on.

Inside there's some very high-quality PCB work. The lower 200 × 100mm board houses the power supply with stabiliser chip and 160mA fuse and a main circuit area that's packed with components including fifteen

i.c.s. The upper board, some 150 × 100mm, has four more i.c.s and eleven transistors. The boards are connected via a multiway ribbon feeder/plug/socket arrangement. As seems to be common practice in the descrambling market, the i.c.s all have their type numbers obliterated!

PR Technology say that the decoder can cope with 63 encryption levels. It was not affected by the recent Filmnet encryption change. This is a point worth bearing in mind if you are in the market for a decoder and are uncertain as to whether to go for a basic cheapie or an upmarket model like the FX-1001. PR Technology also say that an update for Teleclub will be considered should this channel adopt encryption – it will depend on the interest shown.

Plug connection problems could be experienced with a few receivers. PR Technology suggest that the decoder's output is fed to a domestic VCR and then to the TV set itself. This could be a problem if you've no VCR and the set has no facilities for video and audio inputs. The Salora 5902 satellite TV receiver I used for this review has decoder looping at the rear, a common feature, with programming to select via a relay the input from an external decoder. Decoded video thus passes back to the 5902 and processing takes place in the normal way.

PR Technology have available a selection of video leads with various plug/scart variations. It's best to contact PR Technology to discuss lead options for your particular receiver. The firm claims to be able to provide correct leads for all receivers on the UK market at nominal cost.

The FX-1001 sells for £135 inclusive of VAT on a one-off basis. Apply to PR Technology for trade prices/quantity discounts. The firm's policy is to use Securicor for safe transit. This adds £11 for UK mainland delivery. I feel that this hikes the price somewhat, but PR Technology say that their experience with standard parcel post has not been happy and consider that Securicor is the best option available in view of the expensive and delicate unit being purchased. You can of course call at PR Technology.

I tested the decoder over a period of two weeks and found that the picture quality is excellent, matching well with unscrambled Astra signals. You get an updatable unit with potential for a second or possibly third standard. Equally important is the fact that the unit is programmed to cover further changes in the Matsushita system should they be introduced. Overall it's the best decoder I've tried to date and has my full recommendation.

For further details contact PR Technology Ltd., 524 Watford Way, Mill Hill, London NW7 4RQ (telephone 01-959 5575, fax 01-959 4824).

405 Alive

The 405-line group, a growing band of dedicated enthusiasts, has introduced a newsletter entitled 405 Alive providing news, notes on receivers, history etc. – even 405-line video tapes circulate. The latest 48-page bulletin (A5 format) is packed with information, swaps, equipment available, history etc. I recommend membership of this group to anyone interested in keeping alive the spirit and adventure of early television. For details write to Andy Emmerson, 71 Falcutt Way, Northampton NN2 8PH – please include an SAE. And please don't dump any unwanted 405-line receivers, test equipment, etc. – write to the 405 Alive group instead.

Servicing Compact Disc Players

Part 14: Servo Checks and Adjustments

Joe Cieszynski

In the past few instalments in this series we've looked at the various servo systems used in a CD player with a view to establishing the function of each servo and its principles of operation. There are a number of variations on the theme and we can't cover them all. What we've tried to do is to outline the techniques used in "main stream" players. This information should give you enough clues to be able to pick up quickly from manuals or courses the operation of less common and more specialised arrangements.

Many of the larger manufacturers are now producing their own laser assemblies. Each have their own special features, so you can expect to encounter differences here. From the servicing point of view however this shouldn't present problems since the servo circuitry used in CD players is much the same, even with players that use single- and three-beam laser assemblies. Perhaps this is fortunate, because the majority of faults in CD players seem to relate to the servos. In view of this we propose this month to set out a basic approach to servicing in the servo area.

Verifying Servo Operation

Many of the players that enter the workshop with complaints such as no sound, intermittent operation or jumping actually suffer from misadjustment of the focus and/or tracking servos, possibly because of component tolerance changes as the player ages or because the player was not set up correctly last time it came in for repair. But I'm not suggesting that the normal procedure should be to jump into the servo section and turn everything that moves. Far from it! There are other checks that should be carried out before you try the servo adjustments. We've looked at some of these in past instalments and will summarise the basic checks to make in the next couple of months. For now, let's assume that you have ruled out all other options and have come to the conclusion that the next checks must be in the focus and tracking servos.

Checks and adjustments in the servos can be carried out only with the player operating. You will recall however that the player will not respond to user commands until the Table of Contents (TOC) has been read. To enable engineers to work on faulty machines manufacturers often include a test mode – also referred to as the service or adjustment mode – which overrides the control system's normal program, allowing the machine to work to the best of its ability. In the test mode you should be able to select play after which the player will rotate the disc, making essential signals available for test and adjustment purposes.

Is there a way of determining whether the servos are working correctly without actually performing the adjustments and running the risk of masking the real fault? The answer is yes. In Part 4 (June 1989) we outlined a method of observing the r.f. waveform at a timebase speed of around $200\mu\text{sec}/\text{cm}$ while playing a DIY test disc consisting of a good quality one-hour (minimum) disc on which an 0.6mm dropout has been introduced

with the aid of some PCB artwork tape – see Fig. 5, page 612, June.

Use of such a disc will enable you to look at the r.f. waveform with the scope triggered by the dropout. The significance of this check is that you can observe the r.f. signal waveform recovery as the laser moves from the tape back on to the disc. Since the focus error (FE) and tracking error (TE) signals for the servos are derived from the laser pickup, these feedback signals will be lost when the laser beam is crossing the tape. As a result the servos will begin to hunt in an attempt to regain control. The important point is how fast do the servos stabilise once the feedback has been restored? Fig. 1, repeated from Part 4 for convenience, shows the dropout period and the subsequent recovery period with both a good and a faulty servo. The waveform shown at (a) indicates that the focus and tracking servos are not only operational but are also correctly set up. My experience suggests that even the smallest distortion in this waveform indicates misadjustment in the focus and/or tracking servo and would prompt me to run through the appropriate setting up procedures.

Those who possess a Sony YEDS test disc set can obtain this waveform by using the scratch disc. I personally use a Philips SBC426 test disc set which includes a dropout period, but I've found that it doesn't produce a severe enough dropout for scope triggering. This is because the dropout portion is described as an "interruption in the information layer", i.e. as the beam passes the dropout there is still some reflected light that gives rise to a d.c. output from the pickup. The Philips disc does have a number of small black dots that produce 100 per cent dropouts, but these are of short duration

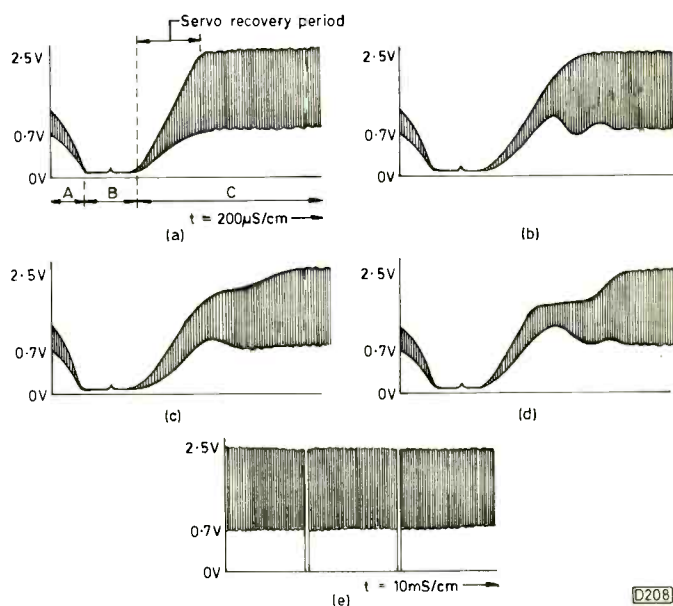


Fig. 1: R.F. waveforms obtained with a dropout disc. (a) Correct operation. Period A is prior to the dropout, period B is the dropout and period C the recovery period. (b) Slow recovery. (c) Still slower recovery, possibly due to multiple misadjustments. (d) A serious error. (e) An overall view of the r.f. waveform.

and can be difficult to locate, especially with a faulty player whose track search may not be working.

Part 4 provided more helpful information on the significance of these waveforms. It would be worth re-reading page 612 of the June instalment alongside the information given here.

But what do you do if the player won't play after attempting to read the TOC and no test mode is provided? Unfortunately there's no simple answer to this. I can only offer some general guidelines based on practical experience. First of all I would check that the servo adjustments are roughly central, which is where they usually are with a working machine. If there are any signs that twiddling has taken place I'd mark the control positions then set them centrally – but not before going through all the other possibilities which, as previously mentioned, we'll summarise in a later instalment. If there were no signs of tampering I might be inclined to check the FE and TE signals, which should be present during the initial TOC reading period. If these signals are absent I'd suspect the laser pickup diodes or r.f. processing chip.

Another way of testing the overall servo loop operation is to inject an l.f. sinewave signal of around 400Hz into each servo, then scope its progress right through to the actuator coils in the two-axis device. In many cases the scope isn't necessary as you can hear the 400Hz signal coming from the two-axis device which oscillates in sympathy. This test will prove whether or not the servo loop is closed, but it won't tell you whether the gain is correct.

If you are still no nearer to finding the fault you may have no option left but to attempt to go through the servo adjustments as set out in the manual. Most of the adjustments have to be carried out whilst the disc is rotating, which means that you will have to perform each one very quickly during the brief TOC reading period, constantly restarting the disc. If this sounds difficult, it is!

Servo Adjustments

The only correct method of setting up the servos in a CD player is to follow the procedures laid down in the manufacturer's service manual. But the manual won't tell you why you are carrying out a particular adjustment or the effect it is having on the circuit's operation. I now intend to clarify these points.

In many service manuals the first adjustment listed is that to the phase-locked loop (PLL) oscillator. This is not part of the focus or tracking servo system but affects a number of basic player operations, including the disc speed. It may therefore be difficult to adjust the focus and tracking until the PLL has been set up correctly. Some manufacturers instruct you to perform this adjustment with the disc rotating. Again this may prove to be difficult with a faulty player, especially if no test mode is provided. In such a case it may be possible to set the free running oscillator speed, using a frequency counter with the machine in the stop mode, but the adjustment should be rechecked before the player leaves the workshop. Part 8 in this series provided further information and setting up instructions for the PLL oscillator.

Most of the other electronic adjustments in a CD player are concerned with the focus and tracking servos. There are six basic adjustments, though few if any players incorporate all of them. They are as follows.

First there are focus and tracking offset. We saw in

Part 10 that the FE signal is obtained by combining the outputs from the four pickup detectors in a certain way, the method of combination depending on the type of optical assembly. A common feature in all focus servos is an amplifier that subtracts the outputs from one pair of pickup detectors from the outputs of the other two detectors. Likewise the TE signal is obtained by subtracting the outputs from the E and F detectors in a three-beam assembly or the outputs from the main detectors in a single-beam assembly.

This subtraction is carried out by feeding the two signals to the inverting and non-inverting inputs of an operational amplifier. The problem here is that i.c. tolerances may produce a d.c. offset even when both inputs are equal. This is overcome by means of the offset (sometimes called bias) adjustment. When an offset adjustment is incorrectly set the servo will regard the d.c. output as an error signal. If this is the focus servo the circuit will adjust the focusing to correct the "error". As a result the player will try to operate with the beam either off track, out of focus or both. Fig. 2 shows a typical offset correction arrangement. Different methods are suggested in manuals for carrying out offset adjustments. Many manufacturers however simply instruct you to set the controls for minimum jitter at the centre of the r.f. waveform (the eye pattern). This is illustrated at (b) in Fig. 2.

Balance

Secondly there are focus or tracking balance adjustments. Amplification and addition is required before the signals are ready for subtraction in the manner just outlined. This normally calls for two further amplifiers in the focus and tracking circuits as shown in Fig. 3. Problems arise when the gains of the two amplifiers in a pair are not equal. The balance adjustment to equalise the gains may be across the inputs of one of the amplifiers or alternatively in a feedback loop.

Gain

Finally there are focus or tracking gain adjustments, see Fig. 4. These set the overall loop gain of each servo and are perhaps the most critical adjustments. If such a control is set too high the servo will be prone to excessive hunting either when the player is jolted or when the beam passes over a scratch or blemish in the disc. If the gain is set too low the servo will not respond quickly enough to such disturbances. In either case the player will be prone to jumping or cutting out altogether.

Because this adjustment is so critical, some manufacturers recommend that you leave it alone. Although this advice is sound, it's not always practical where the player has been tampered with. Apart from this I had an occasion with a Fidelity CD200 where the fault was due to the focus gain having moved out of tolerance. Fidelity state that the adjustment should not be attempted without a servo analyser, which I don't have. After trying everything else I managed to set the gain by using the method outlined in Fig. 1.

The method of adjustment laid down by some manufacturers is to introduce an artificial error while the disc is rotating. This is done by injecting a sinusoidal l.f. signal into the servo to make the two-axis device oscillate in sympathy. The pickup detectors produce an equivalent sinusoidal FE or TE output. You scope this and adjust the servo's loop gain until the signal level is as it should be – Fig. 5 shows the principle. The bandpass

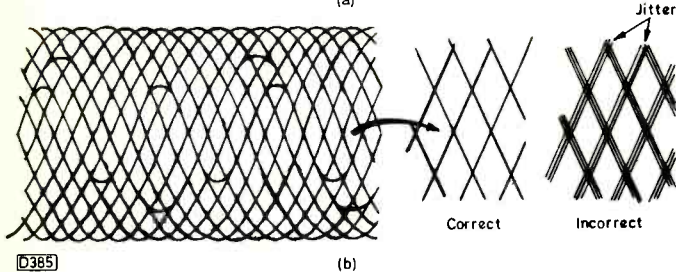
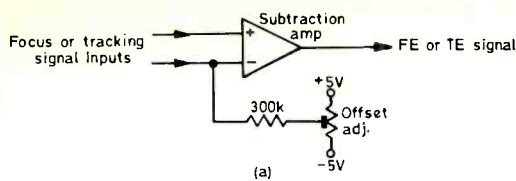


Fig. 2: Typical offset adjustment in a focus or tracking servo. (a) Circuit. (b) Waveforms.

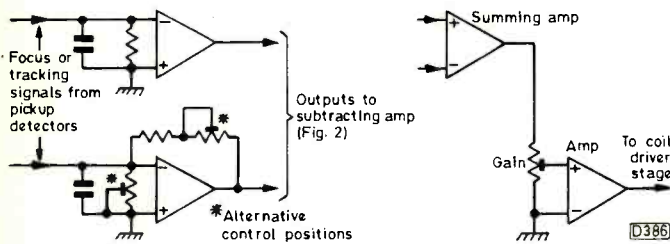


Fig. 3 (left): Focus or tracking balance adjustment.

Fig. 4 (right): Focus or tracking gain adjustment.

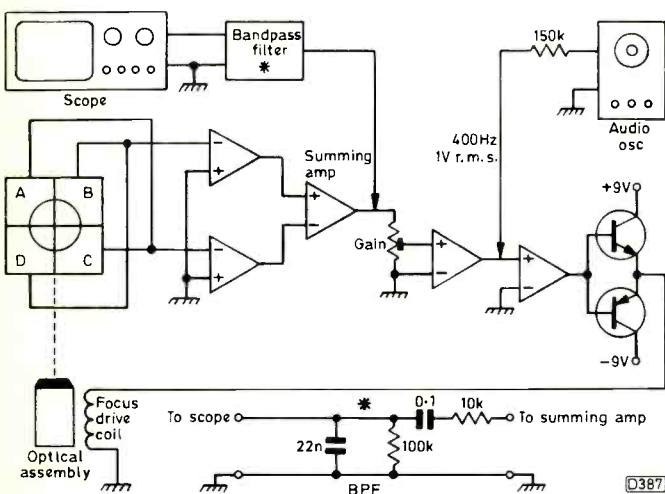


Fig. 5: Method of adjusting the focus or tracking gain by introducing an artificial error in the circuit. The injected signal makes the optical assembly oscillate, resulting in an l.f. error signal. The amplitude of this is measured and the overall loop gain is adjusted until the peak-to-peak signal is at a set level.

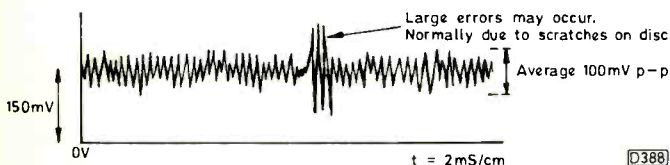


Fig. 6: Typical focus error signal in a correctly working CD player.

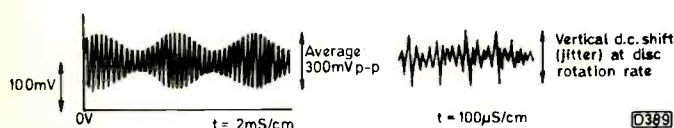


Fig. 7: Typical tracking error signal.

filter is included to remove the normal FE or TE signal which would be superimposed on the l.f. waveform.

Order of Adjustment

As previously mentioned few players incorporate all six adjustments. In practice you may find only three or four, the most common ones being tracking balance, focus offset and focus and tracking gain. The order in which the adjustments should be performed varies from model to model. I normally start out by following the recommended sequence for the particular player concerned, but have learnt from experience that if I can't get past a certain adjustment it may be worth starting from the last one in the list and working backwards from this. For example a certain Sony CDP101 led me a merry dance when I attempted to carry out the adjustments in the order given in the manual. After much time had been spent I decided to start from the end of the procedure, tracking gain. The fault cleared immediately!

In addition to the electronic adjustments discussed in this article there are two important mechanical adjustments that must be correct before the servos can work properly. These are the tangential and diffraction grating adjustments on the optical assembly – not all players have them however. They were dealt with in Part 3 of the series (May 1989).

Fault Location

Anyone familiar with VCR servicing knows that there are certain key signals and waveforms that when displayed on an oscilloscope give a strong indication of the cause of a servo fault. The focus and tracking servos are far less sophisticated than a VCR's drum and capstan servos and in effect there's only one signal in each of them, the FE and TE signals themselves, see Figs. 6 and 7. The FE signal looks like random noise, the cause of this being a combination of errors due to minute disc and mirror impurities, random scratches, servo hunting and disc wobble. The TE signal is often larger because the tracking servo has to compensate for the fact that the spiral track constantly moves away from the position of the laser beam. It also appears as random noise, but with many discs there's a constant vertical movement of the waveform at the same rate as the disc rotation. This is caused by disc eccentricity.

The focus and tracking signal paths consist of a series of three or four operational amplifiers in cascade. Fig. 5 showed a typical arrangement. Fault location amounts to checking the progress of the signal through each stage. In most recent players the servo stages are within one or two chips, but in older machines separate operational amplifiers were used and could on occasion fail.

Clearly to be able to scope your way through the servo stages in this way the disc must be rotating and error signals must be present. With a defective servo this may not be possible, even when the test mode is selected. In such cases it's worth injecting an l.f. signal in the manner shown in Fig. 5, scoping its progress.

As mentioned at the outset, the principles outlined in this article have been very general, intended to provide basic guidance. Each player has its own peculiarities and only experience will tell you how it's best to tackle a particular problem. It's hoped that some of the practical advice contained in this article will help those trying to gain such experience.

Next month more useful checks and procedures.

ECONOMIC DEVICES PO BOX 15, WOLVERHAMPTON, WV2 4AZ

1580H	2.72	25C1678	1.98	AN2140	2.40	BDX548	0.31	BU1126	1.10	HA1196	1.73	MC1330P	1.98	SAS5601	5.42	STR106E	11.20	TA9890	3.60	TD4440	1.95
1585R	3.28	25C1741	1.25	AN224	5.09	BDX628	2.09	BU1371	6.53	HA1301	7.43	MC1350P	0.45	SAS570T	5.42	STR4090	8.01	TA9970	1.80	TD4442	4.15
1588	4.58	25C1810	1.70	AN223	3.33	BDX62A	1.96	BU1205	1.15	HA1306	2.26	MC1351P	1.25	SAS570S	1.95	STR440	6.18	TA9970	2.15	TD4450	4.75
17052	5.61	25C1815	2.00	AN240P	0.90	BDY20	1.21	BU2026	1.00	HA1320	2.06	MC1352P	0.60	SAS580	2.10	STR450	6.18	TA9970	2.15	TD4450	4.75
17074	3.00	25C1820	0.67	AN241	1.71	BDY20	1.18	BU2027	1.65	HA1342	2.05	MC1357P	2.15	SAS6600	1.33	STR453	8.16	TA9970	2.15	TD4460	7.75
17089	2.50	25C1829	2.25	AN245	5.04	BDY20	1.10	BU2115	0.29	HA1348	2.12	MC1358P	1.48	SAS660	1.33	STR454	8.16	TA9970	2.15	TD4460	7.75
17127	2.50	25C1875	4.25	AN253	1.80	BDY20	0.10	BU2117	0.66	HA1365R	2.07	MC1443P	5.50	SAS670D	1.33	STR455	8.16	TA9970	2.15	TD4500	6.96
17376	1.58	25C1893	3.02	AN260	3.85	BDY20	0.08	BU2118	0.67	HA1370	2.15	MC1444P	2.15	SAS670	1.33	STR456	8.16	TA9970	2.15	TD4500	6.96
1N4001	0.60	25C1907	1.30	AN262	0.25	BDY20	0.25	BU2121	0.25	HA1380	1.43	MC1445P	5.94	SAS670D	2.21	STR457	8.16	TA9970	2.15	TD4500	6.96
1N4002	0.07	25C1921	1.37	AN266	7.63	BDY20	0.31	BU2123	0.01	HA1388	2.75	MC1445P	1.75	SAS670D	1.15	STR458	8.16	TA9970	2.15	TD4500	6.96
1N4003	0.06	25C1923	0.30	AN301	2.45	BDY20	0.50	BU2127	0.10	HA1390	2.55	MC1451 BCP	1.10	SAS670D	1.95	STR459	8.16	TA9970	2.15	TD4500	6.96
1N4004	0.05	25C1929	2.25	AN302	3.09	BDY20	0.35	BU2137	0.29	HA1394	3.80	MC1452BPC	2.15	SAS670D	1.95	STR460	8.16	TA9970	2.15	TD4500	6.96
1N4005	0.05	25C1942	1.98	AN305	8.88	BDY20	0.58	BU400	1.24	AA117	9.6	MC1712	3.88	SDA2006	17.10	TA9970	0.87	TC7A50	1.25	TD4513	3.00
1N4006	0.08	25C1969	0.20	AN315	2.46	BC301	0.53	BU400	0.26	HA1377	1.95	MC5192	19.50	SDA2112Z	9.20	TA9970	1.20	TC8A000	1.60	TD4513	2.68
1N4007	0.07	25C1977	0.55	AN316	4.95	BC302	0.48	BU401	0.54	HA1389	0.47	MC774CP	3.49	SDA224	5.26	TA9970	1.45	TC8A001	2.38	TD4513	2.68
1N4008	0.03	25C1983	1.93	AN318	7.16	BC303A	0.36	BU402	0.48	HA1392	0.22	MC8106-5/6	1.23	SDB131	10.20	TC8A002	5.44	TC8A003	2.38	TD4513	2.68
1N4009	0.05	25C1987	1.33	AN321	5.47	BC308A	0.11	BU403	0.18	HA1395	1.67	MC8202	2.06	SDA225	8.27	TC8A004	3.08	TC8A005	2.38	TD4513	2.68
1N5401	0.11	25C1969	2.07	AN321	2.25	BC308	0.17	BU404	0.17	HA1396	2.65	ME0411	1.75	SDB533	9.00	TC8A006	4.22	TC8A007	1.65	TD4513	3.00
1N5402	0.13	25C1983	0.51	AN322	6.78	BC317A	0.13	BU405	0.38	BU508A	1.53	ME2002	0.26	SI125H	7.50	TC8A008	1.25	TC9A10	1.80	TD4513	3.00
1N5403	0.18	25C1985	1.95	AN327	5.37	BC317	0.09	BU406	0.34	BU536	1.55	ME3102	0.28	SI1630H	20.50	TC9A009	2.38	TC1000C	0.61	TD4513	3.00
1N5404	0.10	25C2009	0.63	AN340P	1.53	BC328	0.11	BU407	0.55	BU608	1.65	ME8001	0.34	SKE21104	1.25	TC9A010	1.40	TC1000D	4.73	TD4513	3.00
1N5408	0.05	25C2028	2.33	AN355	1.60	BC337	0.40	BU408	0.40	BU705	0.85	ME8011	0.75	SKE4106	0.85	TC9A011	5.44	TC1000E	5.36	TD4513	3.00
1N814	0.04	25C2028	2.11	AN362	1.50	BC338	0.12	BU409	0.36	BU806	1.03	ML4153H	0.20	SKE4106	0.85	TC9A012	2.42	TC1000F	1.80	TD4513	3.00
1S1555	0.01	25C2028	0.99	AN370	3.95	BC368	0.19	BU410	0.40	BU807	1.40	ML30870 A2	7.95	SKE4106	1.07	TC9A013	1.02	TC1000G	1.16	TD4513	3.00
1S44	0.10	25C2078	3.39	AN5111	4.43	BC440	0.69	BU411	0.32	BU818	0.32	ML38750A53	7.27	SKE42106	1.00	TC9A014	1.98	TC1000H	1.98	TD4513	3.00
1S921	0.10	25C2073	1.54	AN6120N	4.50	BC441	0.46	BU412	0.34	BU844	0.66	ML38750A53	7.27	SKE42106	1.33	TC9A015	1.45	TC1000I	1.45	TD4513	3.00
2N2219A	0.37	25C2085 C	1.65	AN6132	4.42	BC454	0.36	BU413	0.29	BU848	0.50	ML38750A50	14.00	SKE42106	1.95	TC9A016	9.65	TC1000J	1.45	TD4513	3.00
2N2220A	0.16	25C2085 C	1.65	AN6132	4.42	BC454	0.36	BU414	0.29	BU848	0.50	ML38750A50	14.00	SKE42106	1.95	TC9A017	9.65	TC1000K	1.45	TD4513	3.00
2N3054	0.99	25C2141	2.44	AN6160	7.43	BC461	0.47	BU415	0.39	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A018	6.43	TC1000L	1.00	TD4513	3.00
2N3055	0.66	25C2166	0.67	AN6162	2.20	BC462	0.51	BU416	0.14	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A019	6.43	TC1000M	1.00	TD4513	3.00
2N3442	1.16	25C2216	0.69	AN6163	4.20	BC463	0.30	BU417	0.14	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A020	6.43	TC1000N	1.00	TD4513	3.00
2N3702	0.10	25C2233	1.20	AN630	3.95	BC478	0.32	BU418	0.17	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A021	6.43	TC1000O	1.00	TD4513	3.00
2N3703	0.18	25C2236	1.69	AN631N	1.66	BC479	0.41	BU419	0.24	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A022	6.43	TC1000P	1.00	TD4513	3.00
2N3705	0.16	25C2278	1.63	AN6320	4.40	BC480	0.42	BU420	0.31	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A023	6.43	TC1000Q	1.00	TD4513	3.00
2N3706	0.14	25C2314	0.67	AN6330	4.40	BC486	0.40	BU421	0.17	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A024	6.43	TC1000R	1.00	TD4513	3.00
2N3707	0.16	25C2325-Kitt	7.00	AN6310	4.54	BC487	0.08	BU422	0.37	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A025	6.43	TC1000S	1.00	TD4513	3.00
2N3711	0.11	25C2351	1.26	AN6340	6.46	BC488	0.28	BU423	0.36	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A026	6.43	TC1000T	1.00	TD4513	3.00
2N3717	1.56	25C2565	3.84	AN6341	2.22	BC489	0.17	BU424	0.17	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A027	6.43	TC1000U	1.00	TD4513	3.00
2N3772	1.55	25C2570	1.85	AN6363	16.00	BC550	0.10	BU425	0.65	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A028	6.43	TC1000V	1.00	TD4513	3.00
2N3773	1.55	25C2572	1.85	AN6363	16.00	BC550	0.11	BU426	0.65	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A029	6.43	TC1000W	1.00	TD4513	3.00
2N3819	0.40	25C2578	6.75	AN6551	0.50	BC557	0.10	BU427	0.17	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A030	6.43	TC1000X	1.00	TD4513	3.00
2N3823	0.17	25C2571	0.91	AN6552	0.68	BC558	0.10	BU428	0.50	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A031	6.43	TC1000Y	1.00	TD4513	3.00
2N3904	0.15	25C288A	1.85	AN6560	1.86	BC559	0.10	BU429	0.49	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A032	6.43	TC1000Z	1.00	TD4513	3.00
2N3908	0.62	25C3152	1.50	AN7111	1.25	BC560C	0.34	BU430	2.52	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A033	6.43	TC1000A	1.00	TD4513	3.00
2N4101	1.33	25C3273	5.40	AN7125	2.52	BC635	0.14	BU431	0.20	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A034	6.43	TC1000B	1.00	TD4513	3.00
2N4203	1.95	25C3273	2.80	AN7145	2.80	BC636	0.20	BU432	0.57	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A035	6.43	TC1000C	1.00	TD4513	3.00
1N4444	1.16	25C3883	1.33	AN7146	9.90	BC637	0.24	BU433	0.34	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A036	6.43	TC1000D	1.00	TD4513	3.00
2N4923	0.50	25C3888	1.27	AN7151	2.37	BC638	0.15	BU434	0.33	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A037	6.43	TC1000E	1.00	TD4513	3.00
2N5294	0.50	25C394V	0.81	AN7156	3.87	BC640	0.24	BU435	0.34	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A038	6.43	TC1000F	1.00	TD4513	3.00
2N5296	0.50	25C403C	0.60	AN7158	2.10	BC642	0.55	BU436	0.57	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A039	6.43	TC1000G	1.00	TD4513	3.00
2N5297	0.50	25C408	0.34	AN7218	0.80	BC115	0.36	BU437	0.57	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A040	6.43	TC1000H	1.00	TD4513	3.00
2N5298	0.61	25C425	0.92	AN7218	0.80	BC116	0.70	BU438	0.57	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A041	6.43	TC1000I	1.00	TD4513	3.00
1N6109	0.25	25C451A	1.80	AN7107	4.50	BC460	0.42	BU439	1.20	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A042	6.43	TC1000J	1.00	TD4513	3.00
2N6130	0.85	25C535	0.79	AN7110	5.69	BC131	0.42	BU440	1.20	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A043	6.43	TC1000K	1.00	TD4513	3.00
2N6133	1.25	25C536	0.66	AN7113	14.63	BC132	0.42	BU441	0.23	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A044	6.43	TC1000L	1.00	TD4513	3.00
2N6180	0.73	25C573	2.06	AY105K	2.08	BC133	0.53	BU442	0.33	BU848	0.50	H13110	14.00	SKE42106	1.95	TC9A045	6.43	TC1000M	1.00	TD4513	3.00
2N6292	1.16	25C6051	1.54	AY106	2.80																

TELEVISION

TV/VCR SPARES GUIDE 1990

The following list gives spares department addresses and telephone numbers or, where these are the same, service department or head office addresses and telephone numbers. Also included are details of major spares distributors.

- Aiwa** UK Ltd., Unit 5, Heathrow Summit Centre, Skyport Drive, West Drayton, Middx UB7 0LY. 01-897 7000.
- Akai** (UK) Ltd., Haslemere Heathrow Estate, 12 Silver Jubilee Way, Parkway, Hounslow, Middx TW4 6NF. 01-897 6388.
- Alba** Radio Ltd., Unit 1A, Rippleside Commercial Estate, Ripple Road, Barking, Essex. 01-595 8830. Early large-screen CTVs use Philips or Thorn Chassis. Trade only.
- Ambassador.** Brand name used by Sentra Electronics Ltd.
- Ampmac** Ltd., Falkland Close, Coventry CV4 8HQ. 0203 471 241. Spares for GEC, Hitachi, Neptune, Sony. Also Osaki Model 1250. Trade only.
- Amstrad.** Spares available from CPC Ltd. and Chas Hyde & Son Ltd. Reynolds Electronics Ltd. handle computers in Ireland.
- Aro.** Spares available from HRS Electronics plc.
- ASA.** Spares can be ordered from Finlux. Agents in Ireland: Bagenalstown TV Centre, Market Square, Bagenalstown, Co. Carlow. 01-503 21581. Trade only.
- Autovox.** See Comet Group plc.
- Benkson.** B. Benkert Ltd., Benkson House, 26 Thames Road, Barking, Essex IG11 0JA. 01-594 7532. Trade only.
- Beovision/Beocord.** Bang and Olufsen UK Ltd., Eastbrook Road, Gloucester GL4 7DE. 0452 307 377. Trade only.
- Binatone** International Ltd., Binatone House, 1 Beresford Avenue, Wembley, Middx HA0 1YX. 01-903 5211. Trade only.
- Blaupunkt.** Robert Bosch Ltd., PO Box 98, Broadwater Park, North Orbital Road, Denham, Uxbridge, Middx UB9 5HJ. 0895 838 383. Trade only.
- Bush** Radio plc., Wharf Road, Enfield, Middx EN3 4TE. 01-805 2065. Trade only. Spares for Rank produced CTVs (up to T24/T26 chassis) available from HRS Electronics plc.
- Canon** (UK) Ltd., Unit 4, Brent Trading Centre, North Circular Road, London NW10. 01-459 1266.
- Cathay** Electronics Ltd., Handley Close, Preston Farm Industrial Estate, Stockton-on-Tees, Cleveland TS18 3SD. 0642 613 249.
- Cihan.** Spares available from HRS Electronics plc.
- Citizen.** Spares for CD players and LCD TV sets available from HRS Electronics plc.
- Classic** monochrome portables. See Iskra Ltd.
- Commodore.** Spares for Commodore computers available from HRS Electronics plc.
- Comet** Group plc., Service Dept., Unit 6, 162 Armley Road, Leeds LS12 2QN. 0532 791 241. Trade only.
- Connexions** UK plc., Unit 3, South Mimms Distribution Centre, Huggins Lane, Welham Green, Herts AL9 7LE. 0707 272 091.
- Contec.** CTVs sold by Dixons. Spares available from Mastercare Components.
- CPC** Ltd., 186-200 North Road, Preston, Lancs PR1 1YP. 0772 555 034. Official spares stockists for Amstrad, Ferguson, Fidelity, GEC, Hinari, Logik, Matsui, Philips, Pye, Saisho, Sinclair, Sony and Triumph. Other spares available.
- Crown.** Spares available from HRS Electronics plc.
- Decca.** See Tatung (UK) Ltd. and Wizard Distributors. Spares for chassis up to and including the 110/115 series available from D & S Electronic Services, Building 15, Unit 4, Stanmore Industrial Estate, Bridgnorth, Salop WV15 5HR. 0746 766 641.
- Denon.** Hayden Laboratories Ltd., Hayden House, Chiltern Hill, Chalfont St. Peter, Gerrards Cross, Bucks SL9 9UG. 0753 888 447.
- Doric.** Some spares available from UK Rental and Retail Ltd.
- Dwektron** colour sets. See Iskra Ltd.
- Dynatron.** Pre-1981 sets see Philips Service. Post-1981 sets see Roberts Radio Ltd.
- Ekco.** See Philips Service.
- Elftone** Electronics Ltd., 4 Beresford Avenue, Wembley, Middx HA0 1YZ. 01-902 6222.

Etron. Brand name used by Nikkai Imports Ltd.

Expert. Spares from Tatung, GEC or Luxor depending on chassis.

Ferguson Ltd., Service Division, PO Box 1594 Crown Road, Enfield, Middx EN1 1DY. 01-804 7979. Trade only. See also CPC, HRS, Chas Hyde, UK Rental and Retail Ltd. Wizard.

Fidelity. Spares available from SEME, CPC, Wizard and Willow Vale.

Finlux. Lohja UK Ltd., Valley Farm Way, Stourton, Leeds LS10 1SE. 0532 716311. Trade only.

Finlandia. Spares available from UK Rental and Retail Ltd.

Fisher Sales (UK) Ltd., PO Box 294, Watford, Herts WD2 8JF. 0923 222 244.

Fujitsu General. See Teleton Electro (UK) Co. Ltd.

Galaxy monochrome portables. See Iskra Ltd.

GEC. Spares available from Hotpoint Ltd., Celta Road, Peterborough PE2 9JB. 073 368 989.
See also Ampmace, CPC, Chas Hyde, SEME, Wizard.

General. See Teleton Electro (UK) Co. Ltd.

GoldStar UK Sales Ltd., Goldstar House, 264 Bath Road, Slough SL1 4DT. 0753 691 888.
Spares for Model GHV1232I available from Cathay Electronics.

Goodmans Loudspeakers, Tees Building, Unit 2-3, Mitchel Way, Portsmouth PO3 5PR. 0705 673 734.

Granada. Spares available from UK Rental and Retail Ltd.

Grundig International Ltd., Mill Road, Rugby, Warwickshire CV21 1PR. 0788 565 128.
Account holders only supplied. See also Willow Vale. Spares for VCR4000 and SVR4004 ranges available only from Willow Vale.

HMV. Sets use Ferguson or Fidelity chassis.

Harwood. Spares available (trade only) from Jackson Products Ltd., 18th Floor, Station House, Harrow Road, Stonebridge Park, Wembley, Middx HA9 6DE. 01-900 0433.

Hinari. Spares available from CPC, Chas Hyde, SEME.

Hitachi Sales (UK) Ltd., Hitachi House, Station Road, Hayes, Middx UB3 4DR. 01-569 1975.
Account holders can use 01-569 2828 (known part no.) or 01-569 2570 (part no. not known). See also Ampmace, UK Rental and Retail Ltd., Wizard.

HRS Electronics plc., 11 Garretts Green Lane, Garretts Green, Birmingham B33 0UE. 021 789 7575. Wide range of spares including Ferguson, Philips, Rank etc. Trade only.

Huanyu (UK) Ltd., Unit 4B, Barndsley Road, Earlstree Industrial Estate, Corby, Northants NN17 2AR. 0536 205 838.

Chas Hyde & Son Ltd., Prospect House, Barmby Road, Pocklington, York YO4 2DP. 0759 303 068. Official spares distributors for GEC and Sanyo. Some spares available for other brands. Trade only.

Indesit. Spares no longer available from manufacturers/agents.

Iskra Ltd., Redlands, Coulsdon, Surrey CR3 2HT. 01-668 7141.

ITC(bv), P.J.E. Marketing Ltd., Sporhams Farm House, Sporhams Lane, Danbury, Chelmsford, Essex CM3 4AJ. 0245 414 292.

ITT and ITT Nokia. Spares available from Hoopwell Ltd., Unit B9, Larkfield Trading Estate, Larkfield, Maidstone, Kent ME20 6SW, 0622 882 285. See also Wizard.

JVC (UK) Ltd., JVC House, Eldonwall Trading Estate, Priestley Way, Staples Corner, London NW2 7BA. 01-450 3282. Trade only.

Kenwood. See Trio-Kenwood (UK) Ltd.

Konica, Plane Tree Crescent, Feltham, Middx TW13 7HD. 01-751 6121.

Körting. Spares available from Telefaults, St. Michael's Road, Pitts Hill, Turnstall, Stoke-on-Trent ST6 6LS. 0782 813 757.

Lincoln. Spares for Model 35C available from Nikkai Imports Ltd.

Lloytron Electronics Ltd., Service Dept., Kingsonic House, Derby Street, Cheetham, Manchester MM8 8HB. 0618 328 320.

Loewe Opta UK Ltd., Sherwood House, 33-35 Wellfield Road, Hatfield, Herts AL10 0BS. 0707 262 333.

Logik. Brand name used by Dixons. See Mastercare Components, CPC.

Longreach Marketing Ltd., Riverside Business Park, Lower Bristol Road, Bath, Avon BA2 3DW. 0225 448 106.

Luxor. Spares available from NCS.

Marconiphone. See Ferguson Ltd.

Marantz Audio UK Ltd., Unit 15-16, Saxon Way Industrial Estate, Moor Lane, Harmondsworth, Middx UB7 0LW. 01-897 6633.

Mastercare Components Division, Maylands Court, Maylands Avenue, Hemel Hempstead, Herts HP2 7DE. 0442 232 224.

Matsui. Brand name used by Currys. Spares available from Mastercare Components, CPC, Chas Hyde.

Megasat Ltd., 4-5 Pancras Centre, Pratt Street, London NW1 0BY. 01-267 5222.

Metz. Spares available from Visionair Rentals, 5 Crown Point Parade, Crown Dale, London SE19 3NG. 01-670 2555. Trade only.

Micro-X, Unit 2, Drury Way Industrial Estate, Laxcon Close, London NW10 0TG. 01-459 1200.

Mitsubishi Electric (UK) Ltd., Traveller's Lane, Hatfield, Herts AL10 8XB. 0707 276 100.

Morphy Richards Technical Services Ltd., 6 Albany Parade, Brentford, Middx. 01-560 5331.

Murphy. More recent sets fitted with Fidelity chassis. Many sets fitted with Rediffusion chassis. Model CTV3500 refer to Cathay Electronics. Older sets fitted with Rank chassis (spares available from HRS Electronics plc.).

National, National Panasonic. See Panasonic.

NCS, Bridgemoor Close, Westmead Industrial Estate, Westmead, Swindon, Wilts SN5 7YG. 0793 511 636. Trade only.

NEC Home Electronics Division, NEC House, 1 Victoria Road, Acton, London W3 6UL. 01-993 8111. Trade only. See also SEME.

NEI, Network. Spares available from HRS Electronics plc.

Neptune. Spares available from Ampmace Ltd.

Nikkai Imports Ltd., Regents Park House, 45 Byron Street, Leeds LS2 7QJ. 0532 441 640.

NordMende. Spares available from Ferguson Ltd. Agents in Ireland: Reynolds Electronics Ltd.

Olympus Optical Co. (UK) Ltd., 2-8 Honduras Street, London EC1Y 0TX. 01-253 2772. Trade only.

Orion. Spares for some models available from Hinari stockists.

Osaki. Brand name used by Rumbelows. Spares for Models P50G, P60G, T22P, VCR31, VCR32, VCR33 available from Cathay Electronics. Spares for Model 1250 available from Ampmace Ltd.

Pace Microtechnology Ltd., Allerton Road, Bradford BD15 7AG. 0274 488 211.

Panasonic (UK) Ltd., Panasonic House, Willoughby Road, Bracknell, Berks RG12 4FP. 0344 860 133. Non-dealer orders should be sent to SEME Ltd., Chandos House, School Lane, Bucks MK18 1HD. 0280 823 523 trade, 0280 822 755 retail.

Philips Service, 604 Purley Way, Croydon CR9 4DR. 01-686 5414. Account holders only supplied. See also CPC, HRS, Chas Hyde, SEME, Willow Vale, Wizard.

Pioneer High Fidelity (GB) Ltd., 1-6 Field Way, Greenford, Middx UB6 8UN. 01-575 7199.

Plustron. Spares available from Ross Microwave Ovens, 17-23 Waterloo Road, Burslem, Stoke-on-Trent ST6 2EH. 0782 838 462.

Prinz. Brand name used by Dixons. See Mastercare Components.

Proline. Brand name used by Comet Radiovision.

Pye. See Philips Service.

Radionette. See Tandberg.

Rediffusion. Some spares available from UK Rental and Retail Ltd.

Reynolds Electronics Ltd., Unit 20, Chestnut Road, Western Industrial Estate, Dublin 12. 01-500 144.

Rigonda. Technical and Optical Equipment (London) Ltd., Zenith House, 69 Lawrence Road, Tottenham, London N15 4TG. 01-800 8088.

Roberts Dynatron Co. Ltd., Molesey Avenue, West Molesey, Surrey KT8 0RL. 01-979 7474.

Rumbelows. See telephone directory for local service centre.

Saba. Spares only available from Saba GmbH, 7210 Rottweil, Konigsberger Str. 12, W. Germany.

Saisho. Brand name used by Dixons. See Mastercare Components, CPC, Chas Hyde.

Sakura. See Longreach Marketing Ltd.

Salora. Spares available from NCS and UK Rental and Retail Ltd.

Samsung Electronics (UK) Ltd., Industrial Unit A, Stafford Park 12, Telford, Shropshire TF3 3BJ. 0952 292 262. See also Chas Hyde. Agents in Ireland: Reynolds Electronics Ltd.

Sansui Electronics (UK) Ltd., Axis 4, Rhodes Way, Watford, Herts WD2 7SG. 0923 226 499.

Sanyo Marubeni (UK) Ltd., PO Box 294, Watford, Herts WD2 8JF. 0923 222 244. See also Chas Hyde, UK Retail and Retail Ltd.

Schneider (UK) Ltd., Schneider House, 5 Harrowden Road, Brackmills, Northampton NN4 0BE. 0604 769 255.

Seleco. Spares available from Thompson Cook Electronics.

SEME Ltd., Units 2E and 2F, Saxby Road Industrial Estate, Melton Mowbray, Leics LE13 1BS. 066 465 392. Wide range of spares including Ferguson, GEC, Hinari, Philips, Pye, Sharp. Full range stocked for Fidelity and NEC. Trade only except for Fidelity and NEC cabinet parts. Official Panasonic stockist - for separate address and telephone nos. see under Panasonic.

- Sentra Electronics Ltd.**, Mandale Mill, Beacon Road, Wibsey, Bradford BD6 3DQ. 0274 690 241.
- Sharp.** Spares available from Willow Vale Electronics Ltd., 11 Arkwright Road, Reading, Berks. 0734 876 444. See also Chas Hyde, SEME.
- Siemens.** Spares for Model numbers beginning FF available from Mastercare Components (see above). Spares for Model numbers beginning FC available from John Langman Ltd., 5 Bryants Close, Frenchay, Bristol BS16 1PA – 0272 567 184. Spares available in the Republic of Ireland from Siemens Ltd., Domestic Appliances Division, Dublin Industrial Estate, Finglas, Dublin 11 – telephone no. 302 855.
- Sinclair.** Spares available from CPC Ltd.
- Skantic.** See Salora.
- Solavox.** Brand name used by Comet Group plc.
- Sonatel.** Brand name used by Morphy Richards Consumer Electronics Ltd.
- Sony (UK) Ltd.**, Spares Division, PO Box 58, Newbury, Berks RG13 4LX. 0635 60000. Account holders only supplied. Spares obtainable from SES at Oldbury 021 544 8818, Dulwich 01-693 9622, Glasgow 041 554 2751, Leeds 0532 527 387, Staines 0784 466 111. See also Ampmace, CPC, Chas Hyde, UK Rental and Retail Ltd.
- Steepetone Products Ltd.**, Park End Works, Croughton, Nr. Brackley, Northants NN13 5RD. 0869 810 081.
- Sunkyoung Europe Ltd.**, Sunkyoung House, Springfield Road, Hayes, Middx UB4 0TY. 01-561 1200. Trade only.
- Tandberg.** R.D.E. Tandberg, Holly Tree House, The Green, Full Sutton, York YO4 1HW. 075 972 795.
- Tashiko.** Brand name used by Granada. Spares available from UK Rental & Retail Ltd.
- Tatung (UK) Ltd.**, Service Division, Stafford Park 10, Telford, Shropshire TF3 3AB. 0952 613 111. Trade only.
- Technics.** See Panasonic (UK) Ltd.
- Telefunken.** Paul Spring Electronics, 6 Oasthouse Way, St. Mary Cray, Orpington, Kent BR5 3PT. 068 931 341. Trade only. Spares for 712/712A and earlier chassis no longer available.
- Teleton Electro (UK) Co. Ltd.**, 154 Great North Road, Birchwood Industrial Estate, Hatfield, Herts AL9 5JN. 070 727 2841.
- Tensai.** Spares available from Hilspin Sound Services, Electronic House, Front Street, Sacristan, Co. Durham DH7 6JT. 0913 710 283.
- Texet.** The Hiro Co., Ltd., Elizabeth House, Elizabeth Street, Manchester M8 8JJ. 0618 347 432.
- Thompson Cook Electronics**, 51-52 Heming Road, Washford, Redditch, Worcs B98 0EA. 0527 510 785.
- Thomson.** TV and VCR spares available from K.M. Services Ltd., 19 Market Place, Brackley, Northants NN13 5AB. 0280 701 650. Trade only.
- Toshiba Technical Centre**, Units 6/7, Admiralty Way, Southern Trading Centre, Camberley, Blackwater, Surrey GU15 3DT. 0276 694 000. Trade only. See also Chas Hyde, UK Rental and Retail Ltd.
- Trical.** Brand name used by Hinari Consumer Products Ltd.
- Trio-Kenwood (UK) Ltd.**, Kenwood House, Dwight Road, Watford, Herts WD1 8EB. 0923 816 444.
- Triumph.** Brand name used by Currys. See Mastercare Components, CPC.
- UK Rental and Retail Ltd.**, Unit 37, Roman Way Industrial Estate, Preston, Lancs PR2 5BD. 0772 651 551. Spares for Ferguson, Finlandia, Granada, Hitachi, Mitsubishi, Salora, Sanyo, Sony, Tashiko, Toshiba. Trade only.
- Ultra.** See Ferguson Ltd.
- Uniden.** See Longreach Marketing Ltd.
- Vega.** Technical and Optical Equipment (London) Ltd., Zenith House, 69 Lawrence Road, Tottenham, London N15 4TG. 01-800 8088.
- Willow Vale Electronics Ltd.**, 11 Arkwright Road, Reading, Berks RG2 0LU. 0734 876 444. Official spares stockists for Ferguson, Fidelity, GEC, Grundig, Philips, Pye, Sharp. Other spares available.
- Wintronics.** Spares available from Lloytron Electronics Ltd.
- Wizard Distributors**, Empress Street Works, Empress Street, Manchester M16 9EN. 0618 725 438 or 0618 480 060. Spares stocked include Decca, Ferguson, Fidelity, GEC, Hinari, Hitachi, ITT, Philips, Pye, Rank, Sharp, Sony. Trade only.
- Yamaha Electronics (UK) Ltd.**, Yamaha House, 200 Rickmansworth Road, Watford, Herts WD1 7JS. 092 333 166.
- Zanussi.** Spares available from Thompson Cook Electronics.

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	AMSTRAD	VCR4500 VCR5200 VCR9000	VHS T	
		VCR7000	VHS R	
		VCR4600	9VH4600	
FERGUSON/JVC	3292 8903 3V00 3V01 3V06 3V16 3V22 3V23 3V24 3V29 3V30 3V31 3V35 3V36 3V38 3V39 3V49	VHS A		
	FISHER	FVH — D520 D530 D620 D720 P420 P510 P520 P530 P615 P620 P622 P710 P720 P721 P722	VHS U	
		GEN	5458161 5458165	VHS I
			4000H 4001H 4002H	VHS K
HITACHI	VT3000	VHS A		
	VT4000 VT4200 VT5000 VT5500	VHS H		
	VT6500 VT7000 VT8000 VT8040 VT8100 VT8500 VT8700 VT9000 VT9300 VT9500 VT9700 VT9900	VHS I		
	VT11 V14 VT33 VT34 VT330 VT340 VT5030 VTP10 VTP30	VHS K		
ITT	VR3605 VR3033 VR3905 VR3913 VR3914 VR3935 VR3943 VR3963 VR3993 VR3975 VR3985 VR3986 VR3833	VHS A		
	JVC (see also Ferguson)	HP4000 HR2200 HR3300 HR3320 HR3330 HR3350 HR3360 HR3660 HR3750 HR3860 HR4100 HR7200 HR7600 HR7610 HRD110 HRD111 HRD120 HRD121 HRD140 HRD150 HRD220 HRD225	VHS A	
		MITSUBISHI	HS200	VHS A
			HS700 HS303 HS304	VH700
NATIONAL PANASONIC	VEH0099 0103 0115 0121 0131	VHS B		
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	VEH0171 VEH0218	VHS N		
	VEH0171	VHS W		
SHARP	DDRMU 0002 HE17/21/27	VHS S		
	VC581/2/3 651 681/2/3/5 659 699	VHS C		
	DDRMU 0001 HE00 0002 HE02 04 05 06	VHS D		
	2C9 VC110 VC200 VC220 VC300 VC381 VC384 VC386 VC387 VC388 VC477 VC481 VC482 VC930 VC970 VC3300 VC9100 VC9300 VC9400 VC9500 VC9600 VC9700	VHS E		
SANYO	1430242 T0170 1430242 T2300	VHS L		
	VTC5000 VTC5150 VTC5300 VTC5400	VHS F		
	1430242 T0220	BETA D		
	VTC5350 VTC5500	BETA D		
SONY	A6762 044A, 044B, 054A, 147A	BETA X		
	SL3000, 8000, 8080, SLT 6Me, 7, 7E, 7ME	BETA X		
	A6762 012A, 038A, 055A, 129A	BETA A		
	SL5W, 5000 5100 SLC5, C6, C7	BETA B		
PHILIPS	A6762 072A, 122A, 136A, 139A, 213A	BETA W		
	SLC20, C30, C33, C40, C44			
	SLF1, F30, HF72, T20, T30			

Brand	Machine No.	Head Part No.	Price	
FERGUSON/JVC	VID1 01X0-003-381	Tension band T3292/PU545904A	2.55	
	VID2 01X0-018-024	Take up idler T3292/PU47752	5.00	
	VID3 01X0-018-025	Rewind idler assembly T3V16/PU49282	6.20	
	VID4 01X0-018-729	Take up idler T3V00/PU49280	6.95	
	VID5 01X0-040-006	Loading belt T3V29/30/PU48941-2	0.26	
	VID6 01X0-033-454	Roller Assy. (cass. Housing) T3V23/PU49042	4.50	
	VID7 01X0-040-007	Take up idler 3V29/30/PU48967B	2.90	
	VID8 01X0-040-017	Reel motor assembly 3V29/30/PU1381V	27.95	
	VID9 01X0-065-009	Capston motor 3V35/36/38/39/PU55371V	22.10	
	VID10 01X0-065-016	Cass. housing Assy. 3V35/36/38/39/PU29825	22.00	
GEN/HITACHI	VID11 V5577355	GEC 4100/Hitachi VT11E capston motor	23.50	
	VID12 V6413663	GEC 4000/Hitachi VT33 flt rewind arm	2.75	
	VID13 V6861471	GEC 4001/2/Hitachi 93/9500 flt rewind arm	1.95	
	VID14 V6861482	GEC 4001/2/Hitachi 93/9500 play idler Assy.	4.20	
	VID15 V6886971	GEC 4004/Hitachi VT33 flt rewind arm	1.80	
	VID16 V2423461	ET541 Tuner Unit	6.00	
	NATIONAL PANASONIC	VID17 VXP0329	Fast forward idler NV2000	0.85
VID18 VXP0344		Idler NV7000/7200	0.85	
VID19 VXZ0078		Tension Band NV7000	3.50	
VID20 VXP0521		Idler NV370	2.65	
VID21 VXP0463		Reel Idler NV777	3.40	
VID22 VXP0432		Pinch Roller NV333	3.30	
VID23 VXP0401		Idler wheel NV333	1.25	
SANYO/FISHER		VID24 4529V10800	Reel motor VTC5000/5150	9.50
		VID25 1430662T01201	Reel drive pulley VTC 5000	4.95
		VID26 PR2758	Pinch roller VTC5000/5150	3.85
	VID27 1430490400900	Gear idler Fisher FVH-P615	4.50	
	VID28 1430420400300	Heart idler Fisher FVH-P615	2.95	
	SHARP	VID29 RMOTP1029	Capston motor 73/9300	33.55
VID30 RMOTV1008		Reel motor VC9700	17.95	
VID31 NIDL0006		Idler VC387H etc	1.75	
VID32 NIDL0005		Reel idler VC9300 etc	1.85	
VID33 NIDL0004		Idler wheel VC2300	2.15	
VIDEO LAMPS/BULBS	VID34 LA9295	Universal lamp without socket 290mm	0.45	
	VID35 LA9210S	Universal lamp with socket 310mm	0.50	
	VID36 NAT/PAN.	P.C. MTG. leadless lamp	0.50	
	VID37 SHARP 9300	Etc. lamp plus plastic shroud.	2.53	

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	VP 68	DBK135	£0.86
	VP 7100	DBK103	£1.42
	VS 1	DBK134	£1.76
	VS 2 EG	DBK101	£1.08
	VS 3	DBK134	£1.76
	VS 5 EG	DBK101	£0.86
	VS 80	DBK136	£1.42
	VS 9800	DBK103	£1.42
	VS 9500	DBK103	£1.42
VS 9700	DBK102	£1.96	
VS 9800	DBK103	£1.42	
FERGUSON	3292	DBK103	£1.42
	3 V 01/16	DBK103	£1.42
	3 V 22	DBK103	£1.42
	3 V 23	DBK108	£0.83
	3 V 24	DBK137	£0.68
	3 V 31/32	VID7896	£1.65
	3 V 35/36	DBK150	£0.88
	3 V 38/39	DBK150	£0.88
	3 V 42/43/44	VID7540	£0.70
	3 V 45/48/54	VID7540	£0.70
3 V 55/57	VID7540	£0.70	
FISHER	VBS 7000	DBK146	£2.66
	VBS 7500	DBK105	£2.34
	VBS 7000	DBK105	£2.34
	VBS 9000	DBK10	£1.76
	FVHP 420	VID7532	£1.62
	V 4000 H	DBK129	£0.68
	V 4001 H	DBK129	£0.68
	V 4002 H	DBK129	£0.68
	V 4100 H	DBK128	£1.95
	VT 11-VT 88	DBK128	£1.95
VT 3000	DBK103	£1.42	
VT 5000	DBK125	£1.46	
VT 6500	DBK142	£0.77	
VT 7000	DBK143	£0.68	
VT 8000	DBK129	£0.68	
VT 8500	DBK144	£0.68	
VT 9300	DBK129	£0.50	
VT 9500	DBK129	£0.50	
HITACHI	SL 8000	DBK115	£2.66
	SL 8080	DBK115	£2.66
	SL 8500	DBK115	£2.66
	SL 8600	DBK115	£2.66
	SLC 5	DBK100	£1.55
	SLC 6	VID7519	£1.36
	SLC 7	DBK100	£1.55
	SLC 9	DBK130	£1.76
	SLJ 7	DBK100	£1.55
	SLT 7 ME	DBK100	£1.55
SLT 7 MER	DBK100	£1.55	
SANYO	VTC 5080, 5150	VID7807	£1.19
	VTC 6000	VID7807	£1.19
	VTC 5300	DBK105	£0.70
	VTC 5400	DBK105	£0.70
	VTC 5500	DBK106	£1.76
	VTC 6500	VID7533	£0.78
	VTC 9300	DBK104	£2.66
	VTC 9350	DBK145	£2.66
	VTC M10/11/20	VID7809	£0.61
	VTC M21/30/31	VID7809	£0.61
VTC M50	VID7809	£0.61	
SHARP	VC 381/383	DBK117	£1.42
	VC 385/386	DBK116	£1.52
	VC 2300	DBK126	£1.65
	VC 6000/6300	DBK103	£1.42
	VC 6500	DBK107	£2.66
	VC 7300	DBK103	£1.42
	VC 8300	DBK138	£0.86
	VC 9300/9500	DBK132	£0.86
	VC 9700	DBK108	£0.86
	VC 9700	DBK132	£0.86
SONY	NV 300	DBK110	£1.76
	NV 330	DBK110	£1.76
	NV 330 333	VID7521	£1.52
	NV 336	VID7521	£1.52
	NV 450	DBK133	£1.30
	NV 777	DBK131	£1.42
	NV 2000	DBK109	£1.76
	NV 3000	DBK113	£1.76
	NV 7000	DBK111	£1.08
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NV 8600	DBK112	£1.08	
TOSHIBA	V 55/57	VID7543	£0.91
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	V 5475	DBK122	£1.76
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TV Fault Finding

Reports from Philip Blundell, Eng. Tech., Eugene Trundle, Chris Plaice, Nick Beer, J.K. Potts, Mick Dutton, John C. Priest and Chris Avis

Philips K35 Chassis (TRD4 Tuning Panel)

The tuning fault on this set gave me a few more grey hairs. After working all right for about five hours the set would go off tune, with horizontal white bars across the screen. Panel substitution proved that the fault was on the TRD4 panel, but heavy treatment with the hairdryer and freezer had no effect. When the fault occurred the frequency of the tuner's oscillator wouldn't settle. The SAB3034 chip gave out frequency up and frequency down pulses, the tuning voltage varied up and down, the divided down oscillator frequency could be seen to be changing, but the circuit seemed to be overshooting the correct setting. Disconnecting the a.f.c. had no effect. As the SAB3034 seemed to be reacting correctly, and a replacement made no difference, I homed in on the tuning voltage driver IC99. Voltage and resistance checks in this area failed to reveal anything amiss, but when D90 was replaced with a 1N4148 the fault was present all the time. Fitting the correct BA221 replacement in this position cured the fault.

P.B.

Sanyo CBP2146/2846

These sets incorporate PIP (picture-in-picture). We had one whose small PIP intermittently became "negative", with a bizarre overloaded colours effect. Banging and flexing the PCB made little difference. We found that the PIP interface panel's supply rose from 5V to 6.2V when the fault occurred. This was the cause of the problem. On one edge of the interface board there's a large three-legged 5V stabiliser chip, type QC0905A/3052V, fitted to a big copper heatsink. Replacing this chip cured the problem.

E.T.

Grundig STR20A

The sound was o.k. but there was just a blank raster. We found a blob of solder across the two centre pins of the connector on the video/RGB panel.

C.P.

ITT Nokia/Salora SRV1150

To use this satellite receiver with a Sky Videocrypt decoder proceed as follows. Remove R163 and R164 (both 220 Ω). Fit a 68 Ω resistor in the R163 position. Solder a length of insulated wire between the end of R163 nearest the back of the receiver and pin 5 — the end (unused) pin — of the DIN video socket. Pins 2 and 5 of this socket are now the video input and output feeds for connection to the decoder via the DIN/Scart lead. Note that the decoder must be connected to the mains permanently to get pictures on any satellite channel, otherwise pins 2 and 5 on the receiver need to be linked.

C.P.

Philips 2A Chassis with Teletext

The customer complained about a faint pattern of vertical lines about a quarter of an inch apart across the picture, and occasional corrupt teletext. On inspection we confirmed that these symptoms were present and spent a great deal of time checking the components in the chopper circuit, the lead positioning and so on, all to no avail.

The clue was provided by the teletext problem. When we looked at the teletext panel we noticed that only one of the chips used a plug and socket. Removing the socket and soldering the i.c. directly into the PCB provided a complete cure for all the symptoms.

J.K.P.

Sony KV2212 (YE2 Chassis)

This set had no tuner memory. It would scan through the channels but wouldn't stop. To wade in feet first seemed to be rather a daunting proposition, so we decided to check the miniature pushbutton switches under the tuning panel escutcheon. Out of a total of ten switches four had broken springs internally. A complete set was ordered from Sony and when these were fitted the fault was completely cured.

J.K.P.

Ferguson 3780 (TX9 Chassis)

The fault with this set was that the stations drifted off tune. We changed the TAA550 32V regulator, the tuner, etc. but the fault remained. It was only after we'd changed all the diodes on the station tuner panel that the fault cleared. When tested not one of them gave a faulty indication.

J.K.P.

B and O MX2000

No picture was the complaint with this set. As usual the cause was dry-joints on the c.r.t. base socket. Rather pleased to have an easy one for a change, I wrapped it up and took it over to the soak test bench. When plugged in and switched on the standby light remained off. The 12.5V secondary supply was missing — the yellow lead from the transformer PCB makes a good test point — as the 0.47 Ω series resistor RP43 had burnt out. The bridge was o.k., but there was a very heavy load across its output. Lifting the yellow lead didn't remove this load. The only other connection is to the microcomputer panel PCB8, where we found that CR67 (1,000 μ F) was extremely leaky.

N.B.

Ferguson TX100 Chassis

This set wouldn't go — it pumped as though the line output transistor had failed, as tends to happen with this chassis. Indeed it read short-circuit all ways round, until removed from the circuit. With the line output transistor end of the line output transformer's primary winding (pin 10) disconnected there was a short across the 119V line. This short disappeared when the top end of the primary winding was lifted. The short was within the transformer, a replacement restoring normal operation.

N.B.

Philips K40 Chassis

The customer had never been happy with the picture produced by this set. He lived in a poor signal area, but said that the picture was worse than it should have been. He brought the set into the workshop recently because it had gone dead. This was due to the usual dry-joints around the line output transformer, but when we got it

going we found that the i.f. gain was poor, with ringing. We removed the soldered-in i.f. can and discovered some very suspect joints. A new can was fitted but we found it necessary to tweak L5137 to get a stable picture. I recall similar problems with the Pye 731 series i.f. modules and hope that this one isn't going to give the same trouble.

M.D.

Philips 2A Chassis

One of these sets came in because of intermittent tripping. We resoldered the usual joints around the line output transformer but the problem persisted. It wasn't until we saw the width flutter in and out that we were able to pinpoint the cause. This was the line output stage tuning capacitor C2609, which is shown as 9.1nF in the circuit but was 7.5nF in the set.

M.D.

Fisher FTX7110TX/7111TX

A common fault with this set, giving no results, is failure of the 17.5V rectifier DU20. This BY299 diode goes short-circuit, its associated fusible/safety resistor RU44 going open-circuit. RU44 is a bit unusual. It's an 0.1 Ω , 1/4W type. Fitting an 0.33 Ω or an 0.47 Ω resistor will get the set going in an emergency, but the correct component should be obtained and fitted.

J.C.P.

Aiko/Perdio F512T

An intermittent white line (bunching of raster lines) across the upper part of the picture, about 3cm down from the top, may come and go randomly and may occasionally progress to field collapse. The field output chip is a TDA3561, but this is not usually the culprit. Look instead at R55 in the 25V supply to the field output stage. It's sited near the rear edge of the main PCB to the left of the TDA3561, close to the large heatsink surrounding the line output transformer and behind a couple of green Mylar capacitors. In most sets you'll find that R55 is sitting in a large blob of brown resin. This seems to contaminate the resistor's wires during assembly. Remove R55 from the panel, remove the blob of resin, and make sure that the holes for the resistor are clear and clean. Scrape and retin the wires of R55 or fit a replacement. Although the circuit diagram gives the value of this resistor as 4.7 Ω , 1/2W most sets seem to be fitted with a 12 Ω , 1/2W resistor. I usually fit a 10 Ω , 1/2W resistor.

Incidentally field collapse due to R55 going open-circuit or the TDA3561 being defective produces a blacked out screen with these sets. If you encounter the black screen symptom and the e.h.t. is present a quick check on the supply to the field output chip may save you a lot of time.

J.C.P.

Salora L Chassis

The Salora L chassis is also used in Hitachi sets such as the C17-P118. It's prone to going off or to standby intermittently. The problem area is around the diode-split Ipsalo transformer M600. It's a large, heavy component and is mounted solely by means of its leadout wires, with no other support for the core or windings. This seems to be the root of the trouble. You get an assortment of dry-joints at the leadout points to the print lands, also cracked print. It would seem that these are caused by movement of the transformer with respect to

the PCB during transit. Any of the solder points can be dry or cracked, and the print track from pin 1 to D709 is frequently the site of a hairline crack. The usual precautions apply. Remove the transformer completely, check all the leadout wires carefully, scrape and retin if necessary, and check the soldering of the winding ends to the leadouts. Use a magnifying glass to examine the print in the area of the transformer mountings and remedy any suspect cracks etc. Clean up and retin the solder pads and prepare to remount the transformer. I prefer to provide some extra support for the transformer either by fitting double-thickness "Pritt" self-adhesive pads between the core and the PCB or by slipping pairs of large ceramic beads (as used for insulation in electric fires etc.) over the leadout wires at the corners of the transformer connection panel, again to support the weight of the transformer. Then remount the transformer, paying particular attention to the soldering.

When testing afterwards, make a point of applying pressure to the transformer while the set is on to confirm that the repair is secure. Treat other large components in the area in the same way. It also pays to remove the driver transformer MB601 and wirewound resistors RB702 and RB703 then clean, retin and refit as above.

J.C.P.

Ferguson TX10 Chassis (1560/61 Panels)

This TX10 set (1560/61 PCBs) was bought for a song ("nobody knows the trouble I've seen") and was tripping. We cured the tripping by replacing the line output transformer T721, then found that we had field collapse. A new TDA3652 field driver/output chip IC772 restored the scan, but there was an inch of cramp and foldover at the top. The fact that nearly every joint in the field timebase circuit had been remade betrayed past feverish attempts to trace the cause of this fault, which turned out to be due to a hairline break in the print to pin 8 of the chip. We next found that all the tuner drawer presets tuned backwards and in reverse order! The connector from the drawer assembly had been forced on to the signals panel the wrong way round.

C.A.

Toshiba 140E4B

The snowy picture looked as though the tuner was faulty, but a replacement made no difference and there was also a line of vertical "rope" interference on the left-hand side of the screen. The BF324 i.f. preamplifier transistor Q801 was the cause of the low gain, but the rope effect was still noticeable with a weak signal. Mr. Tosh told us to juggle the green jumper lead under the PCB beneath the tuner to minimise the effect. He was right. Such are the wonders of high technology...

C.A.

Ferguson TX10 Chassis

We recondition many ex-rental Baird sets fitted with the TX10 chassis. This one was bought cheaply as a "non-worker". The displayed picture indicated that the tube was good, but the width was inadequate and there was no response from either preset control in the EW correction circuit. There was evidence that extensive work had already been carried out in this area, but one item that had been missed was the 220k Ω width preset RV851. A check showed that it had fallen in value to only 30k Ω .

C.A.

Fault Finding on CCD Imagers

Steve Beeching, T.Eng.

Modern video cameras and camcorders use a CCD (charge-coupled device) imager instead of a camera tube to convert the light from the scene into a scanned, electronic signal. I described the operation of these devices in the May 1989 issue, with extra notes on colour signal processing in the June 1989 issue.

Faults with CCD imagers are fairly rare, but they do occur. In this article we'll discuss the problems that can arise so that you will at least be able to identify them. I must stress though that repairs should not be attempted without the appropriate connection leads and test gear. With some models it's all too easy to damage an expensive PCB by not using suitable desoldering equipment. Care is also required when replacing a CCD imager as the device is susceptible to static damage. In addition it's very difficult to orientate a CCD imager. It has to be aligned before it's soldered to the PCB, but can be powered and checked only after assembly. The owner will soon complain if the picture is tilted when the camera is horizontal, but the PCB will generally not stand another desoldering process.

More Likely Faults

Faults are more likely to be due to failure of one of the power rails or one of the drive pulse networks than the imager itself, though no output is not uncommon. You can test for this by touching the output pin when the imager is powered: if the camera circuits are active a mass of coloured noise will be seen as this point is very sensitive.

Problems can occur in the signal processing circuitry or in the pulse timing networks. These can cause loss of the Y signal or one or both of the red and blue chroma signals.

Typical Circuit

A typical imager circuit is shown in Fig. 1. It's used in the JVC Model GR-C7, which has several clones and was one of the first camcorders to use an imager. Five supply lines from the regulator system are fed to the imager PCB at connector CN11. There's a -8V imager bias supply, a 15V supply and a 20V bias supply for the imager substrate. This latter bias can be set by R5. A 5V supply is used by the video signal processing circuitry and is linked to the substrate bias arrangement. Finally a 9V supply is used by the horizontal drive pulse processing circuitry (not shown). Various arrangements are incorporated to ensure that the imager is not damaged by the absence of one of the supplies. For example D1 clamps the substrate connection pin 20 at 4V should the 20V supply be missing for any reason.

Imager Faults

Contrary to common belief, a CCD imager can burn if the light source is sufficiently intense and lasts long enough. The burn effect shows as a pinkish blur on a white background after the image of the intense light

that caused the burn. Other colour backgrounds will produce their own colour variations, as will the amount of light that caused the scar.

Other imager faults are generally confined to pixel drop-out. You could find a single pixel hole ranging from black to white. With one particular example there were hundreds of coloured spots all over the screen. This sort of failure is not visible at switch on but becomes more obvious over the following hour or so and is more noticeable with the lens cap on and the monitor's brightness control setting increased if necessary. The effect after an hour has in several cases been like the sky at night - in fact we expected to see Enterprise whizzing across at warp factor 5! You can also get just one or two pixels that produce bright light points or light grey ones after a period of time.

It's not unusual to see a green stripe across the top of the screen. This is due to the blanking and the two or more lines it takes for the colour matrix to synchronise for R/B separation. A green vertical stripe at the left-hand side indicates CCD failure, as do multiple vertical or horizontal lines. These lines tend to be light and dark rather than coloured. The CCD must be replaced as the cause of the problem when either vertical or horizontal lines appear in the high-speed shutter mode only.

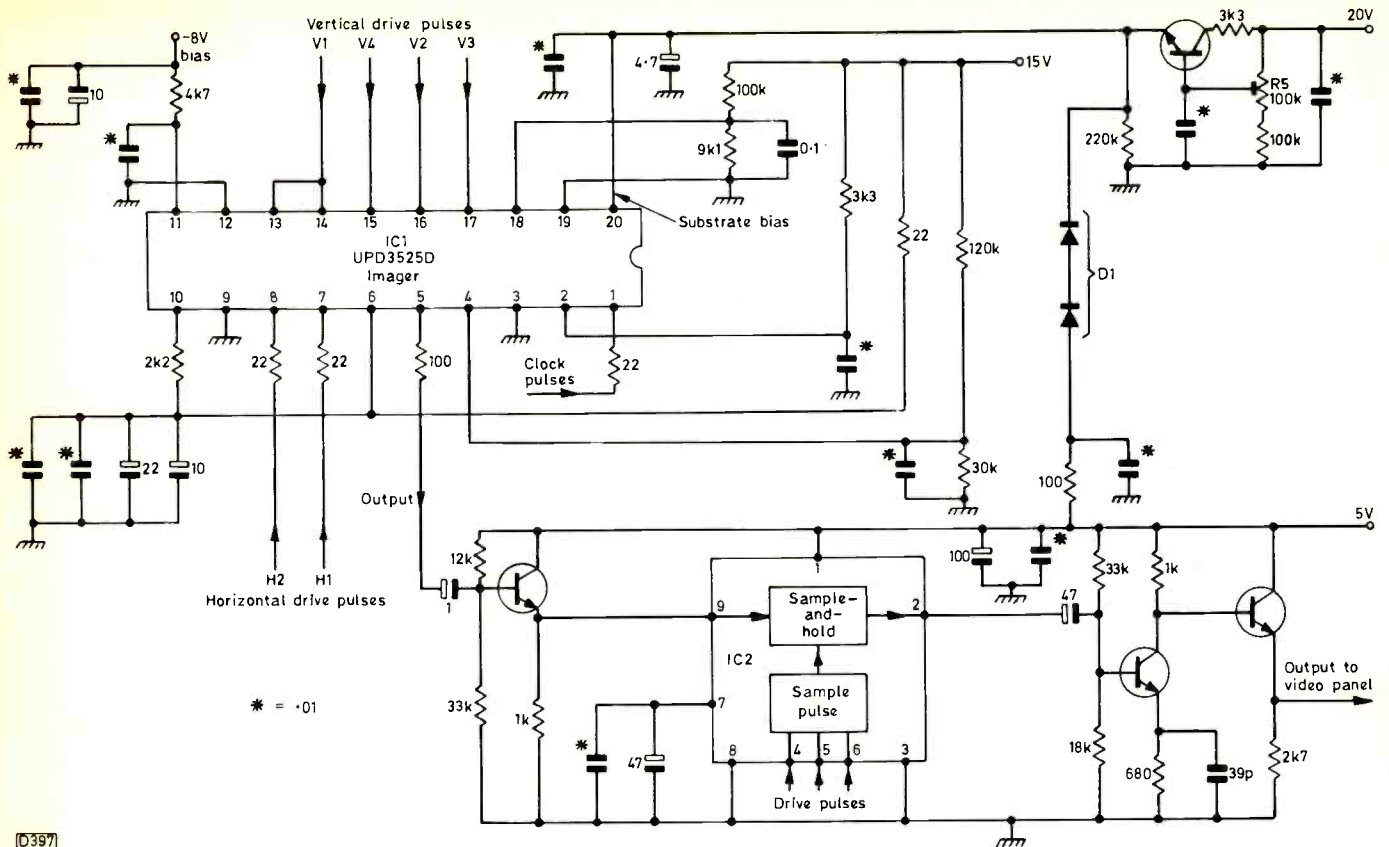
Loss of Drive Signals

The visual effect when one of the horizontal shift register drives is missing is of a very smeary picture with little or no detail - just horizontally smeared, undefined images. If one of the vertical drives is missing the effect is vertical smearing with undefinable images that move around the screen in a coloured, foggy swirl when the camera is moved.

The imager requires a clock signal at 8-16MHz and about 1.5V peak-to-peak. The frequency depends on the CCD and the number of horizontal pixels. With the JVC GR-C7 it's 12.8MHz. This signal clocks a detector on the output side of the horizontal shift register, the main purpose of this detector being to reduce noise by eliminating unwanted residual charges between signal samples. It works by producing an output only when a valid signal element is available. When these clock pulses are missing the screen is blank and noise free. In some versions the clock pulse input pin 1 is biased at 7.5V by two 30k Ω resistors with pulse coupling via a capacitor. We've known one of these resistors to go open-circuit, removing the imager's output.

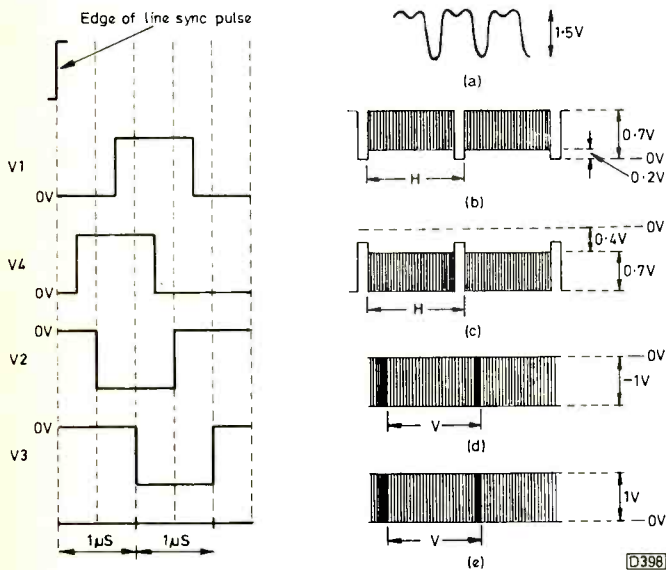
The timing chart shown in Fig. 2 and the scope patterns in Fig. 3 show the waveforms to expect from the imager drive circuits. The horizontal shift register drives H1 and H2 are at line rate, both about 0.7V peak-to-peak. H2 is a negative-going signal. The vertical shift register drives are V1/V4 and V2/V3. These are both about 1V peak-to-peak and are shown at vertical rate, V2/V3 being negative-going. The shadows are the transfer gate pulses.

The vertical shift pulse phase conditions can be clearly seen by locking the scope to the line sync pulses



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Fig. 1: The CCD imager and its associated circuit in the JVC GR-C7 camcorder.



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Fig. 2 (left): Vertical drive pulse timing chart.

Fig. 3 (right): Image sensor drive waveforms. (a) Clock pulses. (b) H1 drive pulses. (c) H2 drive pulses. (d) V2/V3 vertical drive pulses. (e) V1/V4 vertical drive pulses.

and expanding the timebase to $1\mu\text{sec}$ per division. The pulses are about $1\mu\text{sec}$ wide and are displaced by $0.5\mu\text{sec}$ for timing purposes, although again this depends on the number of pixels.

The Video Output

The output at pin 5 of the imager is between 0.75V and 1.5V peak-to-peak and is susceptible to noise

introduced by the scope probe. To obtain a clear display care has to be taken with the earthing. The video may be upside down or not according to the imager type. It's fuzzy due to the presence of the 12MHz sampling carrier. After passing through the sample-and-hold circuit and the odd filter the signal is cleaner and shows up more crisply on the scope.

Video Circuit Faults

Faults in the video processing circuitry are more troublesome in that the fault symptom displayed doesn't necessarily indicate where the component failure is to be found. Faults can vary from a negative picture that's not actually negative but just looks that way because the luminance component is missing to no colour at all, with multiple variations in between.

Warnings!

When working on the camera section you must have the manufacturer's extension leads, as already mentioned, a vectorscope and a set of laboratory standard colour filters as specified for the model concerned. While a vectorscope will set you back by £1,600 to £2,000, the filters are £30-40 each and the test leads some £150 a set. You can't expect to be able to service camcorders on an ad hoc basis, doing one or two every so often. To be economic and make a profit you have to set up to repair them on a continuous basis. The test equipment needed unfortunately rules out the enthusiast who wants to have a go and write off his camcorder or send it to me after having a go. One final warning. The cost of putting right an attempted repair is enormous. Have you seen my new Jag?!

The Room at the Back

J. LeJeune

Christmas had come and gone for another year, followed by the January sale. The same team survived at Electric Dreams, thanks to excellent sales at the turn of the year and Terry Green's idea of offering free safety checks on appliances. The scheme had caused a lot of comment, and neighbouring businesses were trying the same sort of thing with some success.

The satellite TV business had picked up just before the season of goodwill. Gareth had been trained to install and commission this equipment and was thinking, on the quiet, of starting his own dish installation business.

Andy's day started with a 26in. Grundig colour set, one fitted with CUC series chassis. It was dead with the chopper transistor and TDA4600 control chip both blown. Replacements restored operation, but only for a matter of minutes.

"Don't you ever learn?" said Norman. "Whenever the chopper transistor and TDA4600 have failed it's more than likely that the resistor connected to pin 4 will have gone high in value."

Andy looked for R646 and found that it read 2M Ω instead of 270k Ω .

Gareth was toying with an old Ferguson 3V29, though Sid had warned him that parts could now be difficult to obtain. Every now and then he glanced at a small booklet in his tool drawer, *Helping You to Set up Your Own Business* from the Northern Bank. The 3V29's tuning appeared to be critical and it was inclined to drift off. Nor did the a.g.c. work properly. It could be the tuner or the i.f. chip. Gareth flipped a coin and decided that it was the i.f. chip.

Norman was grappling with a belt on a 3V24. Having fitted it he switched on. The machine immediately went into the alarm mode. Very pretty but totally unexpected. Firm in his belief that ninety per cent of VCR faults have a mechanical cause, he checked the various deck switches. S17, the solenoid switch, was sticking in the closed position.

Gareth had by now removed an AN5111 i.f. chip from a scrap tuner board and fitted it in the 3V29. A slight amount of retuning was all that was needed, mainly because it had been altered during the initial fault-finding.

Sid decided to have a go at a 3V23 whose showroom condition was marred by very bad audio wow and flutter. He also noticed a slight disturbance to the playback picture, but the principal effect of the fault was to make some very pleasant piano music sound like the worst efforts of an avant-garde pop group. "Must be something mechanical" he muttered as he scanned the ticket on which Gareth had written 'changed cap servo board, no better'. When he removed the covers and peered into the underside of the deck mechanism Sid found the answer – a disintegrating belt that had deposited lumps of sticky rubber on to the motor drive pulley. He set to work with a cloth and some cleaning fluid, meticulously cleaning every scrap of foreign matter from the surfaces of the motor pulley and the capstan flywheel. He left them to dry as he went to get a new belt from stock.

Norman was by now immersed in an ITT set, CVC45 chassis, with a no picture fault. Andy forsook the safety

of a CD player that wouldn't go wrong and decided to ask Sid for something else.

"Fixed that 3V23" he gloated. "Next time check the belts and pulleys before you go blaming the electronics." His remarks were pointed at Gareth. "Pick up that T4231 NordMende 14in. portable Andy" he said. "Tricky little sets but they still produce a marvellous picture."

Andy's heart sank when he looked at the circuit. Thyristor line output stages were a long call from his special CD and audio training. But if the audio equipment was so reliable he'd be out of a job unless he could try other things as well.

It was some time before Norman announced that he'd "got it". Sid asked what the problem had been. "Well the TBA560 luminance/chrominance processor chip was all right – I checked it by substitution – so I got out the scope and went around the pins. There was no line pulse at pin 8. That led me to R12 which was open-circuit. He put the set on soak test and picked up a Toshiba V9600.

Andy was still struggling with the NordMende, stabbing at various points with his AVO probe and getting none of the answers he required. The set would strike up then shut down again, with a rustle of e.h.t. Gareth eyed his colleagues as he prepared to switch on an Amstrad CTV2200. He'd been working on it on and off for the last couple of days. A pile of dead transistors by his soldering iron stand grew steadily and the job was getting expensive. "Sid" he called, "can you come over before I switch on again?"

The problem was that the line driver and output transistors would go short-circuit a very short time after switch-on. "I've seen it said that dry-joints on the line driver transformer can cause this havoc" Sid commented. They pulled the bench light closer and Sid took out his magnifying glass. The only thing to do seemed to be to go over all the joints carefully. When this had been done the Amstrad sprang to life and stayed on, without any signs of distress.

Norman had the V9600 open and found that the loading belt was in need of replacement. Otherwise the machine seemed set to go on forever. According to the manual changing the belt is tricky. Norman's sharp eyes sought another way to get at it. He removed the two screws that secure the cassette loading platform release, giving him clear access to the belt. A pair of surgical forceps lent an unusual air to his operations, but ten minutes later he straightened up in triumph, loaded a cassette and got the machine going.

Andy was looking despondent and getting nowhere. Norman decided to help out. He switched the set on and watched what happened. "Could be many things" he commented, "but as a first step change the thyristors in the line output stage – very often that's all you have to do." Andy took the advice and went to look for the right ones. When these had been fitted the set worked and a cheer went up.

Sid was back at his desk sorting out the deliveries expected. Norman had broken off probing into an ancient Sony KV1800 and was reading the latest issue of *Television*, scanning the advertisements for components

that were no longer available from the manufacturers. "Reckon some of these parts have rarity value, judging by the prices" he grunted and went on to read about VCR faults. Folk around these parts tend to cling to their electrical and electronic equipment and there are many old-timers still working. Keeping them going is a difficult job but Electric Dreams, while having a futuristic exterior, is a place full of nostalgia once you pass into the room at the back . . .

TEST CASE

328

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.

Ten or twenty years ago the problem of corona discharge used to figure much more prominently in the life of a TV engineer than it does today. In times past we were exhorted to make all joints in e.h.t. circuitry with nice round blobs of solder: a spike would introduce a point of high electrostatic pressure, inviting a discharge into space. Maybe some readers' memories reach back to the days of wired-in rectifier valves and the trouble it took to make them behave!

These days the e.h.t. generator is sealed into the line output transformer and is very reliable. Beefy cable insulation and large tube connector caps seal off the high voltage from the rest of the world and, except where the environment is damp or hostile, there's little trouble. As picture tube technology has advanced, the focus voltage has increased – to the point where in some sets you find that 6-7kV is present at the c.r.t. base connector. And thereby hangs this tale.

The set was a big one, a Bang and Olufsen LX2800. Some form of corona discharge was clearly the trouble, given away by the strong smell of ozone in the relatively small room in which the set lived. Indeed this was the main symptom, the sound and vision performance being good most of the time. A slight hissing could sometimes be heard from within the set, while on rare occasions the picture would defocus momentarily, perhaps with fleeting horizontal black lines or defocused blobs on the display.

It seemed to be a case for straightforward diagnosis in the workshop. We left the set to run, and although no picture fault symptoms appeared the smell was there if you sniffed at the rear of the set. But no discharge could be seen with the back removed and the set in total darkness. We removed the tube's base panel and checked it carefully for signs of corrosion. There were none, but the ozone smell was certainly coming from the

area of the c.r.t. base connector and nowhere else. The base connector, the c.r.t. socket and the tube's focus pin were cleaned and as this seemed to be all that we could do we returned the set to its owner.

We've noticed that Bang and Olufsen owners always seem to be more critical than others, and more incensed when problems occur. In this case the owner was on the phone within a couple of days. He told us that the fault had not been cured and asked what we were going to do about it? We sent David the Downtrodden, who ingeniously fitted a mica sheet between the PCB and the c.r.t. socket beneath the focus spark gap. He thought this would cure the problem, but suggested that we order a new base panel assembly just in case. We did, which was just as well because within a few days we had a call from the Boss, to whom our customer had complained about the incompetents in the workshop. Once more the set was collected and brought back, to have the new panel assembly fitted. Within hours of the start of our soak test it became obvious that the problem had still not been cured.

Since the picture was correctly focused, it seemed unlikely that the focus voltage was excessive – the e.h.t. voltage had been checked several times during our efforts at diagnosis and had proved to be correct. The tube's outer conductive coating and the earth ring on the base panel were correctly earthed, and the focus spark gap had been replaced with the c.r.t. panel assembly.

The cause of the trouble was eventually found. It consisted of a small component that's not usually available as a spare. Can you guess what it was? For the answer, see next month's *Television*.

ANSWER TO TEST CASE 327 – page 389 last month –

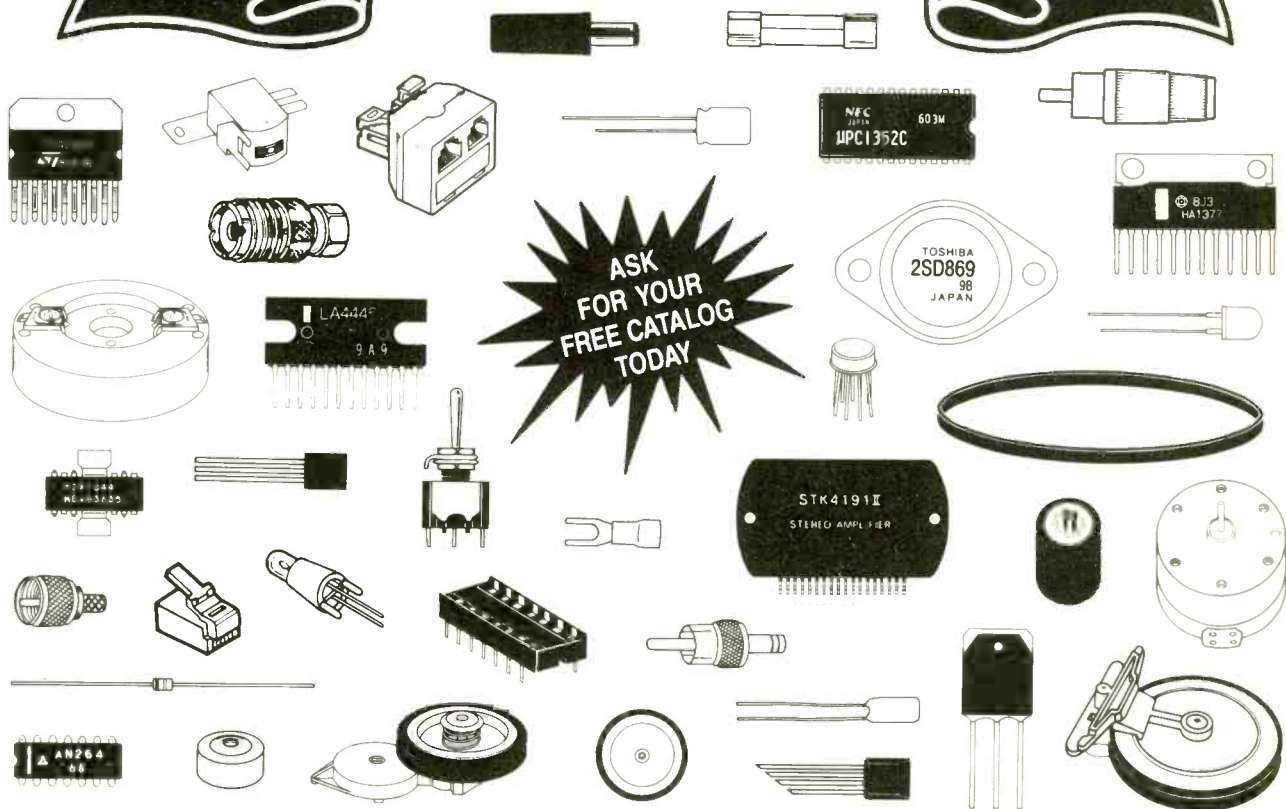
Poor Joe! In his struggle with the Luxor set, described last month, he would have done better to forget all about the synthesis tuning system, the microcomputer control and the associated electronic jungle and concentrate on the simple tuning and a.f.c. section common to earlier, less sophisticated sets.

Joe's treatment of the original corrosion problem had been effective, and there was in fact nothing wrong with the tuning voltage generating system. When Sage tackled the set, he examined the a.f.c. voltage produced by the i.f. chip and found that it flipped rapidly from about 7V to about 5V at some point way off the correct tuning spot. While the tuning was held steady and correct by means of an external voltage, he trimmed the a.f.c. coil LM08 carefully to get a mid-point potential of around 6V at the a.f.c. output from the chip. Control of the tuner was then given back to the CITAC chip and all was well. In the sweep mode the receiver settled correctly on each station. Further slight trimming of the a.f.c. and demodulator coils finally got the tuning and the picture reproduction spot-on.

The problem was that the new a.f.c. coil had not been tuned to the correct frequency. It's tuning is very sharp and critical.

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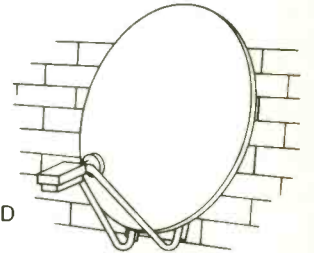
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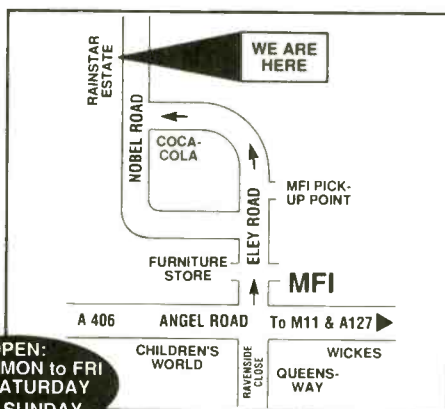
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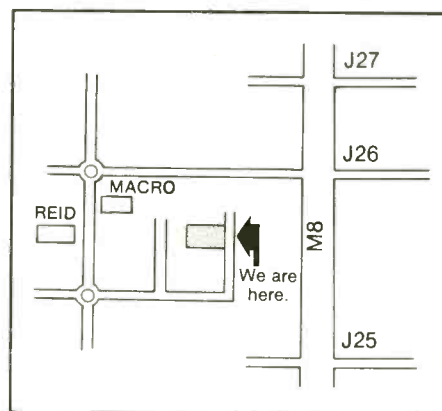


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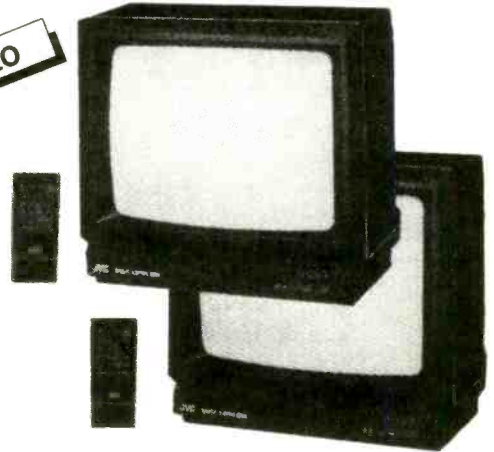
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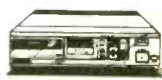
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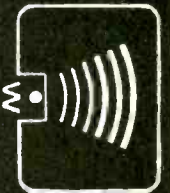
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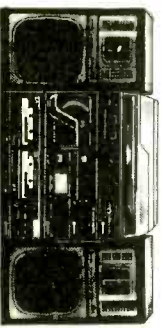
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TD55	TD5555	TD5580	HA1392	LA787	SI052	SK182021
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TD59	TD5959	TD5980	HA1392	LA791	SI056	SK182025
TD60	TD6060	TD6080	HA1392	LA792	SI057	SK182026
TD61	TD6161	TD6180	HA1392	LA793	SI058	SK182027
TD62	TD6262	TD6280	HA1392	LA794	SI059	SK182028
TD63	TD6363	TD6380	HA1392	LA795	SI060	SK182029
TD64	TD6464	TD6480	HA1392	LA796	SI061	SK182030
TD65	TD6565	TD6580	HA1392	LA797	SI062	SK182031
TD66	TD6666	TD6680	HA1392	LA798	SI063	SK182032
TD67	TD6767	TD6780	HA1392	LA799	SI064	SK182033
TD68	TD6868	TD6880	HA1392	LA800	SI065	SK182034
TD69	TD6969	TD6980	HA1392	LA801	SI066	SK182035
TD70	TD7070	TD7080	HA1392	LA802	SI067	SK182036
TD71	TD7171	TD7180	HA1392	LA803	SI068	SK182037
TD72	TD7272	TD7280	HA1392	LA804	SI069	SK182038
TD73	TD7373	TD7380	HA1392	LA805	SI070	SK182039
TD74	TD7474	TD7480	HA1392	LA806	SI071	SK182040
TD75	TD7575	TD7580	HA1392	LA807	SI072	SK182041
TD76	TD7676	TD7680	HA1392	LA808	SI073	SK182042
TD77	TD7777	TD7780	HA1392	LA809	SI074	SK182043
TD78	TD7878	TD7880	HA1392	LA810	SI075	SK182044
TD79	TD7979	TD7980	HA1392	LA811	SI076	SK182045
TD80	TD8080	TD8080	HA1392	LA812	SI077	SK182046
TD81	TD8181	TD8180	HA1392	LA813	SI078	SK182047
TD82	TD8282	TD8280	HA1392	LA814	SI079	SK182048
TD83	TD8383	TD8380	HA1392	LA815	SI080	SK182049
TD84	TD8484	TD8480	HA1392	LA816	SI081	SK182050
TD85	TD8585	TD8580	HA1392	LA817	SI082	SK182051
TD86	TD8686	TD8680	HA1392	LA818	SI083	SK182052
TD87	TD8787	TD8780	HA1392	LA819	SI084	SK182053
TD88	TD8888	TD8880	HA1392	LA820	SI085	SK182054
TD89	TD8989	TD8980	HA1392	LA821	SI086	SK182055
TD90	TD9090	TD9080	HA1392	LA822	SI087	SK182056
TD91	TD9191	TD9180	HA1392	LA823	SI088	SK182057
TD92	TD9292	TD9280	HA1392	LA824	SI089	SK182058
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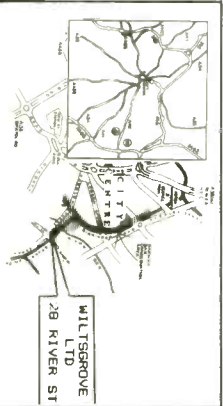
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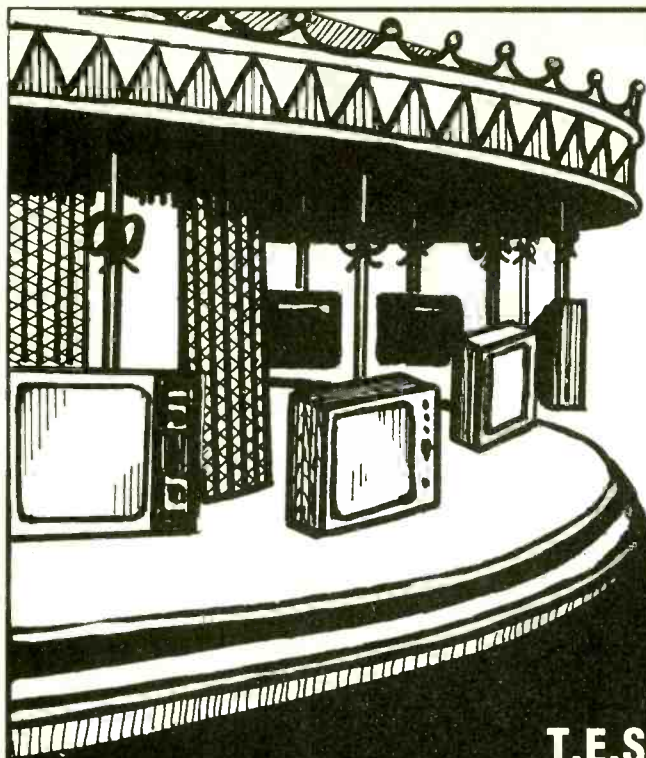
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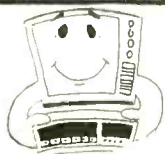
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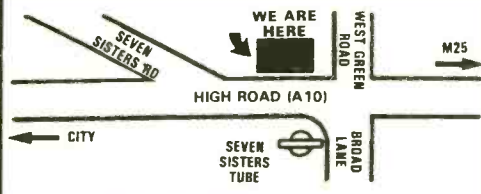
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REPLACEMENTS		GENUINE HEADS		GENUINE		BELT KITS		REPLACEMENTS	
All our replacement heads are brand new precision Japanese heads not refurbished.									
Panasonic		Panasonic		Panasonic		Panasonic		Panasonic	
3HSS(N)	£16.00	NV2000, NV2010	£44.00	NV2000, NV2010	£6.50	NV2000, NV2010	£3.50	NV2000, NV2010	£3.00
Fits model numbers:		NV7000, NV7200	£44.00	NV7000, NV7200	£6.50	NV7000, NV7200	£3.00	NV7000, NV7200	£3.00
NV2000, NV2010, NV7000, NV7200,		NV333, NV366, NV370	£44.00	NV333, NV366	£2.80	NV333, NV366	£3.00	NV333, NV366	£3.95
NV333, NV8600, NV8610.		NV366	£64.50	NV370, NV830, NV850	£2.80	NV370, NV830, NV850	£3.95	NV8600, NV8610	
3HSS-U(I)(N)	£19.90	NV688, NV777, NV778	£64.50	NV688	£6.50	NV688	£3.50	Ferguson	
Fits model numbers: NV370 & Philips VR6460.		NV730	£67.50	NV777, NV788	£4.70	NV777, NV788	£2.90	3V00, 3V16, 3V22	£3.50
3HSS(4N)	£38.50	All others available P.O.A.		NV8600, NV8610	£6.50	NV8600, NV8610	£2.90	3V23	£2.90
Fits model number: NV366		Ferguson		NV730	£1.90	NV730	£3.50	3V29, 3V30	£2.90
3HSS(4N)(S)	£38.50	3V00, 3V16, 3V22	£59.90	NV230, NV430, NV870	£3.20	NV230, NV430, NV870	£2.90	3V35, 3V36, 3V38, 3V39	£2.90
Fits model number: NV730		3V29, 3V30	£59.90	NV870, NV810	£2.80	NV870, NV810		Sanyo	
Ferguson		3V32	£66.90	Ferguson		Ferguson		VTC5000, VTC5150	
3HSS(V)	£16.00	3V35, 3V36, 3V38, 3V39	£59.90	3V00, 3V16, 3V22	£6.50	3V00, 3V16, 3V22	£6.50	VTC5300, VTC5400	£2.50
Fits model numbers: 3V00, 3V16, 3V22, 3V29, 3V30, 3V31, 3V35, 3V36, 3V38, 3V39, HR2200, HR3300, HR3360, HR3360, HR7200, HR7300, HRD120, HRD130.		Sharp		3V23	£3.90	3V23	£3.90	VTC9300	£4.25
3HSS4VB	£44.50	VC7300, VC7700, VC7750	£69.90	3V29, 3V30	£4.90	3V29, 3V30	£4.90	Sony	
Fits model numbers: 3V32.		VC8300	£69.90	3V35, 3V36, 3V38, 3V39	£3.90	3V35, 3V36, 3V38, 3V39	£3.90	SLC5, SLC7	£3.60
Sharp		VC9300, VC9500, VC9700	£62.00	Sanyo		Sanyo		SLC6	£4.95
3HSS(SP)	£26.50	VC381, VC383, VC386	£62.00	VTC5000, VTC5150	£1.99	VTC5000, VTC5150	£1.99	SL8000, SL8080	£4.25
Fits model numbers: V9600, V31B, V33B.		VC482	£62.00	VTC5300, VTC5400	£4.50	VTC5300, VTC5400	£4.50	Sharp	
Toshiba		All others available P.O.A.		VTC9300	£6.50	VTC9300	£6.50	VC7300, VC7700, VC7780	£3.50
PS3B(T)	£26.50	Sanyo		Sony		Sony		VC8300	£3.90
Fits model numbers: V9600, V31B, V33B.		V9600	£49.50	SLC5, SLC7	£6.50	SLC5, SLC7	£6.50	VC9100, VC9300, VC9500	£3.90
Hitachi		V31, V33	£59.90	SLC6	£7.50	SLC6	£7.50	VC381, VC383, VC386	£3.90
3HSS(H)	£26.50	V55, V56	£59.90	SL8000, SL8080	£6.50	SL8000, SL8080	£6.50	Hitachi	
Fits model numbers: VT8000, VT9300 etc.		Hitachi		SLC20, SLC30	£6.50	SLC20, SLC30	£6.50	VT5000, VT5500	£4.50
Sony		VT5000, VT5500	£49.50	SLC9	£54.50	SLC9	£54.50	VT8000, VT8300, VT8500	£1.50
PS3B(S)	£19.95	VT6500, VT8000, VT8300	£49.50	Toshiba		Toshiba		VT9300, VT9500, VT9700	£1.50
Fits model numbers: SLC5, SLC6, SLC7, SL3000 also various NEC models.		V8600	£69.90	V9600	£59.90	V9600	£59.90	VT11E, VT14E, VT17E, VT19	£3.90
PB4B(2S)	£26.50	V31, V33	£59.90	V31, V33	£59.90	V31, V33	£59.90	VT33E	£3.90
Fits model numbers: SLC20, SLC30, SLC40, SLF1.		V55, V56	£59.90	Hitachi		Hitachi		VS2, VS3, VS4, VS5	£3.95
PS5B(3S)	£44.20	Hitachi		VT5000, VT5500	£49.50	VT5000, VT5500	£49.50	VS9300, VS9500, VS9700	£3.50
Fits model numbers: SLC9, SLT50, SLC8, SLF60.		VT6500, VT8000, VT8300	£49.50	VT6500, VT8000, VT8300	£49.50	VT6500, VT8000, VT8300	£49.50	Many others available	
Amstrad/Saisho		VT8500, VT8700	£49.50	VT8500, VT8700	£49.50	VT8500, VT8700	£49.50	SENSOR LAMPS	
3HSS(R)	£28.50	VT9300, VT9500, VT9700	£49.50	VT9300, VT9500, VT9700	£49.50	VT9300, VT9500, VT9700	£49.50	All Panasonic	£1.80
Fits model numbers: VCR7000 and all models using Orion chassis.		VT11E, VT14E	£45.50	VT11E, VT14E	£45.50	VT11E, VT14E	£45.50	All Ferguson/JVC	£0.65
3HSS(F)	£28.50	VT17E, VT19E	£54.60	VT17E, VT19E	£54.60	VT17E, VT19E	£54.60	Sharp VC9300 etc.	£2.90
Fits model numbers: VCR4500, VCR5200, VCR9000 etc.		VT33E	£49.50	VT33E	£49.50	VT33E	£49.50	Sharp VC7300 etc.	£1.80
Fisher/Fidelity		Philips		Philips		Philips		Amstrad 7000	£2.30
3HSS(SF)	£29.90	VR6460	£44.00	VR6460	£44.00	VR6460	£44.00	All Hitachi	£1.80
Fits model numbers: FVHP615, FVHP710, V1000.		VR6462, VR6467	£42.90	VR6462, VR6467	£42.90	VR6462, VR6467	£42.90	SENSOR L.E.D.'s	

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NV333, NV366, NV370, NV430	£4.95
NV730	£7.95
Ferguson/JVC	
3V00, 3V16, 3V22, 3V23, 3V24	£4.95
HR3300, HR3360, HR3660, HR2200	£4.95
3V29, 3V30, HR7200, HR7300	£4.95
3V35, 3V36, 3V38, 3V39 HRD120	£4.95
Sanyo	
VTC9100, VTC9300	£4.95
VTC5000, VTC5150, VTC5300, VTC5400	£4.95
Sony	
SLC5, SLC7	£5.95
SLC6	£5.95
SL8000, SL8080	£5.95
Sharp	
VC7300, VC7700, VC7750	£4.95
VC8300	£4.95
VC9100, VC9300, VC9500	£4.95
VC381, VC383, VC386	£4.95
VC651 etc.	£4.95
Hitachi	
VT5000, VT5500	£5.95
VT8000, VT8300, VT8500	£4.95
VT9300, VT9500, VT9700	£4.95
VT11E, VT14E, VT17E, VT19	£4.95
VT33E	£5.95
Akai	
VS9700	£6.95
VS2, VS3, VS4, VS5	£6.95
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Amstrad/Saisho etc.	£18.20
Panasonic NV333, NV366	£16.80
Sanyo VTC5000, 5300, 5400	£9.90
Panasonic NV7000, 7200	£19.80
DRUM MOTORS	
Ferguson/JVC 3V00, 3V22, etc.	£29.90
Sharp VC7300, VC7700	£26.40
Sharp VC8300	£26.40
Hitachi VT5000	£25.80
CAPSTAN MOTORS	
Sharp VC8300	£39.90
Sharp VC7300, VC7700	£29.30
Ferguson/JVC 3V00, 3V16, 3V22	£24.75
Ferguson/JVC 3V29, 3V30	£34.50
Ferguson/JVC 3V35, 3V36, etc.	£25.80
Hitachi VT5000	£25.80
Hitachi VT8000, 8500, etc.	£34.50
Hitachi VT9300, 9500, etc.	£34.50
Hitachi VT11, VT14, VT17	£28.80
Sony C5, C7	£42.90
Akai VS1-VS5	£29.90
<i>Many, many more!</i>	
IDLER WHEELS	
Panasonic	
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NV730 (Genuine)	£4.50
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Sanyo	
VTC9100, VTC9300	£1.90
VTC5000 Reel drive pulley	£6.50
VTM10 Reel drive pulley	£9.90
Sony	
SLC5, SLC7	£4.95
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Sharp	
VC9100, VC9300, VC9500 (Genuine)	£3.90
VC381, VC383, VC386 (Genuine)	£3.90
VC482, VC483, VC581 (also Saisho) (Genuine)	£3.90
VC482 etc. (Equivalent)	£2.98
VC9300, 381 etc. (Equivalent)	£2.98
Hitachi	
VT8000, VT8300, VT8500	£4.72
VT9300, VT9500, VT9700	£4.75
VT11E, VT14E, VT17E, VT19	£3.96
VT33, VT63, VT64, VT65	£3.96
Akai	
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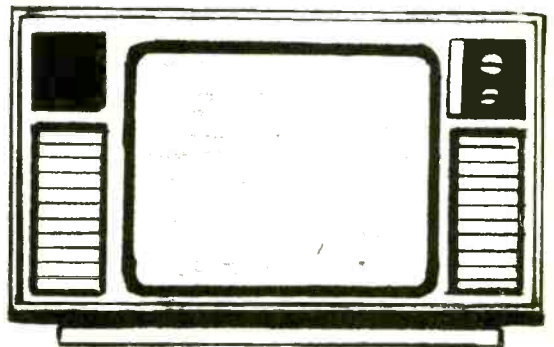
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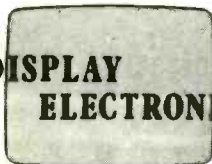
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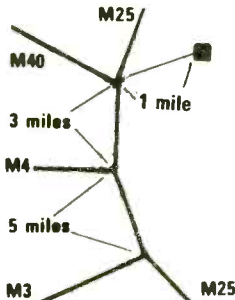
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AN3822K £6.95	AN7172K £2.95	LA11711 £6.50	LA4170 £1.75	SA5000 £1.95	STK5315 £6.75	TA7628P £1.95	BC639 £0.22
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AN5011 £2.95	AN7178 £2.50	LA11714 £3.50	LA4180 £1.95	SA5042 £8.00	STK5325 £5.75	TA7668P £4.95	BD243C £0.50
AN5030 £5.25	AN7470 £2.20	LA11715 £3.50	LA4182 £1.95	SA501A £3.95	STK5332 £3.50	TD1A101A £1.40	BD244C £0.50
AN5033 £5.25	BA1335 £2.50	LA11716 £4.75	LA4183 £2.20	ST3001A £2.20	STK5337 £7.25	TD1A1011 £1.40	BFR90 £0.70
AN5071 £1.20	BA1355 £2.20	LA11717 £4.75	LA4192 £1.75	ST4411C £3.50	STK5338 £4.50	TD1A1015 £1.50	BFR91 £0.70
AN5135K £3.95	BA5102A £2.50	LA11718 £4.75	LA4201 £1.60	STK441C £1.60	STK5421 £6.50	TD1A1170N £1.50	BFY90 £0.50
AN5150 £3.50	BA5115 £2.50	LA11719 £3.00	LA4220 £1.50	STK0039 £1.50	STK5422 £6.50	TD1A1170S £1.50	BRV56 £0.20
AN5151N £2.50	BA5204 £2.50	HA11724 £3.00	LA4250 £2.30	STK0040 £4.25	STK5451 £3.30	TD1A1171 £3.30	BU208A £1.00
AN5296 £2.20	BA5402A £2.50	HA11727 £5.50	LA4261 £2.30	STK0049 £6.50	STK5481 £5.95	TD1A1510 £1.50	BU2080 £1.00
AN5265 £1.75	BA5406 £1.50	HA11744 £5.95	LA4270 £2.75	STK025 £2.75	STK5482 £5.95	TD1A1515A £2.95	BU26A £1.20
AN5410 £3.95	BA5408 £2.20	HA11745 £7.50	LA4280 £2.95	STK077 £6.95	STK5720 £4.25	TD1A1522 £1.95	BU407 £0.70
AN5411 £3.50	BA6104 £2.20	HA11745NT £7.50	LA4420 £1.50	STK078 £6.95	STK5725 £4.25	TD1A1770A £2.95	BU408 £0.95
AN5435 £2.20	BA6109 £1.60	HA11747A £7.50	LA4422 £1.50	STK033 £5.25	STK5730 £4.25	TD2A002 £0.80	BU426A £0.80
AN5436 £2.20	BA6122 £2.50	HA11747AN £7.50	LA4423 £1.50	STK035 £5.25	STK5732 £11.75	TD2A003 £0.95	BU426E £0.70
AN5510 £2.75	BA6124 £2.50	HA11749 £4.25	LA4440 £2.50	STK437 £7.50	STK7638 £5.95	TD2A004 £1.95	BU500 £1.00
AN5512 £2.95	BA6208 £1.95	HA11750 £5.00	LA4466 £2.20	STK443 £8.95	STK7309 £6.50	TD2A005 £1.95	BU508A £1.00
AN5515 £2.20	BA6209 £1.95	HA12002 £1.95	LA4446 £2.20	STK457 £7.50	STK7348 £4.95	TD2A006 £1.50	BU5080 £1.00
AN5521 £2.20	BA6218 £1.95	HA12003 £2.20	LA4460 £1.80	STK459 £7.50	STK7404 £6.95	TD2A007 £1.50	BU5085 £1.00
AN55612 £3.75	BA6219 £2.20	HA12045 £2.25	LA4461 £1.80	STK461 £8.50	STK8050 £9.50	TD2A030 £1.50	BU520 £1.00
AN5613 £2.50	BA6229 £2.20	HA12046 £3.75	LA4465 £2.30	STK463 £7.50	STK8250 £8.95	TD2A210 £3.95	BU521 £1.00
AN5620X £3.50	BA6238A £1.95	HA13001 £1.90	LA4466 £2.30	STK465 £7.95	STK8260 £12.50	TD2A200 £6.00	BU522 £1.00
AN5622 £3.20	BA6239A £2.20	HA13007 £4.50	LA4500 £2.50	STK466 £7.95	STR370 £5.20	TD2A211A £1.30	BU523 £1.00
AN5700 £1.75	BA6302A £1.80	HA13008 £4.95	LA4505 £2.80	STK1060 £7.95	STR371 £5.20	TD2A253A £3.30	BU524 £1.00
AN5701 £1.20	BA6304 £1.75	HA13118 £2.75	LA4507 £2.50	STK1070N £9.50	STR381 £5.20	TD2A350 £4.50	BU525 £1.00
AN5722 £1.60	BA6305 £1.95	HA13403V £2.50	LA4508 £2.50	STK2028 £7.50	STR440 £5.20	TD2A3505 £4.20	BU526 £1.00
AN5732 £1.85	BA6328 £2.20	K2101 £1.95	LA4510 £1.75	STK2029 £6.50	STR441 £5.20	TD2A3510 £4.50	BU527 £1.00
AN5732 £1.85	BA6411 £2.20	K2206 £1.75	LA4520 £2.50	STK2028 £6.50	STR441 £5.20	TD2A3515 £4.50	BU528 £1.00
AN5750 £3.75	BA7005 £2.20	K2212 £1.20	LA4570 £2.75	STK2038 £6.50	STR450 £5.20	TD2A3560 £3.90	BU529 £1.00
AN5753 £1.95	BA7023L £2.20	K2261 £1.20	LA6390 £1.75	STK2048 £9.50	STR451 £5.20	TD2A3560 £3.95	BU530 £1.00
AN5900 £1.40	BA7751AL £1.95	K2284 £1.20	LA7031 £2.60	STK1070N £9.50	STR451 £5.20	TD2A3562A £4.50	BU531 £1.00
AN6130N £2.50	XB341 £4.50	LA1130 £2.50	LA7032 £2.95	STK2129 £2.95	STR454 £5.20	TD2A3562A £4.50	BU532 £1.00
AN6136 £1.95	HA1196 £1.75	LA1135 £2.50	LA7042 £2.50	STK2139 £8.00	STR455 £5.20	TD2A3650 £3.50	BU533 £1.00
AN6247 £1.75	HA1197 £1.80	LA1140 £2.20	LA7520 £2.35	STK2155 £9.50	STR457 £5.20	TD2A3651 £2.70	BU534 £1.00
AN6250 £1.50	HA1199 £1.50	LA1150 £1.75	LA7530 £2.75	STK2230 £2.75	STR1096 £4.95	TD2A3652 £3.50	BU535 £1.00
AN6310 £5.50	HA1338 £2.95	LA1170 £1.75	LA7800 £1.50	STK2240 £9.50	STR2005 £5.95	TD2A400-2 £2.50	BU536 £1.00
AN6326N £3.50	HA1339A £3.50	LA1185 £1.60	LA7801 £2.50	STK2250 £9.50	STR2012 £6.20	TD2A400-2D £2.50	BU537 £1.00
AN6327 £3.50	HA1366W £1.80	LA1230 £1.50	LA7806 £2.50	STK3041 £6.50	STR2015 £5.20	TD2A4503 £4.50	BU538 £1.00
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AN6330 £2.95	HA1367 £3.50	LA1320 £1.60	LA7820 £2.20	STK3044 £6.75	STR3125 £6.20	TD2A4510 £3.95	BU540 £1.00
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AN6356N £3.85	HA1396 £3.75	LA2200 £1.50	LA7849 £2.50	STK4025 £6.50	STR50020 £6.20	UPC1278H £2.30	BU547 £1.00
AN6357N £4.50	HA1397 £2.50	LA2400 £1.50	LA7831 £2.50	STK4121N £6.50	STR50103A £5.50	UPC1278H £2.30	BU548 £1.00
AN6359N £3.50	HA1398 £3.50	LA3101 £1.75	LA7833 £2.95	STK4122N £5.75	STR5041 £6.20	UPC1285V £2.50	BU549 £1.00
AN6360 £2.60	HA1122W £2.95	LA3160 £0.95	LA7838 £3.75	STK4131H £6.75	STR5804 £6.20	UPC1287H £2.75	BU550 £1.00
AN6362 £4.50	HA11211 £2.30	LA3161 £1.20	LA7815 £3.75	STK4132H £6.75	STR5804 £6.20	UPC1287H £2.75	BU551 £1.00
AN6371 £3.25	HA11215A £2.20	LA3201 £0.95	LA7816 £3.75	STK4141V £7.95	TA7205AP £1.60	UPC1287H £2.75	BU552 £1.00
AN6387 £5.50	HA11219 £1.75	LA3210 £0.85	LA7817 £2.75	STK4142H £7.95	TA7222AP £1.30	UPC1287H £2.75	BU553 £1.00
AN6562 £1.50	HA11221 £2.20	LA3220 £1.50	LA7818 £2.95	STK4151H £7.50	TA7229AP £1.50	UPC1287H £2.75	BU554 £1.00
AN6610 £1.80	HA11229W £2.50	LA3300 £1.65	LA7819 £1.60	STK4152H £7.50	TA7230P £1.50	UPC1287H £2.75	BU555 £1.00
AN6671K £4.95	HA11225 £1.95	LA3301 £2.00	LA7820 £1.60	STK4161H £7.95	TA7232P £1.95	UPC1287H £2.75	BU556 £1.00
AN6676 £5.50	HA11226 £4.50	LA3310 £2.20	LA7821 £2.00	STK4162H £7.95	TA7233P £2.50	UPC1287H £2.75	BU557 £1.00
AN6677 £4.95	HA11227 £2.20	LA3350 £2.00	LA7822 £2.00	STK4171H £8.95	TA7240AP £2.95	UPC1278H £2.75	BU558 £1.00
AN6876 £1.50	HA11235 £1.95	LA3361 £1.20	LA7831 £2.50	STK4172H £8.95	TA7241AP £2.95	UPC1278H £2.75	BU559 £1.00
AN7062 £2.75	HA11244 £2.95	LA3370 £2.50	LA7832 £2.50	STK4181H £8.95	TA7243P £2.95	UPC1287H £2.75	BU560 £1.00
AN7106K £2.50	HA11251 £3.75	LA3376 £1.65	LA7833 £2.95	STK4191H £9.50	TA7250BP £2.95	UPC1287H £2.75	BU561 £1.00
AN7143 £2.50	HA11401 £2.80	LA3600 £1.50	LA7834 £2.50	STK4192H £9.50	TA7251BP £2.95	UPC1287H £2.75	BU562 £1.00
AN7147 £2.50	HA11423 £2.20	LA4030 £2.50	LA7835 £2.50	STK4332 £4.50	TA7270P £2.50	UPC1287H £2.75	BU563 £1.00
AN7148 £2.30	HA11440 £2.95	LA4031P £1.95	LA7836 £1.75	STK4352 £5.90	TA7271P £2.50	UPC1287H £2.75	BU564 £1.00
AN7149N £2.50	HA11580 £5.25	LA4032P £1.90	LA7837 £2.20	STK4793TV £7.75	TA7280P £2.95	UPC1287H £2.75	BU565 £1.00
AN7156N £2.30	HA11701 £3.50	LA4100 £1.00	LA7838 £1.50	STK4813 £9.50	TA7281P £2.95	UPC1287H £2.75	BU566 £1.00
AN7169 £3.70	HA11704 £5.20	LA4102 £1.00	LA7839 £1.75	STK4833 £9.50	TA7299P £2.95	UPC1287H £2.75	BU567 £1.00
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BC327-25	£0.07	BUX84	£0.60
BC328	£0.07	TIP29	£0.30
BC337	£0.07	TIP31	£0.30
BC547A	£0.07	TIP32	£0.30
BC548	£0.07	TIP41	£0.27
BC549	£0.07	TIP42	£0.25
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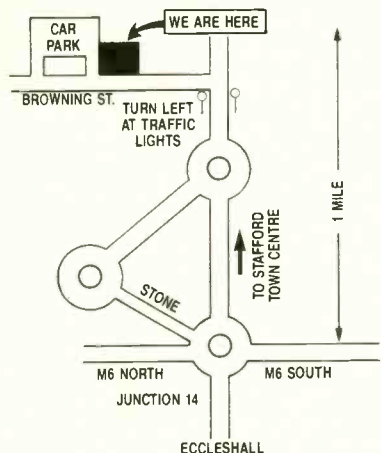
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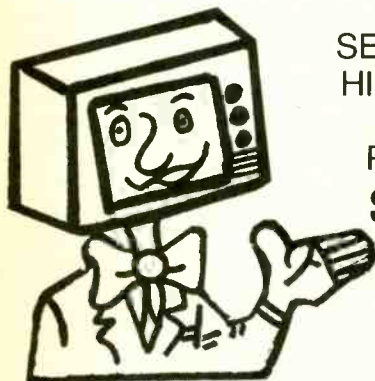
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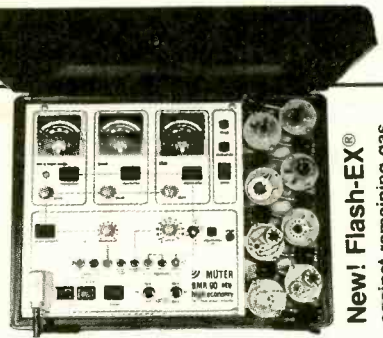
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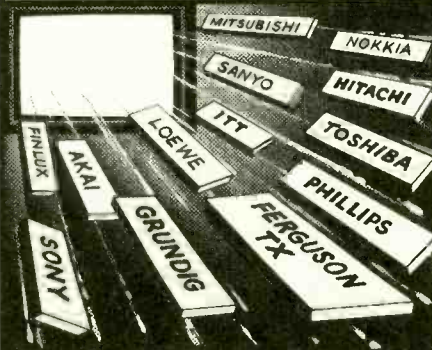
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						22/400	10p	Philips K4-K35, RC530-RC5300,	
						8400	15p	RC5370, RC5375, repaired same day	
						33/400	20p	RC4001 Full Remote KT3 K30 Teletext	£10.00
						400/400	20p	Handsets exchanged	£15.00
						394K/400V	20p	NEW TYPE RC4001 9 CH not 12	£6.00
						100m-160v	40p	GE C Full Remote Infra-red, 1983 models	£15.00
						220/400	25p		
						47/500	15p		
						0.1/1200V wire end	20p		
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						150m/385v	£1.00	TOSHIBA HAND SETS	
						47/1000v	65p	24 Button CT938 Fullremote	£5.00
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						0.0047/1500	10p	VCR Front Display Panel	£7.00
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						750pf/2KV	10p	Hitachi infra red handset	£19.00
						3000PF/3000V	10p	Philips full remote KT3, 16c 929c 20K 934,	
						4n7/2KV	15p	7228/7324, K12 26c 797/1ST 60K 1826	
						6n2/2KV	10p	G11 Full remote top button assy	£12.00
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