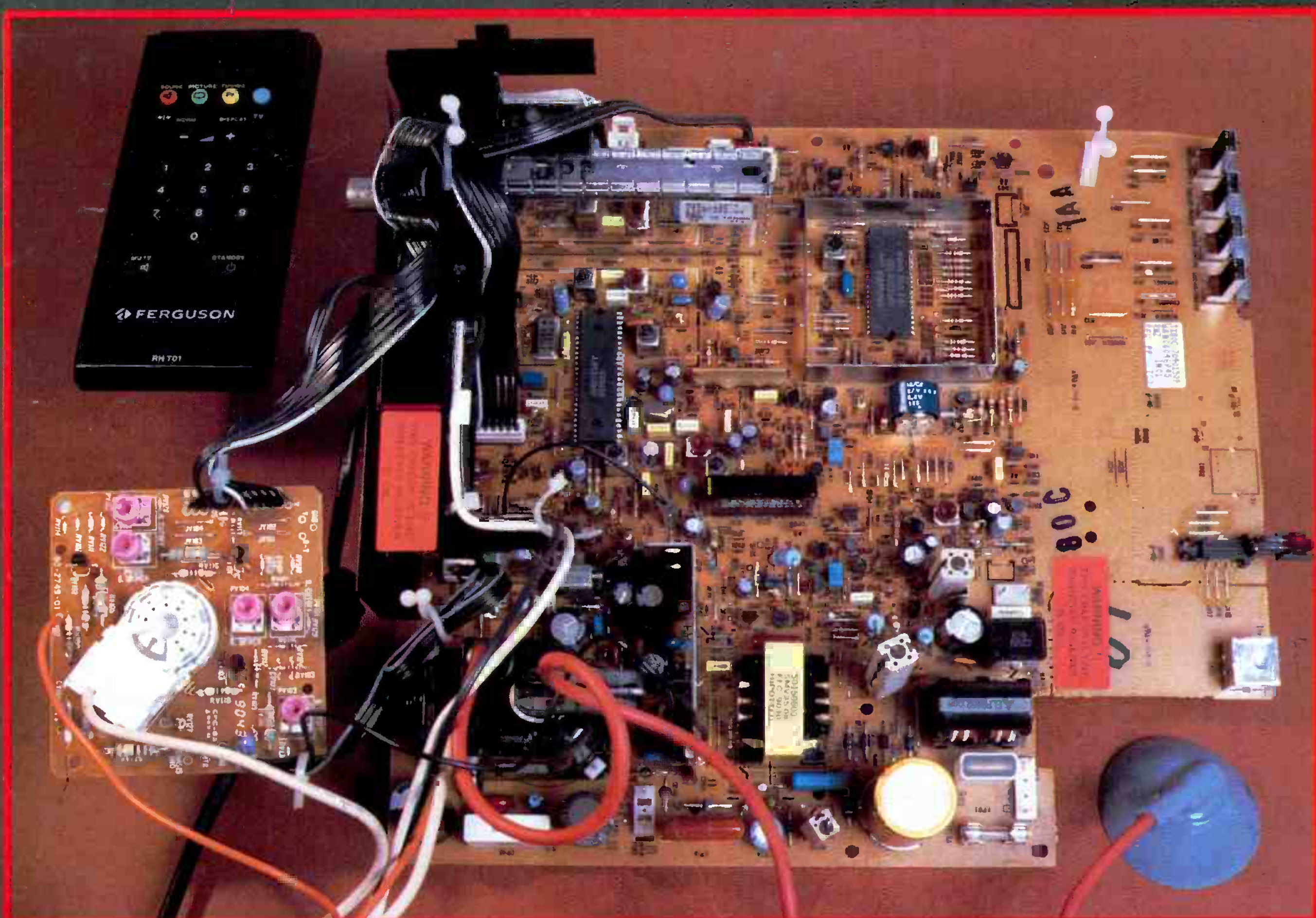
APRIL 1992 £1·95

TELEVISION

SERVICING·VIDEO·SATELLITE·DEVELOPMENTS

FREE 32-PAGE CATALOGUE



Inside the Ferguson TX80 Chassis
All About Solders and Fluxes
Fault Notes on HRD110/3V38 VCRs
Build this Simple AC/DC HV Tester
Satellite TV Notebook•DX-TV
VCR Clinic•TV Fault Finding

04
9 770032 647030

UNAOHM REACHES 2000... MHz THRESHOLD!

UNAOHM has a long tradition as a leading manufacturer of instrumentation developed to solve all the problems related to the reception of television signals – terrestrial and satellite, analog (PAL, SECAM, etc.) and digital (Teletext, Pay TV, MAC, etc.).
The field strength meter, in particular, has become indispensable for the proper installation of a TV distribution system. The recent technological developments in TV reception make continuously increasing use of frequencies up to 2 GHz. As a result, technicians and installers must consider these developments when designing and carrying out new installations and, therefore, procure the necessary instrumentation to meet the latest requirements and those of the near future.
UNAOHM is proud to present a new line of 2 GHz instruments including sweep generators/markers/noise generators/attenuators and related accessories, all of which have been recently developed to meet the standards of the latest and most advanced technological requirements.
Our engineering team is at the complete disposal of our professional clientele to study the possibility of modifying our standard models to meet their specific needs.

SWEEP MARKER EP 688

- **Frequency Range:** 10 MHz - 2 GHz in two bands.
- **Output Level:** +6 dBm - −80 dBm.
- **Calibrated Attenuator:** 0 - 86 dB, in 1 dB steps.
- **Impedance:** 50 Ω.
- **Synthesized Marker:** from 10 MHz up to 2 GHz.
- **Band Marker:** ±2 to ±14 MHz in 0.5 MHz steps.
- C.R.T. display of all programmed functions.

TV SWEEP MARKER EP 657

- **Frequency Range:** 4-1800 MHz in nine bands.
- **Output Level:** +6 dBm - −69 dBm.
- **RF Attenuator:** 1 dB step calibrated up to a total of 75 dB.
- **Impedance:** 50 Ω.
- **Markers:** comb, fixed band and variable (in the same ranges as the sweep).
- Digital Frequency Meter.

RF ATTENUATORS AT 71/50 - AT 71/75

- **Attenuation:** 0-127 dB, programmable with variable steps from 1 to 10.
- **Impedance:** 50 Ω (for AT 71/50) and 75 Ω (for AT 71/75).
- **Frequency:** 0-2 GHz (AT 71/50) and 0-1,8 GHz (AT 71/75).
- **Connector:** N (AT 71/50) and BNC (AT 71/75).
- **Reading:** displayed on a backlit LCD.

NOISE GENERATOR NG 752

- **Frequency Range:** 50 MHz to 2 GHz.
- **Attenuator:** three steps: 6, 10 and 20 dB.
- **Output Level:** −30 dBm/MHz BW
- **Output Impedance:** choice of 50 Ω (NG 752-50) and 75 Ω (NG 752-75).

SATELLITE SOLUTIONS (UK) LTD.
35, Quarry Park Close - Moulton Park - Northampton NN3 1QB - Tel. (0604) 670900 - Fax (0604) 671343

TELEVISION

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

INDEXES AND BINDERS
Indexes to Vols. 37 and 38 are available at £1 each from the Editorial office (address above). Photostats of the indexes to Vols. 31-36 can be supplied at £1 each. Make cheques etc. payable to Reed Business Publishing Ltd.

Binders that hold twelve issues of *Television* are available for £5 from Television Binders, 78 Whalley Road, Wilpshire, Blackburn BB1 9LF. Make cheques out to "Television 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 published designs nor comment on alternative ways of using them.

this month

OUR NEXT ISSUE DATED MAY WILL BE PUBLISHED ON APRIL 15

AAY32	9p
AC107	40p
AC125	30p
AC126	30p
AC127	30p
AC128	35p
AC128K	40p
AC141K	45p
AC142K	45p
AC176	22p
AC167K	28p
AC187	25p
AC187K	40p
AC188	25p
AC188K	40p
ACY18	48p
ACY19	48p
AD149	60p
AF125	50p
AF127	50p
AF139	30p
AF239	30p
BA145	10p
BA148	10p
BA145	6p
BA157	12p
BB105B	18p
BB205B	24p
BC107	8p
BC108	8p
BC109	8p
BC109C	10p
BC118	11p
BC140	20p
BC141	20p
BC142	20p
BC143	20p
BC147	8p
BC148	8p
BC149	8p
BC157	8p
BC159	8p
BC160	30p
BC171	10p
BC172	10p
BC177	14p
BC178	14p
BC179	14p
BC182	7p
BC182L	7p
BC183	7p
BC183L	7p
BC184	7p
BC184L	7p
BC212	7p
BC212L	7p
BC213	7p
BC213L	7p
BC214	7p
BC214L	7p
BC237	7p
BC238	7p
BC239	7p
BC300	20p
BC301	20p
BC302	20p
BC303	20p
BC304	25p
BC308	10p
BC327	7p
BC328	7p
BC337	7p
BC338	7p
BC441	28p
BC446	8p
BC449	15p
BC461	28p
BC477	18p
BC478	18p
BC479	18p
BC490	18p
BC516	22p
BC528	22p
BC537	25p
BC546	8p
BC547	8p
BC548	8p
BC549	8p
BC550	8p
BC556	8p
BC557	7p
BC558	8p
BC559	8p
BC560	8p
BC637	20p
BC638	20p
BC639	20p
BC640	20p
BCY33	200p
BCY34	200p
BCY70	16p
BCY71	16p
BCY72	16p
BD115	30p
BD124P	50p
BD131	25p
BD132	25p
BD133	50p
BD135	20p
BD136	20p
BD137	20p
BD138	20p
BD139	20p
BD140	20p
BD142	45p
BD144	90p
BD150	35p
BD157	38p
BD158	38p
BD166	30p
BD175	30p
BD177	30p
BD179	32p
BD181	45p
BD182	60p
BD184	60p
BD187	30p
BD201	33p
BD202	38p
BD203	42p
BD204	42p
BD222	31p
BD225	31p
BD232	31p
BD233	30p
BD234	32p
BD235	28p
BD236	30p
BD237	21p
BD238	24p
BD239	30p
BD240	40p
BD241A	40p
BD243A	50p
BD244	50p
BD245	50p
BD246A	50p
BD265	45p
BD267	45p
BD269	45p
BD278	50p
BD311	100p
BD312	100p
BD313	100p
BD314	100p
BD315	150p
BD317	150p
BD331	100p

BD332	40p
BD361	60p
BD362	80p
BD370	30p
BD371	30p
BD410	50p
BD433	28p
BD434	30p
BD435	31p
BD436	30p
BD437	28p
BD438	36p
BD439	40p
BD440	40p
BD441	40p
BD533	50p
BD534	38p
BD535	38p
BD536	38p
BD537	40p
BD538	40p
BD643	50p
BD645	50p
BD647	50p
BD649	50p
BD675	40p
BD676	40p
BD677	38p
BD678	40p
BD679	40p
BD680	40p
BD681	45p
BD682	45p
BD705	50p
BD707	50p
BD709	50p
BD711	50p
BD736	50p
BD826	50p
BD828	50p
BD897	50p
BD899	50p
BD901	50p
BD977	50p
BDX32	100p
BDX33	60p
BDX65	80p
BDW23	55p
BDW24	55p
BDW93	50p
BDW94	50p
BDY92	100p
BF137	35p
BF154	25p
BF167	30p
BF173	40p
BF178	30p
BF180	16p
BF181	18p
BF183	20p
BF194	7p
BF195	7p
BF196	8p
BF197	10p
BF198	10p
BF199	8p
BF200	16p
BF225	30p
BF240	16p
BF245	25p
BF254	15p
BF255	12p
BF256	18p
BF257	18p
BF258	18p
BF259	18p
BF262	25p
BF263	25p
BF270	18p
BF273	15p
BF311	21p
BF336	20p
BF337	20p
BF338	20p
BF362	30p
BF367	13p
BF371	17p
BF392	18p
BF420	16p
BF421	18p
BF422	21p
BF423	25p
BF450	20p
BF455	12p
BF458	19p
BF459	19p
BF482	20p
BF469	20p
BF470	28p
BF471	28p
BF472	28p
BF479	20p
BF494	16p
BF495	16p
BF506	25p
BF595	16p
BF596	16p
BF615	30p
BF617	30p
BF757	40p
BF759	40p
BF760	40p
BF763	40p
BF869	22p
BF870	22p
BF871	22p
BF872	23p
BF960	38p
BF961	35p
BF963	40p
BF964	38p
BF966	40p
BFR40	25p
BFR90	52p
BFR91	99p
BFT43	30p
BFT84	28p
BFW92	35p
BFX29	20p
BFX84	20p
BFX85	20p
BFX87	15p
BFX88	15p
BFX89	60p
BFY17	30p
BFY18	40p
BFY50	14p
BFY51	14p
BFY52	14p
BFY56	25p
BFY64	25p
BFY90	45p
BLY48	85p
BR100	14p
BR103	37p
BR303	85p
BRY49	38p
BRY56	33p
BSS74	33p
BSX20	15p
BSX26	18p
BT100A	70p
BT106	180p
BT109	90p
BT116	80p
BT119	100p
BT146	99p
BT151	58p

BTY79	140p
BU100A	110p
BU104	80p
BU105	80p
BU108	100p
BU109	80p
BU110	110p
BU111	140p
BU124	60p
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BU180	150p
BU184	100p
BU204	75p
BU205	70p
BU206	100p
BU208	70p
BU208A	70p
BU208AT	90p
BU208D	80p
BU209	140p
BU225	190p
BU226	190p
BU312	120p
BU325	55p
BU326	75p
BU406	70p
BU406D	85p
BU407	55p
BU407D	80p
BU408	75p
BU408D	85p
BU409	95p
BU426A	70p
BU500	100p
BU508A	75p
BU508AF	95p
BU508D	80p
BU508DF	115p
BU526	75p
BU536	100p
BU546	140p
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BU626	150p
BU636	150p
BU801	80p
BU806	75p
BU807	70p
BU902	130p
BU903	130p
BU920	130p
BU921	130p
BU922	130p
BU930	130p
BUT11AF	70p
BUT12	80p
BUT56A	150p
BUX80	180p
BUX82	180p
BUX84	50p
BUX85	50p
BU69A	200p
BUY71	300p
BUZ71	75p
C106D	28p
J174	38p
J300	50p
ME0411	38p
ME0414	125p
ME3001	12p
ME4103	12p
ME8001	15p
ME9021	12p
MJ900	200p
MJ1000	200p
MJ1001	200p
MJ10012	300p
MJ15001	325p
MJ15002	300p
MJ15003	325p
MJ15004	370p
MJ2501	110p
MJ2955	55p
MJ3000	115p
MJ3001	115p
MJE30A	30p
MJE340	25p
MJE350	80p
MJE520	30p
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MP8112	45p
MP8113	55p
MP8512	50p
MPS6571	20p
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MPS9013	20p
MPS9015	20p
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MPSA06	15p
MPSA13	15p
MPSA20	15p
MPSA42	15p
MPSA43	15p
MPSA70	15p
MPSA92	20p
MPSA93	20p
MR510	35p
MR856	36p
OC28	250p
OC29	250p
OC35	250p
OC36	250p
OC45	50p
OC71	30p
OC72	50p
OC200	180p
R2008B	100p
R2010B	100p
S2800D	52p
S2800M	72p
T2800D	52p
T2800M	72p
TIP29	15p
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TIP29C	25p
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TIP31A	22p
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TIP32	24p
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TIP33	50p
TIP33C	60p
TIP34	50p
TIP34C	60p
TIP35C	65p
TIP36C	60p
TIP41A	20p
TIP41C	22p
TIP42A	20p
TIP42C	22p
TIP47	40p
TIP48	40p
TIP50	60p
TIP51	120p
TIP52	120p
TIP53	120p
TIP54	140p
TIP105	65p
TIP106	65p
TIP107	65p
TIP110	40p
TIP111	50p
TIP112	40p
TIP115	45p
TIP116	48p

TIP117	50p
TIP120	37p
TIP121	46p
TIP122	47p
TIP125	47p
TIP126	56p
TIP127	56p
TIP130	30p
TIP131	30p
TIP321	30p
TIP141	90p
TIP142	90p
TIP145	65p
TIP146	90p
TIP147	100p
TIP150	90p
TIP151	90p
TIP2955	42p
TIP3054	45p
TIP3055	42p
TIS44	40p
TIS61	15p
TIS90	15p
TIS91	18p
TIS93	20p
VK1010	88p
VN10KM	60p
VN66AF	100p
VN88AF	115p
ZTX107	11p
ZTX108	11p
ZTX109	12p
ZTX212	27p
ZTX300	13p
ZTX301	16p
ZTX302	18p
ZTX303	24p
ZTX304	17p
ZTX320	29p
ZTX500	13p
ZTX501	13p
ZTX502	18p
ZTX503	18p
ZTX504	25p
ZTX550	24p
2N696	26p
2N697	22p
2N698	40p
2N706	22p
2N708	22p
2N914	28p
2N930	18p
2N1131	28p
2N1132	28p
2N1613	24p
2N1711	24p
2N1893	30p
2N2102	50p
2N2218A	24p
2N2219	24p
2N2221	23p
2N2222	23p
2N2369	15p
2N2484	20p
2N2646	40p
2N2904	20p
2N2905	20p
2N2906	18p
2N2907	18p
2N2926	8p
2N3019	28p
2N3053	18p
2N3054	40p
2N3055	38p
2N3055H	50p
2N3440	58p
2N3442	85p
2N3585	120p
2N3702	9p
2N3703	9p
2N3704	9p
2N3705	9p
2N3706	9p
2N3707	9p
2N3708	9p
2N3710	12p
2N3711	12p
2N3771	85p
2N3772	90p
2N3773	100p
2N3799	18p
2N3819	29p
2N3866	68p
2N3903	11p
2N3904	11p
2N3905	11p
2N3906	11p
2N4031	25p
2N4036	25p
2N4037	25p
2N4062	12p
2N4064	100p
2N4401	12p
2N4403	12p
2N4443	76p
2N4444	76p
2N5061	20p
2N5088	20p
2N5192	50p
2N5241	500p
2N5245	45p
2N5294	30p
2N5296	30p
2N5320	90p
2N5321	60p
2N5366	25p
2N5401	12p
2N5448	12p
2N5496	80p
2N6107	40p
2N6109	40p
2N6292	40p
2N6385	120p
2N6403	160p
3N143	65p

DIODES

Rectifier Diodes

BY100	40p
BY103	32p
BY127	8p
BY133	8p
BY164	40p
BY179	35p
BY184	32p
BY196	20p
BY206	11p
BY207	11p
BY208	18p
BY210	22p
BY225	120p
BY226	18p
BY227	19p
BY228	28p
BY296	20p
BY298	23p
BY299	22p
BYX10	15p
BYX55/350	30p
BYX55/600	25p
BYX70/500	32p
BY70/800	36p

OA47	10p
OA90	10p
OA91	10p
OA200	10p
OA202	10p
IN.914	2p
IN.4001	3p
IN.4002	3p
IN.4003	3p
IN.4004	3p
IN.4005	3p
IN.4006	3p
IN.4007	4p
IN.4148	2p
IN.5400	9p
IN.5401	8p
IN.5402	8p
IN.5403	8p
IN.5404	8p
IN.5405	11p
IN.5406	12p
IN.5407	12p
IN.5408	12p
RGP15	15p
RGP30	16p
SKE4F2/06	60p
SKE4F2/08	80p
SKE4F2/10	100p
SR2M	60p

I.C. SOCKETS

8PIN	5p
14PIN	6p
16PIN	7p
18PIN	10p
20PIN	12p
22PIN	13p
24PIN	14p
28PIN	16p
40PIN	18p

ZENERS

400 MW BZY88 RANGE 2V7 to 39V	6p
1.3W BZX61 RANGE 2V7 to 39V	10p

CRYSTALS

Freq in MHz

1.0	260p
2.0	200p
2.4576	180p
3.276	115p
3.579	95p
4.0	110p
4.194	130p
4.43	95p
5.0	130p
6.0	115p
8.0	125p
8.867	125p
10.0	140p
11.0	250p
12.0	120p
14.0	125p
14.756	200p
15.0	160p
18.0	130p
18.432	130p
24.0	250p
48.0	160p

VOLTAGE REGULATORS

7805	25p
7806	25p
7808	25p
7812	25p
7815	25p
7818	25p
7824	25p
7905	25p
7906	30p
7908	30p
7912	30p
7915	30p
7918	30p
7924	30p
78L05	24p
78L08	24p
78L12	24p
78L15	24p
78L18	24p
78L24	24p
79L05	35p
79L08	35p
79L12	35p
79L15	35p
7818KC	100p
7824KC	100p
LM309K	100p
LM317K	200p
LM317T	100p
LM323K	350p
LM723	35p
78H08KC	800p
78H12KC	700p
79HGKC	800p

VALVES

DAF96	100p
DAF96	80p
DL92	80p
DY86	70p
DY87	80p
DY802	90p
EABC80	85p
EB91	50p
EBF80	60p
EBF89	60p
ECC82	90p
ECC83	120p
ECC84	80p
ECC85	90p
ECH81	100p
ECH84	90p
ECL80	65p
ECL82	80p
ECL84	100p
ECL85	60p
ECL86	90p
EF80	80p
EF85	80p
EF89	85p
EF183	75p
EF184	85p
EL34	280p
EL36	90p
EL84	100p
EL95	85p
EL500	100p
EL504	130p
EY86	70p
EY87	70p
EY88	80p
EZ35	80p
EZ80	90p
EZ81	70p
PC97	100p
PCC85	60p
PCF80	100p
PCF200	135p

PCF801	110p
PCF802	80p
PCF806	115p
PCH200	100p
PCL81	65p
PCL82	80p
PCL84	60p
PCL85	80p
PCL86	80p
PCL805	80p
PFL200	110p
PL36	120p
PL82	60p
PL83	60p
PL84	80p
PL95	180p
PL500	110p
PL504	120p
PL508	200p
PL519	430p
PY81	100p
PY88	100p
PY500A	190p

LED's

3mm	
RED	5p
YELLOW	8p
GREEN	8p
5mm	
RED	5p
YELLOW	8p
GREEN	8p

RECTANG. LED's

5mm × 2.5mm	
RED	5p
YELLOW	8p
GREEN	8p

LINEAR IC's

AN203	210p
AN210	165p
AN214Q	170p
AN228	280p
AN240P	150p
AN241	135p
AN252	150p
AN259	250p
AN262	140p
AN271	230p
AN274	250p
AN301	330p
AN303	250p
AN304	360p
AN305	320p
AN315	210p
AN316	350p
AN360	100p
AN362	140p
AN366	150p
AN503	450p
AN610	160p
AN612	160p
AN3215K	650p
AN3310	350p
AN3312	350p
AN3320K	800p
AN3331K	900p
AN3792	400p
AN3794	450p
AN3795	500p
AN3821	800p
AN3821K	900p
AN3822K	900p
AN3830K	800p
AN3990K	300p
AN3991K	400p
AN5010	450p
AN5011	400p
AN5015	350p
AN5020	200p
AN5025	250p
AN5030	550p
AN5033	500p
AN5034	500p
AN5111	550p
AN5132	250p
AN5135	600p
AN5138	450p
AN5150	600p
AN5151	600p
AN5215	100p
AN5250	150p
AN5256	150p
AN5260	350p
AN5262	175p
AN5265	150p
AN5352	600p
AN5355	450p
AN5410	375p
AN5411	450p
AN5421	150p
AN5429	420p
AN5431	300p
AN5440	400p
AN5510	400p
AN5512	250p
AN5515	200p
AN5520	550p
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AN5625	400p
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AN5753	170p
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AN5790	300p
AN5791	350p
AN5836	450p
AN5862	300p
AN6135	150p
AN6238	400p
AN6247	200p
AN6270	400p
AN6300	600p
AN6306	550p
AN6307	250p
AN6320	300p
AN6328	400p
AN6332	450p
AN6337	420p
AN6341	350p
AN6344	440p
AN6350	610p
AN6359	810p
AN6360	400p
AN6362	480p
AN6371	510p
AN6387	560p
AN6811	130p
AN6884	240p
AN7105	210p
AN7110	130p
AN7114	150p
AN7115	160p
AN7116	130p
AN7120	130p
AN7130	110p
AN7140	450p

AN7145	195p
AN7146	210p
AN7154	180p
AN7156	240p
AN7168	260p
AN7178	270p
AN7222	300p
AN7254	150p
AN7256	250p
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AN7311	90p
AN7410	250p
AY3-1015	290p
AY3-1270	800p
AY3-1350	450p
AY3-8910	360p
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BA333	100p
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BA402	60p
BA511	160p
BA514	160p
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BA521	160p
BA524	240p
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BA527	95p
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BA534	290p
BA536	180p
BA546	180p
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BA1360	160p
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CA3160	85p
CA3661E	140p
CA3162E	460p
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CA3193E	230p
CA3240E	90p
CA3260E	170p
CA3290E	150p
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CX877	300p
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HA13001	170p
HA13002	250p
HA13006	400p
HA13007	400p
HA13108	350p
HA13412	600p
HA13432	400p
HA17524	250p
HA17805	100p

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ICL7660	240p
ICM7555	60p
ICM75556	80p
KA2101	100p
KA2102	150p
KA2130	150p
KA2206	150p
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KA2263	100p
KA2264	100p
KA2284	100p
KA2401	150p
KA2412	350p
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KA2914A	300p
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LA2101	270p
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LA3201	80p
LA3210	65p
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LA4032	140p
LA4051	160p
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LA5527	150p
LA5700	300p
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LA7224	150p
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LF357	70p
LF398	300p
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LM324	30p
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M51848	150p
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M58725P	500p
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MAB8441P	650p
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MB3713	130p
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MB3722	280p
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MC1469	290p
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MC1489	50p
MC1496	65p
MC3302	70p
MC3401	45p
MC3403	60p
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NE565	110p
NE566	130p
NE567	115p
NE571	290p
NE592	85p
NE5532P	140p
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SAA1024	250p
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SAB3013	200p
SAB3035	600p
STA301A	200p
STA401A	220p
STA403A	270p
STA404	290p
STA405A	280p
STA431A	250p
STA432A	220p
STA434A	270p
STA435A	270p
STA441C	220p
STA456C	240p
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STA901M	280p
STA8012	260p
STK0025	420p
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STK0049	610p
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STK0060	820p
STK0070	1100p
STK0080	680p
STK011	370p
STK015	490p
STK016	800p
STK025	700p
STK043	900p
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STK080	600p
STK082	580p
STK084	660p
STK085	1050p
STK086	870p
STK420	400p
STK430	500p
STK433	490p
STK435	400p

STK436	490p
STK437	500p
STK439	550p
STK441	680p
STK443	740p
STK457	600p
STK459	560p
STK460	720p
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STK463	780p
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STK501	580p
STK561	550p
STK563	480p
STK583	600p
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STK745	600p
STK760	600p
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STK772B	480p
STK780	650p
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STK1040	700p
STK1049	800p
STK1050	750p
STK1060	760p
STK1070	940p
STK1080	990p
STK2025	700p
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STK2250	760p
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STK3044	575p
STK3062	600p
STK3082	700p
STK3083	550p
STK3102II	600p
STK3152II	990p
STK3156	560p
STK4017	450p
STK4019	600p
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STK4060	580p
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STK4112	950p
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STK4122	560p
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STK4142	800p
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STK4161	800p
STK4162	800p
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STK4181	820p
STK4182II	800p
STK4191	1000p
STK4192	1000p
STK4231II	990p
STK4272	720p
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STK4843	720p
STK4853	900p
STK4863	850p
STK4873	990p
STK4893	1400p
STK4913	1180p
STK5314	550p
STK5315	600p
STK5322	620p
STK5324	520p
STK5325	580p
STK5331	400p
STK5332	220p
STK5333	700p
STK5335	450p
STK5337	600p
STK5338	350p
STK5339	500p
STK5342	300p
STK5361	420p
STK5372	300p
STK5412	660p
STK5421	625p
STK5422	600p
STK5431	650p
STK5434	650p
STK5436	600p
STK5441	500p
STK5451	480p
STK5457	425p
STK5461	700p
STK5462	500p
STK5466	850p
STK5467	500p
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STK5481	420p
STK5482	350p
STK5483	550p
STK5488	600p
STK5490	500p
STK5725	800p
STK5730	600p
STK6431	850p
STK6722	900p
STK6732	1500p
STK6822	1200p
STK6922	800p
STK6932	600p
STK6962	320p
STK6972	630p
STK6981B	850p
STK6982	800p
STK7216	500p
STK7217	560p

STK7226	800p
STK7308	410p
STK7309	450p
STK7310	550p
STK7348	410p
STK7356	650p
STK7358	650p
STK7402	660p
STK7404	400p
STK7406	800p
STK7408	880p
STK7410	1200p
STK7554	1000p
STK7561	700p
STK7563	950p
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STK73410	550p
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STR381	490p
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STR384	570p
STR440	520p
STR441	440p
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STR454	470p
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STR456	600p
STR457	680p
STR470	680p
STR1096	380p
STR1195	450p
STR1229	450p
STR2005	580p
STR2012	650p
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STR2024	650p
STR2105	680p
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STR3212	330p
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STR53043	650p
STR54041	500p
STR55041	650p
STR58041	480p
STR59041	650p
STR60001	660p
STR61001	750p
STR80145	700p
STRD1806	800p
STRD1816	800p
T2800D	52p
TA7054	190p
TA7061	115p
TA7063	70p
TA7066	120p
TA7073	200p
TA7089	300p
TA7119	150p
TA7120	55p
TA7130	80p
TA7137	83p
TA7140	130p
TA7157	140p
TA7176	240p
TA7193	400p
TA7200	200p
TA7203	180p
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TA7271	400p
TA7272	260p
TA7273	350p
TA7274	260p
TA7280	330p
TA7281	270p
TA7282	260p
TA7283	260p
TA7288	260p
TA7299	400p

TA7310	100p
TA7312	120p
TA7313	110p
TA7314	210p
TA7315	200p
TA7317P	240p
TA7324	200p
TA7325	90p
TA7328	200p
TA7335	200p
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TA7341	250p
TA7343	250p
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TA7358	200p
TA7401	400p
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TA7630	300p
TA7632	400p
TA7640	150p
TA7641	170p
TA7658	130p
TA7668	160p
TA7680	480p
TA7688	250p
TA7698	720p
TA7699	1200p
TA7705	300p
TA7750	200p
TA7757	250p
TA7769	300p
TAA550	25p
TBA120S	40p
TBA396	70p
TBA520	120p
TBA530	120p
TBA540	100p
TBA560	120p
TBA800	40p
TBA810AS	60p
TBA820	65p
TBA820M	40p
TBA920	120p
TBA950	100p
TBA990	80p
TC4621AF	225p
TC5020	220p
TC5054	280p
TC5065BP	150p
TC5081AP	180p
TC5082P	170p
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TC9106	500p
TC9109	450p
TC9121P	580p
TC9122P	430p
TC9123	600p
TC9125BP	410p
TC9132	400p
TC9134	750p
TC9142	320p
TC9143	300p
TC9145	150p
TC9147BP	700p
TC9148	200p
TC9149	225p
TC9150	425p
TC9152	425p
TC9153	300p
TC9154AP	275p
TC9156	300p
TC9163	375p
TC9164	400p
TC9172P	300p
TC9176P	500p
TC9178AF	1600p
TC9179F	2000p
TC9305	300p
TCA740	130p
TCA940	100p
TCEP100	100p
TD62308AP	200p
TD62381	200p
TD62382	200p
TD62506	200p
TD62705	250p
TD62781AP	250p
TD62795	200p
TD62803	700p
TD6304AP	300p
TD6306P	350p
TD6350P	200p
TD6359N	500p
TD6359P	300p
TDA1001	200p
TDA1002	200p
TDA1003	150p
TDA1005A	220p
TDA1008	350p
TDA1010A	100p
TDA1011	120p
TDA1012	120p
TDA1013A	120p
TDA1015	100p
TDA1016	200p
TDA1020	150p
TDA1022	350p
TDA1023	200p
TDA1024	200p
TDA1025	320p
TDA1028	220p
TDA1029	250p
TDA1035	120p
TDA1037	190p
TDA1044	250p
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TDA1062	200p
TDA1070	400p
TDA1072	300p
TDA1074	420p
TDA1082	290p
TDA1083	200p
TDA1085	400p
TDA1097	550p
TDA1151	60p
TDA1154	50p
TDA1170	85p
TDA1180	140p
TDA1190	90p
TDA1200B	80p
TDA1220	150p
TDA1235	350p
TDA1236	295p
TDA1270	150p
TDA1327	250p
TDA1330	150p
TDA1352	200p
TDA1410	219p
TDA1412	100p

LINEAR IC's — Cont.

TDA1420	200p
TDA1470	140p
TDA1510	380p
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- HRD140/HRD141/HRD143/HRD150/HRD157/HRD158/HRD160/HRD5101/HRS10 £15.75

FERGUSON
- 8947/8948/3V42/3V44/3V45/3V46/3V47/3V52/3V54/3V55/3V56/3V57 £15.75
- 8950/8951/3V64/FV10/FV11/3V65/FV20/FV21/FV22/FV26 £17.00
- 3V48 £24.50
- 3V43/3V53 £31.50
- 8930/8940/3V29/3V30 £10.00
- 8945 £24.00
- 3V00 £10.00

JVC
- HRD170/171/210/211 £17.00
- HRD565/566 £24.50
- HRD725/HRD755 £31.50
- BR7000E/BR7000S £30.00
- HR7200/7300/7350/2650 £7.20
- HRD455 £20.00
- HRD520 £22.00

JVC & FERGUSON
- 3V32/8942/HR7655 £23.00
- HRD180/3V59/FV12L/HRD230 £30.50
- HRD370/3V58/FV13H/HRD430/HRD470 £31.00
- HRD250 £27.00

KENWOOD
- KV901/KV903/KV905 £6.50
- KV917 £24.50

LOGIK
- VR960 £17.00
- VR950 £21.50

LOEWE
- OC410/420/440 £24.00
- OC50/OC55/OC60/OC65 £15.00

LUXOR
- 9225 £21.50

MATSUI
- VX500E/VX600A/VX800A/VX810A/VX880A/VX770B/VX773B £13.50
- VCRL3/VX730 £15.00
- VX735/VX755 £16.00
- VX735A/VX755A/VX765/VX850 £17.50

MITSUBISHI
- HS303/HS304/HS320/HS700 £19.50
- HS306/HS318/HS710 £23.00
- HS307 £37.00
- HS319 £37.00
- HS330 £40.00
- HS338 £30.00
- HSE11 £37.00
- HS300/HS301/HS302/HS310 £23.50
- HS200 £6.50
- HS337/HS347 £22.00

NATIONAL PANASONIC 4HSS-3HSSN
- NV3000/NV300/NV7200/NV333/NV7500/NV7800/NV7850/NV322/NV332/NV340/NV390/NV2000/NV2010/NV7000/NV8170/NV8200/NV8400/NV8600/NV8610/NV8620 £6.50

NATIONAL
- NV777/NV330 £17.00
- NV430 £14.25
- NV460 £16.50

NATIONAL
- NV730/NV770 4 Head £18.50
- NV366 £18.50
- NV180 £25.00
- NV370/NV380 £8.50
- NV788 £43.50
- **NV810/NV830** £35.00
- NV850/NV950 £38.00
- NV870/NV890/NV970 £48.00
- NVG33 £38.00
- NVG30/NVG31/NVG130 £20.00
- NVG10/NVG11/NVG12/NVG14/NVG15/NVG16/NVG120/NV250/NV280/NV450/NV465 £16.50
- NVG18 £30.00
- NVG20/NVG21/NVG22/NVG25/NVG28/NVG200/NVD48 £25.00
- NVG50 £30.00
- NVG45/NVG46 £30.00
- NVH70 £50.00
- NV688 £32.00
- NV600 £23.00
- NVH65 £50.00
- NVG7/NVG9/NV230 £18.00

N.E.C.
- N9011/N9012/N9013E/N9014E/N9014G/N9015/N9016/N901A/N902A/N9033/N9034/N9054/N9063/N9065/N9066/N906A £20.00
- N911A/N915A/N916A/N917 £27.00
- PCV754/PV2300/PV2400/PV760/PV794/PV770/PV774/PVC763E £18.00
- N380/N381/N830/N831/N832/N833/N834/N835/N836 £7.00
- 8261/AH1 £45.00

NORDMENDE
- 4609-460/V100/V140/V200/V250/V304/V341/V450/V550 £7.00
- V1001/V1005/V1015/V1025/V1035/V1041/V1055/V1065/V1105/V2006 £18.00
- V110/V333 £20.00
- V101/V102/V103/V112/V141/V142/V200/V300/V3005/V300/V301/V302/V350/V500 £7.00
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- V1305 £33.50
- V380 £27.00
- V502/V503/V5005 £37.00

ORION
- VH3/VH555/VH600/VH700/VH844/VH900/VH1000 (ALL MODELS) £13.00

PHILIPS
- VR6460/VR6520/VR6920/64VR60/VR6420 £8.50
- VR6711 4 HEAD £41.00
- 6920/VR6440 £58.00
- VR6441/VR6540/VR6541/VR6640/VR6642 £14.00

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REDSON
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- 6A10/6A70 £33.00
- 8A10/VR6038 £39.50
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- VHR7000/VR5005 £15.00
- VR6004/VR6005/VR6011/VR6013/VR8014/VR6020/VR6022/VR8014/VR6023/VR6024/VR7004/VR7011/VR7014/VR7720/VR7730/VR8011 £7.00
- VR6018/VR7018 £30.00
- VR6028 £27.00
- VR7016 £24.00

SAISHO
- VR100/VR605/VR705/VR805/VR905/VR1000/VR1100/VR1200/VR1600 £13.50
- VR3300X/VR3600X/VR3650/VR3800 £15.00
- VR3200/VR3500 £16.00
- VR3300/VR3600 £16.00

SALORA
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SAMSUNG
- SVX301/VB900/VB910/VVT510/VT320/VT5600/VX510/VX511/VX520/VX616/VX626/VX627/VX717 £19.00

SANYO
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- VTC5500/VTC5650/VTC9100/VTC9300/VTC9350/VTC9355/VTC9455/VTC9500 £19.00
- VHR1110/VHR1150/VHR1300/VHR1700/VHR2300 £16.00
- VHR3200/VHR3270/VHR3100/VHR3150/VHR3300/VHR3400 £18.00
- VHR1100/VHR1200 £18.00
- VHR1500/VHR2500 £28.00

SHARP
- VC300/VC381/VC383/VC386/VC387/VC388/VC482/VC483/VC486/VC3300/VC8381/VC9100/VC9300/VC9500/VC9700/VC9400/VC9600 £14.00
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- VC6000/VC6200/VC6300/VC7300/VC7700/VC7750/VC8000/VC8300 £31.00

SONY
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- V21/V31/V33/V50/V51/V53/V9600 £14.50
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- V71/V73/V74/V75/V81/V82/V83/V84/V85/V86/V87 £14.00
- V63 £18.00
- V93 £20.00
- V9680 £42.00
- V5470/V5480 £18.00
- V8600/V8700 £38.00

TRIUMPH
- VR9500/VR9501/VR9525 £13.00

VCR PINCHROLLERS

AKAI
- VS9300, VS9500, VS9700, VS9800 £2.50
- VS1, VS2, VS3, VS4, VS5, VS6, VS9, VS10 £3.20
- VS105, VS112, VS115, VS116, VS126, VS244, VS245, VS247, VS248, VS515, VS516 £2.80
- VS201, VS301, VS303, VS304, VS603, VS606, VS607, VP58-P82 £2.80
- VS125, VS155, VS165, VS220, VS240, VS250, VS512, VSX9 £2.50

AMSTRAD
- VCR4500, VCR4600, VCR4600 MKII, VCR4700 £2.50
- VCR5200 £3.20
- VCR7000 £3.20

FERGUSON
- 3V00, 3V16, 3V22, 3V23 £2.50
- 3V29, 3V30, 3V31, 3V32 £2.50
- 3V35, 3V36, 3V38, 3V39, 3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 3V58, 3V59, 3V64, 3V65, FV10, FV11, FV12, FV14 £2.50

FISHER
- FVHP420, FVHP520, FVHP530 £3.20
- FVHP615, FVHP710, FVHP715, FVHP716, FVHP722, FVHP725, FVHP830 £3.20
- FVHP905, FVHP970, FVHP980, FVHP990 £3.20

HITACHI
- VT11, VT33 £2.50
- VT61, VT62, VT63, VT64, VT65, VT86, VT88, VT110, VT122, VT120, VT128, VT130, VT135, VT138, VT150, VT168, VT220 £2.50
- VT5000, VT8000, VT9300, VT9500 £2.50

ITT
- VR3605, VR3905, VR3935, VR3985, VR3986, VR3993, VR3994 £3.20
- VR3913, VR3914, VR3943, VR3954, VR3963, VR3984 £3.20

JVC
- **HR300, HR3330, HR3360, HR3660, HR4100, HR7700** £2.50
- HR7200, HR7300, HR7600, HR7610, HR7650, HR7655 £2.50
- HRD110, HRD111, HRD120, HRD121, HRD140, HRD150, HRD160, HRD225, HRD455, HRD565, HRD725 £2.50

MITSUBISHI
- HS200, HS300, HS301, HS302, HS303, HS304, HS310, HS320, HS700 £2.50
- HS306, HS307, HS400, HS710 £2.50

NATIONAL
- NV100, NV180, NV300, NV333, NV340, NV366, NV600, NV688, NV777, NV788 £2.50
- NV230, NV370, NV430, NV460, NV730, NV810, NV830, NV850, NV870, NV890, NV2000, NV2010, NV3000, NV7000, NV7200, NV7800, NV8600, NV8610, NV8620, NVG14 £2.50
- NVG7, NVG19, NVG12, NVG18 £3.20
- NVG21, NVG25, NVH65 £3.20

PHILIPS
- VR6460 £2.50
- VR2020, VR2021, VR2022, VR2023, VR2024 £3.20

SANYO
- VHR1100, VHR1300, VHR1500, VHR2300 £3.20
- VTC5000, VTC5150, VTC5500, VTC9300, VTCM10, VTCM20 £2.50

SHARP
- VC381, VC386, VC2300, VC3300, VC7300, VC7700, VC8300, VC9100, VC9300, VC9500, VC9700 £3.20
- VC387, VC481, VC483, VC486, VC496, VC561, VC582, VC583, VC585 £3.20
- VC651, VC681, VC685, VC750, VC780, VC781, VC785, VC787, VC793, VCT72 £3.20

SONY
- SLC5, SLC6, SLC7 £3.20
- SLC9, SLC20, SLC24, SLC30, SLC33, SLC44, SLHF100, SLF1, SLF11, SLF25, SLF30, SLF60, SLF100 £3.20

VCR BELT KITS

AKAI
- VP7100 £1.60
- VS-1 £1.50
- VS2EG £1.00
- VS4 £1.20
- VS5EG £1.00
- VS9300 £1.60
- VS9500 £1.55
- VS9700 £1.60
- VS9800 £1.55

AMSTRAD
- TVR1-2-3 £2.10
- VCR4600 & MKII £2.10
- VCR4700 £2.10
- VCR5200 £2.10
- VCR7000 £0.80

FERGUSON
- 3292, 3V00, 3V01, 3V16, 3V22 £1.50
- 3V23 £0.65
- 3V29, 3V30 £1.20
- 3V31, 3V32 £0.85
- 3V35, 3V36 £0.80
- 3V38, 3V39 £0.80
- 3V42, 3V43 £0.65
- 3V44, 3V45 £0.65
- 3V34, 3V54, 3V55 £0.65
- 3V58, 3V59, 3V64, 3V65 £1.40
- 8950, 8951, FV10, FV11, FV12, FV13, FV14 £1.40

FISHER
- VBS7000 £2.45
- VBS9000 £1.20
- FVHP520, FVHP530 £0.80
- FVHP710, FVHP716 FVHP722, FVHP905, FVHP906, £1.20
- FVHP907, FVHP910 £1.30
- FVHP615, FVHP715, FVHP725, FHP830 £1.20

GEC
- 4005 £1.50

HITACHI
- VT11, VT33 £1.00
- VT5000 £1.20
- VT5500 £1.30
- VT8000 £0.80
- VT8500 £0.80
- VT9300 £0.50
- VT9500 £0.50

HITACHI
- VT9700 £0.60
- VT14, VT17, VT19, VT35, VT38, VT88, £1.20
- VT52, VT62, VT64, VT65, VT86 £1.50

ITT
- VR3605, 3905, 3935, VR3985 £1.00
- VR3913, VR3914 £1.00

JVC
- HR3300, HR3330 HR3360, HR3660 £1.50
- HR4100 £1.80
- HR7200 £0.70
- HR7600 £0.80
- HR7610 £0.95
- HR7650 £0.75
- HR7655 £0.90
- HR7700 £0.77
- HRD110, HRD111, HRD120, HRD225, HRD250, HRD455, HRD565, HRD566, HRD725, HRD755 £1.00
- HRD170, HRD180, HRD230, HRD370, HRD430, HRD530 £1.30

MITSUBISHI
- HS200 £2.00

NATIONAL
- NV300 £1.60
- NV333 £1.35
- NV777 £1.00
- NV2000 £1.50
- NV3000 £1.60
- NV7000 £0.95
- NV7200 £0.90
- NV8600 £1.60
- NV7500, NV7800 £1.10
- NV340, NV366 £1.40
- NV600, NV788 £1.20
- NV230, 250, 280, 370, NV380, 430, 450, 460, NV465, 600, 630, 730, NV810, 830, 850, 870, NV890 £1.35

PHILIPS
- VR6460 £1.70

SANYO
- VTC5000 £0.75
- VTC5300 £1.00
- VTC5500 £0.95
- VTC9300 £2.20
- VTC1100, 1300, 1500 £1.00

SHARP
- VC381, VC383, VC386 £1.25
- VC6300 £1.50
- VC7300, 7700, 7500 £1.50
- VC8300 £1.50
- VC8381, VC9100 £1.25
- VC9300, VC9500 £1.35

SONY
- SL-C5, SL-C6 £1.40
- SL-C7 £1.40
- SL-C9 £1.65
- SL8000, SL8080 £2.00

TOSHIBA
- V55, V57 £0.85
- V5250, V5280 £2.30
- V5480 £2.10
- V5475 £1.60
- V7540 £1.60
- V8600 £1.50
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Each Kit Contains Belts Set, Pinch Roller, Tension Band & Idler Tyres

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- 3V35-36,38-39 £5.50p
- 3V29/30 £6.25p
- HRD110/111/120/225 £5.50p
- HR7200 £6.25p

HITACHI
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FISHER
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SONY THYRISTOR SG264A 600p SG613 1000p

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- Coax Plug .18
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- 1uf at 400v .25
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- 4.7uf at 400v .35
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- 10uf at 400v .75
- 22uf at 250v .40
- 33uf at 250v .55
- 47uf at 250v .65
- 100uf at 250v 1.25

(All the above are pcb mounting)

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R2M	.95
BY133	.15
BY227	.20
BY229/800	.95
BY299/800	.35
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1N5408	.20
BZX61C (1.3 Watt) 5v6, 6v8, 7v5, 9v1, 12v, 15v, 24v, 33v, 68v, 120v, 130v (5 per Value)	1.00

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- GRUNDIG CUC2410 18"/26" 19.95
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CNX83A	3.95
HA1377	2.95
HA13001	4.50
HM6251	5.95
HM6232	5.95
LA4445	2.45
LA4460	2.45
LA4461	2.45
LA7800	2.95
LA7801	2.95
M293B1	7.95
M491BB1	14.75
M58401I/84RS	12.95
MC13002P	4.95
SAA1293-02	6.95
SAA5000A	4.95
SAA5012	4.95
SL1430	1.95
SL1432	1.95
STK5325	7.95
STK5331	6.95
STK5332	6.95
STK5333	12.50
STK5335	6.95
STK5421	7.95
STK5422	6.95
STK5471	8.75
STK5481	8.95
STK5482	8.95
STK7308	7.95
STK7348	7.95
STR441	6.75
STR4090	8.95
STR4211	4.50
STR5412	4.95
STR40090	8.95
STR50020	7.95
STR50103A	6.50
STR54041	9.95
STR55041	6.95
STR58041	6.95
STR6020 (KIT)	5.95
TA7227P	2.95
TBA120U	1.95
TBA820M	1.75
TDA1035T	2.95
TDA1037	2.75
TDA1044	2.95
TDA1170S	1.95
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TDA1512	3.50
TDA1515	4.50

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TDA2005	2.95
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TDA2541	2.95
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TDA2576A	3.25
TDA2577	3.75
TDA2577A	3.95
TDA2578A	2.95
TDA2579	3.75
TDA2581	2.95
TDA2582	2.50
TDA2591/3	2.95
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TDA3571BQ	7.95
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TDA3653A	4.95
TDA3654A	3.95
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TDA4503	4.50
TDA4505E	6.95
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TDA4601	3.50
TDA4601DIL	4.75
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TDA9503	3.75
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UPC1378H	3.95
UPC1394C	2.95
UPC1420CA	8.50

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- Ferguson TX85 21.75
- Ferguson TX90 (14") 19.75
- Ferguson TX90 (20") 21.50
- Ferguson TX99 22.75
- Ferguson TX100 90D 19.95
- Ferguson TX100 110D 19.95
- Ferguson TX100 110D FST 23.50
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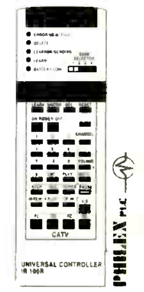

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COVER PHOTO
This month's cover photograph shows the Ferguson TX80 chassis – see article on pages 406-411.

REED BUSINESS PUBLISHING

Japanese Gloom

The Japanese consumer electronics industry is going through a difficult period. Sony is currently losing something like £1m a day and has announced that it expects to make its first full-year operating loss, of some ¥20bn (about £90m), since being listed on the Tokyo stock exchange in 1958. It has just announced a 36 per cent decline in profits for the third quarter of its financial year. Sony's position is not helped by having to service the considerable debt it took on when it purchased CBS records and Columbia Pictures. One result of this move however is that Sony's operating profits from its entertainment businesses are at present only 30 per cent less than what it makes on its electronic hardware. Despite the poor returns, Sony is increasing its output of consumer electronics products and is forecasting increased sales for the year, in the case of 8mm camcorders up from 3·8 to 4·1m units, an increase from 9·5 to 13m CD players, TV sets up from 6·1 to 7m and VCRs up from 3 to 3·5m. Its factories are still humming, but the prices it's having to sell at aren't converting into profits.

For nearly all Japanese electronics companies the financial year end is in March, so announcements and projections are at the moment (early March) coming in thick and fast. It seems that a sharp decline in profitability has occurred since the autumn. Only last October JVC was forecasting a reasonable profit for the year, but poor sales since then have now led to forecast losses for the year. Matsushita is still operating profitably, but at a much reduced level. A fall of 43 per cent in pre-tax profits is forecast for the year, which is 26·6 per cent lower than a forecast made just three months previously. Other major Japanese electronics manufacturers have issued reduced profits forecasts, down by 37 per cent in the case of Hitachi and 58 per cent in the case of Toshiba, though it's not possible to assess the percentage relating to brown (black?) goods in these forecasts. Falling semiconductor prices, in particular for the latest generation of memory devices, are significant here while Toshiba has been having a difficult time with its portable computers. Many Japanese companies are considering reduced capital expenditure, though R and D budgets are likely to be left alone.

It's not that Japanese consumers have stopped buying. What seems to be happening is that demand for the current range of products has peaked and the traditional impetus provided by new products is for the present lacking. The result is fierce price competition to move current production and falling profitability. Export markets are flat.

One technique that has been a feature of the Japanese market is frequent model changes to stimulate sales. But, just when you might expect ever more frenzied activity in this respect, the powerful Ministry of International Trade and Industry (MITI) has called for fewer changes. Manufacturers of VCRs and air conditioners have been used to making model changes every six months. With cordless telephones and word processors face-lifts have been even more frequent. MITI has come down heavily against this, claiming that frequent model changes do not benefit the consumer, use up natural resources and lengthen working hours unnecessarily. There is also the problem that spares become difficult to obtain since it's obviously uneconomic to hold stocks of everything for such vast ranges of models. Mind you, things can be even worse in other Japanese markets. Back in 1981, during a battle between Honda and Yamaha over market share, Honda released 113 new models over an eighteen-month period and changed its entire range twice. If that sort of thing is going on throughout Japanese industry, it puts their R and D spending in something of a new light, with a decided question mark as to whether it's all worthwhile. Consumer electronics industry leaders seem to be in agreement with MITI's recommendations however, which include insistence that a new model remains unaltered for at least a year after its launch. Matsushita's vice president Tsuzo Murasa has pointed out that effort should go into added value rather than frequent model changes.

The reduced profitability has come quite quickly and could be a phase that will soon pass. It seems however that Japanese manufacturers are not too hopeful of this in the absence of truly new offerings. We have reported on several initiatives, in the form of multimedia products, in these pages recently. Accouncements continue. Matsushita has been holding talks with American Telephone and Telegraph with a view to setting up a joint venture to develop "pen-based portable computer systems", while Sharp has asked Intel to develop flash memory devices that could be used instead of magnetic storage in consumer and computer products. But such initiatives won't bear fruit overnight. Meanwhile the industry is stuck with difficult markets and declining profits.

COMPETITION

The winners of the two preset tuned f.m./m.w./l.w. radios in last month's competition were Alan Holden of Winford, Cheshire and C.H. Miller of Newport, Gwent. Our congratulations to them. For those interested in the questions that were asked, fifth harmonic tuning flattens the top of the line flyback pulse and thus improves the e.h.t. regulation; the chroma delay that has to be compensated for in the luminance channel is caused by the narrow chroma channel bandwidth – it's a basic factor in electronics that signals pass more quickly through wideband circuits; finally a short line sync time-constant is required with off-tape signals to cater for short-term jitter.

The Images of the Future Conference

George Cole

On February 4th the trade journal *Electrical and Radio Trading* and the Television and Radio Industries Club co-hosted the Images of the Future Conference. This year the conference was awash with new audio and video formats. Previous articles in this magazine have outlined the basic features of these new systems, many of which will be in the shops by the end of the year. A notable absence was the Sony Mini Disc format, a record/playback system that uses miniature compact discs.

Commodore had its CDTV system on show. It's a multimedia format that stores sound, pictures and text on a compact disc. The format was launched in the spring of 1991, but sales in the consumer market have been disappointing to date. Commodore has decided to rename the system Amiga CDTV and plans to launch, at around £300, a CD-ROM drive that can be connected to the company's best-selling Amiga 500 computer. There are some half a million Amiga 500s in the UK, and Commodore thinks that better progress will be made by concentrating on the computer market. The CD-ROM drive is expected to encourage software companies to develop discs for Amiga CDTV.

Gaston Bastiaens talked about the rival Philips CD-I (compact disc interactive) format, which was launched in the USA last autumn with machines selling for around £450. The system's Japanese launch will be this spring, with the European launch in the summer. Mr. Bastiaens revealed that Philips plans to launch a portable CD-I player later this year but couldn't confirm that the first CD-I players to be sold in Europe will have full-motion video capability. CD-I was undoubtedly one of the stars of the show: dealers who saw and used the system were very enthusiastic about it. They also seemed to like the Kodak-Philips Photo CD system, which allows the user to store up to a hundred photographs on a compact disc and display them on a TV set's screen. Photo CD will also offer sound, text and recording capability. Priced at around £400, the first Photo CD players should be available this summer. Photo CD discs can also be played on a CD-I deck.

Canon was demonstrating its ION still video camera. Still video has not been a success in the consumer market, so Canon is aiming to appeal to professional users and the educational market. Image data bases and desk-top publishing are two intended applications.

Philips' senior product manager Gerry Wirtz talked about the company's digital compact cassette (DCC) format, a high-quality digital audio tape system. DCC has the bonus of being backwards compatible with existing analogue compact cassettes. Mr. Wirtz produced some interesting statistics about the compact cassette. Around 2·5 billion cassettes and 180 million players are sold each year, excluding China, Eastern Europe and the Third World. About a billion cassette players are in use around the world, with each household owning an average of three cassettes. This puts the audio compact cassette in the same popularity league as the light bulb! But sales are declining, which is why Philips thinks that the time is right to introduce the new tape format. DCC will be launched in September, the first deck, provisionally called Model DCC900, costing around £350-400. The deck is smart, with a centre loading drawer and a display panel that gives you the name and number of the track.

The afternoon session was devoted to TV developments. It began with a talk by Jean Majo Cruzate, a special adviser to the EC commission, who admitted that the original 1986 EC directive on MAC and satellite broadcasting was flawed. The directive related only to high-powered DBS satellites, not medium-powered satellites like Astra. As a result, most Astra channels use PAL. As Mr. Cruzate explained, when the directive was drawn up no one expected medium-powered satellites to be used for direct-to-home transmissions.

The new directive was agreed by the twelve Council of Ministers in December 1991 and has a second reading in March. It states that any new service starting from 1995 must use D2-MAC, though dual PAL/MAC transmissions are permitted. The directive also leaves the door open for digital TV systems. Linked to the directive there's a memorandum of understanding which is designed to help launch a 16:9 D2-MAC service. Several hundred million ECUs will be made available to broadcasters, programme makers, hardware companies and other interested parties. The idea of this is to break the no hardware/no software block. Mr. Cruzate added that around twenty hours of HD-MAC broadcasts were made during the Albertville Olympics for showing at fifty reception sites around Europe. This is expected to rise to 1,000 sites during the Barcelona Olympics.

BSkyB's public affairs director Roy Gallagher drew attention to the fact that thirteen per cent of the UK's population now receives BSkyB and that there are over a million subscribers to the film channels. He predicted that around 40-50 per cent of UK households will have a satellite TV dish or be connected to a cable system by the year 2000. He added that BSkyB sees D2-MAC as a possible system for widescreen TV. Earlier Astra's marketing managing director Jonathan Hart had dealt with possible interference problems between Astra 1B and Eutelsat II F3: he stated that those with properly installed 60cm or larger dishes shouldn't experience interference.

Widescreen TV

Nokia's marketing and sales vice president Michael Schmohl started on a controversial note by showing slides of press cuttings that described the EC's policies on MAC as a shambles. He suggested that companies should forget about D2-MAC and jump in now with 16:9 PAL sets as Nokia has done. He also claimed that 1,250-line double-scan pictures, as used by the Thomson widescreen set, actually lowered the picture resolution. Not surprisingly, this was denied by Ferguson and the next speaker, the BBC's assistant to the director of engineering Charles Sandbank, pointed out that the use of digital signal processing, i.e. interpolation, would improve the quality of double-scan pictures.

Mr. Sandbank talked about the PAL Plus project, which is part of the EC's Eureka programme whose members include broadcasting organisations such as ZDF, ORF and the BBC, and hardware companies like Nokia, Philips and Grundig. He began by stressing that PAL Plus is not a device to sabotage MAC. It's designed to improve the picture quality with terrestrial transmissions by offering widescreen pictures, reducing cross-colour and cross-

luminance, increasing the luminance bandwidth and adding digital audio sound (though the UK already uses Nicam).

Mr. Sandbank explained that a 16:9 format reduces the picture content with a 4:3 set by 25 per cent as black bands occupy the top and bottom of the screen. A system called pan and scan can be used: this scans the central part of the picture, but Mr. Sandbank pointed out that this "shoot and protect" method puts all the action in the middle of the picture and wastes the potential of the 16:9 format. In the letterbox format a 4:3 receiver displays 432 visible lines while a 16:9 set detects a coded signal and expands the picture to 575 active lines. Mr. Sandbank said that any widescreen system would be only partly compatible with existing sets, in just the same way that the PAL system is with monochrome sets. He demonstrated widescreen pictures on a Nokia TV set and said that the 16:9 perspective is more like the way in which we view things in real life. Mr. Sandbank finished by saying that concern about the effects of 16:9 pictures on standard sets had forced the group to consider a half-way house with a 14:9 aspect ratio and 504 active lines. This would introduce the public to widescreen TV gently. He predicted that PAL Plus and HD-MAC broadcasting would start in 1995 and that digital TV systems wouldn't appear before the year 2000.

During the question and answer session someone asked if dealers and the public would get confused by all the different approaches to widescreen TV. To recap, these are (1) Nokia's PAL 625-line/50Hz 16:9 sets, (2) the Thomson/Ferguson 1,250-line/50Hz PAL 16:9 sets, (3) the Philips 625-line/100Hz PAL 16:9 sets, (4) the prospect of D2-MAC 16:9 broadcasts, (5) the prospect of 16:9 or 14:9 PAL Plus broadcasts and (6) the prospect of HD-MAC 16:9 broadcasts. Not surprisingly no one seemed to be too sure about this, though it seems that dealers and TV service engineers can forget about HDTV in this century.

Finally my thanks to Bob Crabtree, *Electrical and Radio Trading's* product editor, for his help in the preparation of this article.

AC/DC High-voltage Tester

Ian Rees

As their popularity rises and many get older, microwave ovens appear for repair in ever increasing numbers. Faced with an oven whose light is on and the fan is working but nothing is heating, it would be nice to be able to check the 2kV a.c. and 4kV d.c. pulse voltages. I'm not very happy however about connecting any CMOS test equipment to circuits where more than 1kV is present, especially when it's in pulse or a.c. form. Using an old analogue 20kΩ/V meter, I made a high-voltage probe to get some indication of voltage. Unfortunately ohms are a bit lawless under these circumstances, so the best I had was an indication of high voltage: the values obtained were meaningless, especially with pulsed d.c. Was there an alternative solution to the problem?

When I was still a student I recall reading about the early method of measuring the electrostatic charge stored in a bank of Leyden jars. Apparently monks would form a circle and hold hands. The end two would touch the jar's terminals and the resulting shock would make them jump. The height of the jump was used as a measure of the charge. I can vouch for the effectiveness of this method after my multimeter's earth lead became detached without my noticing it while I was probing the 4kV pulse. I can assure you that the jump was considerable, but the involuntary jerk of my arms sent the multimeter, which was still connected to the probe, crashing from the bench to the floor. My dignity and poise in tatters, I decided that there had to be a better way.

I like the idea of having an instrument in the form of the e.h.t. testers used with TV sets, where everything is in the handle so that you can pay attention to exactly where the probe tip is and read the scale easily without diverting your eyes. The instrument described in this article was built in this form and indicates a.c. or d.c. without the need to select ranges. A small bonus, though this is not needed with microwave ovens, is its ability to indicate whether there's a positive or negative potential at the tip.

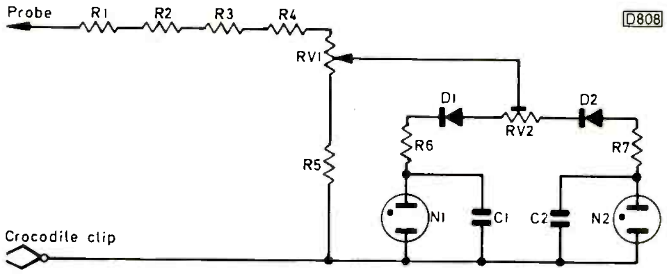

Fig. 1: Circuit of the high-voltage tester.

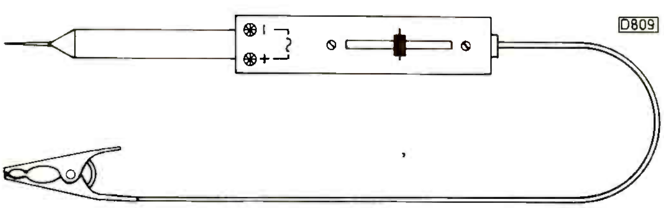

Fig. 2: Construction of the meter. To avoid arcing, it's best to connect the meter before switching the oven on:

Circuit Operation

Fig. 1 shows the simple circuit that evolved after much experimentation. R1-4 are the probe resistors, which are contained in the plastic body of a pen attached to a small box. RV1 is a 100kΩ linear slide potentiometer that's calibrated in kV. R5 ensures that the required readings fall at about the centre of RV1's slider movement.

The voltage tapped from the slider is applied to the preset potentiometer RV2 which is used to balance the striking voltages of the two neons N1 and N2. The small wire-ended neons used light at around 65V. When they just strike their light output is very low, so they are not ideal as indicators. By adding capacitors C1 and C2 across them however the circuit becomes a relaxation oscillator. As the neons approach their striking voltage, the capacitors have been charging. At the moment of strike, the capacitor is discharged by the neon. This produces a bright flash that subsides until the capacitors are recharged via the series resistors R6 and R7 and the legs of RV2. A very accurate transition can be achieved, giving a very useful, unambiguous voltage indication.

D1 and D2 rectify the a.c. and make the neons flash alternately. When a positive d.c. voltage is present at the probe tip only N1 will flash. In a microwave oven the voltage at the magnetron's cathode is negative, thus only N2 flashes.

The tester can be used in the same manner as a logic probe with digital circuits, but the slider is calibrated in kV. It draws around 1mA from the circuit being tested. Thus the probe resistors need to be rated at 1W. I have tried 0·25W resistors which seem to be o.k. if the test is brief, which it usually is.

Setting Up

The flash rate of the neons can be balanced by connecting 250V a.c. via a 47kΩ resistor to the junction of R4 and RV1. With the slider of RV2 at its centre setting, adjust RV1 until one of the neons flashes. Then adjust RV2 for an equal flash rate from both neons. Repeat the procedure a few times until you are sure that the two neons are giving an indication at the same point.

Calibration is a problem if, like me, you don't have access to an accurate high-voltage meter. I've found however that when connected to a good oven's 2kV a.c. output the tester will indicate with both neons just flashing at a rate of about one second when RV1 is at its mid-setting. Similarly N2 only will flash, indicating a −4kV pulsed d.c. voltage, at a few millimetres to one side of the same setting. Any deviation from these conditions suggests that a fault is present.

Construction and Use

Provided care is taken over the construction and use of this tester there's no reason for you to end up monk testing your microwave ovens. As Fig. 2 shows, the tester can be used single-handedly with the slider operated by your thumb.

An MPS (Maplin) "narrow box", part number FT31J, is used for the main case. Its dimensions are 124 × 29 × 29mm. To keep my fingers away from any hot parts I would have liked the slider potentiometer RV1 to have been an all-plastic affair. The one used, also bought from MPS, has a plastic shaft but a metal body. It's a dual potentiometer, but only one side is used. As a precaution I connected its metal body to the earthy crocodile clip end.

A piece of matrix board was cut and attached to the slide potentiometer. Apart from the probe resistors R1-4 all the components are mounted on this board. The probe resistors are strung up the body of the tube. This allows you to be at a respectable distance from the test point. A flying lead terminated with a strong crocodile clip completes the assembly.

As an aside, it's always worth checking the integrity of the connections to the crococile clip lead before any tests are attempted in case a fracture may have occurred, particularly at the clip end.

Finally, remember that one hand in your pocket won't work with a microwave oven because the high voltage is earthed. Take care!

Component details

R1	470kΩ, 1W	RV2	250kΩ preset
R2-4	820kΩ, 1W	C1, 2	0·047μF, 400V
R5	47kΩ, 0·25W	D1, 2	BY127
R6, 7	100kΩ, 0·25W	N1, 2	Wire-ended neons
RV1	100kΩ lin. slider		

Inside the Ferguson TX80 Chassis

J. LeJeune

Innovative and yet somehow familiar in its concept, the TX80 is the last of the old Ferguson designs to reach the market. The chassis shows some Thomson influence, but its Enfield origins are stamped plainly all over it. This is nowhere more so than in the power supply and line output section, which nostalgically recalls the Thorn 9000 series chassis with its Syclops circuit. The key element here is the use of a single transistor as both the chopper and the line output switching device.

Basically the TX80 is just another small-screen TV receiver for 90° c.r.t.s with screen sizes from ten to fifteen inches. It's no basic receiver however. Features incorporated as standard include microcomputer-based remote control, on-screen graphics with a simple menu system to make adjustment of the operating controls easy, a sleep timer and a child lock facility. There's considerable integration in the low-level stages, where a single LSI chip incorporates the vision and sound i.f. strips, the luminance and chrominance signal processing stages, sync separation and the timebase generator circuits. The designers didn't go i.c.-crazy however: where a single transistor is all that's necessary, that's what is used. Since the receiver has a live chassis there's no scart socket. In any case while the tube is adequate for TV purposes its resolution is not sufficient for use as an 80-column computer monitor.

Picture quality is nevertheless excellent. The Samsung c.r.t.s give a bright picture with ample purity reserve. Audio on the other hand comes from a very small loudspeaker and leaves a little to be desired. Even so it's distortion free and the cabinet doesn't vibrate at high volume levels. The cabinet design is attractive, especially the 10in. model, and blends in with most domestic schemes.

Fig. 1 shows in simplified block diagram form the main sections of the chassis.

The heart of the set is of course the combined chopper and line output stage – it's known as a Wessel circuit. Fig. 2 shows the arrangement in block diagram form. Things start with the oscillator, which produces a line-frequency sawtooth output whose amplitude is determined by the comparator transistor TP03. The comparator senses the h.t. voltage produced by the chopper, and sets the supply to the oscillator. As this supply increases or decreases, so the amplitude of the sawtooth output is varied – see Fig. 3. The pulse-width modulator transistor TP05 converts the sawtooth waveform into a variable mark-space ratio

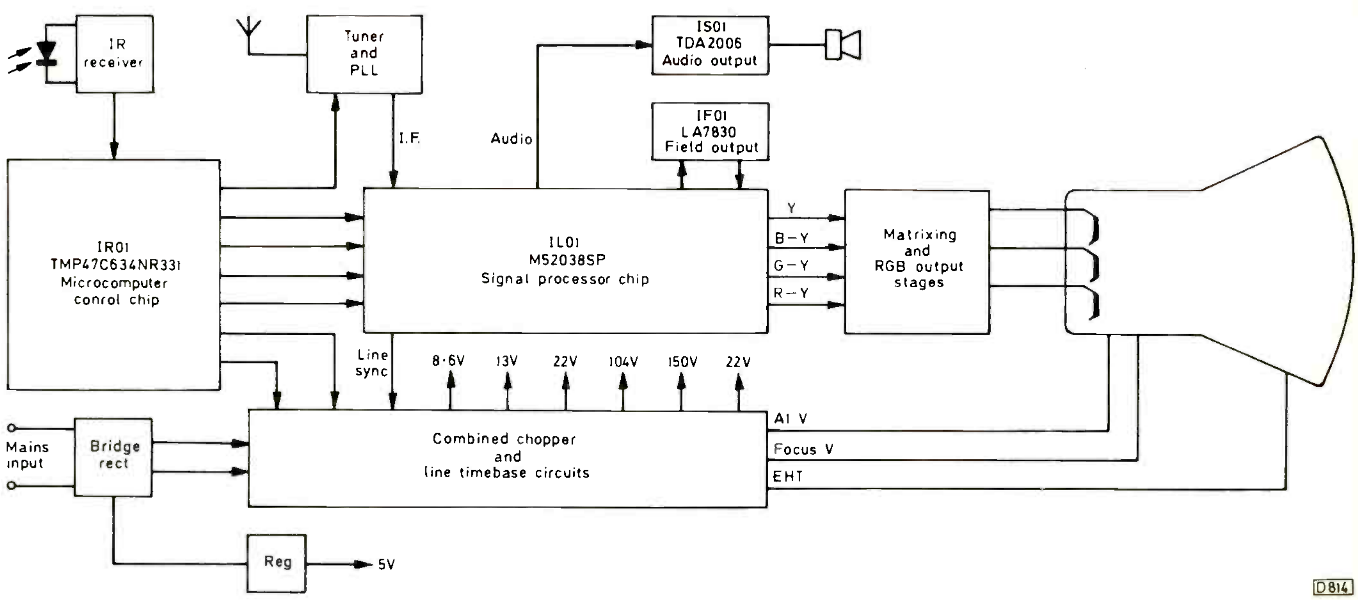

Fig. 1: The main sections of the Ferguson TX80 chassis, shown in block diagram form.

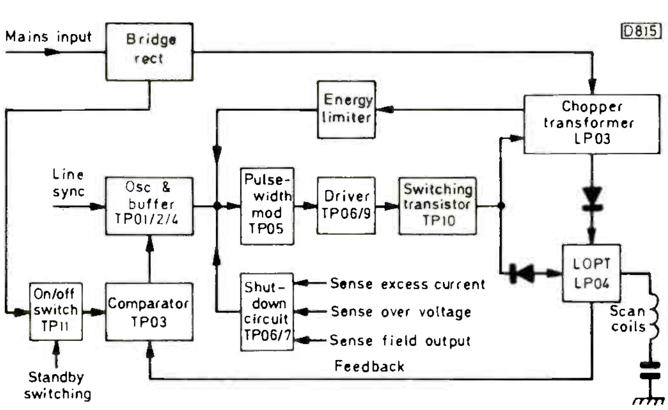

Fig. 2: Block diagram of the combined chopper power supply and line timebase arrangement.

squarewave which passes via the driver stage to the base of the switching transistor TP10. This drives two transformers, the chopper transformer LP03 (Wessel transformer) and the line output transformer LP04. In case anyone is puzzled by the idea of using a variable mark-space ratio waveform to drive the line output stage, the point to remember is that the switch-off time, which initiates the flyback, remains constant. It's the switch-on time during the forward scan that varies to take into account loading and mains input voltage variations. The initial part of the forward scan is controlled by the efficiency diode in the normal way. Comprehensive protection arrangements are built into the circuit.

We'll now take a closer look at the circuit action. Fig. 4 shows the complete circuit of the power supply/line output section of the receiver. Note that the receiver chassis is

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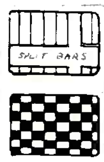

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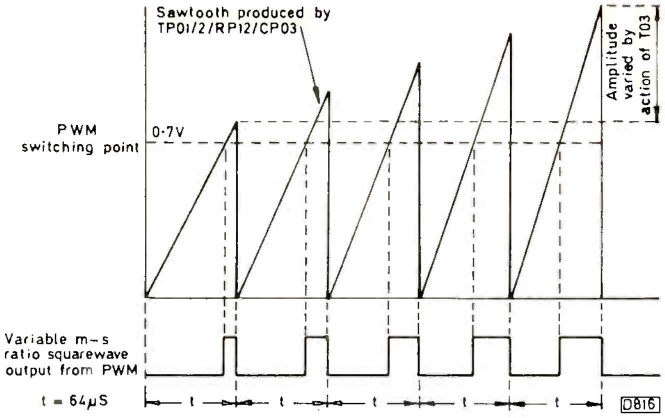

Fig. 3: Illustrating the action of the comparator, oscillator and pulse-wide modulator stages in providing a variable mark-space ratio drive waveform.

always live with respect to ground. It uses a bridge rectifier (DP26-29) to deliver three supplies, one full-wave rectified and the other two half-wave rectified. In this respect it could be said that the bridge is fully utilised. The full-wave output is smoothed by the reservoir capacitor CP31 and fed to the chopper transformer LP03 at approximately 360V d.c. One half-wave rectified supply is fed to the switch transistor TP11 whose collector feeds the comparator, oscillator, pulse-width modulator and driver stages. The other half-wave rectified supply is smoothed by RP39/CP41 and fed to a 5V regulator which in turn provides the supply to the microcomputer control chip IR01. The latter produces the on or standby command at pin 20. This is fed to TP12 which in turn controls TP11: in the standby condition TP11 is off and there is thus no supply to the oscillator etc., shutting down the Wessel system.

The main switching transistor TP10 is driven by a bootstrapped low-voltage driver stage (TP06/9) which is d.c. coupled to the pulse-width modulator transistor TP05. The input to TP05 is a variable-amplitude sawtooth which is produced by a relaxation oscillator whose timing components are RP12 and CP03. The two transistors in this circuit, TP01/2, act in a thyristor-like manner, switching off when there's insufficient current to maintain them in saturation. CP03 charges via RP12 from the voltage at the collector of the comparator transistor TP03. As CP03 charges, the emitter voltage of the pnp transistor TP02 will increase until the point is reached where it's 0·7V above the fixed base voltage set by RP26/RP05. At this point TP02 switches on and passes current to the base of TP01 which thus also switches on. The two transistors saturate heavily, rapidly discharging CP03 via RP65. Once CP03 has been discharged, TP02 and TP01 switch off and CP03 begins to charge again. The sawtooth waveform produced in this way is fed via the emitter-follower buffer transistor TP04 to the base of the pulse-width modulator transistor TP05. CP48 blocks the d.c. voltage at TP04's emitter and DP37 acts as a d.c. restorer, clamping the negative-going peak of the sawtooth waveform to chassis. TP05 conducts when the slope of the sawtooth waveform exceeds 0·7V.

The comparator transistor TP03 receives its collector supply from TP11, via RP01, RP02 and its load resistor RP03. CP01 smooths the supply and DP02 stabilises it at 18V. TP03's base voltage is obtained from the potential divider network RP08, RP61, PP01, RP07 which is connected across the 104V h.t. line: this is the main supply produced by the line output transformer, thus the conditions in the line output stage are sensed. TP03's emitter is held at 5·4V by DP46 and DP06. This combination of a zener diode and an ordinary signal diode gives a near-zero temperature coefficient.

Variations in the 104V h.t. supply are thus sensed by TP03 and inverted. A rise in the h.t. voltage will result in a fall in TP03's collector voltage and a corresponding fall in the amplitude of the sawtooth waveform fed to TP05. The action is illustrated in Fig. 3. When the h.t. voltage rises, the width of the drive pulses used to switch the chopper transistor TP10 on and off decreases. Thus TP10 remains on for a shorter period of time and the h.t. voltage is reduced to the correct figure. The action works in reverse should the h.t. voltage fall.

TP11 is used for standby switching. It has half-wave rectified mains voltage at its emitter at all times. Transistor TP12 inverts the control signal from the microcomputer chip, its base voltage going high to turn on the supplies and bring the set out of standby. When TP11 is switched on CP01 and CP13 charge via RP01 and RP17 respectively. TP03's collector and emitter voltages rise gently, so that the chopper comes to life gradually rather an abruptly. Once the chopper is running DP12 adds to the charge held by CP15. The feed to TP03's emitter circuit via RP27 provides a stable zener current to improve the regulation.

The driver stage is interesting as it employs a bootstrap circuit to ensure that the level of drive generated is adequate. The first transistor TP06 is an inverting amplifier: when it's on, the following transistor TP09 is off. In this condition DP08's cathode is at virtually chassis potential and the bootstrap capacitor CP07 will charge via DP36 from the 8·6V rail. During this time the switching transistor TP10 is also off. When the squarewave drive turns TP06 off, TP09's base voltage rises and it switches on. The negative side of CP07 is now connected to the 8·6V line via RP23 and TP09. Since CP07 is already charged to about 7V, its positive side is now at about 15V with respect to chassis. DP36 is thus cut off and the 15V appears at TP09's base via RP29. This ensures that TP09 is saturated throughout the time that TP10 is required to be conductive. When TP09's emitter voltage rises, CP08 charges via TP10's base, switching TP10 on. Diodes DP30, DP15 and DP16 conduct and limit the charge across CP08 to 2·1V. RP21 and LP02 in parallel provide some base drive current waveform shaping. When TP06 is switched on again to initiate the flyback, CP08's positive side is connected to chassis via DP08 and TP06 and TP10's base is driven negative.

The receiver's principal supply rail, from which the line output stage is operated, is the 104V h.t. line. When TP10 is switched off, the line output transformer is tuned by CP18 to produce the flyback. At the end of the flyback the efficiency diode DP13 begins to conduct and the first half (approximately) of the forward line scan is produced. TP10 can be turned on during this period, but it will have no effect on the line scan because of the isolating action of diodes DP10 and DP48. Thus TP10 doesn't drive the line output side of the circuit until DP13 stops conducting. At this point TP10 must be conducting in order to take over the supply of current to the line scan coils. The isolating action of DP10/48 enables TP10 to drive the chopper transformer before it also starts to drive the line output transformer. When DP13 switches off, the voltage at pin 2 of LP04 rises and DP10/48 switch on.

LP03 generates two secondary voltages during the flyback period. DP21 produces 22V across CP24 for the audio output chip while DP11 rectifies the output at pin 1. The cunning part of this circuit is that DP11 also serves as a boost diode, feeding pin 6 on the line output transformer

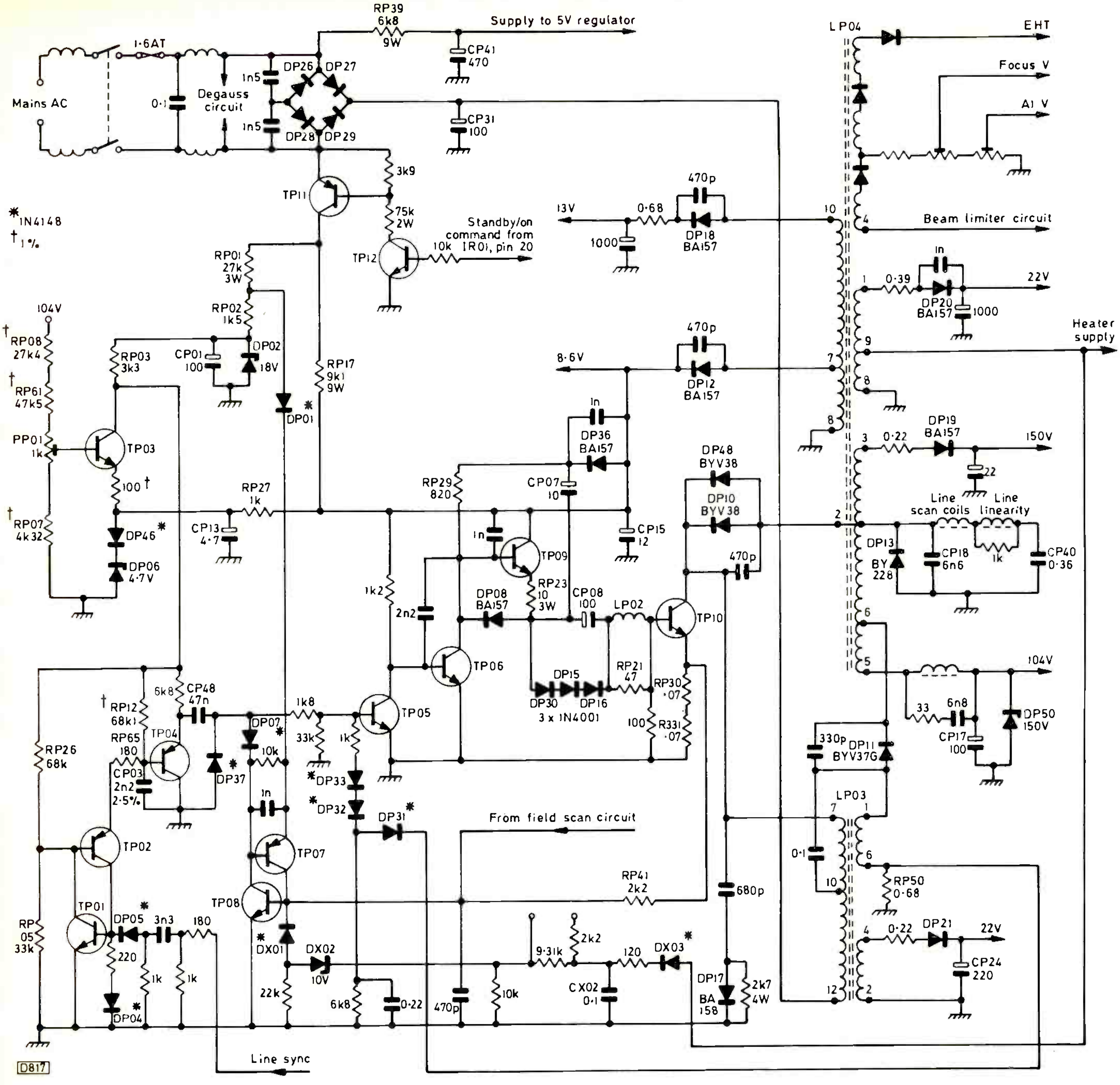

Fig. 4: Complete circuit of the power supply and line timebase sections of the chassis.

LP04. Autotransformer action between pins 6 and 5 of LP04 produces the 104V supply across CP17. No rectification is required at pin 5 as CP17 is the boost reservoir capacitor.

LP04 also produces various other supplies – the tube's heater supply, its e.h.t., focus and first anode supplies, 13V and 8·6V supplies, 22V for the field output stage and, from another overwinding on the primary, 150V for the RGB output transistors.

There are four protection systems in this circuitry. One guards against excessive voltages, which could cause the c.r.t. to produce X-rays; another guards against excessive current in TP10; a third (the energy limiter) prevents excessive current in the line output stage; the fourth protects the field scan coils in the event of the field scan coupling capacitor going short-circuit.

The shut-down circuit uses transistors TP08 and TP07 in a latching circuit that's identical in configuration to the oscillator TP01/2. Three inputs at the base of TP08 can trip the power supply. The first is via RP41 from the emitter of TP10. If TP10 passes excessive current, the voltage developed across RP30/31 will be sufficient to produce the trip action. A second input comes from the field scan current circuit. If the field scan coupling capacitor goes short-circuit excessive power will be dissipated in the scan coils. The trip action prevents damage here. The third input comes via DX01, DX02 etc., the source being the heater winding on the line output transformer. This circuit looks for excessive voltage conditions in the transformer. DX03 rectifies the heater supply and if the voltage developed across CX02 rises sufficiently zener diode DX02 switches on to initiate the trip action.

If TP08's base voltage rises because of an increase in any of these inputs, TP08 and TP07 will switch on and latch up. This action discharges CP01 via DP01. Thus the oscillator is stopped and the drive to TP10 ceases. When CP01 has been discharged, TP08 and TP07 will switch off. CP01 can then charge again, giving a soft-start action. If the problem was a transient one and has cleared, the reciever will resume normal operation. If the fault is a permanent one

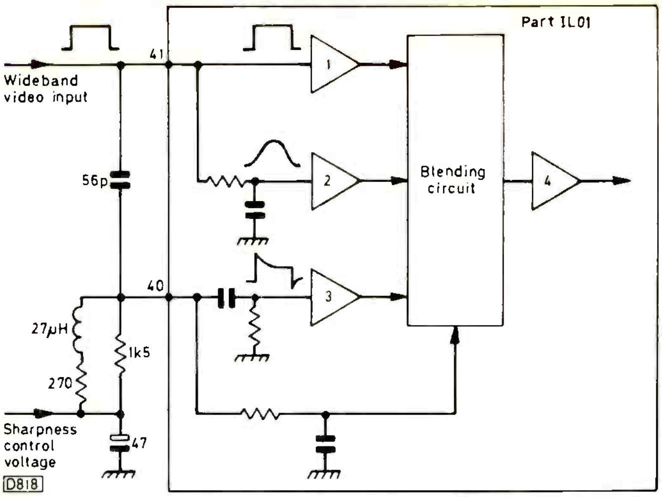

Fig. 5: Block diagram showing the operation of the sharpness control circuit.

however the power supply will trip continuously.

The fourth protection system, the energy limiter, monitors the voltage across RP50, which is connected between the earthy end of the winding on LP03 that supplies the line output stage and chassis. A rise in the current flowing in this winding, due to high current demand in the line output stage, will produce an increasingly negative voltage at pin 6. This negative bias is fed to the base of the pulse-width modulator transistor TP05, increasing its switch-on threshold. As a result it produces shorter drive pulses, reducing the power output.

Chopper power supplies operate by storing energy in the transformer as flux, releasing it during the off period of the switching device. It follows that the transformer's power output depends on the energy fed into it on the primary side. The input voltage is set by the peak value of the mains supply. The current that flows depends on the switching device's on time and the effect of back-e.m.f. in the transformer. Close regulation is achieved by adjusting the switching device's on period. The regulation loop in the TX80 starts with the 104V developed across CP17 and takes in the comparator, oscillator, pulse-width modulator, driver and output switching (TP10) stages.

Signal Çircuits

We'll next take a brief look at the signal stages, most of which are incorporated in the M52038SP 52-pin processing chip IL01. This chip also incorporates the sync circuitry and produces field and line drive outputs. The latter is used to synchronise the oscillator in the power supply.

A Thomson tuner, type MTP-I-2021 for the u.h.f. bands only, is used. It features a dual-gate MOSFET r.f. amplifier stage and has excellent noise and gain figures. Tuning is effected by an integral phase-locked loop which is controlled by data and clock inputs from the microcomputer chip IR01 (42 pins this time).

Volume, brightness, contrast, colour and sharpness control are all carried out within IL01. An interesting item in this section of the receiver is VV01 which is in the circuit between the demodulated video output from IL01 and its luminance and chroma inputs. VV01 incorprates luminance and chroma separation filters, a chroma carrier trap and the luminance delay line.

Sharpness Control

The sharpness control system is another unusual feature, see Fig. 5. Full bandwidth video (luminance) is fed in at pin 41 of IL01 while differentiated video (video with a high degree of overshoot) is fed in at pin 40, which also receives the sharpness control voltage. The full bandwidth luminance signal passes via amplifier 1 to the blending circuit. An h.f. reduced signal is fed to amplifier 2 while the h.f.-emphasised (differentiated) signal is fed to amplifier 3. The control voltage acts on the blending circuit which combines the outputs from the three amplifiers in various proportions, from insufficient to excessive h.f. content at the extremities of the range with a flat response at somewhere about the centre of the range. The control works very well and can be used to good effect when playing video recordings or with satellite TV transmissions that are not all they might be. The sharpness adjusted signal then passes to the contrast control part of the chip.

Colour Decoding

The luminance output from IL01 is passed via a buffer transistor to the the c.r.t. base panel which contains the RGB matrixing and output circuits. Chroma signal decoding is carried out in the conventional way within IL01 which provides B − Y, G − Y and R − Y outputs.

Sync System

IL01 has a separate video input pin for the sync separator section. There's an external field sync pulse integrating network. The line sync pulses are fed internally to a phase-locked loop that controls a 500kHz master crystal oscillator. A five-stage binary divider (divide by 32) gives 15·625kHz. This divided down output is fed to the phase detector whose other input consists of line flyback pulses which are obtained from the line output transformer's heater winding (the pulses from this source are also used for several other purposes in the receiver).

The Field Timebase

The integrated field sync pulses are fed back into IL01 at pin 45. They are then shaped to produce trigger pulses that are used to reset the vertical counter circuit. This divides down the line frequency pulses to 50Hz. Each trigger pulse resets the counter and at the same time resets the field ramp waveform to zero. This ramp voltage is produced across an external capacitor by a constant-current source within IL01. The charging rate is modified by feedback from the LA7830 field output chip IF01 to provide fixed linearity correction. There's also a.c. feedback to provide height control and d.c. feedback to stabilise the d.c.centre point of the output from IF01.

The field output chip is operated in the conventional manner, with bootstrapping to obtain a peak-to-peak output of nearly twice the supply voltage. This ensures a rapid flyback during the field blanking period.

Audio Output Stage

The TDA2006 audio output chip provides surprisingly good results via the small, forward-facing 16Ω 2W elliptical speaker. A diode in the d.c. feedback circuit prevents excessive distortion on large output voltage excursions.

Microcomputer Control

In common with many other advanced small-screen receivers the TX80 uses a microcomputer chip, IR01, to oversee the set's operation and provide a menu-driven remote control system that's easy to follow. The operations performed by this chip can be classed in four groups as follows: (1) it provides pulse-width modulated user control outputs that are integrated by external *RC* filters to produce d.c. voltages for the signal processing chip IL01; (2) it carries out the usual key scanning to detect front panel input commands; (3) it accepts the IR remote control input, provides an I2C bus that's used principally to control the tuner, and carries out sync kill, mute, hold and reset functions; (4) it contains the system and character-generator clocks and provides graphics sync and RGB outputs.

Some Pin Functions

As previously mentioned, pin 20 provides the standby signal to toggle the power supply on and off. As there's no front panel mains switch in the initial models, this is the principal method of switching the receiver on and off. 3V at pin 20 = on, 0V = standby.

Pin 37 provides the sync killer output. This is used to defeat the sync separator circuit in IL01 during tuning operations and at switch on, to prevent spurious signals from triggering the timebases incorrectly and causing possible damage.

The mute circuit input at pin 36 is used during sweep or search tuning to tell IR01 when a valid video signal has been received. Sweep tuning is halted when this occurs.

The hold pin 34 is held high momentarily at switch off to preserve the analogue control settings in memory. This ensures that the receiver powers up next time with the previously-used settings. The reset pin 33 is held low for a short period at receiver power up to ensure that no spurious signals generated by the rising currents and voltages in the set are taken as valid commands by IR01.

The components connected to pins 28 and 29 tune the on-screen graphics read-out oscillator (pixel generator). Pin 27 takes in field sync for graphics while line sync is fed in at pin 26 (again from the heater circuit). The graphics outputs appear at pins 22-25, the latter being the blanking output that creates the black-box area in which the symbols or characters are displayed. The graphics blanking is mixed with line blanking from the heater supply then amplified, sharpened, clipped and sent to pin 22 of IL01.

Battery Converter

The 10in. model is ideal in size and performance for those on the move in caravans, coaches and lorries. It therefore has an integral battery converter to enable the receiver to be used away from mains supplies. The converter is set to operate with a 12V d.c. input and cannot be altered to work with any other voltage. The input can vary over the range 11·8 to 14·8V. It's a fairly basic d.c.-to-d.c. circuit, self-oscillating and running at about 17kHz.

In Conclusion

Although the TX80 is an intricate little receiver, packed with features, it has proved to be extremely reliable in service, not one being seen in the workshop since it started to be sold. It has but one minus point so far as the public is concerned, the rear-mounted mains switch on Models A10R and A14R. On the latest model to use the chassis, the A36R, the on-off switch is once again at the front.

Teletopics

EURO VIDEOPHONE STANDARD?

GEC Marconi plans, by licensing its low-cost videotelephone technology to a number of international companies, including BT and Deutsche Bundespost Telekom, to establish a European standard for domestic videophones that work with existing telephone networks. Amstrad, which already has a licence, has previously announced that it will be launching a videophone that's expected to sell for under £500 later this year. Marconi has been collaborating with BT, which achieved a world lead in video compression technology during the Eighties. If the standard is accepted it will be the first international one for analogue system videophones, along the lines of the H261 standard for digital telephone systems. Both the video and the audio signals are compressed, the video to a 14·4Kbit/sec data stream and the speech to a 5·6Kbit/sec stream. The voice compression system was originally developed for military radio use. The camera section uses a Marconi CCD array that was originally developed for night sights. Seiko Epson is supplying the 4in. liquid-crystal display.

NOKIA BUYS FINLUX

Nokia, whose TV brands include ITT, Salora, Luxor, Schaub Lorenz and Oceanic, has bought fellow Finnish TV manufacturer Finlux from its parent company Metra for approximately £26m. Completion date for the takeover was March 15th. Nokia Consumer Electronics traded at a loss in 1991 and was only slightly profitable in 1990 while for the past three years Finlux has been making only marginal profits. The combined company will have a strong position in the Scandinavian and German markets in particular. There's to be some reorganisation, with main TV manufacture concentrated at Finlux's Turku plant and Nokia's German plant at Bochum, monitor manufacture at Salo, small-screen TV receiver production at the company's Portuguese plant while the main production centre for satellite TV equipment will be at Motala in Sweden. The company's French TV manufacturing plant is to be closed down.

RUMBELOWS TO GO RENTAL

As mentioned briefly on our leader page last month Thorn EMI has decided to switch its loss-making retail chain Rumbelows to a largely rental operation. It will continue to trade as Rumbelows, offering customers a choice of outright payment, rental or various arrangements in between, but will be run in harness with the company's rental chains. This is expected to produce considerable savings on the servicing, distribution and purchasing sides. Job losses of around 800 out of a total of 4,000 are likely. Rumbelows 450 high-street outlets and 41 out-of-town stores have about six per cent of the electrical retail market. The number of high-street shops is expected to be reduced to between 250 and 400 over the next two years.

SATELLITE TV

According to the *Financial Times* satellite TV monitor the number of dish installations in January declined substantially, to some 70,000. December had been a particularly good month however. This could set BSkyB back a bit – it was expected that the venture would break even at the operational level (before interest charges) this month. News Corporation, which owns 50 per cent of BSkyB, hopes that it will show a profit by the end of the year.

BSkyB has issued a warning about buying the old BSB receiving systems and Squarials. It seems that Sky is determined to shut down the Marco Polo transmissions at the end of the year. While some retailers are clearing stocks of BSB equipment for as little as £12 others are thought to be charging unsuspecting customers anything up to £150.

Swift Television Publications (17 Pittsfield, Cricklade, Swindon, Wilts SN6 6AN – telephone/fax 0793 750 620) has introduced the Satmaster computer program, by D.J. Stephenson, as an aid for satellite TV installations. It's claimed to be suitable for both professionals and enthusiasts and requires the use of an IBM PC compatible with MS DOS 3·0 or higher. The program caters for just about every need from the installation of motorised systems to a printout of a full link-budget analysis for any satellite at any location anywhere in the world.

SERVICING "LEAD BODY"

A "lead body" for the domestic appliance and consumer electronics servicing industries has been set up to establish competence standards that will form the basis of National Vocational Qualifications (NVQs). The membership of the Electrical and Electronics Servicing Lead Body represents a wide cross-section of the servicing industry ranging from multinational manufacturers to small independent retailers/service agents. It includes all the major trade associations together with the relevant trade union. The main work of the body, writing the standards and producing the NVQs, is well under way. This will be followed by in-depth consultation with the industry as a whole. An ambitious target has been set – to have the first NVQs approved and ready for submission to the National Council for Vocational Qualifications for accreditation this autumn. Administration is being undertaken by the Electronics Examination Board, which has been involved with competence testing for the industry for over fifty years. Further details can be obtained from the EEB at Savoy Hill House, Savoy Hill, London WC2R 0BS (071 836 3357).

DEVELOPMENTS AT SHARP

Sharp and Apple Computer have been discussing a technology exchange that would enable Sharp to manufacture for the consumer electronics market multimedia products using Apple's computer technology such as Quicktime and its Macintosh user interface. As mentioned in the leader last month, Sharp has launched in Japan an HDTV receiver with a retail price of approximately £4,475, about a quarter of that of previous Japanese HDTV models. A survey carried out by Sharp indicates that up to sixteen per cent of Japanese households might be prepared to buy an HDTV receiver at this price.

VIDEO NEWS

Ferguson has announced four VCRs with built-in Video Plus programming systems. Model FV61LV is a budget machine at around £330; Model FV62LV at £360 is a four-head version; Model FV67HV at £430 includes a Nicam decoder and hi-fi stereo sound; while top of the range Model FV68TX at £500 also has Startext and jog/shuttle dial.

Akai has announced that the Video Plus system is compatible with its current range of VCRs but not with those which are at least four generations old. Amongst the new products that Grundig will be launching at this year's Brown Goods Shows is a top of the range VCR, Model GV280, that incorporates a timebase corrector.

Philips has established a CD-I label with the US company Fathom Pictures for the issue of CD-I and Photo CD software. Leisure, sport and interactive entertainment titles will be included. The third international Multimedia and Conference on CD-I will be held in London on April 28-29th.

Commodore claims that the introduction of an Amiga CD-ROM drive will create a user base of 100,000 for its CDTV system, now named Amiga CDTV, in a short period of time. It has also announced that major software houses are backing the system with dual-format releases for the Amiga computer and CDTV systems.

PHOTO CD NEWS

Agfa-Gevaert is to license Photo CD technology from Kodak. It will use Photo CD as an additional source input for its Digital Print System, which enables photofinishers to produce prints from slides on regular colour negative paper. These prints are known as DigiPrints because the quality is improved by digital image enhancement systems. The system will make it easier to produce high-quality hard copy prints of Photo CD images.

Kodak demonstrated Photo CD imaging workstations at the Photo Marketing Association trade show in Las Vegas last February. The workstations will enable photofinishers to transfer 35mm film images on to compact discs. Kodak also demonstrated two Photo CD players. Model PCD870 will include a favourite picture selection system, a two times tele facility and panning effects. The PCD270 is a more basic version. The company also plans to launch a Photo CD jukebox that will store thousands of images. This will be aimed at professional users such as medical and photographic libraries.

DOLBY SURROUND SOUND AVAILABILITY

Toshiba point out that for the first time in the UK every film appearing in the annual top fifty video rental chart featured the enhanced sound performance provided by a Dolby Surround sound track. The company expects the demand for equipment featuring Dolby Surround sound to increase significantly since almost 4,000 films will have it by the end of 1992 and nearly every video software company in the UK will be branding its video sleeves with the Dolby Surround logo. The Toshiba CTV range currently includes three models with Nicam digital stereo and Dolby Surround sound. A hi-fi stereo VCR is required to obtain Dolby Surround sound when playing prerecorded cassettes.

NEW PHILIPS TV CHIPS

Details of several interesting new TV chips have been released by Philips Semiconductors. There are three teletext decoder chips that combine the video processing and the teletext decoding functions. The SAA5244P/A has an on-chip page memory, making it a genuine single-chip teletext decoder. The SAA5246P/E is for use with an external SRAM to provide a four- or eight-page memory. The SAA5247P/B has an on-chip memory that stores a single page, extension arrangements for Fastext and in addition a background memory controller for four external DRAMs that can be rapidly scanned on each page request, giving near-instantaneous (200mS maximum) access to up to 512 pages. A new Nicam decoder chip, type SAA7282, replaces several chips in previous Philips designs, providing a two-chip decoder in conjunction with the established TDA8732 DQPSK demodulator chip.

UPCONVERTER

TW Electronics, Kennet Building, Woolton Hill, Newbury, Berks RG15 9UJ (0635 253 706, fax 0635 254 038) has introduced at only £15 a v.h.f./u.h.f. upconverter that enables a standard u.h.f. UK TV set to tune across the v.h.f. bands. Useful for DXing and for travellers to Continental Europe and Ireland. Installation is simple and the unit can be used with potentiometer or sweep-tuned TV sets.

LATEST PUBLICATIONS

Mauritron Technical Services, 8 Cherry Tree Road, Chinnor, Oxfordshire OX9 4QY (0844 51 694, fax 0844 52 554) has published a revised and updated edition of its Video Recorder and Camcorder Equivalents listing. Price is £5, order code MTP143. It's a very helpful item to have. Mauritron has a great deal more on offer: a catalogue is available under order code NC7.

ElectroValue's 1992 catalogue is now available from the company at 28 St. Jude's Road, Englefield Green, Egham, Surrey TW20 0HB (0784 433 603, fax 0784 435 216). It lists a wide range of components, accessories, test equipment etc.

Two new British Standards have been published. BS7429:1991 at £38 is a specification for television receivers and monitors for use in education and training. BS7536:1991 at £59 is a specification for the domestic digital bus (D2B) system. Prices are considerably less for members of the BSI. Copies can be obtained from BSI Sales, Linford Wood, Milton Keynes MK14 6LE (0908 220 022, fax 0908 320 856).

Butterworth-Heinemann Ltd., Linacre House, Jordan Hill, Oxford OX2 8DP has published at £10.95 a second edition of *Newnes Audio and Hi-Fi Engineer's Pocket Book* by Vivian Capel. It contains a great deal of reference data and general technical information on audio technology.

NOW AVAILABLE

Cirkit now stock the recently introduced Toko prewound balun transformers. There are three basic configurations, double balanced mixer, distributor and directional coupler, all wound with bifilar wire. The core material is chosen for wideband applications, typically 6-600MHz, with individual examples up to 1·3GHz. Each type is available in a range of turns ratios. For details apply to Cirkit Distribution Ltd., Park Lane, Broxbourne, Herts EN10 7NQ (0992 444 111 for sales, 0992 441 306 for enquiries, fax 0992 464 457).

The Unaohm EP737 panoramic field strength meter, covering the v.h.f./u.h.f., satellite and cable TV bands plus f.m. radio, is available from Satellite Solutions, Unit 35, Quarry Park Close, Moulton Park, Northampton NN3 1QB (0604 670 900).

VCR Clinic

Reports from Philip Blundell, AMIEIE, Eugene Trundle, Ian Bowden, John Edwards and R.J. Avis, AMIEIE

Philips VR6462

There were E-E signals but when play or the test pattern was selected there was no output from the modulator. The +12b supply was disappearing – check it at R3160. By disconnecting PCBs I was able to establish that the fault was on the P302 signals panel where C2329 (220μF, 16V) was short-circuit. **P.B.**

Philips VR6180

This machine had a deck problem: when a cassette was inserted the deck couldn't find the stop position. The cassette would go in, the deck would start to lace up, then it would eject the cassette and switch off. Inspection showed that the cassette-down switch COD3 was working correctly. Deck state is also sensed by switch COD2 however – the one at the back by the threading motor. This one was sticking in the closed position. So it was just a question of fitting a new micro switch. **P.B.**

Philips VR6468

There was a buzzing noise on the sound while a hot smell came from the inside. The hot smell was coming from Tr7108, which is one of the drum motor drive transistors. A check on this transistor's drive waveform (HMC2) showed that there was an oscillation on it. Replacing Tr7108 and its driver transistor Tr7107 made no difference, in fact the oscillation appeared to be coming from the P8051-C21D4 chip. A replacement cured the problem. **P.B.**

Grundig VS510

There was no teletext – when this mode was selected the page number appeared but there was no clock while the no teletext active message was present at the bottom of the screen. Tests around the SAA5231 chip on the DOS/TEXT board showed that there was no video input at pin 27. The BC848 transistor CT1655 was open-circuit. **P.B.**

Philips VR6490

This machine kept stopping in play. The reel rotation signal was intermittent, though the reel was turning all right. On investigation we found that the ribbon cable to deck plug P1504 wasn't clamped into the connector. A press on the locking bar was all that was required. **P.B.**

Philips VR6460

This machine was dead – no clock, no deck activity, nothing. The AT supplies were present but there was no activity on the I2C bus data line. It was shorted to chassis (47Ω), but the short cleared when the keyboard was unplugged. A new TMS3763ANL28 chip was required. **P.B.**

Philips VR6462

The ticket said that the complaint was no sound – also that the machine had been to another repairer. Playback sound was o.k. but the E-to-E sound was weak with buzzing. A look at the sound subpanel showed that there had been a lot of soldering activity – also a new 5·5MHz sound filter had been fitted! Fitting the correct 6MHz type cut down the buzz while a tweak on coil S5 brought back the sound. Someone hadn't read the small print on the diagram – 6MHz for /05, i.e. for 6MHz UK use. **P.B.**

JVC HRD520

The half-loading mechanism in this machine enables the counter and index functions to work in the fast-forward and rewind modes when the tape isn't wrapped around the drum. This machine's owner insisted that it sometimes failed to count in the fast tape transport modes. We found that the counting worked perfectly if fast forward or rewind was entered from stop after play, but if fast forward or rewind was selected immediately after tape insertion the guide pole failed to pull out a tape loop and there was no count. The mode switch was responsible. Since we had none in stock we dismantled and cleaned the original one, which had tiny black spots on its stator contact bars. **E.T.**

JVC HRD580

This machine's recordings were marred by horizontal black flashes across the screen – the sort of interference you get from a latchety aerial plug or an intermittent tuner. The effect could be seen on the E-to-E pictures. Some heating and freezing on i.f. panel 07 revealed that one end of R38, the demodulated video feed, was dry-jointed. **E.T.**

Sanyo VTC5150

This old Betamax machine led me a dance. Whichever mode was selected it would stop after a few moments. Since the machine would sit there happily in the pause mode the reel sensor system was clearly implicated. There were pulses from the reel sensor optocoupler in the other modes. These pulses were being amplified sufficiently by Q3012 to keep the tape counter working but not sufficiently for the microcontroller chip IC3001. The optocoupler's output pulses were of low amplitude because the LED and photodiode beneath the take-up reel were thick with dust. A good blow-through cured the problem. Shades of Test Case 335! **E.T.**

Sanyo VHR4350

If eject is sometimes accompanied by tape looping, with consequent tape damage, remove the bottom cover and take a look at the reel drive system. There's a "switched clutch" that slides up and down the gear shaft between the spools. On several occasions we've found the clutch to be tight on the shaft. **E.T.**

Sharp VC383

This machine wouldn't record in colour. Presented with a tape recorded elsewhere it would play this back with perfectly acceptable colour, which seemed to eliminate all the colour circuitry that's common to record and playback.

One of the exonerated components was the 5·06MHz chroma filter FL503 between the sub- and main colour signal converters though it had, maybe because of an internal open-circuit, become very lossy. The manual provides few clues to the colour-under subcarrier signal levels. The main one is the chroma record current which was found to be about 6dB down. The cause of the trouble was the HA1178NT chip. **E.T.**

Samsung SI1240

We've had the same fault with two brand new SI1240s. The symptom is that the machine performs no functions and switches off after a few seconds, perhaps with the cassette-in symbol showing even when the FL cradle is empty. The cause of the trouble is failure of the KA8301 loading-motor drive chip. An equivalent is the more common BA6209. **E.T.**

Sony SLV474

This machine has digital video circuitry to produce picture-in-picture displays and a useful edit monitor screen that shows as small inset pictures the incoming video signal and the last off-tape image when going from play pause to record pause. The user employs this latter facility when copying from a camcorder, and the fault on this machine was particularly important to him. The fault symptom was as follows. In the edit monitor or picture-in-picture mode the inset display would be very dark at first. It would then lighten slowly until it was almost whited out.

Before being fed to pins 8, 7 and 6 respectively of the AD converter chip IC108 the video signal is split into its Y, R − Y and B − Y components. The chip also has a black-level clamp that operates prior to AD conversion, the clamp pulses being fed in at pin 15. The video signals, in component form, are fed into the chip via 1μF capacitors, so the d.c. voltages at the input pins must come from within the chip. The voltages at the two colour-difference signal input pins were correct at 3·4V. At the Y input pin 8 however the d.c. voltage fell dramatically when the high-impedance voltmeter was connected. As a result the digitised picture became very dark. Because of a fault within the chip the black level at this input wasn't being clamped. **I.B.**

Ferguson FV41

After playing back for a couple of hours a chroma fault would appear. The symptoms were as follows: on the left-hand side of the screen the colour remained correct but farther across to the right its phase changed, e.g. blue changed to orange. The fault would clear if the tape was stopped and then re-started or the cue and review functions were used. As the conditions around the chroma signal processing chip IC08 were correct we decided to swap it with one in another machine. The fault moved with the chip, proving that the latter was defective. **I.B.**

Panasonic NV-MS90

The reported fault was of a dark or no picture from the camera section of this camcorder. What was happening was that the luminance disappeared after a few minutes' use. When we dismantled the machine we found that the slightest pressure applied to the process PCB made the fault come and go. Checks showed that the luminance signal was always present at pin 7 of IC306, which is an output to switching and one-line delay circuitry: when the fault was present the signal at pin 24, where it should return after the switching and delay operations, was missing. The cause of the problem was within the subpanel delay chip IC302 – the input at pin 11 was always present but the output at pin 22 disappeared in the fault condition. **I.B.**

Mitsubishi HS306

If the machine stops intermittently during play or record check IC5A4 – it's mounted on the metal bracket along the front. **R.J.A.**

Hitachi VTM622

This fairly new machine had no servo pulses on record only, being o.k. with prerecorded tapes. The cure was simply to clean the audio/control head. I wonder if this is going to become a problem, as with the VT410 series? **R.J.A.**

Hitachi VT120

When a tape was inserted this machine would sometimes load it very slowly half way then just sit there and switch off, leaving the tape half laced. On one occasion the machine accepted the tape normally then switched off, again without ejecting the cassette. Suspecting a faulty loading motor, we applied an external 9V supply to its terminals. The carriage operated normally. As the M54649L carriage motor/loading chip IC902 has given trouble in the past we checked the voltages here while trying to load a tape. There was only 2-3V across the motor, measured at pin 10, so we checked the 12V supply at pin 9. This dropped to 2V when the chip was asked to drive the motor. As replacing the chip made no difference attention was turned to the source of the 12V supply, at pin 7 of the STK5471 regulator chip. A new chip restored normal operation. **J.E.**

Amstrad VCR4700

After about an hour in either the play or record mode this machine would give a quiet "squeak" then unlace and switch off. Using a dummy cassette we saw that the take-up spool carrier faltered and stopped: the capstan, belt and clutch drive wheel rotated normally until the system control went into the stop mode due to absence of the reel pulses. Fitting the clutch modification kit provided the cure. It's common for the clutch unit to be responsible for tape creasing: I'd not seen one seize before. **J.E.**

Saisho VR705

The deck functions operated normally but there was no E-E or tape playback signal. The switched 9V supply was missing. It's produced by Q507 (2SD1266) which had 20V at its collector. Fitting a new transistor cured the problem. **J.E.**

Matsui VX755A/Saisho VR3600

This machine wouldn't accept a tape. The standby indicator was on and the clock display was normal. When an attempt was made to insert a tape the standby indicator went off and the machine shut down. The cause of the fault was traced to the supply end sensor on the carriage. **J.E.**

Obituary: Shizuo Takano, father of VHS

Shizuo Takano, known in the video industry as the father of VHS, died on Sunday January 19th. He was the man who sold JVC's VHS format to the world: legend has it that Takano toured the globe with a trunk full of VHS equipment, stopping at major electronics companies in an effort to gain support. The strategy worked, and VHS has long been the de facto world standard home video system.

Shizuo Takano was born in the Aichi Prefecture in 1923. He graduated from Hamamatsu Technical College in 1943, specialising in precision equipment. After a two-year spell in the navy he joined JVC in 1946, where he stayed for over 36 years. In 1955 he was a member of JVC's Video Development Team, which was headed by Kenjiro Takayanagi who was one of the founding fathers of television. The team's aim was to develop a VTR for the professional and broadcasting markets, but they were beaten by the Ampex Quadruplex system which was launched in 1956.

The JVC team subsequently developed, in 1959, the KV1. It was the world's first two-head, helical-scan VTR. They tried selling it to broadcasters, but by then the quadruplex recorder had become well established. During the Sixties video companies around the world began work on three-quarter inch video formats for the broadcast, industrial and educational markets. In 1969 Sony, JVC and Matsushita (parent company of JVC, Panasonic and Technics) joined forces to establish the U-Matic format, which was launched in 1971 and soon became the broadcasting standard.

The companies then turned their sights towards the nascent home video market. Sony began working on its Betamax system, Matsushita on a format known as VX and JVC on VHS. Takano became chief of JVC's Video Product Division in 1970, while the company's home video development team was headed by Yuma Shiraishi. It's hard to believe this now, but VHS was almost killed off before the first prototype VCR was even developed. JVC executives decided that home video wasn't going to be a big market after all. They reduced Shiraishi's team from ninety to ten and scrapped the budget. But thanks to the belief and support of Takayanagi and Takano, the home video team was able to work on in secret.

Shizuo Takano

Konosuke Matsushita, then Matsushita's chairman, was shown the first VHS prototype and liked it so much that he decided to back VHS in preference to his own company's VX system. In 1974 Takano and JVC's home video team were invited to view Sony's prototype Betamax VCR and were asked to support the format. JVC declined and the video format war began. Sony gained the support of Sanyo and Toshiba, but JVC received backing from Matsushita, Hitachi, Sharp and Mitsubishi. Even so in the middle of 1976 the Japanese Ministry of Trade and Industry tried to persuade JVC to drop VHS and support Betamax. Once more the invitation was declined.

The first VHS VCR was launched on September 9th, 1976 at the Okura Hotel in Tokyo. Sales began well, but dropped sharply in 1977. A panicky sales team begged Takano to cut the prices. Furious at this suggestion, Takano threatened to add features and up the price instead. He then set out on his world sales tour. What won over the companies he visited was Takano's willingness to show VHS prototypes, discuss future VHS developments and offer to grant VHS licences to companies that wanted to make their own VCRs. He also offered badge engineered VCRs to companies that didn't wish to invest in the production technology. Takano's marketing strategy was superb – his methods are today studied in business school classes around the world.

In 1974 Takano became general manager of JVC's Video Products Division. He was appointed Director in 1976 and became Managing Director in 1980, while remaining general manager of the Video Products Division. He was appointed Senior Managing Director in 1983, Vice President in 1986 and Auditor in 1990.

I met Takano on my first ever visit to Japan, in 1988. I hadn't been in journalism long and was somewhat apprehensive. Takano's official JVC photograph had led me to expect a somewhat stern and reserved man, but I couldn't have been more wrong. What I found was an extremely open and warm person, with a great sense of humour. Takano made me feel very welcome. After a busy day of briefings and factory tours the press group joined Takano at a restaurant where there was much drinking and joking.

Takano died of a respiratory ailment at 2·43 a.m. The wake was held on the following day, January 20th, the funeral service being held on the 21st. Over two thousand people paid their respects. Takano is survived by a wife and two children. His legacy will live on through the hundreds of millions of VHS recorders in homes across the world.

In closing I'd like to thank Shuji Kurita, Deputy General Manager of JVC's Japan Public Relations Department, for providing me with many biographical details.

G. Cole

Letters

HD AND WIDESCREEN TV

In the January leader article you suggest that to drop MAC and go for a digital alternative, the next generation, would be to put HDTV in Europe back several years. I don't think that this is really the point. The factors that are holding up the introduction of broadcast HDTV services have much less to do with wrangling over transmission standards than with the state of the art in display devices. As the chairman of Sony Broadcast said recently, HDTV "is not about the number of lines or the aspect ratio but is all about sitting close to large screens". HDTV pictures that are displayed on screens similar in size to those now used for 625-line pictures don't look sufficiently different from present day TV pictures to justify a very significantly higher price tag.

At the moment, large screens mean big, expensive c.r.t.s that are no basis for a mass market product. If ordinary members of the viewing public can't afford sets fitted with these bulky and expensive devices, or don't want to accommodate them in their homes, then HDTV is a dead duck regardless of how little bandwidth the signals can be squeezed into.

By the time that we get large, flat "hang-on-the-wall" screens of performance adequate for HDTV and at an affordable price, which means at least another ten years, HD-MAC will look as antiquated technologically as PAL does now. I believe that we should leave the choice of an HDTV transmission standard open until advances in display technology make domestic HDTV receivers viable and only then select the best transmission format from those available at the time, which will almost certainly mean a digital system.

In the same issue John Dagg argues that the aspect ratio for HDTV should be wider than 16:9. I feel that this is a related issue. Very wide (greater than 2:1) pictures look wonderful on really big screens but look just silly on a small screen. Hence the dislike for the "letterbox" format for showing Cinemascope films on TV. Perhaps we should leave the choice of aspect ratio open as well.

Incidentally, Mr. Dagg is incorrect in saying that "almost every film made since 1952 has been made in Cinemascope/Panavision format. In fact only about twenty per cent of cinema features made in this period have used this format. The majority are shot "unsqueezed" with an aspect ratio of between 4:3 and 5:3. When they are shown in the cinema the top and bottom are cropped to provide a picture of between 1·66:1 (5:3) and 1·85:1 (5·55:3) aspect ratio. When shown on TV or transferred to video cassettes additional picture information above and below that shown in the cinema can often be seen. This sometimes results in microphone booms, lighting cables etc. making an unscheduled appearance!

David Looser,
Ipswich.

WHAT A LIFE!

After reading Donald Bullock's reports over the last few months I can't see how he makes a reasonable living at the rates he charges. An example of this is the dead Fidelity CTV140 mentioned in the February issue. A realistic charge for this would have been something like £20-£30 labour plus £10 parts plus VAT. If Donald made his customers wait several days for the repair they would be more likely to pay a sensible figure.

Let's have some examples on this page of what other dealers think the minimum charges should be, e.g. VCR minimum £20-£30, TV minimum £20-£25, Camcorder minimum £35.

John Read,
Watford, Herts.

Perhaps like myself Donald Bullock bought several hundred BY127s from a well-known Midlands supplier a while ago when they were on special offer. But position D508 in the Matsui 1440A is not the place to dispose of them. The diode used here is of the zener type, its purpose being to conduct in the event of the h.t. voltage rising to an excessive figure due to a fault condition, thus protecting the line output stage and the remainder of the receiver. Some models from ITT and other manufacturers use a similar arrangement. Incidentally I don't know why they bother to put a fuse in the Matsui sets: R501 does the job admirably and F501 rarely blows! But keep the good work up Donald, I really look forward to your column.

Derek Farler,
Keynsham, Bristol.

A WARNING

Part of my business is the sale of good and reliable colour sets with a guarantee. I've found the best sets to be the ITT ones fitted with the German made Pico chassis. But one drawback is the line output transformer, which develops a fault that the super chopper power supply circuit is able to handle without blowing up.

Recently another well known wholesaler has started to supply the line output transformer at a much cheaper price than the manufacturer. So I bought a couple. One was needed urgently for an under-guarantee breakdown. I fitted the transformer, which dropped into place correctly, then switched the set on. The tube's heaters were brighter than a 100W bulb. Then, though I switched off immediately, a puff of smoke came from the c.r.t.'s base panel. On investigation I found that the c.r.t. had gone short-circuit between its first anode, cathode and focus electrodes. I'd the wrong LOPT of course, but was assured that I had the correct one. A few words with the supplier produced a return authorisation, but they've credited me with just the transformer. So I've lost the cost of the set and a replacement c.r.t.

Hugh MacMullen,
Newquay, Cornwall.

MARCO POLO RECEPTION

Since BSkyB has undertaken to continue its Marco Polo transmissions until at least the end of 1992, there has been renewed interest in BSB receivers of late. BSB receivers and dishes are available from surplus dealers at very reasonable prices, and will provide Sky One, Sky News and Sky Sports all free of charge. In addition two film channels are available on subscription. Many people may feel that it would be worth buying a system for use this year. In fact the increasing number of Marco Polo installations could perhaps induce BSkyB to continue, and perhaps one day to expand, its services from this satellite. We can but hope, especially as the future of HDTV in Europe is linked to the success of D-MAC.

I picked up a Philips STU902 receiver and a Marconi Squarial for just £50. Installation was a simple matter of setting up the declination, using the supplied template, mounting the bracket on a suitable wall (tricky in my case as there is no clear view of the Southern sky anywhere, so I fitted it as best I could to a garden wall) and then pointing the boom to the compass direction given in the instructions. As my compass took objection to being close to the LNB that I'd already assembled, I put a plumb line on each end of the boom and used these for alignment with the compass some inches below the dish. Cable and F connectors were easily obtained locally and, when fitted, the signal strength was found to be maximum first time. In fact I found that the dish is remarkably tolerant of direction error and obstructions.

A call to BSkyB immediately had the system authorised, the whole job taking less than two hours. Not only have I obtained some extra channels to watch (perhaps not exactly the best programming though) but in addition I've learnt something about satellite TV reception. Perhaps the experience alone makes it all worthwhile, and even if the service does come to an end in December the equipment will have a certain scrap value. If you want to play with satellite TV cheaply, this is the way to do it.

Colin McCormick,
Plymouth, Devon.

PHOTOSTATS SERVICE

Newer readers may have missed important servicing features published in *Television* over the past few years. We have therefore started a photostat service to make this information readily available. Photostats of the following servicing features, listed in alphabetical order, can be supplied at the prices shown. Please send requests to: Television Editorial Department, Room L323, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Cheques/POs should be made payable to Reed Business Publishing Ltd. There are two standard prices, see below.

Feature	*Price*
B and O L/LK2500/2800 chassis	A
Decca 80/100 chassis	A
Decca 120/130 chassis	A
Ferguson FV31R VCR	A
Ferguson TX10 chassis	A
Ferguson TX100 chassis	A
Finlux 1000 series chassis	A
Fisher FVH-P520 VCR	A
Mitsubishi CT2227	A
Mitsubishi Euro-4 chassis	A
Mitsubishi HS304 VCR	A
Panasonic D1 VCR deck	A
Panasonic G VCR deck	B
Panasonic NV333/366 VCRs	A
Panasonic NV370/830/850 VCRs	A
Panasonic NV730 VCR	A
Panasonic NV777/788 VCRs	A
Panasonic NV2000/2010/3000 VCRs	A
Panasonic U3 chassis	A
Panasonic U4 chassis	A
Panasonic U5 chassis	A
Salora F chassis	A
Salora G and H chassis	B
Salora J chassis	A
Salora K and L chassis	B
Sanyo CTP7130/1/2	A
Sony KV2252/2256/2752/2762	B

Prices, A = £2.50, B = £3.50.

HELP WANTED

Can anyone supply any of the following: a tuning/timer preset door (front right) for the Saisho VR805 VCR; (2) a circuit diagram for the Pye T175 monochrome portable; (3) a circuit diagram for the Decca/Korting 82514 pattern generator? N. Brown, 27 Devonshire Park, Bideford, N. Devon EX39 5HZ (0237 479 732, evenings).

Can anyone supply h.t. transformers for a Philips T190 12in. monochrome portable and a Network NW1202 12in. monochrome portable? Michael J. Ladd, Ty'r Gwynt, Mountain Road, Pembrey, Dyfed SA16 0BX (055 464 418).

Could anyone supply me with some octal valve screening cans and nats if possible, also 6K8, 6Q7 and 6K7 valves? These are required for restoration work. Ken Jones, G3PS2, 24 Station Road, Okehampton, Devon EX20 1EA (083 753 021).

Can anyone sell me a Fisher FVH-P722 VCR for use for spares? B.D. Whellams, 17 Highbury Terrace, Halstead, Essex CO9 2EB (0787 477 368).

Can anyone supply a Sanyo luminance delay line, type L7127, as used in the TJ series chassis (Models CTP5101 etc.)? Roger Burchett, 12 Ormonde Road, Hythe, Kent CT21 6DN (0303 267 969).

Can anyone supply surplus, secondhand, complete or in part remote control adaptor kits for the Philips Model VR2020/22 VCR (V2000 format)? David Avery, 28 Gwydr Crescent, Uplands, Swansea (0792 475 904).

Can anyone supply an X and Y timebase for the Philips 7122-701-61012, EBMH1GRGT oscilloscope, or a 25-pin modem to plug in? I have the X and Y amplifiers. S. Orbell, 39 St. Andrews Road, Gorleston, Gt. Yarmouth NR31 6LT.

Can anyone supply details of the manufacturer and model number of the radiocassette marketed by Dixons as their Prinzsound CTA650? I cannot obtain a service sheet without this information. E.G. Kempshall, 109 Portland Road, Hove, East Sussex BN3 5DP.

I feel that I must write to acknowledge the kind and overwhelming response I received to my plea for help in the February issue. It's nice to know that in these difficult times such a large number of people in the trade are prepared to spend money and time for no reward to help others. It has certainly revived my faith in the trade.

Philip Pick, Sight and Sound,
Caythorpe, Lincs.

VCR PATTERN PARTS

There's been debate in these pages in the past over the pros and cons of mechanical pattern parts for VCRs. I prefer to fit genuine originals but on occasions when parts are obsolete, out of stock or there's a large price differential I offer the customer the choice. It's my policy never to fit pattern parts without the customer being aware of the situation. Some pattern parts can be a bonus to the user – MCES video heads for example provide quality equal to the originals, longevity of life that's often better and a twelve-month guarantee. But other pattern heads are not so good. We had a Panasonic NV333 in recently whose heads had been replaced by that famous dealer A.N. Other with a pattern version. Its owner complained that the quality had never been up to much but that now, some five months later, the picture was unbearable. It was, too: there was severe picture pulling, over-saturated chroma and peak white overshoot. It took me a little while to discover that the new heads were the cause because the symptoms were not consistent with normal head failure, and after all they had been fitted only recently. The owner was a little upset and scrapped the machine.

One practice that annoys me is when spares wholesalers supply pattern parts which are not listed as such in their catalogues. This is particularly annoying when the supplier in question is an "authorised distributor" and the order codes are for the genuine part. Here are two recent examples.

The first concerned a Mitsubishi HS307 that needed a new pinch roller. We ordered the part from a supplier that had previously sent us genuine Mitsubishi parts without any problems, using the same order code group as before, but an anonymous one arrived in a bag. Its centre bearing was made extensively of plastic instead of the original bronze. When the pinch roller was placed on the shaft it spun for approximately one turn then stopped, whereas the original type would carry on spinning for countless times. I fitted it, along with a new audio-control head, and aligned the unit. On making a test recording I found that the sound level varied. The alignment was checked and found to be o.k. Refitting the original roller cured the problem, but not before much head-scratching. An original type was then obtained from Mitsubishi. The second case was an Alba machine that suffered from severe tape riding, with consequent edge damage, after fitting a new pinch roller. This roller was again not of the same type as the original, and furthermore had another manufacturer's name on the bag.

I could go on giving such examples. How many readers suffered a couple of years ago with those pattern 3V35 idlers that were too small? Wholesalers should take greater care over what they supply, and should be accountable for the losses that occur when headaches such as these arise. I feel that the problem doesn't show up as much as it should because many engineers are not too fussy when working on VCR mechanics – torques aren't checked, lubrication isn't carried out, nor is tape path alignment when new heads are fitted. If the sound level varies slightly following a repair they don't worry. I've seen completed repairs where new heads have been fitted in high specification machines that previously gave perfect still pictures and noiseless slow-motion, but because alignment has not been carried out they no longer do despite the new heads! Also machines where no servo alignment has been carried out following drum replacement, with the result that the switching point obscures the bottom inch of the picture. For some inexplicable reason if the cowboys muck up a repair the owner will come to me to sort it out and will pay, but if the machine goes dead six months after I've cleaned the heads the owner comes back to me demanding a free repair!

Nick Beer,
Bideford, N. Devon.

Microcomputer Notes

Commodore C64

After reading about Mr. Matthews' problems with one of these microcomputers (February issue, page 257) I thought that some comments on my own experiences with them might be of help. To recap, the problem reported by Mr. Matthews was a blank screen but no other results, the cause being failure of one of the regulators in the potted power supply.

In one case I cut down the potting on the transformer as far as possible in order to expose the lead-out wires for the mains input and the 9V secondary. I ignored the 5V secondary as I don't trust the regulator used here. Instead, a good-quality switch-mode power supply was used to provide the 5V output. The unit to hand happened to be a 180W Gould unit. Obviously this power isn't required but, being an efficient power supply, the unit draws only sufficient current from the mains supply to provide 5·2V across its output terminals, and maintains this output with impressive accuracy over a load current range of zero to more than 30A.

The second repair along these lines was for a friend who wanted the system up and running to keep his children out of mischief. As a 9V transformer was on this occasion ready to hand no attempt was made to hack the old power supply apart, though the original power lead came in handy. The switch-mode power supply I used this time came from the monitor unit of a professional system that had been scrapped. The option now exists to provide −5V, −12V and +12V rails as well as the standard +5V and 9V a.c. supplies should these be required by another unit.

The biggest advantage of computer type switch-mode power supplies is that when they fail, which appears to be rare in comparison with three-terminal linear regulators, they usually cease to function and cut off the outputs. This is much preferable to a series element going short-circuit and dumping the unregulated secondary voltage on to the 5V output.

If a linear regulator is retained, a precaution I consider to be well worthwhile is to add a crowbar thyristor. Simply connect the thyristor between the 5V rail and chassis. Use a low-value resistor and capacitor from the gate to chassis. A simple transistor and potentiometer as a "variable zener" connected from the 5V line to the thyristor's gate allows precise setting of the trip voltage. This arrangement saves a fortune in expensive house-coded LSI chips.

I. Field

Amstrad PCW9512 Printer

This printer produced consistently faint printing and was much quieter than usual. A telephone enquiry to Amstrad produced the answer "replace the hammer armature". This is plastic with a ferrous insert, and can develop cracks. Like Donald Bullock, when I did this the result was that the printer ceased to produce any impression at all.

According to the gentleman on the phone, there should be a 2·4V pulse at the hammer current test connector. As this was the case I concluded that the fault was a mechanical one. I'd been warned that the position setting of the hammer electromagnet is very critical. The fixing screws were very hard to undo. Once they were loose the magnet could be repositioned and resecured, using Loctite on all the screws. Doing this provided a complete cure.

P.S. Wallis, G3YJI

TV Fault Finding

Reports from Steve Cannon, L.V. Cooper, Graham Rees, Liz Hopkins, John Edwards, Ed Rowland, Mick Dutton, Eugene Trundle, Michael Dranfield and Denis Foley

Panasonic TC1785

This set came in dead and quick checks showed that no voltages were being generated by the power supply. In the circumstances it's a good idea with these sets to remove Q806, the standby switch transistor, then wind the set up via the variac. This time the set started up, with all the voltages correct. Q806 was then checked and found to be open-circuit. A new 2SA683 transistor put matters right. **S.C.**

Hitachi CPT2658/Salora L Chassis

The symptoms were severe herringbone patterning, both with off-air and scart input signals, striations down the side of the picture and both the line phase and frequency were wrong. In cases like this it's usually a good idea to tie the faults down to one part of the chassis. But it was a bit difficult here because separate faults seemed to be present in the i.f./video, line oscillator and line output departments. The only thing in common of course is the 12V supply. A check was made for ripple but none could be detected. We decided to replace CB616, the 1,000μF reservoir capacitor for the 17V supply that feeds the 12V regulator, and as if by magic all the symptoms cleared. **S.C.**

Hitachi G8Q Chassis

This set was dead – no surprise here. Praying that the mains fuse hadn't been blasted, we removed the back. Thankfully the fuse was o.k., so a full power supply rebuild wouldn't be necessary. As the h.t. was present and correct we checked the supply to the timebase generator chip IC701. The 12V supply was present but line drive wasn't being generated. A check was then made on the standby line from the microcomputer panel. The voltage here is normally between 8-12V when the set is running, 0V in standby. It was found to be 3·5V. This led us to suspect a fault on the microcomputer panel, and sure enough when the standby line was disconnected the set started up. Before condemning the microcomputer chip we decided to check a few other components. This proved to be a fruitful approach as the 1N4148 diode D1504 in the standby circuit was faulty. **S.C.**

Philips 2A Chassis

The h.t. and e.h.t. came up for an instant at switch on, then the main h.t. decayed to a steady 30V with the other secondary power supply voltages low. It seemed certain that the cause of the trouble was in the line output stage because disconnecting the feed to the line output transformer brought all the supply lines back up. Checks showed that the output transistor, the EW modulator diodes, the secondary rectifiers fed from the transformer and the tuning capacitors were all o.k. The only thing left was the transformer. A new one restored normal operation. **S.C.**

Panasonic TX25W2 (Alpha 3 Chassis)

In our experience this very new chassis is not one of Panasonic's better ideas – the failure rate has been far too high. The first fault with this particular set was that R555, the fusible safety resistor in the h.t. feed to the line output stage, was open-circuit. When it was replaced, the set was in a shut-down condition. A check showed that the line output transistor was o.k., but it seemed clear that something was wrong in the line output stage. We checked the EW modulator diodes as these can cause the same symptoms. Not this time however. So we began to suspect the line output transformer, a common cause of failure with modern sets. But this set had just been unboxed. It couldn't be faulty, could it? It was though. **S.C.**

Grundig CUC2400 Chassis

This set wouldn't come out of standby when the mains on/off switch was used. The circuit indicated that the power supply earth was not isolated from the main chassis earth. This was not true of the set we had. I eventually found the usual network that connects the two earth rails, i.e. the 4·7MΩ resistor and its associated parallel capacitor. A check on the resistor showed that it was open-circuit, a replacement restoring normal operation of the on/off switch. The offending resistor is located near the front of the panel, on the right-hand side very close to the right-hand chassis rail. I forgot to make a note of its circuit reference number, but as it's not shown in the circuit diagram we used it probably wouldn't be much help anyway. **L.V.C.**

Samsung CI3312Z

The complaint was of lack of height. The obvious thing to do was to check the d.c. voltages around the field output chip, IC901. These were all o.k., but a new chip was tried in case. This made no difference so I moved back to the TDA8305 chip IC101. The d.c. voltage at the ramp generator pin 2 was found to be low. Replacing R302 cured the problem. It had risen in value from 470kΩ to about 1·5MΩ. **G.R.**

Rediffusion Mk 4 Chassis

This set was dead with the start-up resistor 4R2 getting very hot. A check on the start supply showed that it was correct at 14·5V, and no shorts could be found on the secondary side of the chopper transformer. A scope check at pin 15 of the TDA1060 chopper control chip showed that the drive output was at only about 0·1V peak-to-peak – the manual gives the correct amplitude as being 0·4V peak-to-peak. So we checked the supply voltage again: the reading was still 14·5V. When the supply was scoped however we found that a 60V peak-to-peak ripple was present on it. A check on 4C6 (1,000μF) showed that it had dried up, a replacement restoring the set to life. **M.Dr.**

Hitachi CPT1646R

The report with this set said that it was dead. When we switched it on the e.h.t. rustled up then very quickly died away. An LM317T three-terminal adjustable regulator is used in this chassis, with a large bypass resistor. A check

on the LM317T showed that all pins were at about 150V. We tried powering the set via a variac and found that at about 70 per cent of the full mains input everything worked all right. So no other damage had been done. A new LM317T was tried, on the assumption that the original one was short-circuit, but the fault condition remained the same. As the voltage at the adjustment pin couldn't be reduced using the set-h.t. control, the cause of the fault was likely to be in this area. Tracing back from the adjustment pin brought us to two resistors, R907 (56kΩ) and R908 (22kΩ). R908 turned out to be open-circuit.
M.Dr.

Philips 2A Chassis

This set was dead with a very black mains fuse. The obvious things to check were the chopper transistor and the mains bridge rectifier diodes. They were all o.k. In a situation like this, where no obvious short can be found, I usually remove the degaussing thermistor and try again – this device can be responsible for violent fuse blowing. With the thermistor out the set remained dead, but this time the mains fuse remained intact. I then spotted a small blue capacitor, C2664 (1·5nF), with a split down the side. It turned out to be open-circuit. So did the associated BYD33J diode D6664. With replacements fitted the set remained dead. Checks showed that there was no output from the mains bridge rectifier – and no a.c. input either! Study of the circuit diagram soon showed what had happened – Philips dealers will be aware of this. I'd left the degaussing thermistor out, intending to replace it after finding the cause of the fault. In this chassis the thermistor is in series with the incoming mains feed to the bridge rectifier, acting as a surge limiter as well. Replacing this item restored the set to full working order. **M.Dr.**

Fidelity ZX3000 Chassis

There was a green cast on the picture, as if the tube had a slight heater-cathode leak. A check on the tube showed that it was o.k., so attention was turned to the RGB output stages on the c.r.t. base panel. Comparison voltage checks in the green and red stages brought us to TR10's base bias resistor R214 which had risen in value from 100kΩ to 150kΩ. A replacement restored correct colour. **M.Dr.**

Amstrad CTV2000

This set had top field foldover. I'd had this fault before, so I went straight for C720 (4·7μF, 160V) which decouples Q702's collector. As the set is now about nine years old we replaced C718 and C739 as well for good measure. **M.Dr.**

Hinari CT4

This set was dead and on inspection we found that a small hole had been burnt in the PCB around one leg of L406. Further investigation brought us to R406 (680Ω) which was open-circuit. A replacement restored normal operation.
L.H.

Triumph CTV8000

We get quite a few of these Currys own brand sets in. Just when we think we've got it all sussed out along comes one like this. It was dead and on opening it up we found that there was a hairline crack on the bottom panel. Bridging it brought back a lot of voltages but nothing else. After disconnecting the final anode cap and finding only a weak spark we looked more closely at the tube base. A do-it-yourselfer had had a go and had put the tube base back upside down! **L.H.**

Huanyu 37C-2

The problem with this set was line collapse. It was caused by dry-joints on transformer T782 in the scan circuit. **L.H.**

Matsui 2160/Saisho FST210R

There was a small, pulsating picture, the sound varied up and down and the brightness was low. We get quite a few of these sets so we went straight to the line output transformer-derived 180V rail where the reading was low at only 73V. Fitting a new STR58041 chopper chip (IC501) restored normal operation. **L.H.**

Ferguson TX100 Chassis

If the standby light works but the set goes dead when a channel is selected and all the lights go out, check for a 12V drop across RL1. If this is absent replace TR9 (BC107).
L.H.

Saisho CT147R

A common cause of the dead set symptom, though with 229V at the collector of Q604, is R662 (180kΩ) being open-circuit. A replacement is normally all that's required to restore the set to life. **J.E.**

Ferguson TX99 Chassis

When this set was switched on the e.h.t. came up but there was no picture, just the occasional flicker of flyback lines. There was no sound and it was impossible to change from channel one. R239 (100Ω) was open-circuit due to an internal short in the M494B1 tuning/standby chip IC241.
J.E.

Philips G11 Chassis

Dead except for a hum was the report with this set. When we switched on we found that the tube's heaters glowed and the e.h.t. rustled up, so the power supply and the line timebase were obviously o.k. A check on the 17V feed to the audio and i.f. panel showed that this voltage was missing. The 1A fuse was intact and the BY210-800 rectifier diode seemed to be o.k. when checked with an ohmmeter and the scope component tester. After a lot of other checks got us nowhere we decided to fit a new diode. Everything then burst into life. It all goes to show that there's still no trustworthy general-purpose component tester, the best advice being "if in doubt, whip it out". **J.E.**

Sony KV2062

This set was dead with a blown 3·15A mains fuse. A check on the bridge rectifier showed that D609 was short-circuit. Fitting a replacement and giving the set a long soak test proved that all was now well. **J.E.**

Philips CTX-E Chassis

This set would sometimes fail to come on. We also noticed that the stations were not being memorised. As a result we replaced the back-up battery. There was no further trouble after we'd done that. **E.R.**

Ferguson TX90 Chassis

We've had two of these sets in recently. The problem with the first one was no colour. D103 (BAV20), which is in series with the sandcastle pulse feed to the colour decoder chip, was open-circuit. The second set wouldn't store channels. IC902 (M293B1) had failed. **E.R.**

Some Quickies

Here are some quickies we've had recently:
Mitsubishi CT2027BM: Intermittently dead was the problem with this set. The cause was dry-joints on transformer T571.
Philips 14CF1014 (CF1 chassis): This set was dead with its line output transistor Tr7560 short-circuit. Dry-joints on the chopper transistor Tr7317 were the cause. **E.R.**

ITT CT3306 (Monoprint A Chassis)

The problem was no line sync. This set uses a TDA2579 sync/timebase generator chip. Our first suspicion was of missing line feedback pulses, especially when we found that they come via a high-value (680kΩ) resistor. A scope check showed that everything was in order here, also that the video input was correct at pin 5. Field lock was solid, and a new TDA2579 made no difference. The frequency could be set to drift through at the centre of the hold control's setting with the video input shorted, so we came to the conclusion that the cause of the problem must be one of the peripheral components associated with the line phase discriminator circuits. This brought us to pins 6, 7 and 8. After checking the three electrolytics we noticed the small disc ceramic capacitor (C609, 100pF) which is connected to pin 7. Perfect lock was obtained after replacing it. On test the capacitor was found to have slight leakage. **M.D.**

ITT CVC1215 Chassis

This set wore a Solavox badge – Model 22R09. The fault was distortion across the centre of the picture when the set had warmed up. Any disturbance to the chassis would clear the problem. We eventually found that the cause of the trouble was the line output transistor's heatsink. It completes the earth path from several print areas. Resoldering these cured the fault. **M.D.**

Sharp C1421

This set was dead with the standby relay not energised. Linking across the relay produced a snowy raster with no tuning control. Checks around the microcomputer chip IC1002 showed that there was no voltage at the reset pin 11. This was due to operation of the overload protection transistor Q604. By isolating the various protected circuits we found that the basic cause of the trouble was zener diode D607, which was short-circuit. **M.D.**

Harwood TS2604P

I'd never seen one of these sets before. It had been bought at a discount store and had gone wrong just out of guarantee. The shop had told the customer that it would be cheaper to buy a new set. When I switched the set on the mains input was present and there was 350V across the chopper transistor, as I found out all too soon (there's no discharge resistor across the reservoir capacitor!). The power supply is on a separate panel. When this was removed I found that R3 had sprung open. Resoldering it didn't get the set to run, and further investigation showed that the 400mA fuse B3 had blown. After fitting a replacement the set started up and a picture appeared. It was very defocused and dim however. I left the set on soak test for a while and noticed that the brightness level altered as it warmed up. Suddely the screen went to peak white, with flyback lines. I found that there was no supply to the RGB output transistors as the coil (L4) that's in series with the feed had gone open-circuit. Removing it and resoldering the coil ends to the pins cured the problem. **M.D.**

Tatung 160 Chassis

The set of which this chassis formed a part had been well and truly blown up! The BU508 line output transistor and TDA3651 field output chip had both died and R411 was burnt. Using a mains light bulb as a dummy load we found that the power supply was churning out 285V instead of the correct 117V. The culprit was D808 in the set-h.t. sampling circuit: it read 380Ω both ways. **E.T.**

ITT CVC1203 Chassis

The power supply in this CT2612 receiver, which uses the CMP1204 power module, had gone into the superboost mode. The voltage on the h.t. line was over 200V. C733 (10μF), the h.t. reservoir capacitor, had been blown apart, scattering its wet, woolly and metallic entrails over much of the set's inside. The h.t. comparator stage functioned all right, or at least was trying to, but the 13V reservoir capacitor C703 (10μF) in the primary side of the chopper circuit was faulty in some way – its replacement restored normal operation. **E.T.**

Panasonic U3W Chassis

A few days after I'd replaced faulty field output transistors (Q402/3) this set came back with the complaint of no sound or vision: it was in permanent standby. Checks showed that the voltage at pin 5 of the AN5435 timebase generator chip IC501 was high, thus switching off the line drive. The h.t. was normal, and the set came to life when the service switch was on. This led to the discovery that Q403's emitter current was high. A fresh pair of field output transistors, plus a new AN5435 i.c., did no good at all. A phone call to Panasonic provided the necessary help. When the field output transistors are replaced, the associated bias diodes D406/7 should also be replaced. **D.F.**

Hitachi G8Q Chassis

We were unable to tune in any stations, obtaining only a blank raster with most programme numbers while the buttons at the front of the set operated incorrect functions. Replacing the tuner unit and the microcomputer chip got us nowhere. A call to Hitachi produced the advice that the memory chip IC502 should be reprogrammed. This is an involved process and the instructions that have to be followed are not listed in the manual. Details for some models were included in the August 1991 issue of *Television*, on page 732. This procedure does get one out of the trouble. **D.F.**

Long-distance Television

Roger Bunney

Virtually static high-pressure systems over the UK during much of January resulted in extensive tropospheric reception, also serious fog. Three periods produced excellent tropospheric propagation – during the 11-16th, the 20-22nd and, the most intense period, the 27-31st. Together with a little Sporadic E and F2 layer reception this made January an unusually active month.

Tropospheric propagation over the 11-16th produced generally strong signals from France, Germany, Denmark and the Benelux countries in Band 3 and at u.h.f. Highlights were Poland ch. R36 on the 11th, Czechoslovakia ch. R10 on the 13th and Austria chs. E6 and 8, Czechoslovakia ch. R10 and various Swiss Band 3/u.h.f. stations on the 15/16th. Many DXers logged the new German network logos, e.g. "MDR 1 Programm", for the first time. The Luxembourg chs. E7/24/36 were also seen on several days. January 20-22nd produced a less active spell, with reception mainly from the east/north east – most signals came from Norway, Sweden, Germany and the Danish first and second networks.

The major event from the 27th onwards saw the month out. It was again accompanied by thick fog. Very strong German signals were seen on all days through to the 31st. The emphasis early in the period was towards reception from Scandinavia. On later days it tended to veer to the east/south east. Austria ch. E8 was seen on the 28th, along with the usual signals including RTE (Ireland). An unusual sighting on the 30th was Canal Plus on chs. E39 and 50 with PAL encoding. The peak day for reception was the 30th. Here at Romsey Band 3 was completely jammed with signals and the u.h.f. bands were in chaos. DXers logged signals from France, Germany, Switzerland, Denmark, Norway, Czechoslovakia and the Benelux countries in all bands. As a bonus there were several 435MHz amateur TV callsigns and even the American Forces' ch. E70 (A80) transmitter was logged at good strength.

SpE had its moments, in particular with a very intense opening on the 4th. The log is as follows:

4/1/92 RAI (Italy) ch. IA; +PTT (Switzerland) E2, 3; MTV (Hungary) R1, 2; CST (Czechoslovakia) R1, 2, 3; TVR (Romania) R2; TSS (Russia) R1, 3; ORF (Austria) E2a, 3, 4; ARD (Germany) E2, 3, 4; Canal Plus L3.
5/1/92 TVE (Spain) E3; RUV (Iceland) E4.
8/1/92 TSS R1.
11/1/92 TVE E2, 3, 4; +PTT E2, 3.
12/1/92 TVE E2, 3; +PTT E2.
19/1/92 DR (Denmark) E3; RAI IB.
21/1/92 RAI IB.
26/1/92 RTE (Ireland) ch. B.

There were several good days for F2-layer reception, with strong signals from the Middle East. Odd to report that on the 31st/Feb. 1st a very large sunspot group was visible in the centre of the Sun. This could be seen – through the fog – with the naked eye, a very unusual event. But despite careful tuning on the following evening no auroral activity was noted. (Never observe the Sun directly under normal conditions.) The F2 log is as follows:

9/1/92 Irib (Iran) E2; Dubai E2.
14/1/92 Irib E2; TSS R1.
17/1/92 Very weak unidentified signals on chs. E2/R1.
27/1/92 Irib E2.
28/1/92 TSS R1; evidence of Australia ch. A0; unidentified signals on chs. E2/R1/E3.
29/1/92 Irib E2; Dubai E2; TSS R1.
30/1/92 Dubai E2; TSS R1.
31/1/92 Irib E2; Dubai E2; Chinese caption writing seen on ch. C1/R1.

Our thanks to Roger Fussell (Torpoint), Peter Schubert (Rainham), Simon Hamer (Powys), Cyril Willis (King's Lynn), David Glenday (Arbroath), Tim Anderson (St. Leonards), Brian Renforth (Newcastle) and Ryn Muntjewerff (Holland) for sending in reception reports.

It's interesting that low-power signals can be received via SpE reflection amongst much higher power co-channel signals. The Australian bulletin *Yagi* reports that on December 31st one of its members received, with a scanner, New Zealand ch. 1 (45·28MHz vision carrier) from TV2 Wingagui: the unusual point is that the transmitter's output power is 1W!

George Gaskin reports from Gibraltar that RTM (Morocco) has changed its first network station identification logo to a conventional five-pointed star with the figure one in the centre.

News Items

Czechoslovakia: Andrew Emmerson reports that the Czech network has started on a programme to convert from SECAM to PAL colour. A Bratislava transmitter under construction will operate with PAL only. The phased changeover is expected to take ten years. Though modern Czech receivers can operate on the SECAM D and PAL B/G standards, there are still many traditional Russian-made single-standard SECAM D sets in use. These will have to be replaced over the next few years.

Poland: Permits are being issued for new f.m. transmitters operating in the 88-108MHz band, with services due to start next winter.

Ireland: The Irish government has promised to launch a predominantly Gaelic-language channel by next December. RTE Gaelic programmes will be supplemented by locally-produced material. The Broadcasting Bill is to be amended to provide RTE with more commercial air time to help fund the production of Gaelic-language programmes.

Holland: TROS plans to adopt cable-only distribution – cable now reaches almost 90 per cent of Dutch households.

Germany: There have been fundamental changes in the broadcasting arrangements in the eastern part of the country with the establishment of the MDR (Mitteldeutcher Rundfunk) and ODR (Ostdeutcher Rundfunk) and the demise of the DFF. MDR and ODR took over from the DFF on January 1st. The MDR headquarters is at Leipzig while ODR is located at Babelsberg near Berlin.

50MHz Amateur band: The Polish authorities are to allow radio amateurs to use the 50MHz band in certain areas not served by Band 1 TV transmitters. Estonian authorities have given the 80-80·5MHz allocation to radio amateurs, with e.r.p.s limited to 50W in the Tallin region and 200W elsewhere. Other Russian republics are expected to follow suit. Maximum power for use by Swedish amateurs in the band has been increased to 200W, though with restrictions depending on the proximity and power of the nearest Band 1 TV transmitter. Our thanks to *Six News* for this information.

Satellite TV

Up to nine high-power transponders have been carrying Winter Olympics material via the French Telecom 2A satellite, which will be at 3°E for the duration of the Olympics.

Filmnet is reported to be phasing out PAL and is expected to go D2-MAC completely by the end of March, probably with Eurocrypt scrambling.

Eutelsat II F3 at 16°E has been carrying out tests by relaying much of Eutelsat I F4's cable TV output. So far there have been no reports of interference to Astra signals.

There seem to be quite a lot of new satellite TV channels. The Adult Channel is now carried on Astra while Free Choice TV is being promoted via the Dutch PTT leased 11·150GHz transponder on Eutelsat II F1 at 13°E, with a Dutch postbox address. Eutelsat II F2 at 10°E is carrying two new services on a test basis, Show TV with MTV relays and an inlaid test caption and an as yet unidentified service for cable distribution. Indian- and Chinese-language services are expected shortly via Astra, on a shared transponder time basis.

MAXSAT continues despite problems elsewhere in the Maxwell Communication Group. A recent contract for this satellite linking company involves Westminster news circuit uplinks from the ITN studio via three Eutelsat transponders for ITV regional use.

Scientific Atlanta is to up-grade a number of European Earth stations in a move towards digital transmission via the new Eutelsat II satellites. Countries involved include the UK, Ireland, Italy, Greece, Cyprus and Tunisia.

The new Intelsat VII and VIIA series of satellites will be launched from 1993 onwards for service in the C and Ku bands and SNG operations. Five craft have been ordered so far, with options on a further two. Each satellite will have three independently steerable Ku band spot beams and six steerable C band spot beams. Facilities to accept Ku band uplinks and translate them to C band (4GHz) downlinks will be included, basically for lower-powered SNG use. The Ku band downlink e.i.r.p. will be 47dBW, appropriately more with the C band links.

We have received a correction from the Bophuthstswana Broadcasting Corporation. Bop-TV is scrambled, using Videocrypt, and is uplinked from Bophuthatswana, not Botswana. Bop-TV and Mmabatho TV are both downlinked from Intelsat VI F4 at 27·5°E, the frequencies used being 3·884 and 3·926GHz respectively, with left-hand polarisation.

Equipment for TV-DXing

At this time of the year thoughts are turning to the forthcoming SpE season. In the 405-line era enthusiasts had to modify receivers to work with the Continental standards. The problem was eased with the start of 625-line transmissions in the UK, but the difficulty then arose that many receivers weren't equipped with a v.h.f. tuner. One approach to this problem is to use an upconverter to translate the v.h.f. TV bands to a section of the u.h.f. spectrum so that a u.h.f. tuner can be used to, in effect, give v.h.f. coverage. The alternative approach is to use a surplus v.h.f. tuner, building it into a suitable package with its i.f. output being fed to a convenient point in the main receiver.

The latter approach, using an outboard tuner, makes it possible to incorporate filtering to decrease the i.f. bandwidth and thus improve the noise performance. Several articles on this subject appeared in *Television* in the early Eighties. Fortunately the varicap tuner became commonplace, and in due course the improved MOSFET types gave greatly enhanced performance – low noise, freedom from overloading and, with some, quite incredible bandwidth coverage.

The HS Publications (Derby) D100 DX-TV converter combines these approaches, with a tuner and i.f. processing followed by upconversion to a single u.h.f. channel, all bandwidth filtering being carried out in the outboard tuner package.

Today, with the mass of imported TV equipment available from the Orient, many receivers come complete with a multiband tuner. Such receivers may therefore have a group of memory channels that can be used for the Band I DX favourites such as E2, R1 etc. With remote control, channel hopping is simplicity itself. Monochrome and colour sets are both available with a multiband tuner. I recently saw an advertisement for a Nikkai 14in. monochrome receiver with full v.h.f./u.h.f. tuning via separate knobs at just over £50. The Nikkai and other imported TV sets have full i.f. bandwidth operation of course, but it's possible to add simple filtering at the tuner's i.f. output. If this is done the sound signal will deteriorate or just not be heard of course.

A great many receivers that are suitable for DXing are available in both the retail and wholesale markets. Multistandard models are available in the Nikkai and Yoko ranges for example. Alternatively single-standard models with v.h.f./u.h.f. coverage can be used. Multistandard sets are likely to be able to handle system B/G/I/L transmissions with PAL/SECAM colour. The upconverter approach is still a useful way of obtaining inexpensive coverage of the v.h.f. bands, but for ease of tuning a fully variable u.h.f. knob is best, i.e. forget push-button tuning.

Band 1 coverage should include chs. E2/3/4, chs. IA/B (system B), chs. R1/2 (system D), ch. IB (system I, Ireland) and chs. L2/3/4 (system L, France). Very occasionally ch. A2/3/4 signals (system M) are received from North America. These channels all lie within the 45-70MHz Band 1 spectrum.

Satellite Notebook

Nick Beer

Here are some more of our experiences with satellite TV receiving equipment.

Mains Problems

We get a lot of calls from owners of various types of IRDs complaining that the decoder doesn't function, the clear channels being fine. This is generally found to be the case. All that's required to cure the problem is a hard reset, i.e. switch off at the mains, wait a couple of minutes then switch back on cleanly. The fault is characterised by the fact that there are no on-screen graphics, "please insert card" for example. It's as if a decoder wasn't there.

These calls come from areas where mains supply problems at irregular intervals are commonplace, or from anywhere after bad weather. We've not had this problem with the Ferguson SVA1 stand-alone decoder we supply. These lock-up problems are not restricted to satellite TV equipment of course, and seem to occur with some brands more than others. In our experience Ferguson seems to be particularly unlucky in this respect. The 3V55/57 VCRs were a major problem. So was the Pace manufactured SRA1S satellite TV receiver. The latter would go into the VCR lock mode in standby, necessitating a hard reset followed by SETUP 987 from the remote control handset. Initially, these problems produce a large number of service calls. Subsequently customers manage to carry out the "repair" themselves. It can do manufacturers' reputations no good. Contemporary Salora/Luxor receivers and Panasonic VCRs didn't suffer from the problem.

Outdoor Weaknesses

I'm sure that many readers will have come across the popular Maspro 65cm dish kits used by the Nokia group. The set-up is quite neat and the head-end small. I first encountered it when Salora dropped the use of the Fuba 55cm fibreglass dish a few years ago in the system with the 5902 receiver and started to supply the Maspro metal kit instead. Assembly was a bit more involved, but instead of a three-part head-end we now had a combined feedhorn and polariser with a very small LNB. Reception is very good: the 55cm dish had been rather on the borderline in parts of our area (N. Devon), the newer kit being more comfortable.

It was not long however before I began to find that the reliability is not so hot. At the time we'd commissioned Startrak to install much of our equipment, and their workmanship was less than ideal with the examples of this kit they installed. The polariser connections consist of a pair of tags with push-on spades. These in turn have plastic sleeves which are pushed over them. The design is poor, with little thought to longevity. Startrak gave no more thought to them and didn't waterproof the connections in any other way. Consequently we had a fair number of failures caused by the tags simply rusting away. The user would complain of intermittent loss of half the channels followed by their permanent loss. Sometimes the user would complain that only one channel, say Screensport, had disappeared, but in fact they were watching only this horizontally polarised channel and hadn't noticed that MTV, Lifestyle etc. weren't there either!

With this fault the likelihood is that water will have permeated the cable, which will often have to be replaced as well. My predecessor in satellite TV maintenance used to solder the leads on to the tags, seal them in silicone rubber (the RS type, not bath sealer etc.) then wrap the entire neck of the polariser with self-amalgamating tape. I never had one re-offend after that treatment – they daren't!

A further problem associated with this fault is that if the equipment has been installed for any length of time it can be almost impossible to separate the LNB and the polariser. The screws corrode into place, and even after removing them parting the two units can be fun – bimetallic reaction?

At one stage we had some complaints about variable reception: the signals would rise and fall in windy weather. On checking the installations concerned we found that the wall brackets were extremely flexible, to the extent that with only minimal force the whole assembly would move some way in the azimuth sense. A comparison between the brackets and earlier ones showed that the gauge of the steel legs was about half that previously used. When they were contacted, Salora/Luxor said that they knew all about the problem – they hadn't told anyone however! Apparently the brackets had been locally sourced and the wrong gauge of steel had been used for one batch.

Another weakness that is now showing up with these kits relates to the dish itself – it rusts badly. This usually starts around the edge, where the rust starts to blister the layers of steel apart. I've seen some really bad examples. Where this has happened Nokia has supplied a free replacement and paid the market rate for installing it. I suspect that this could be costing them a lot of money. The ironical thing is that the replacements supplied are of the same type – they come complete with polariser but not the LNB. One of our replacements is rusting again already – the customer complained within two weeks!

Receiver Problems

Compared with many designs the power supplies in the Pace-made Ferguson SRA1 and SRA1S receivers are a weak point. They are exceptionally hot in operation, which means that there's inherent unreliability. The later S version was improved in this respect, but both units suffer from similar problems. In early versions the heat soon discoloured the PCB: now the print itself in some receivers is disintegrating.

One problem that's becoming common is power supply hum, which causes bars on the vision. Bridge rectifier, reservoir capacitor and regulator failures are commonplace, also dry-joints and broken print. A good idea as to which component in which supply is in trouble can be gained from the symptoms – is the fault limited to one polarity and if so which one, how many bars are there, etc.?

More recent Pace-made units have been built to a better standard however: we still get complaints from new owners that they run hot, but the reliability seems to be much better. Early unreliability was due to poor design. The company seems to have learnt from its mistakes, though that connector for the Videocrypt PCB in the SS9000/SRA1 shows a lack of experience.

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DECLARATION OF QUALITY

AS DISTRIBUTORS OF QUALITY VIDEO SPARES FOR THE LAST TEN YEARS, WE FULLY UNDERSTAND THE REQUIREMENTS OF THE REPAIR TRADE. THERE IS A CERTAIN QUALITY WHICH MUST BE MAINTAINED IN ORDER TO EXECUTE HONEST, RELIABLE REPAIRS. THEREFORE, WE GUARANTEE THAT ALL VIDEO SPARES SUPPLIED BY US ARE OF THE FINEST QUALITY AND WE CAN ASSURE YOU THAT ALL STOCKED ITEMS WILL BE DISPATCHED THE SAME DAY.

AIWA

AV-66

	Part No.	Price
Video Head	VID 2546	£16.95
Pinch Roller	VID 1755	£3.87
Belt Kit	VID 7519	£1.32
Idler Replacement Set	VID 1001	£4.04
Idler	VID 1005	£1.81
Capstan Motor	VID 2160	£24.27
Tension Band	VID 1423	£3.54
Reel Table Rubber Tyre	VID 1335	£0.90
CTL Unit	VID 2637	£59.75

AV-77

	Part No.	Price
Video Head	VID 2546	£16.95
Pinch Roller	VID 1755	£3.87
Belt Kit	VID 7509	£1.95
Idler Replacement Set	VID 1000	£5.62
FWD Limiter	VID 1002	£3.37
Idler	VID 1004	£1.40
Idler	VID 1005	£1.81
Capstan Motor	VID 2118	£28.50
Tension Band	VID 1423	£3.54
CTL Unit	VID 2567	£46.43

AKAI

VS-9800

	Part No.	Price
Video Head	VID 2511	£9.95
Pinch Roller	VID 1756	£2.95
Belt Kit	VID 7506	£1.56
Take Up Idler	VID 1025	£4.65
REW Idler	VID 1026	£5.92
Unloading Idler	VID 1027	£9.30
FF Rubber Tyre	VID 1029	£0.78
FF Rubber Tyre	VID 1030	£0.82
Unloading Idler Rubber Tyre	VID 1207	£0.90
Capstan Motor	VID 2119	£42.31
Drum Motor	VID 2120	£18.73
Cassette Lamp	VID 1943	£0.35
Tension Band	VID 1391	£3.54
Repair Kit	VID 7911	£15.45
Take Up Rubber Tyre	VID 1028	£0.75

ALBA

VCR-4000

	Part No.	Price
Video Head	VID 2713	£23.74
Pinch Roller	VID 1787	£3.63
Belt Kit	VID 7596	£3.63
Idler	VID 1049	£4.05
Cassette LED	VID 1981	£1.48
Tension Band	VID 1399	£2.64

AMSTRAD

VCR-4600

	Part No.	Price
Video Head	VID 2676	£20.94
Pinch Roller	VID 1758	£3.05
Belt Kit	VID 7593	£1.73
Clutch	VID 1226	£4.32
Gear Holder	VID 1227	£11.70
RF Clutch	VID 1231	£6.52
Cassette LED	VID 1981	£1.48

VCR-9000

	Part No.	Price
Video Head	VID 2502	£15.45
Pinch Roller	VID 1758	£3.05
Belt Kit	VID 7592	£1.15
RF Clutch	VID 1225	£3.82
Clutch	VID 1226	£4.32
Gear Holder	VID 1227	£11.70
Cassette LED	VID 1981	£1.48

BANG & OLUFSEN

VHS-65

	Part No.	Price
Video Head	VID 2506	£16.08
Pinch Roller	VID 1788	£3.05
Belt Kit	VID 7538	£1.23
FF/REW Idler Arm	VID 1020	£1.73
Clutch Plate	VID 1211	£9.81
Capstan Motor	VID 2147	£18.02
Cassette LED	VID 1981	£1.48

DECCA

VRH-8300

	Part No.	Price
Video Head	VID 2511	£9.95
Pinch Roller	VID 1814	£3.05
Belt Kit	VID 7812	£1.07
Reel Idler	VID 1036	£2.80
Take Up Clutch	VID 1037	£3.05
Take Up Idler	VID 1038	£1.56
Brake Pad	VID 1361	£0.36
Reel Motor	VID 2169	£28.12
Capstan Motor	VID 2164	£37.18
Loading Motor	VID 2168	£9.30
Cassette Lamp	VID 1947	£0.42
Tension Band	VID 1389	£1.73
Repair Kit	VID 7913	£18.95
Take Up Reel Table Rubber Tyre	VID 1080	£0.66
Supply Reel Table Rubber Tyre	VID 1080	£0.66

FERGUSON

3-V-30

	Part No.	Price
Video Head	VID 2647	£9.81
Pinch Roller	VID 1814	£3.05
Belt Kit	VID 7812	£1.07
Reel Idler	VID 1036	£2.80
Take Up Clutch	VID 1037	£3.05
Take Up Idler	VID 1038	£1.56
Brake Pad	VID 1361	£0.36
Reel Motor	VID 2169	£28.12
Capstan Motor	VID 2164	£37.18
Loading Motor	VID 2168	£9.30
Cassette Lamp	VID 1947	£0.42
Tension Band	VID 1389	£1.73
Repair Kit	VID 7913	£18.95
Take Up Reel Table Rubber Tyre	VID 1080	£0.66
Supply Reel Table Rubber Tyre	VID 1080	£0.66

3-V-36

	Part No.	Price
Video Head	VID 2647	£9.81
Pinch Roller	VID 1813	£3.05
Belt Kit	VID 7543	£0.99
Take Up Clutch	VID 1031	£3.21
Take Up Idler	VID 1038	£1.56
Reel Idler	VID 1039	£3.30
Brake Pad	VID 1361	£0.36
Capstan Motor	VID 2165	£22.87
Loading Motor	VID 2168	£9.30
Front Loading Motor	VID 2168	£9.30
Cassette LED	VID 1981	£1.48
Tension Band	VID 1389	£1.73
Remote Control	IR 9100	£11.92
Repair Kit	VID 7918	£18.09
Mains Transformer	VID 2223	£21.61
Take Up Reel Table Rubber Tyre	VID 1080	£0.66
Supply Reel Table Rubber Tyre	VID 1080	£0.66
Cassette Housing	VID 1099	£20.61

3-V-57

	Part No.	Price
Video Head	VID 2573	£17.29
Pinch Roller	VID 1813	£3.05
Belt Kit	VID 7540	£0.66
Clutch Mechanism	VID 1083	£14.56
Capstan Motor	VID 2188	£44.62
Loading Motor	VID 2167	£13.69
Front Loading Motor	VID 2168	£9.30
Cassette LED	VID 1981	£1.48
Tension Band	VID 1388	£2.06
Repair Kit	VID 7920	£17.58
Cassette Housing	VID 1315	£20.61

FV-10B

	Part No.	Price
Video Head	VID 2580	£25.68
Pinch Roller	VID 1817	£11.25
Belt Kit	VID 7564	£2.72
Idler Arm	VID 1091	£2.31
Reel Motor	VID 2193	£15.04
Capstan Motor	VID 2190	£25.53
Loading Motor	VID 2412	£6.18
Front Loading Motor	VID 2412	£6.18
Cassette LED	VID 1981	£1.48
Tension Band	VID 1386	£1.65
Repair Kit	VID 7921	£14.16

FV-12L

	Part No.	Price
Video Head	VID 2581	£37.81
Pinch Roller	VID 1817	£11.25
Belt Kit	VID 7564	£2.72
Idler Arm	VID 1091	£2.31
Reel Motor	VID 2193	£15.04
Capstan Motor	VID 2190	£25.53
Loading Motor	VID 2412	£6.18
Front Loading Motor	VID 2412	£6.18
Cassette LED	VID 1981	£1.48
Tension Band	VID 1386	£1.65
Repair Kit	VID 7921	£14.16

FIDELITY

VCR-100

	Part No.	Price
Video Head	VID 2502	£14.72
Pinch Roller	VID 1758	£3.05
Belt Kit	VID 7593	£1.73
Clutch	VID 1226	£4.32
Gear Holder	VID 1227	£11.70
RF Clutch	VID 1231	£6.52
Cassette LED	VID 1981	£1.48

FINLUX

VR-1030

	Part No.	Price
Video Head	VID 2558	£42.99
Pinch Roller	VID 1803	£4.12
Idler	VID 1006	£2.80
Tension Band	VID 1432	£5.17
Remote Control	IR 9034	£13.46
Repair Kit	VID 7930	£12.76

VR-2010

	Part No.	Price
Video Head	VID 2578	£56.31
Pinch Roller	VID 1827	£7.00
Belt Kit	VID 7588	£1.56
Idler	VID 1252	£3.97
Loading Gear	VID 1253	£6.37
Modification Set	VID 1254	£10.35
Tension Band	VID 1431	£4.27
Remote Control	IR 9034	£13.46

FISHER

FVH-P520

	Part No.	Price
Video Head	VID 2500	£21.95
Pinch Roller	VID 1788	£3.05
Belt Kit	VID 7532	£1.89
Take Up Idler	VID 1015	£5.36
FF/REW Pulley	VID 1016	£0.85
Idler	VID 1023	£2.88
Tension Band	VID 1378	£2.31
Take Up Reel Table Rubber Tyre	VID 1293	£0.66
Supply Reel Table Rubber Tyre	VID 1293	£0.66

FVH-P530

	Part No.	Price
Video Head	VID 2500	£21.95
Pinch Roller	VID 1788	£3.05
Belt Kit	VID 7532	£1.89
Take Up Idler	VID 1015	£5.36
FF/REW Pulley	VID 1016	£0.85
Idler	VID 1023	£2.88
Tension Band	VID 1378	£2.31
Take Up Reel Table Rubber Tyre	VID 1293	£0.66
Supply Reel Table Rubber Tyre	VID 1293	£0.66

FVH-P720/720K/721

	Part No.	Price
Video Head	VID 2500	£21.95
Pinch Roller	VID 1810	£3.63
Belt Kit	VID 7532	£1.89
Gear Idler	VID 1013	£4.95
Idler	VID 1014	£2.80
Loading Gear Set	VID 1230	£1.65
Cassette LED	VID 1981	£1.48
Tension Band	VID 1376	£2.10
Take Up Reel Table	VID 1295	£7.83
Supply Reel Table	VID 1294	£5.77

FVH-P722/725

	Part No.	Price
Video Head	VID 2501	£21.95
Pinch Roller	VID 1810	£3.63
Belt Kit	VID 7813	£1.05
Gear Idler	VID 1013	£4.95
Idler	VID 1014	£2.80
Loading Gear Set	VID 1230	£1.65
Cassette LED	VID 1981	£1.48
Tension Band	VID 1376	£2.10
Take Up Reel Table	VID 1295	£7.83
Supply Reel Table	VID 1294	£5.77

FVH-P980K/KV

	Part No.	Price
Video Head	VID 2501	£24.43
Pinch Roller	VID 1818	£3.05
Belt Kit	VID 7568	£2.40
Idler	VID 1093	£4.20
Clutch	VID 1094	£13.52
Cassette LED	VID 1981	£1.48
Tension Band	VID 1377	£2.10
Supply Reel Table	VID 1296	£10.97

FUNAI

VCR-4600

	Part No.	Price
Video Head	VID 2676	£20.94
Pinch Roller	VID 1758	£3.05
Belt Kit	VID 7593	£1.73
Clutch	VID 1226	£4.32
Gear Holder	VID 1227	£11.70
RF Clutch	VID 1231	£6.52
Cassette LED	VID 1981	£1.48

VCR-5843

	Part No.	Price
Video Head	VID 2708	£24.31
Pinch Roller	VID 1758	£3.05
Belt Kit	VID 7615	£3.67
Idler	VID 1364	£2.25
Cassette LED	VID 1981	£1.48

GEC

V-4004

	Part No.	Price
Video Head	VID 2506	£16.08
Pinch Roller	VID 1788	£3.05
Belt Kit	VID 7538	£1.23
FF/REW Arm	VID 1020	£1.73
Clutch Plate	VID 1211	£9.81
Capstan Motor	VID 2148	£18.02
Cassette LED	VID 1981	£1.48
Tension Band	VID 1379	£2.31
Repair Kit	VID 7922	£16.50

GOLDSTAR

GHV-8000/8200/8210/8215

	Part No.	Price
Pinch Roller	VID 1815	£5.19
Belt Kit	VID 7585	£1.32
Idler	VID 1052	£1.98
Bracket Centre	VID 1223	£25.81
Clutch Gear	VID 1228	£2.22
Limiter Roller	VID 1440	£1.32
Cassette LED	VID 1981	£1.48
Tension Band	VID 1399	£2.64

VCP-4100/4130

	Part No.	Price
Video Head	VID 2645	£63.81
Pinch Roller	VID 1815	£5.19
Belt Kit	VID 7585	£1.32
Idler	VID 1052	£1.98
Bracket Centre	VID 1223	£25.81
Clutch Gear	VID 1228	£2.22
Limiter Roller	VID 1440	£1.32
Cassette LED	VID 1981	£1.48
Tension Band	VID 1399	£2.64

VCP-4200/4326

	Part No.	Price
Video Head	VID 2645	£63.81
Pinch Roller	VID 1815	£5.19
REW Belt	VID 7234	£0.37
Cassette LED	VID 1981	£1.48

GRANADA

VHS-EY1/EY2

	Part No.	Price
Video Head	VID 2539	£16.35
Pinch Roller	VID 1822	£3.21
Belt Kit	VID 7605	£2.47
Reel Drive Unit	VID 1255	£7.09
Loading Gear A	VID 1268	£1.72
Loading Gear B	VID 1271	£1.20
Capstan Motor	VID 2404	£39.37
Cassette LED	VID 1981	£1.48
Tension Band	VID 1414	£8.18

GRUNDIG

MVS-400

	Part No.	Price
Video Head	VID 2596	£16.62
Pinch Roller	VID 1757	£3.21
Belt Kit	VID 7567	£1.87
Idler	VID 1052	£1.98
Loading Gear	VID 1222	£2.25
Clutch Gear	VID 1228	£2.22
Limiter Roller	VID 1440	£1.32
Cassette LED	VID 1981	£1.48
Tension Band	VID 1400	£2.55
Remote Control	IR 8965	£20.56

VS-520 GB

	Part No.	Price
Video Head	VID 2595	£27.43
Pinch Roller	VID 1821	£12.12
Timing Belt	VID 1482	£7.20
Centre Pulley	VID 1482	£7.20
Cassette LED	VID 1981	£1.48
Tension Band	VID 1401	£3.37

HINARI

VXL-30/354

	Part No.	Price
Video Head	VID 2518	£21.00
Pinch Roller	VID 1815	£5.19
Belt Kit	VID 7566	£2.31
Clutch	VID 1316	£5.47
Idler	VID 1317	£3.54
Loading Motor	VID 2167	£13.69
Cassette LED	VID 1981	£1.48

HITACHI

VT-11

	Part No.	Price
Video Head	VID 2504	£19.94
Pinch Roller	VID 1788	£3.05
Belt Kit	VID 7538	£1.23
FF/REW Idler Arm	VID 1020	£1.73
Clutch Plate	VID 1211	£9.81
Capstan Motor	VID 2147	£18.02
Cassette LED	VID 1981	£1.48
Tension Band	VID 1379	£2.31
Repair Kit	VID 7922	£16.50

VT-16 S

	Part No.	Price
Video Head	VID 2505	£24.87
Pinch Roller	VID 1788	£3.05
Belt Kit	VID 7538	£1.23
FF/REW Idler Arm	VID 1020	£1.73
Clutch Plate	VID 1211	£9.81
Capstan Motor	VID 2147	£18.02
Cassette LED	VID 1981	£1.48
Tension Band	VID 1379	£2.31
Repair Kit	VID 7922	£16.50

VT-33/330

	Part No.	Price
Video Head	VID 2504	£19.94
Pinch Roller	VID 1788	£3.05
Belt Kit	VID 7538	£1.23
FF/REW Idler Arm	VID 1020	£1.73
Clutch Plate	VID 1211	£9.81
Capstan Motor	VID 2148	£18.02
Cassette LED	VID 1981	£1.48
Tension Band	VID 1379	£2.31
Repair Kit	VID 7922	£16.50

VT-61/62/63/64

	Part No.	Price
Video Head	VID 2628	£24.25
Pinch Roller	VID 1818	£3.05
Belt Kit	VID 7583	£3.87
FF/REW Idler Arm	VID 1020	£1.73
Clutch Plate	VID 1211	£9.81
Capstan Motor	VID 2154	£18.02
Cassette LED	VID 1981	£1.48
Tension Band	VID 1379	£2.31
Repair Kit	VID 7924	£16.55

VT-8000/8500

	Part No.	Price
Video Head	VID 2509	£15.96
Pinch Roller	VID 1788	£3.05
Belt Kit	VID 7803	£0.99
Take Up Idler	VID 1015	£5.36
Wind Roller	VID 1016	£0.85
FF/REW Idler	VID 1023	£2.88
Capstan Motor	VID 2155	£50.50
Tension Band	VID 1381	£1.98
Remote Control	IR 9097	£12.63
Repair Kit	VID 7928	£15.49
Take up Reel Table	VID 1302	£11.47
Supply Reel Rubber Tyre	VID 1300	£0.74

VT-9300/9500/9700

	Part No.	Price
Video Head	VID 2509	£15.96
Pinch Roller	VID 1788	£3.05
Belt Kit	VID 7802	£0.90
FF/REW Idler Arm	VID 1019	£2.88
Play Idler	VID 1075	£3.79
FS Brake	VID 1212	£1.73
Capstan Motor	VID 2156	£57.81
Cassette Lamp	VID 1951	£0.90
Tension Band	VID 1382	£1.80
Remote Control	IR 9096	£14.92
Repair Kit	VID 7927	£15.49
Take Up Reel Table	VID 1303	£8.32

ITT

VR-3913

	Part No.	Price
Video Head	VID 2511	£9.95
Pinch Roller	VID 1814	£3.05
Belt Kit	VID 7812	£1.07
Reel Idler	VID 1036	£2.80
Take Up Clutch	VID 1037	£3.05
Take Up Idler	VID 1038	£1.56
Brake Pad	VID 1361	£0.36
Reel Motor	VID 2169	£28.12
Capstan Motor	VID 2164	£37.18
Loading Motor	VID 2168	£9.30
Cassette Lamp	VID 1947	£0.42
Tension Band	VID 1389	£1.73
Repair Kit	VID 7913	£18.95
Take Up Reel Table Rubber Tyre	VID 1080	£0.66
Supply Reel Table Rubber Tyre	VID 1080	£0.66

VR-3993

	Part No.	Price
Video Head	VID 2647	£9.81
Pinch Roller	VID 1814	£3.05
Belt Kit	VID 7523	£1.32
Reel Idler	VID 1036	£2.80
Take Up Clutch	VID 1037	£3.05
Take Up Idler	VID 1038	£1.56
Roller Bar	VID 1363	£3.86
Brake Pad	VID 1361	£0.36
Reel Motor	VID 2169	£28.12
Capstan Motor	VID 2187	£46.18
Loading Motor	VID 2168	£9.30
Front Loading Motor	VID 2168	£9.30
Cassette Lamp	VID 1946	£0.49
Tension Band	VID 1389	£1.73
Repair Kit	VID 7914	£20.34
Take Up Reel Table Rubber Tyre	VID 1080	£0.66
Supply Reel Table Rubber Tyre	VID 1080	£0.66

JVC

HR-3300

	Part No.	Price
Video Head	VID 2511	£9.95
Pinch Roller	VID 1756	£2.95
Belt Kit	VID 7506	£1.56
Take Up Idler Large	VID 1025	£4.65
REW Idler	VID 1025	£4.65
Unloading Idler	VID 1027	£9.30
FF Rubber Tyre	VID 1029	£0.78
Unloading Idler Rubber Tyre	VID 1207	£0.90
Capstan Motor	VID 2119	£42.31
Drum Motor	VID 2120	£18.73
Cassette Lamp	VID 1943	£0.35
Tension Band	VID 1391	£3.54
Repair Kit	VID 7911	£15.45
Take Up Rubber Tyre	VID 1028	£0.75

HR-D110/111/120/121

	Part No.	Price
Video Head	VID 2647	£9.81
Pinch Roller	VID 1813	£3.05
Belt Kit	VID 7543	£0.99
Take Up Clutch	VID 1031	£3.21
Take Up Idler	VID 1038	£1.56
Reel Idler	VID 1039	£3.30
Brake Pad	VID 1361	£0.36
Capstan Motor	VID 2165	£22.87
Loading Motor	VID 2168	£9.30
Front Loading Motor	VID 2168	£9.30
Cassette LED	VID 1981	£1.48
Tension Band	VID 1389	£1.73
Repair Kit	VID 7918	£18.09
Mains Transformer	VID 2223	£21.61
Take Up Reel Table Rubber Tyre	VID 1080	£0.66
Supply Reel Table Rubber Tyre	VID 1080	£0.66
Cassette Housing	VID 1099	£20.61

MATSUI

VX-850

	Part No.	Price
Pinch Roller	VID 1815	£5.19
Belt Kit	VID 7566	£2.31
Clutch	VID 1316	£5.47
Idler	VID 1317	£3.54
Cassette LED	VID 1981	£1.48

MITSUBISHI

HS-307

	Part No.	Price
Video Head	VID 2606	£71.56
Pinch Roller	VID 1808	£3.05
Belt Kit	VID 7542	£1.58
Reel Idler Unit	VID 1040	£8.48
FF Idler Rubber Tyre	VID 1081	£0.74
Capstan Rubber Tyre	VID 1264	£1.32
Cam Gear A	VID 1274	£1.20
Gear 2	VID 1275	£1.20
Cam Gear B	VID 1276	£1.27
Gear 1	VID 1277	£1.27
Cassette LED	VID 1981	£1.48
Tension Band	VID 1393	£2.55
Take Up Reel Table	VID 1307	£2.92
Supply Reel Table	VID 1299	£2.70

HS-318

	Part No.	Price
Video Head	VID 2607	£42.37
Pinch Roller	VID 1808	£3.05
Belt Kit	VID 7559	£2.85
Reel Idler Unit	VID 1040	£8.48
FF Idler Rubber Tyre	VID 1081	£0.74
Capstan Rubber Tyre	VID 1264	£1.32
Cam Gear A	VID 1274	£1.20
Gear 2	VID 1275	£1.20
Cam Gear B	VID 1276	£1.27
Gear 1	VID 1277	£1.27
Cassette LED	VID 1981	£1.48
Tension Band	VID 1393	£2.55
Take Up Reel Table	VID 1307	£2.92
Supply Reel Table	VID 1299	£2.70

NEC

N-830 EG631/632/633

	Part No.	Price
Video Head	VID 2647	£9.81
Pinch Roller	VID 1813	£3.05
Belt Kit	VID 7543	£0.99
Take Up Clutch	VID 1031	£3.21
Take Up Idler	VID 1038	£1.56
Reel Idler	VID 1039	£3.30
Brake Pad	VID 1361	£0.36
Capstan Motor	VID 2165	£22.87
Loading Motor	VID 2168	£9.30
Front Loading Motor	VID 2168	£9.30
Cassette LED	VID 1981	£1.48
Tension Band	VID 1389	£1.73
Repair Kit	VID 7918	£18.09
Mains Transformer	VID 2223	£21.61
Take Up Reel Table Rubber Tyre	VID 1080	£0.66
Supply Reel Table Rubber Tyre	VID 1080	£0.60
Cassette Housing	VID 1099	£20.61

N-895

	Part No.	Price
Video Head	VID 2514	£49.68
Pinch Roller	VID 1813	£3.05
Belt Kit	VID 7540	£0.66
Clutch Mechanism	VID 1082	£15.37
Capstan Motor	VID 2166	£50.43
Loading Motor	VID 2167	£13.69
Front Loading Motor	VID 2168	£9.30
Cassette LED	VID 1981	£1.48
Tension Band	VID 1387	£2.25
Remote Control	IR 8947	£20.37
Repair Kit	VID 7919	£22.18
Cassette Housing	VID 1315	£20.61

N-9013/9014/9033/9034/9053/9054/9055

	Part No.	Price
Video Head	VID 2695	£21.34
Pinch Roller	VID 1828	£8.00
Belt Kit	VID 7601	£3.13
Reel Drive Pulley	VID 1265	£6.52
Cassette LED	VID 1981	£1.48

PANASONIC

NV-2000/2010

	Part No.	Price
Video Head	VID 2520	£9.81
Pinch Roller	VID 1757	£3.21
Belt Kit	VID 7800	£1.73
Idler	VID 1054	£0.85
Idler	VID 1055	£0.85
Cam Gear	VID 1221	£1.12
Intermediate Gear	VID 1216	£1.23
Driving Gear	VID 1217	£0.99
Cassette Lamp	VID 1948	£0.24
Tension Band	VID 1397	£3.38
Repair Kit	VID 7901	£19.35
Take Up Reel Table	VID 1312	£10.12
Supply Reel Table	VID 1310	£8.62

NV-300/333

	Part No.	Price
Video Head	VID 2520	£9.95
Pinch Roller	VID 1787	£3.63
Belt Kit	VID 7521	£1.48
Play Idler	VID 1048	£2.58
Idler	VID 1057	£0.94
Idler Arm	VID 1220	£4.20
Cam Gear	VID 1215	£1.08
Intermediate Gear	VID 1216	£1.23
Driving Gear	VID 1217	£0.99
Reel Motor	VID 2158	£18.95
Capstan Motor	VID 2421	£39.43
Cassette LED	VID 1982	£1.62
Tension Band	VID 1399	£2.64
Repair Kit	VID 7903	£10.42
Take Up Reel Table	VID 1312	£10.12

PHILIPS

	Part No.	Price
Video Head	VID 2526	£10.87
Pinch Roller	VID 1757	£3.21
Belt Kit	VID 7530	£1.32
Idler	VID 1052	£1.98
Loading Gear	*VID 1222	£2.25
Idler	VID 1370	£1.98
Idler	VID 1371	£5.94
Limiter Roller	VID 1440	£1.32
Cassette LED	VID 1981	£1.48
Tension Band	VID 1400	£2.55
Repair Kit	VID 7906	£8.92

VR-6540

	Part No.	Price
Video Head	VID 2537	£19.61
Pinch Roller	VID 1815	£5.19
Belt Kit	VID 7547	£0.90
Idler	VID 1060	£1.89
Master Cam	VID 1265	£6.52
Reel Motor	VID 2127	£26.06
Loading Motor	VID 2142	£14.35
Cassette LED	VID 1981	£1.48
Tension Band	VID 1420	£5.10

PYE

DV-761

	Part No.	Price
Video Head	VID 2621	£82.18
Pinch Roller	VID 1827	£7.00
Belt Kit	VID 7588	£1.56
Idler	VID 1252	£3.97
Loading Gear	VID 1253	£6.37
Modification Set	VID 1254	£10.35
Tension Band	VID 1431	£4.27

SAISHO

VR-2000/3800

	Part No.	Price
Pinch Roller	VID 1815	£5.19
Belt Kit	VID 7565	£1.07
Idler	VID 1060	£1.89
Reel Motor	VID 2121	£4.24
Cassette LED	VID 1981	£1.48

SALORA

SV-8620

	Part No.	Price
Pinch Roller	VID 1808	£3.05
Belt Kit	VID 7600	£3.13
FF/REW Idler Arm	VID 1233	£2.97
FF/REW Idler Arm	VID 1234	£2.85
FF/REW Idler	VID 1235	£1.12
Cassette LED	VID 1981	£1.48
Tension Band	VID 1394	£2.92
Take Up Reel Table	VID 1308	£4.72
Supply Reel Table	VID 1305	£4.12

SAMSUNG

VI-510/520/611/616/621

	Part No.	Price
Video Head	VID 2648	£23.80
Pinch Roller	VID 1815	£5.19
Belt Kit	VID 7598	£1.73
Idler	VID 1232	£1.48
Idler	VID 1346	£3.37
Reel Motor	VID 2407	£15.40
Capstan Motor	VID 2409	£25.06
Loading Motor	VID 2142	£14.35
Cassette LED	VID 1981	£1.48

VX-710/720/730

	Part No.	Price
Video Head	VID 2648	£23.80
Pinch Roller	VID 1759	£3.05
Belt Kit	VID 7608	£4.12
Cassette LED	VID 1981	£1.48

SANYO

VHR-1100 EX/EE/G

	Part No.	Price
Video Head	VID 2583	£25.68
Pinch Roller	VID 1787	£3.63
Belt Kit	VID 7558	£2.49
Reel Drive Roller	VID 1076	£6.27
Reel Motor	VID 2198	£13.04
Cassette LED	VID 1981	£1.48
Tension Band	VID 1411	£2.40

VHR-1500 EX/G

	Part No.	Price
Video Head	VID 2585	£46.87
Pinch Roller	VID 1787	£3.63
Belt Kit	VID 7558	£2.49
Reel Drive Roller	VID 1076	£6.27
Reel Motor	VID 2198	£13.04
Cassette LED	VID 1981	£1.48
Tension Band	VID 1411	£2.40

VTC-M10/11/20/21

	Part No.	Price
Video Head	VID 2530	£23.75
Pinch Roller	VID 1758	£3.05
Belt Kit	VID 7809	£0.45
Reel Drive Pulley	VID 1079	£5.94
Idler	VID 1219	£1.90
Reel Motor	VID 2179	£17.39
Tension Band	VID 1408	£1.87
Supply Reel Table	VID 1319	£8.62

SENTRA

VX-5000/8000

	Part No.	Price
Video Head	VID 2713	£23.74
Pinch Roller	VID 1787	£3.63
Belt Kit	VID 7596	£3.63
Idler	VID 1049	£4.05
Cassette LED	VID 1981	£1.48
Tension Band	VID 1399	£2.64

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What a Life!

Donald Bullock

Steve Beeching and his charming wife popped in the other day. They came in a station wagon that made our Ford look a bit utility. "Some car!" I said. "It's the wife's" Steve replied. Seeing that Greeneyes was paying careful attention I changed the subject.

We had a pleasant hour's chat in the bar, much of it spent in mutual sympathy over the lives we lead. Then Steve told us about the items of electronic wizardry that he and his son service as a matter of course. Things that I've heard about though scarcely seen, let alone tackled. Steve has a decided advantage over lesser mortals like me – an extremely fine brain. He also has an enthusiasm that's good to see, dedication to his work and a fine sense of humour. He needs all these in dealing with things like camcorders. I'm reasonably certain that I never want to have to open one of them up!

Thanks for calling in, Steve. We had a good hour or two. Call again sometime – I forgot to tell you how big I am on G11s!

Mrs Whelp's Panasonic NV370

During Steve's visit Mrs. Whelp called with a Panasonic NV370. Next day I put it on the bench. When I switched on there was no channel number display and no LED was alight but the clock flashed merrily and the idler quivered a bit before losing interest. I decided to take a look at the power supply and soon found an open-circuit fusible resistor – R1101. Not a bad start I thought: maybe I'm about to get a run of easy little moneyspinners.

Saisho CT142RX

The next job was a Saisho CT142RX colour portable. I seem to get a lot of Saisho/Matsui sets. This one was dead though the channel 1 LED was alight. The mains fuse F501 (2·5AT) and the 5·6Ω, 5W surge limiter resistor R501 were both open-circuit while the STR50103 chopper chip IC501 had expired. I replaced these three items then checked the line output transistor, which was o.k. So I switched on. No difference!

There was plenty of h.t. at the mains bridge rectifier's output, but no 103V output from the chopper chip. A further check showed that there was no start-up voltage at pin 2. A check on the two feed resistors R502/3 indicated that they were o.k., but how did I know whether they were up to passing current? I've been had before with that one. So I fitted replacements. Still no start-up voltage. My earlier hopes about a run of moneyspinners were fast evaporating. Could the two transistors Q107/8 in the power switching circuit be faulty? In went two new ones, again to no effect. Perhaps the line output transformer, which is also linked to this point, was damping things? The connection is made via the RH1 diode D508 which turned out to be dead short. Why hadn't I tried that first?

A Luxor SX9

The next patient was a 26in. Luxor set, Model 18067349 (SX9 chassis) which was also dead. It's not a set I know, and I didn't have a circuit diagram. There was h.t. about, and the two BU208A transistors in the line output stage and the power supply were all right. Bearing in mind the last set, I decided to go round the diodes with a component tester. No luck this time however. Then, while examining the print side of the board, I saw that some of the joints looked less than healthy. So I went round those on the line linearity coil and the line driver transformer. This brought results, though of an intermittent nature. I then found that the two large copper heatsinks that bridge parts of the copper print were dry-jointed. Resoldering these cured the trouble.

Philips CTX-E Chassis

As I was refitting the back a bearded fellow pulled into the drive. There was a Philips 20CT2026/05 colour set (CTX-E chassis) on the back seat of his car.

"I've brought this set all the way from Lancashire" he said. "Well over a hundred miles. It belongs to my mother who's down here on a visit. Thought I'd bring it along as well as it's intermittent and you did my own set recently."

I plugged it in, took the back off and gazed at the print under the line output transformer. What I expected to see was there – dry-joints. Attention to these and, a few minutes later, all was well.

"Marvellous" he said, "too good to be true!"

"S'nothing" I said, blowing on my nails.

Egbert's Alba VCR6000X

Just then Egbert Crust bowled into the drive, as though he was pedalling an invisible bicycle up a steep hill against a headwind. He was carrying an Alba VCR6000X video recorder.

"Don, for heaven's sake fix this recorder by tonight" he gasped, "otherwise Marina will pack me in."

After he'd bolted I plugged his machine in. It was haywire, like Egbert. On opening it up I found that the loading belt was badly distended. While fitting a new one I saw why. The mechanism had jammed and the belt was fighting it. I removed all the belts and judiciously applied some WD40 to the mechanism. Then I cleaned the pulleys carefully and refitted the belts. This restored perfect operation.

Decca 140 Series Chassis

My next caller brought in a 16in. Decca set, Model DP1473 (140 series chassis). "The picture's unstable and goes off after a minute" she said. I removed the back and switched the set on. Up came an unstable picture with clattering sound, and after a minute the set went dead. As I turned it on to its side it came on again, and I found that I could make the fault come and go by tapping the chassis. So I switched off and busied myself resoldering some dry-looking joints in the power supply. Suddenly something dropped out and rolled on to the floor. It was a large, heavy ferrite bead. I then found a small loop of wire that had obviously been threaded through it and soldered to the chassis. After putting this right (the circuit designation was L803) I tried the set again.

This time there was no picture and sound disturbance at all, but the set went off after a minute as before. Tapping around plug and socket MC01 brought the set to life briefly, but resoldering it didn't help. I then found that flexing the centre front of the panel controlled the fault. Out came the magnifier and I saw that one of the pins of the TDA4600-2 chopper control chip had never been soldered. Attending to this provided a complete cure.

Mrs Rabble's Toshiba VCR

Then Mrs. Rabble brought a Toshiba V309 video recorder along in a pushchair. With her was her precocious little daughter, who immediately went around the room twiddling the controls of every set she saw.

"Do you think you could, er, ask the little girl to stand by the door with you" I asked. "She might get hurt, and we wouldn't want that would we?"

"Oh don't worry about that" snorted Mrs. Rabble. "The point is that you mended this video for us a few months ago and it's never been right since. We haven't had time to bring it back before. My husband says you didn't do it properly. His workmate said you don't know anything about videos. Said we should have took it to Snoddies."

I looked at her and her protege and nodded sympathetically. "They do seem to have all the answers" I replied."

"I'll wait while you do it" she said, adjusting her stance to permanent stay.

I opened the machine and looked inside. A powder compact and a partly nibbled Mars bar were caught up in the mechanism. I took them out and handed the bar to the child and the compact to Mrs. Rabble. "One each" I said. Then I tried the machine, replaced its cover and handed it back. "I haven't the time to do you a bill now" I said, scribbling a few details on my pad. "It'll be only nominal, fifteen pounds or so. I'll drop it in the post to you."

Mrs. Rabble breathed in sharply, smiled weakly and stalked out.

The HRD230 and the Curate's GEC TV

Just as I pulled a JVC HRD230 VCR on to the bench the door opened and the Reverend Goode beamed in. "I know you don't do house calls" he said, "but if you find yourself in my parish sometime do pop in and look at the curate's massive TV set. The tuning buttons don't work."

Off he went and I concentrated on the JVC video. It was all right in the fast forward and rewind modes, but play was fickle. I turned it upside down, removed the base then took out, cleaned and retightened the screw that earths the mechanism control board print. This didn't help. I noticed an evil-looking STK5481 power supply chip and changed it at once, but again there was no difference. So I fitted an idler. Play seemed to be better, but the take-up spool faltered now and again. Then I saw that the tape was also faltering at the pinch wheel. Cleaning it made no difference, and I noticed that the capstan was stopping. So I took out the motor and treated it with WD40. The machine worked well for over an hour on soak test and I was about to pronounce it fit when it stopped again. There was nothing for it but fit a new motor, and they're not cheap. The replacement restored the machine to normal operation.

A couple of hours later I had to take Greeneyes into town. I decided to drop in on the curate on the way back. The set was a huge GEC model. I switched it on and, as its lazy tube warmed up, I instinctively took out my handkerchief and gave the buttons a brisk rub. By then the picture had come up and the tuning was perfect.

"Oh" said the curate, "your very presence has made it work. How clever! Thank you, thank you." He opened the door and I walked out. "God be with you" he cooed.

As I walked back to the car I thought there really must be a better way.

next month in TELEVISION

● SERVICING THE PHILIPS CD104 CD PLAYER
This popular model has been around in various guises since the mid-Eighties. Amstrad for example used the basic machine in some midi systems while Mission put it in a smarter looking box. In addition to machines that come into the workshop with specific faults, some come in because they have been part-exchanged for a more recent model and require certain checks and adjustments to ensure reliable operation before being resold. Mike Leach provides guidance on all aspects of servicing.

● MASTER-SLAVE SWITCH-MODE POWER SUPPLIES
A number of TV chassis use a switch-mode power supply arrangement that's known as the master-slave system because the line oscillator chip, which contains the pulse-width modulator, is the master and is mains isolated from the power supply control/driver chip which operates as its slave. Ray Porter describes the circuit operation and fault-finding procedures.

● TELEPHONE TEST SET
To make ends meet Ian Rees is willing to tackle in his workshop almost anything that runs on electricity. Nowadays cordless telephones, ordinary phones and answerphones arrive in a steady trickle, also the occasional modem and fax machine. They don't present any great difficulties but it helps to have a source of signal apart from the BT line for both monitoring and calling. Hence the test set described next month.

● REBUILDING THE 1590's POWER SUPPLY
The Thorn 1590 and 1591 series chassis were the basis of a very popular range of monochrome portables. Power supply failure is a recurrent problem and unfortunately the series regulator transistors used are now hard to obtain. So J. LeJeune set about designing an updated version of the power supply. It works well and doesn't get too hot.

● TEST REPORT: TANDY 22-167 DMM
Tandy's new 22-167 Micronta autoranging digital multimeter is a high-speed sampling bar-graph instrument that has the look of a meter you'd expect to cost far more. David Botto gave it a thorough test and found it good value for money.

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Solders, Fluxes and Solder Creams

Eugene Trundle

Soldering is such an everyday job that we give it little thought. All you need is a reel of flux-cored solder, a hot clean iron and the sense to apply them to the joint simultaneously. This is only a very small aspect of the subject however. When we have to deal with metals other than copper; when, as in certain Sony TV sets, hot-running resistors have to be replaced; when we want to plumb our own satellite waveguide splitters; when we're confronted with surface-mounted assemblies; in these and many other circumstances there's much else we should know about solder, fluxes and their forms, applications and properties. Time to take a closer look then!

Types of Solder

All solders contain tin, an expensive silvery-white metallic element that melts at 232°C. Pure tin can be used as a solder, but it's costly and relatively weak. For use in virtually all applications it's mixed with one or more other metals to form an alloy. Every characteristic of a solder depends on the composition of the alloy. Many different basic metals are alloyed with tin to make the various types of solder available. In order of importance, they are lead, silver, copper, cadmium, antimony, bismuth and indium.

The most common combination is tin with lead, in the proportions 60/40. This alloy has a melting point of 183°C and good "wetting" quality, which means that it runs readily and coats the surface of the work. With each combination of metals used to make solder there's a certain percentage ratio that gives the lowest melting point. It's known as the eutectic alloy, and gives the quickest transition between the solid and liquid states as the melting point is passed in either direction. Fig. 1 shows this graphically for tin-lead alloys, whose eutectic combination is 63/37. An instant change from the liquid to the solid state is undesirable in many applications, because the slightest movement or vibration at the transition point can cause joint fissures that can lead to trouble later. 60/40 solder has a plastic range of 5°C: the higher the proportion of lead used, the greater the plastic range but the lesser the wetting ability – and the cheaper the solder.

A common additive in solder is copper, typically as a 1·5 per cent proportion of the alloy, an amount calculated precisely to prevent any copper absorption from the soldering iron bit during the soldering operation. It also prevents erosion of PCB print and fine copper wires by absorption into the solder.

The next main group of solder alloys are the HMP (high-melting point) types which have a typical transition temperature of 300°C due to their very high lead content of over 90 per cent. Silver, at about 1·5 per cent, is normally added to the HMP alloy to improve its strength and wetting power. In addition to being used to make joints that are expected to get hot in use, this type of solder has excellent low-temperature characteristics in service. Solder that contains silver also has the important property of preventing *leaching*, i.e. absorption of the silver content of the workpiece, which is important in some applications.

The main applications for low-melting point solders are in work with gold and silver, heat-sensitive devices and flexible printed circuits. The lowest melting point alloy that can be drawn into conventional wire is made of a 50/32/18 tin-lead-cadmium alloy. It liquifies at 145°C. A 15/33/52 tin-lead-bismuth alloy with a melting point as low as 96°C is available in paste form. A 43/57 alloy of tin and bismuth turns liquid at 139°C.

Lead-free solders are sometimes required – lead is a very toxic material. They are expensive, containing over 95 per cent tin with the balance made up of antimony (high-melting point alloy) or copper. There's also a 96/4 tin-silver alloy, a bright, strong solder for use with stainless steel.

A special alloy is required to solder aluminium, which is not the metal most amenable to this operation. It consists of a tin-lead-cadmium alloy in the proportions 18/80/2. The other main requirement when soldering aluminium is a very strong and active flux. We'll come to fluxes and their characteristics later.

Apart from this and the other special cases mentioned above, in general virtually any solder alloy will work with any metal that's solderable – which is most of them! Non-solderable metals are chromium, pure beryllium, magnesium and titanium, which are not the ones you bump into every day. Apart from aluminium, which has already been mentioned, the more difficult metals to solder are steel, nichrome and cast iron (the latter must be machined before attempting to solder it), all of which require the use of very strong fluxes. The most readily solderable metals are copper, silver, tin and lead.

Thus the large number of solder alloys available – see Table 1 – is accounted for not only because of the variety of metals that may have to be bonded but also because of the vast range of soldering methods in use and the subsequent conditions of service. Factors like physical strength, toxicity, operating temperature, corrosion resistance and, much more rarely, electrical or thermal conductivity have to be taken into account. Cost is a large factor of course: the more tin and exotic metals in the mix, the more expensive the solder.

In general, it's necessary to raise any solder about 60°C above its melting point the ensure a good, strong joint.

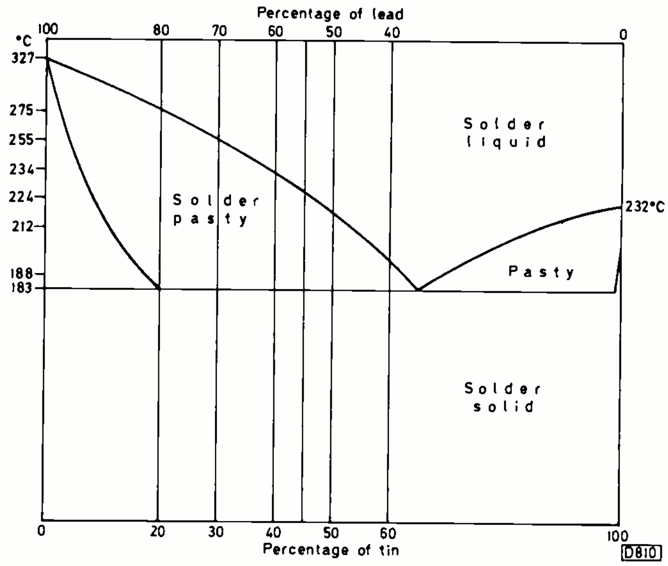

Fig. 1: Characteristics of tin/lead solder alloys. Most alloys have a plastic range which increases as the eutectic combination is departed from. Alloys of other metals have similar characteristics.

Table 1: The Multicore range of tin/lead alloy soldiers.

Alloy Tin/Lead	Multicore Colour Code (Reel and Case Labels)	Melting Temperature Solidus °C	Liquidus °C	Recommended Minimum Bit Temperature* °C	Uses
Sn63 60/40, Sn60	Blue Red	183 183	183 188	243 248	High quality work requiring low melting point alloy
Savbit 1 50/50 45/55 40/60	Green/Red Yellow Crimson/Buff Green	183 183 183 183	215 212 224 234	275 272 284 294	Hand soldering radio, telephone and electrical equipment; batteries
30/70	White	183	255	315	Fuses, motors, radiators, lamps
20/80	Purple	183	275	335	Lamps
15/85	Orange	227	288	348	Lamps
T.L.C. (Tin/Lead/Cadmium)	Pink	145	145	205	Specially low melting point solder. Soldering on Gold
L.M.P. with 2% silver content (and Sn62 alloy)	Red/Blue	179	179	239	Particularly useful when soldering ceramics or other silver-coated surfaces
P.T. Pure Tin	Light Blue	232	232	292	Used when a lead-free solder is required
High Melting Point (H.M.P.)	Dark Blue	296	301	361	Special high melting point solder to B.S.219 Grade 5S
95A	—	236	243	303	High melting lead-free alloy
96S (Sn96)	—	221	221	281	Bright strong non-toxic solder.

*Soldering iron bit (tip). Solder baths can operate 10°C lower.

Thus the recommended bit temperature for the most common type of solder (60/40 tin-lead) is about 250°C. For HMP solder it's about 360°C. In service it's necessary to ensure that the soldered joint always remains at least 40°C below its *solidus* temperature, i.e. the point of transition from the liquid or plastic to the solid state. This safety margin is particularly important when the joint is subject to any physical stress or vibration.

Since all solders are conductive there's no need for the two metals to be joined together to be in contact: indeed the best physical joint strength is achieved when the two surfaces to be joined are about 0·1mm apart. All types of solder have good capillary properties and will flow into gaps and crevices spontaneously to seal and bond them – so long as there's an exit at the end or side to release air and flux.

Physical Forms

Solder is manufactured in many physical forms. Trapezium-shaped bars are available for use in equipment manufacturers' solder baths. Other bulk forms are oval and round sticks, solid wire and pellets. To avoid the contamination and oxidation inherent in casting ingots of solder, the better manufacturers use an extrusion process to produce bulk forms of solder. Mainly outside the consumer electronics industry *preforms* are used, in the form of rings, gaskets or any other shape of flat insert, for use between two surfaces which are subsequently bulk heated. They can even be made with flux inserts, but are now being superseded by solder pastes and creams, which can be painted on as a "liquid preform". Solder cream is an increasingly important product to which we'll return later.

The most familiar form of solder to those of us at the bench is of course flux-cored wire. It's available in about twenty different alloys, for different purposes: the ones we use are the general-purpose 60/40 or 63/37 tin-lead alloys, ideally with some copper content, and the HMP type. Solder wire comes in 10-24 SWG, of which the most useful for general purpose and conventional PCB work is 18 SWG and for surface-mount and similar fine work is 22 SWG.

Flux is a vital agent in any soldering operation. Its incorporation in solder wire is the key to easy, reliable jointing. Continuity of the flux is important: if it's missing, joints made with the "bare" solder will not flow and run properly and won't bond as they should. Maybe this is not such a problem if you can see what's happening while you are soldering: but it can happen that a flux-starved joint looks acceptable and has electrical continuity but, remaining dry inside, it's likely to lead to trouble later.

Especially in natural rosin form (see later) flux is a crystalline and physically rather unpredictable substance in that it's difficult to ensure consistency and continuity in a core. Like seaside rock, solder starts in a very 'fat' form and is progressively reduced in diameter, not by rolling as with candy at Brighton but by being drawn through progressively smaller dies. It's easy to appreciate that a very small void in the flux at the extrusion stage will result in a very long discontinuity in the drawn-down wire.

Hence the need for several cores of flux in the wire. Provided that each core is extruded from a separate nozzle, the chances of a complete loss of flux at any point are very small. As far as I know, the only manufacturer who makes solder wire with truly separate flux cores is Multicore Solders Ltd. The Ersin type is the best known of these. Other manufacturers' products have a single thread of flux or a pseudo-multicore structure in which the flux cores (which sometimes collapse together at the centre, see Fig. 2) are injected through a single nozzle with five holes in it. From the reliability point of view this process is little different from single-core injection. The other advantage of multicored solder wire is that there's only a thin wall to melt before flux is struck and released, enhancing heat

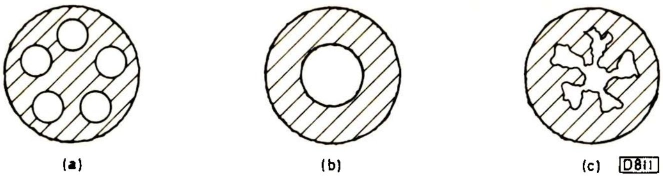

Fig. 2: Cored solder: (a) shows the genuine five-core type with completely separate flux channels, (b) shows a single flux core while (c) shows an imitation multi-cored solder in which the flux cores are not truly separate.

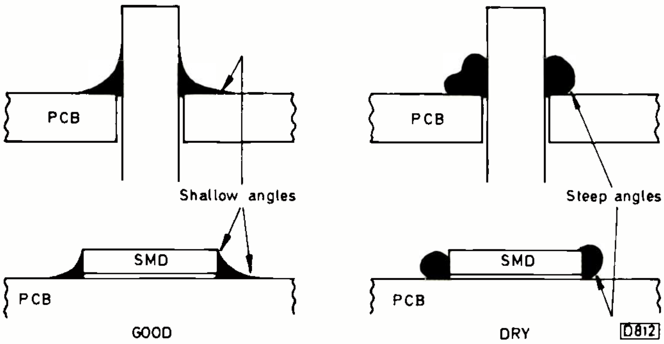

Fig. 3: Judging the goodness of a solder joint. If the solder 'blobs up' around the joint it's likely to be dry – good joints have a lean profile.

transfer and the melting of more solder. This speeds up the hand soldering process.

When using flux-cored solder wire it's essential that the solder is applied directly to the joint, so that the flux isn't burnt and de-activated before it can act. Ideally the joint should be above the solder's melting point before the solder is applied. This is easy with a blow-torch on a copper pipe, rather more difficult with a soldering iron and an electrical joint. Hold the solder wire on the joint, then apply the iron to both. If more solder is needed, feed it in between the iron and the workpiece. Most defective joints are caused by: dirt/oxides on the workpiece, allied to which is the use of an insufficiently active flux; the flux burning out before it contacts the joint; an insufficient heat supply, for example when the heat is sapped by thermal conduction of the workpiece; and inadequate temperature.

Whatever the heating method used the quality of a soldered joint can be judged by the angle between the surfaces of the workpiece and the solder. A good joint has a contact angle of 45° or less, while poor wetting is betrayed by an angle of 90° or more, see Fig. 3. This applies to all types of joints, whether you're plumbing in a sink or an aerial socket, soldering a mains transformer to a PCB or dealing with a pinhead-sized surface-mounted device. We don't propose to go into the techniques used when soldering SM assemblies here, since they were covered in pages 482-3 of the May 1987 issue and 202-5 of the January 1991 issue.

Fluxes

The subject of flux has been touched on several times already. When it's in the form of a core in solder wire we don't have to think much about it. If however we have to solder a dirty or difficult metal, rework SM assemblies or cobble up a waveguide or a car radiator, a knowledge of fluxes and their properties is useful.

Soldering is possible only when the surfaces to be joined are clean and free of oxides. The surfaces of all metals oxidise quickly – almost instantaneously when hot. The job done by the flux is to remove the oxides and other contaminants chemically at the instant of soldering, thus facilitating the intermetallic bond between the solder and the workpiece. Flux is also a conductor of heat and a wetting agent – to prove the point, try making a joint with pure solder and a bare iron!

The most common flux base material is rosin, the gummy or crystalline yellow secretion of pine trees. When molten, pure rosin has the ability to wet both metals and metal oxides, but it's not sufficiently acid to dissolve oxides. Thus it's a very mild flux, suitable only for use when soldering clean copper, silver or tin. It leaves a hard, protective non-corrosive residue on the joint.

For a more effective fluxing action activators are added to the rosin. They have a corrosive action only at high temperatures. During the soldering operation the reagent is destroyed by combination with the oxide or driven off by the heat. Any that remains recombines with the flux on cooling, leaving a non-corrosive residue. Activators are often made of halides – compounds of bromine, chlorine, iodine and ammonia. Other activators are zinc and ammonium chloride, ammonium hydroxide and various organic and inorganic acids. It's important to use the mildest flux that can do the job reliably. There are many grades of flux: R, non-activated; RMA, mildly activated; RA, fully activated – up to very corrosive acid and special types whose residues must be cleaned from the work afterwards and which are not suitable for electrical or electronic applications.

Natural rosin is not a very stable material. Synthetic substitutes, based mainly on benzine-type compounds, are available. This synthetic resin has better stability during reflow and leaves a paler and very inert residue that in most cases doesn't have to be removed from the work. Like rosin flux, the synthetic type is available in several levels of activation. Water-washable fluxes have been developed to avoid the need for CFC solvents where residues must be removed.

The flux is already present in the solder wires and creams we use, but a pot of general-purpose flux paste is useful to have available for such jobs as soldering aerial sockets to tuners and VCR modulators/boosters etc. A useful liquid flux for use with SM boards is type MB045 from OK Industries (0703 619 841). It's specially designed for SM rework purposes, both component removal and replacement, helping to inhibit and remove oxide growth, facilitating heat transfer to the joint and preventing the solder from "stringing" when a component is removed from the board. Another application of liquid or paste flux in repair work is the realignment of skewed SM components. All the joints are generously anointed with flux and the component is heated to the reflow temperature: it will tend to realign itself with the PCB lands due to surface tension in the molten solder.

Solder Cream

Solder cream is a coarse grey paste (see Fig. 4) which consists of three ingredients: atomised solder particles, a liquid flux and a vehicle in the form of a waxy, oily or jelly-like compound. It's been around since the early Seventies and is now a highly-developed product. Virtually all the alloys previously discussed are available in paste or cream form. In fact the permutations of solder-particle size, flux type and vehicle characteristics in production runs to scores. For SM assembly use the most popular alloy is again 60/40 or 63/37 tin-lead, with a liquidus point of around 187°C. The mix very often contains very small amounts of silver (two per cent) and perhaps antimony (0·3

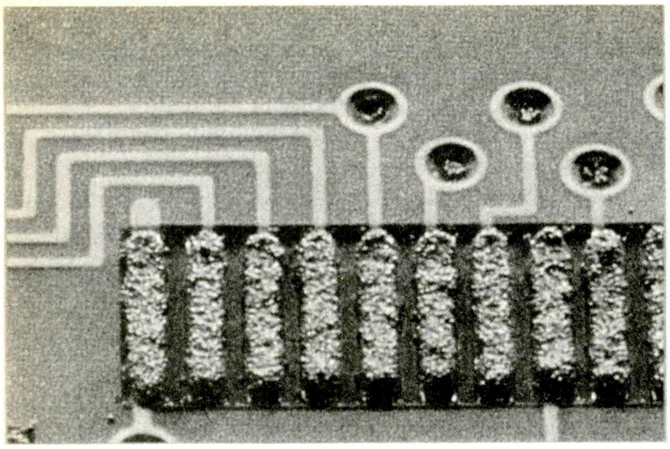

Fig. 4: Solder paste in place: the photograph clearly shows its grainy texture.

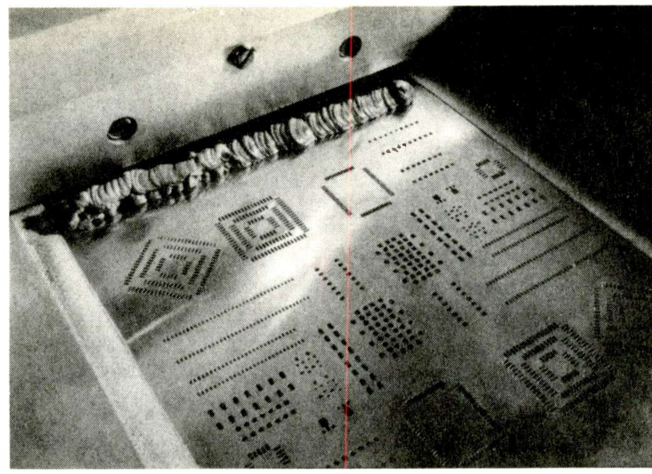

Fig. 5: A brass stencil for the precision application of solder cream during SM assembly manufacture. The cream, at the top, is ready to be wiped across the stencil, which is precision aligned with the PCB beneath it.

per cent).

The grains of flux powder in solder paste are usually spherical, with diameters ranging from 25 to 100 microns. The finer grains are used with fine-pitch PCBs that have component leg spacing as close as 0·015in./0·4mm – as with the small 100-leg packages now in use. The particle diameter in a typical general-purpose solder paste is screened to 45-75 micron size. In the manufacture and storage of solder cream it's important that the solder powder acquires as little oxide content as possible, so that the flux action can be concentrated on the work rather than the solder itself. An oxide content of 0·5 per cent is acceptable: 2 per cent is bad.

The flux used in a solder cream can be of any of the types described so far. For SM use it's generally a rosin-based RMA type or a mildly-activated synthetic substitute that may be water soluble.

The vehicle, in which the solder powder and flux are suspended, largely determines the physical properties of the cream – viscosity, tackiness and slump. Solder creams have a metal content of between 75 and 90 per cent, the rest consisting of flux and vehicle, both of which are driven out of the joint during the soldering (*reflow*) process. For dispensing from a syringe, an 85 per cent metal content cream with a more runny consistency (lower viscosity) than that used in manufacturing is generally specified.

During factory production of SM boards the solder cream is placed on the panel precisely, using a stencil or a screen-printing technique, see Fig. 5. A flexible squeegee is passed over the surface, pushing the solder cream into the holes: cream used with stencils has to have a higher viscosity and metal content. The SM board is then heated by one of several methods to reflow the solder and connect and fix the components.

There are several thermal phases in the reflow process, see Fig. 6. The assembly is first brought up from room temperature smoothly to drive off moisture and solvents and prevent thermal shock. Next the temperature is taken above the solder liquidus for about thirty seconds to ensure full and even reflow. The assembly is then allowed to cool fairly rapidly, assisted by fans. The whole process takes about six minutes in an infra-red furnace, which is the most common arrangement. Other methods are vapour phase reflow, in which the SM assembly passes through the hot vapours above a vat of boiling fluorinated hydrocarbon, using the latent heat of condensation to reflow the solder; and finally hot bar and laser heating, with each component dealt with separately.

One disadvantage of solder cream is its tendency to deteriorate with time, especially at high temperatures. Always keep the container sealed to prevent evaporation: storage should be in a refrigerator, at 5-10°C. Kept in this way the shelf life of a large pack is about twelve months while that of a small pack, e.g. a 25g syringe, is around six months. The problem is that after being removed from the fridge the cream needs about 24 hours to acclimatise to room temperature, which is hardly convenient for the sort

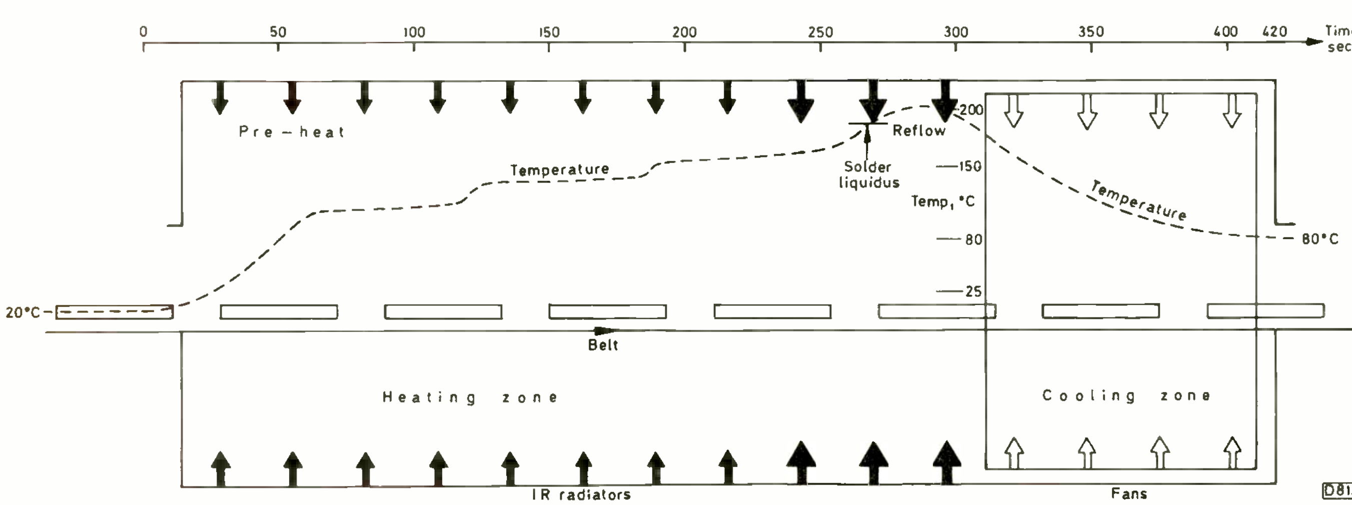

Fig. 6: Infra-red reflow furnace operation. The time scale is shown at the top and a graph of the temperature (called the thermal profile) is drawn across the centre.

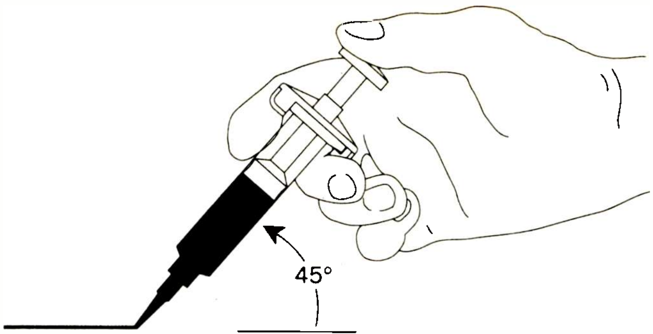

Fig. 7: Dispensing solder cream from a syringe during an SM rework operation. There are several types of syringe dispenser, operated by muscle power as here, from air pressure or on a 'popgun' principle. To provide a smooth flow some needles and flow tips are Teflon lined.

of use it gets in a repair workshop!

Shelf life and storage temperature requirements depend very much on the vehicle/binder used. That adopted by ESP (0234 211 582) permits storage at room temperature for a shelf life of one year. So this is the most practical type for service departments and rework stations. It comes in 35 and 70g syringes, which are ideal for hand dispensing. ESP also markets dot-maker dispensers and complete rework/repair kits. Another company that markets dispensers, syringes, barrels and needle-tips for use with solder cream is EFD (0582 29 444).

Correct dispensing of cream on to a PCB requires practice and the right needle diameter. For fine work the narrower the needle the better, but the internal diameter must be at least three times the particle diameter, i.e. no smaller than 0·016in. For best control the dispenser should be held at an angle of about 45°, see Fig. 7.

Jargon

Many terms that may be new to the service technician are encountered in the realm of soldering. To help with this a glossary of terms, listing those most applicable to our field of operations, accompanies this article.

Acknowledgements

My sincere thanks are due to ESP, Multicore Solders Ltd., OK Industries, RS Components and the Technical Support department of Sanyo UK Sales Ltd. for help in the preparation of this article.

Glossary of terms.

Alloy: A combination of two or more metals to obtain specific properties.

Creep: Deformation of a solder joint, especially under mechanical load.

Curing: Preheating of solder cream to drive off evaporants.

Dispensing: Deposition of solder cream in lines or dots, using a syringe.

Eutectic: The proportion of the metals in an alloy that produces the lowest melting point of which the combination is capable.

Fine line cream: Small-particle (less than 75 microns) solder paste for fine-pitch applications.

Flux: Material used to dissolve surface oxides, improving the flow and wetting of solder.

Flux residues: Material left on and around soldered joints after the reflow.

Leaching: Absorption by solder of metal, e.g. copper or silver, from the joint material, workpiece or soldering iron.

Liquidus: Temperature at which an alloy becomes wholly liquid.

Low residue: Term applied to fluxes that leave little or no deposit after the soldering or reflow operation.

Medium: The non-metallic content of a solder cream, including flux, solvent and a vehicle.

Metal content: Quantity of alloy in a solder cream, expressed as a percentage of weight.

Preforms: Flat shapes cut from solder tape to fit specific locations.

R: A pure rosin flux.

RA: A rosin flux containing activators for use on difficult, dirty or oxidised metals.

RMA: Mildly activated rosin flux.

Reflow: The process of melting solder creams or preforms.

Resin: Flux based on synthetic compounds rather than natural rosin.

Rheology: The physical/flow properties of a solder cream.

Rosin: A secretion of pine trees.

Sequential soldering: The use of solders with different melting points and progressively cooler soldering/reflow temperatures.

Slump: Tendency of a solder cream to spread from the shape and position in which it was dispensed or printed.

Solder balls: Discrete balls of solder that separate from the main mass during reflow.

Solidus: Temperature at which an alloy becomes wholly solid.

Tackiness: Adhesive property of a solder cream or flux: useful for holding components in position before reflow.

Temperature gradient: The rate of change of temperature across a surface or in time.

Thermal shock: Effect on components and joints of rapid heating or cooling. Thermal gradients of more than 2°C/sec can be harmful, especially to multilayer ceramic structures.

Tombstoning: Graphic description of the way in which small SM components, e.g. resistors and capacitors, jump up when one end reaches the reflow temperature before the other one does during soldering.

Thixotropic: A solder cream whose viscosity changes according to the rate at which it is disturbed.

Viscosity: A measure of the resistance of a cream to shear or flow, i.e. stiffness or runnyness.

Wetting: The spreading ability of molten solder over a joint or workpiece.

Wicking: Flow of solder away from a joint up a lead or leg, usually due to a temperature differential.

Fault Notes on the JVC HRD110/Ferguson 3V38

John Coombes

The JVC HRD110 was on sale during the period 1984-5. It appeared in various guises including the Ferguson 3V38/39/49, the ITT VR3605 and the Toshiba V55. The following fault notes summarise our experiences of these machines.

No results: First check the 500mA fuse F1 which may simply have gone open-circuit. If a replacement blows check for shorted turns in the mains transformer. The next item to check is the 2·5A fuse F2 which again may simply be open-circuit. If this fuse has blown check for shorts in the 0·01μF filter capacitors C1-5 and the bridge rectifier diodes D3-6 (two type 30D2, two type 10E2). Next ensure that relay RY1 is operating and is not open-circuit. Q2 (2SD637) and/or Q3 (2SD880) could be short-circuit. If the power regulator appears to be working correctly check whether CP2 on the servo/logic/audio panel is open-circuit.

No clock display: Check the 315mA fuse F3. If a replacement blows check for shorts in D11 (11E2), Q8 (2SA1020), C20 (33μF) and/or D12 (HZ30-2L). Alternatively C18 (100μF) could be leaky.

If the l.t. supply to the clock display is present the display itself (FDP) could be faulty. Check the voltages around the UPD7538C chip IC1 very carefully: if necessary check the chip by replacement. Other possibilities here are absence of the reset pulse at pin 1 or the voltage at pin 41. If the latter is missing, suspect IC2 (TL077P) and/or Q1 (DTC114). Check these items by replacement. As Q1 is a digital transistor the resistance readings you obtain will not be what you might expect.

Will not take tape into the cassette housing: Ensure that the l.t. supply is present at pins 1/2 and 8/9 of the M54544L chip IC204. If not, check whether circuit protector CP1 is open-circuit then if necessary check IC204 by replacement. Alternatively the up/down detector switch could be faulty.

Cassette housing moves in and out: First check the voltage at pin 39 of the M50740-602SP chip IC201. If this is unstable the resistive network RA204 could be faulty or dry-jointed. Don't confuse this fault with intermittent loading of the tape into the cassette housing due to a faulty front loading motor or broken or damaged cogs on the cassette housing unit.

Tape loads but no capstan rotation: Check the loading belt which may be stretched and/or the loading switches which may be faulty.

Intermittent stopping in play/record: This is usually due to a faulty take-up reel sensor or coupler. Check by replacement.

No fast forward/rewind: The usual cause is a worn reel idler. Alternatively the reel belt may be stretched or cracked and thus slipping.

No play/intermittent play: The usual cause is a worn rubber drive wheel on the idler arm, the result being no tape take up. If necessary check the take-up spool and the capstan belt which may be stretched or cracked, causing slipping and tape looping around the capstan flywheel spindle. If the tape is creased in pleats and looping, check the pinch roller by replacement.

Sound Faults

Intermittent sound on record: If you get this fault accompanied by coloured patterns on the picture ensure that C27 has been increased in value from 0·0015μF to 0·0082μF – this value can vary with model. Alternatively the cause of the fault could be broken leads at the full erase head.

Intermittent record sound: If this fault occurs along with no picture, check the plugs and sockets associated with the audio/control head. Things to look for here are poor connections, dry-joints or even high-resistance connections. Alternatively the cause of the intermittent sound could be a worn audio head.

Recorded sound at low level, possibly with excessive treble: Check the audio record signal at pin 1 of connector CN1. If incorrect, L4 could be open-circuit or there could be dry-joints or cracks on the PCB.

Electronic Faults

Bent verticals/poor sync with E-E signals: Check the a.g.c. voltage at pin 3 of the M51316P chip IC1 very carefully. If it's incorrect C7 (0·047μF) is probably faulty. Alternatively you may have to check IC1 by replacement.

Noise bars on playback: The capstan servo is unlocked. Check for a trapezoidal waveform at TP403. If this is missing, check crystal X401 by replacement. Otherwise replace IC403 (HA11751NT).

Playback o.k. but no fast forward or reverse search capstan drive: You may have to trace through the whole of the capstan servo drive circuit to find an open-circuit component. R605 (100kΩ) is a possibility.

Capstan motor stops intermittently in reverse search: Check the voltages around IC206 (M54544L) very carefully, especially at pin 6 which should go to zero in the reverse search mode. If this voltage doesn't fall to zero, check Q218 (DTA144F) and/or D229 (1SS133), by replacement if necessary.

No playback luminance: Check the voltages around IC101 (M51454L) and/or IC102 (HA11738). If an incorrect voltage is found, check the chip by replacement. Alternatively you may find that R111 (22kΩ) is open-circuit. In this event there may be no luminance with chroma flashing.

No record luminance: Check the voltages around IC102 (HA11738) and/or IC103 (HA11724). If an incorrect voltage is present check the chip by replacement. An alternative is leakage in D104 (MA27). You may have to check this on the high ohms range.

CD Player Casebook

Reports from Mike Leach and P.J. Roberts, G1VUV

Rotel RCD865

This player uses the later type of Philips laser assembly, similar to that employed in the Philips CD371. The reported fault was very poor sound from cold and very bad background crackling. We found that the sound returned to normal, with no crackling, when the machine had been on for approximately five minutes. Once the sound had returned, no amount of provocation would make it go away again. So fault finding was limited to only a few minutes at a time. As this few minutes wasn't long enough I gave in and spoke to Rotel about the matter. An extremely helpful chap advised me to check the state of the printed circuit under the PDM board, where the connections from the main board are soldered on to the PDM board. I was surprised to find several pieces of very fine print all cracked around the plug connections, as described on the phone. After carefully repairing all the print and resoldering the PDM board back into place we soak tested the machine for several days. All was well. Thank you Rotel, you saved us a great deal of time. **M.L.**

Sharp DX450EM

The complaint with this machine was no results. One of the power supply fuses, F202 (500mAT), had blown. When I replaced it and switched on the machine read the TOC all right but when play was pressed nothing happened. This was due to the fact that the sled motor had jammed, so the laser wasn't able to move towards track one. I gave the top bearing a very small drop of thin oil. This released the bearings and the laser was now able to move across the disc. Track one played o.k., but when I selected say track five or six the sled started to move and the fuse blew again. The motor had to be replaced. When I'd done this the machine still blew the fuse when the sled started to move, but this time it was because I'd used a 400mA instead of a 500mA fuse. The new motor and a correctly rated fuse cured the problem and the machine once again produced good results. **M.L.**

Philips CD104

No sound was the problem with this machine. It read the TOC all right and would go into the play mode, but there was no output. Checks showed that the supply lines were all o.k., and the earth feed-through connections had all been resoldered on a previous occasion. When I applied a small amount of freezer to the SAA7000 interpolator chip IC6514 normal sound was restored. A new chip put matters right. **M.L.**

Sony CDP-M35

This machine came in with the two circuit protectors PS901 and PS902 open-circuit. After replacing them and switching on they again blew. A look at the circuit diagram showed that these protectors are in the +12 and −13 supplies to the various motor drive circuits. Cold checks then showed that there was a short-circuit in the sled motor drive circuit. I removed the two transistors, Q605 (2SC3666) and Q606 (2SA1426), then replaced the circuit protectors (type N15) and switched on. As expected the machine powered up and read the TOC. Obviously it wouldn't play because there was no sled drive, but I'd proved the point. Fitting new transistors restored normal operation. After completing the electrical repair I checked the mechanics thoroughly in case an obstruction in the sled mechanism could have caused the motor to stall, damaging the transistors. As all was well here and the motor itself appeared to be o.k. the machine was returned to the customer. **M.L.**

Pioneer XRP500

The ticket attached to this midi system said "no CD". It didn't read the TOC with any disc. In fact it was obvious when listening to the machine that the turntable motor was struggling to achieve the correct speed. I was surprised by this as it's a much later model than the Pioneer range that's now giving turntable motor problems, but after stripping the CD mechanism down I saw that the motor is of a similar type to that used in earlier machines. Fitting a new motor, part number PYY1109, once again produced good results. **M.L.**

Rotel RCD865

Intermittent output from the left-hand channel was the complaint with this machine. It had apparently given trouble for some time. When the fault was present there was no sound whatsoever from the left-hand channel. The cause of the problem turned out to be poor connections to the audio leads on the right-hand side of the PDM board. The cure is to remove the audio plug from the board and hard wire it. I understand that this is becoming a common fault with these machines. **M.L.**

Pioneer PD5010

This player would sometimes fail to read the TOC: when it finally did and started to play it would skip. As you will probably know by now, there's at present a high failure rate with spindle motors (PYY1109) in Pioneer players. This player uses a different type however and I didn't suspect it. What I did suspect at this stage was the little brown plastic bearing on the clamper holder (receptacle). On inspecting this I found that a large pit had worn away at the centre, applying friction to the disc clamper and thus preventing smooth rotation of the disc. With a new receptacle (part number VNL268), lubricated and fitted in the clamper holder, normal operation was restored – the machine played the test disc with no difficulty. **P.J.R.**

Philips CD150

This player was included as part of a midi system (FCD565/35). The symptom was no sound from the left-hand channel. Scope checks showed that the signals in both channels were present at the output from the DACs, also at pin 2 of the LM833N chips 6308 and 6309. But there was no output at pins 1 and 7 of IC6308. I then noticed that R3362 (100Ω) had burnt up and, with the power off, a cold check showed that there was a short-circuit at pin 4 of IC6308. Another cold check was made after removing the chip. As the short-circuit was still present the chip was cleared of suspicion. On tracing back we found that C2382 (47μF) was short-circuit. **P.J.R.**

Pioneer PDM700

The original fault symptoms – failure to read discs, not even the TOC, with the disc not reaching full speed (approximately 500 r.p.m.) – were indicative of a faulty spindle motor. But the customer had taken the top off to see if he could fix the unit himself and in doing so had created another fault – a very dim display. A few quick checks around the display showed that there was no −26V supply at pin 57 of the display driver chip IC201. This supply was traced back to Q18 (2SA933S) which had −32V at its collector, −26V at its base and +3V at its emitter. When Q18 was removed it was found to be open-circuit between its emitter and base. I used a BC640 as a replacement. With this fitted and a new PYY1109 spindle motor installed the display lit and the unit played discs without difficulty. **P.J.R.**

TEST CASE

352

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.

Late winter is traditionally a quiet time, in the Test Case workshop anyway. So on this Saturday various workshop worthies had taken the day off. Sage was in Wales, getting to grips with the technology of his beloved steam railways; Television Ted was decorating his living room; while Service Manager – well, no one seems to know where he gets to most of the time... Thus it was that Dylan found himself in sole charge of the service department, a situation that can lead to much material for this column! Cherry-picking at the items on the repairs-inwards shelf, he settled for a middle-aged, VHS top-loader VCR whose job card accused it of poor sound. Probably wants its head cleaning thought Dylan. Stuffing himself with bacon-flavoured crisps, Dylan hooked it up and removed the top cover.

He fed in a prerecorded tape, *The Search for Spock*, and found that the voices of Captain Kirk, Scottie and the others fluctuated somewhat in volume. There was also a hiss that was not all due to the motion of Starship Enterprise. Going boldly where many men had gone before, Dylan cleaned the audio head with surgical spirit. This did little for the audio reproduction from the tape, which Dylan knew had a good sound track. Looking for further clues, he recorded the workshop test card and test tone while finishing his crisps. Playback of the newly-recorded sound was even worse than that from the Star Trek tape: the volume level fluctuated between low and almost absent. To get a normal sound level, he had to advance the setting of the monitor TV set's volume control quite a lot. This led to the intrusion of hiss and buzz, especially when the off-tape sound waned. Dylan turned the TV set's volume down, switched the VCR off and went to look for a service manual.

Following the instructions it gave, Dylan carefully set up the audio record signal and bias levels, using an oscilloscope. The same scope, hooked to the VCR's audio output socket, showed that doing this had little effect on the sound output with the machine's own recordings and absolutely none with tapes recorded in other ways. Think again, boyo, Sage's voice seemed to echo from the far land of Gwynedd.

Dylan thought again, got out his dental mirror and studied the path of the tape past the audio head stack. He saw that while the tape started off in perfect alignment with the audio and control track heads within a few seconds it moved down a fraction of a millimetre. The pinch roller was very shiny and quite worn. So he replaced it with a new one. The tape no longer moved downwards during its passage past the head stack, but with both library and self-recorded tapes the results were still far from being right.

The sound waxed and waned over a period of one or two seconds. Because of this, Dylan was reluctant to suspect the electronic circuitry which, so far as he could make out, differed in the record and playback modes. What mechanical problem, he wondered, could cause this fault? Dylan wished he'd picked up the next VCR on the shelf – it had ruined a *Keep Fit with Jane Fonda* tape. Instead, he picked up the phone and called Ray Ripoff, a rather shady ex-workshop staff member who now runs his own servicing outfit next to the Tandoori Takeaway in King's Road.

Ray had problems of his own – a bounced bodge job had been occupying him all morning. He advised Dylan to wind the grubscrew at the back of the audio/control head so that the head tilted outwards slightly "to get a good grip on the sound". Dylan did this – to the point where servo lock was lost as there was no control head contact with the tape – but still failed to get adequate sound. What was the real cause of the problem? Was it mechanical or electronic? For the answer and a further item in the Test Case series, see next month's issue.

ANSWER TO TEST CASE 351
– page 363 last month –

Brightness faults are usually easy to deal with. Last month however Sherlock was having difficulty with a TV set fitted with the Ferguson TX99 chassis (20in. version). There seemed to be no logical cause for its excessively bright picture: the tube's first anode voltage was correct, and the brightness control voltage applied to the colour decoder chip was also correct. The symptoms didn't change when a new decoder chip was fitted, and instead of being high the d.c. levels at the bases of the RGB output transistors were low. It was this latter anomaly that provided the clue to the cause of the fault.

The RGB output transistors were clearly passing excessive current. If the base voltages were low, something was amiss in the emitter circuits. The emitters of the three RGB output transistors are connected together and taken to chassis via the pnp transistor TR20, which normally provides a stable bias. It had become leaky between its emitter and collector, a replacement providing a complete cure. Sherlock's mistake was to overlook the biasing of the RGB output stages and rush straight back to the colour decoder chip when he discovered that the voltages at the picture tube's cathodes were all low.

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		KBL08	£1.95	SR2M	£0.75
				T9053V	£1.40
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ASK FOR SEMICONDUCTORS NOT LISTED

VIDEO HEADS

AMSTRAD
3HSSR-VCR7000 (Saisho/Orion) £18.00
PSF1-VCR4500,5200,9000 .... £15.00
PSF2-VCR4600,4700 .... £15.00
PSF3-VCR6000 .... £21.50

FERGUSON
3HSSV-2 Head universal £7.50
3HSSVA-3V42,44,45,46 etc £20.00
3HSS4VB-3V32/HR7655 .... £25.00
3HSS4VC-3V48/HRD565 .... £26.00
3V48,58,59,65,FV10,11,12,13,14,20,21,26
And most other Fergusons .... POA

HITACHI
3HSSHA-VT8000,9000 series £17.00
3HSSHB-VT11,33 etc £17.00
10082-VT120,220 .... £29.00
10081-VT130,135 .... £30.50

PANASONIC
3HSSN-2 Head universal £7.50
3HSSU1N-NV100,370,380/Philips VR6460 .. £11.00
3HSSU2N-NV230,470,480,G9,10,11,15PX £21.00
3HSSU3N-NV430,460 .... £16.00
3HSS3N-NV777,330 .... £18.50
3HSS4NB-NV730 .... £26.00
3HSS4NA-NV366 .... £24.00
NVG30,33,40,45,46,130, & most other Panasonics .... POA

SANYO
3HSSSY-VHR1100,1110,1300 .... £20.00
3HSS3SY-VHR1500 .... £34.00

SHARP
3HSSSP-VC9300,9500,9700,381,481,482,483,486 etc £17.00
3HSSSPB-VC581,583,651,670 etc £17.00
VC7000,8000 series (Brass) £42.00

OTHER MAKES
Alba 4000, Goldstar 8000, Sentra 8000, Solavox 1000 .... £22.50
Fisher FVHP510,520,530,615,710 etc £18.00
Fisher VBS7000,9000 etc £25.00
Hinari VXL2,4,3,20,25 .... £18.00
Hinari VXL5,6,20H £15.00
Mitsubishi HS306,710 .... £30.00
Orion VC150,180,VH1,2,3 etc £18.00
Saisho VR100,605,705,805,905 .... £18.00
Samsung Universal 2 Head £24.25
Toshiba V71,73,74,75,81,82,83,84,85,87 .... £20.00
Toshiba V93 .... £21.00

ASK FOR VIDEO HEADS NOT LISTED
The above heads are new.

BELT KITS

Belt Kits for most models are stocked. Some examples are:

AKAI
VS1,2,5 .... 1.20
VS4,6,9,15 .... 1.10
Ask for models not listed.

AMSTRAD
TVR1,2,3, VCR4600, 4700,5200 .... 1.90
Ask for models not listed.

FERGUSON/JVC
3V00/3V16/3V22 etc 1.60
3V29/3V30 .... 1.20
3V35/36/38/39 .... 1.10
3V42/43/44/45/48/53/54/55/57 .... 1.00
Ask for models not listed. Loading belts on certain models also available.

FISHER
FVHP520/530 .... 1.00
FVHP615/620/622/710/711/715/716/720/721/725/830/840 .... 1.00
FVHP905/906/907/908/910/911/915/916 .... 1.20

GRUNDIG
VS400/410/440/450/460 .... 0.65
VS180/200/220/262/265/267 .... 2.20
VS310/315/320/380/385 .... 2.40
Ask for models not listed.

HITACHI
VT11/14/17/19/33/34/35/38/39/88 .... 1.30
VT8000/8500 .... 1.00
VT9300/9500/9700 .... 1.00
Ask for models not listed.

PANASONIC
NV230/250/280/370/380/430/450/460/465/485/630/810/830/850/870/890 .... 1.60
NV300/330/332/333/430/366 .... 1.60
NV7000/7200/2000/2010 .... 1.50
Ask for models not listed.

PHILIPS
VR6367/6467/6561/6751/6760 .... 2.25
VR6460/6920/6520 .... 2.40
Ask for models not listed.

SANYO
VTC5000/5150/6500 .... 0.65
VHR1100/1300/1500 .... 1.00
Ask for models not listed.

SHARP
VCF3/VC402/500/571/581/582/583/584/585 .... 1.10
VC9300/9500/9700 .... 1.95
VC8000/8300 .... 1.95
Ask for models not listed.

Many other belt kits in stock. Examples are Alba, Funai, GEC, Goldstar, Granada, Grundig, Hinari, ITT, Mitsubishi, NEC, Orion, Saisho, Samsung, Schneider, Sony, Tensai etc.

NEW LINES

LOPT Hitachi CPT1476 .... £18.00
LOPT Hitachi CPT2276 etc £19.00
LOPT Matsui 1440 .... £18.00
Trip Grundig CUC2401 etc £17.00
OTHER GRUNDIG TRIPLERS IN STOCK

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ITT CVC25/30/32 .... 9.50
ITT Compact 80 Series 110 .... 16.75
ITT Compact 80 Series 90 .... 19.75
ITT CVC45 .... 18.00
ITT 1109F 14.00
ITT CVC1204 .... 11.50
ITT CVC800/1/3 .... 21.50
ITT CVC1100 .... 16.50
ITT CVC1150/1175 .... 20.00
ITT 6325 .... 18.50
ITT 3546 .... 18.50
ITT 1200/1 .... 20.00

Other ITT transformers available

Fidelity all models up to 20" ZX3000 .... 15.50
Fidelity Panel for ZX2000 .... 1.00
Fidelity 22" ZX3000 .... 24.50
Hinari CT4/5 & TVA1 .... 14.75
Philips KT3 .... 12.95
Rank Bush T20A 11.50
Thorn TX100 Green Spot 110 .... 16.75
Ferguson TX90 LOPT 17.75
Ferguson 3V35/36 Mains Transformer 23.00
Ferguson 3V44/44/45 Mains Transformer 18.85
Sony – Please state model for price
Universal Tripler 4.75
Universal Tripler with focus unit 9.50
Decca 120/130 series tripler 8.50
Thorn TX10 Focus Unit Kit 9.00

Hitachi and Matsui LOPTs in stock

VIDEO MOTORS

REEL MOTORS
Ferguson 3V29/30 .... £20.00
Ferguson 3V58,59,65,FV10,11,12,13,14,20,21,22 .... £17.25
Ferguson FV260 .... £14.50
Hitachi 8000,8300,8500 .... £8.50
Sanyo VTC5000,5150,5400,5300,6500 .... £7.50
Sharp VC9300, 9500 etc, Original £15.00
Panasonic NV333,366 Original £13.20
All other Panasonics .... POA

CAPSTAN MOTORS
Ferguson 3V35,36 Original £22.50
Ferguson/JVC (Mechanical models) £20.00
Hitachi VT11 Original £30.00
Hitachi VT33 Original £32.00
Hitachi VT64 Original £19.75
Hitachi VT8000 series Original £34.50
Hitachi VT9000 series Original £34.50
Sharp VC7000 series Original £30.50

MODE CONTROL MOTORS
Ferguson 3V42,43,44,45,48,49,52,53 .... £6.00
Ferguson 3V58,59,65,FV10,11,12,13,14,20,21,22,26 .... £4.50

Sharp Reel Motor Pulley only £1.20

Replacement of plastic pulley on a number of Sharp Reel Motors with the above metal pulley gives better rewind/FF performance.

IDLER ASSEMBLIES

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3V29/30 Take up Clutch £2.85
3V29/30 Reel Idler £3.00
3V35 Reel Idler £3.00
3V35,36,38,39 Take up Clutch £2.85
3V58,59,64,65,FV10,11,12,13,14 Idler Arm £1.80
Clutch Assembly 3V44,45,48,49,52,53,54,55 .... £14.00
Clutch Assembly 3V42,43 .... £14.00

FISHER
FVHP615,905,910, Idler Assembly Original £5.00
FVHP615 Gear Idler Assembly £4.35
FVHP905,910 Gear Idler Assembly £5.00
FVHP520,530 Idler £3.00
FVHP520,530 Pulley £0.70

HITACHI
VT11,33 etc. Original Idler Arm £2.50
VT11,33 etc. Idler Replacement £1.75
VT9300,9500 etc. Play Idler £3.65
VT9300,9500 etc. F/F Idler £2.95
VT9300,9500 etc. Idler £2.95
VT8000,8500 etc. F/F Rew Idler £2.95
VT800,8500 etc. Play Idler Assembly £3.00
VT8000,8500 etc. FF/Rew Pulley £0.70
VT11,33 etc. Clutch Assembly £8.00

PHILIPS
VR6460,6920 Idler Arm (Original) £3.00
DV464,6462,6463,650 etc. Idler Mod. Kit £4.50
VR6542,6843 Reel Idler £6.50
VR6542 Reel Drive Pulley £7.75
VR6843 Reel Drive Pulley £9.50

PANASONIC (All Original)
NV370 Idler Arm Unit VXP0521 Gen £3.00
NV8600,8610 Play Idler VXP0243 .... £0.95
NV332,777,788 Idler Unit VXP0463 .... £3.00
NV600,688 Idler VXP0515 .... £3.00
NV333,366 Idler Arm 2 Unit VXL0997 .... £10.50
NV8400,8600,8610 etc. VXP0245 .... £0.95
NV333,366 etc. Idler VXP0401-NV700,7200,7800 Idler VXP0344 .... £0.90
NV2000,3000 Play Idler VXP0331-NV2000,3000 Idler VXP0329 .... £1.10
Back Tension Bands .... From £1.50
All Panasonic Maintenance Kits .... POA

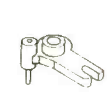
QUOTE PANASONIC PART No. FOR PARTS NOT LISTED

SANYO
Idler VHR1100,1300,1500 .... £5.50
Idler VHR2100,2300,2500,2700 .... £5.50
Reel Drive Pulley Unit VTC5000,5150,6500 .... £5.00
Idler Roller Assembly VTC5000,5150,6500 .... £2.25

SHARP
Idler VC9300,9500 etc £1.75
Idler VC481,581 etc £1.95
Idler (original) VC9300,481,581 etc £3.50
Idler Assembly (original) VC651,681,685 .... £6.50
Idler Assembly (original) VC780,781,785,787,793,VCT72 .... £6.50

AMSTRAD
4500,4600 MOD KIT INCLUDES PINCH ROLLER AND IDLER CLUTCH £5.00

Limiter Post Assembly £1.75
Makes & Models: Hinari VXL4, Matsui VX730,735,735A,755,770, 800A,810,820,880,990. Saisho VR1100,1200,1200HQ,1600,2500, 3200,3300,3300X,3500, 3600,3700



IDLERS FOR AKAI, SAMSUNG, MITSUBISHI, NEC, ETC. IN STOCK

REMOTE CONTROLS

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Sony type RC661, RM652, RM654, RM657, RM663, RM664, RM651 .... £15.50
Panasonic Models TC2110, 2255, 2655, 2680, TX1752, 2251, 2656, 5500 .... £14.50
Panasonic Models TC1632, 1642, 2232, TX2034, 2044, 2200, 2234, 2244, 2636, 3300 .... £14.50

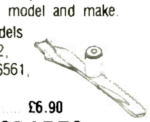
TV ON/OFF SWITCHES

ITT, Philips, Decca, Thorn, Fidelity, Grundig, Sony and Hitachi. State model for price.

PINCH ROLLERS

A range of Pinch Rollers is in stock, most of them @ **£2.80**. Makes include Akai, Amstrad, Ferguson, Fisher, Funai, GEC, Goldstar, Grundig, Hinari, Hitachi, ITT, JVC, Marantz, Mitsubishi, NEC, Nordmende, Orion, Panasonic, Philips, Samsung, Sanyo, Schneider, Sharp, Sony, Tensai, Thomson, Toshiba etc. Please state model and make.

Philips Pinch Roller for models VR6180, 6185, 6285, 6362, 6367, 6467, 6468, 6470, 6561, 6670, 6760, 6761, 6870 .... £6.90



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Video Tape Splicing Kit £6.95
Hitachi TV Frame Module HM6251 .... £5.50
Hitachi TV Frame Module HM6232 .... £5.50
Cassette Housing Assembly Ferguson 3V35,36,38,39,42,43,44 .... £25.25
Cassette Loading Roller Assembly 3V23,3V31,3V32 .... £3.50
Philips 1.2V Back up Battery £1.75
Philips 2.4V Back up Battery £2.80
5.5V Back Up Cap £1.85
Degaussing Positor Blue £3.00
Degaussing Positor White £1.30
Cassette Housing Assembly Hitachi VT11 .... £19.50
End Sensor for Hitachi VT63,64,65 (Pair) £2.75
Cassette LED Sensor for Panasonic etc £1.60
I.C. Circuit Protectors £0.60
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Push Button Unit Thorn TX90 .... £12.75
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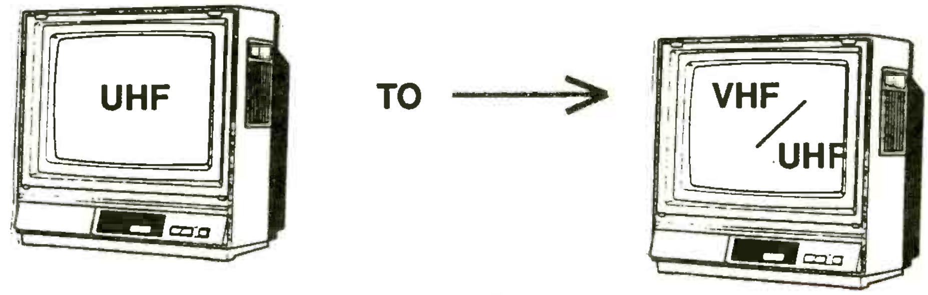

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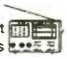

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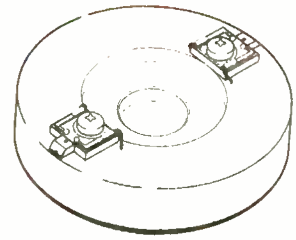

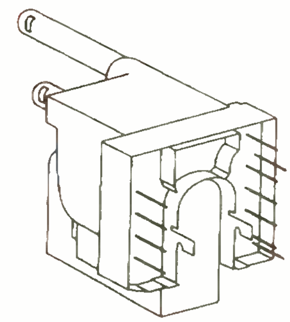

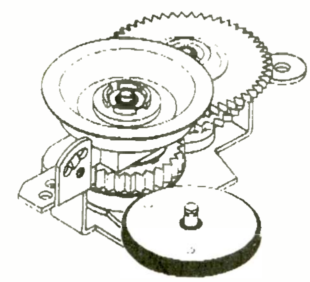

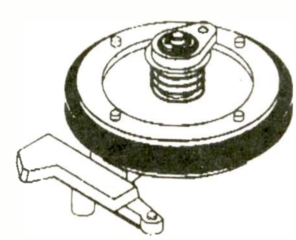

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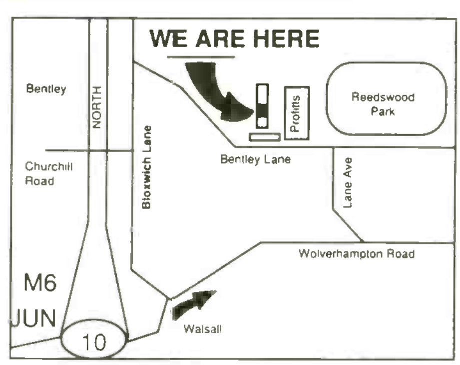

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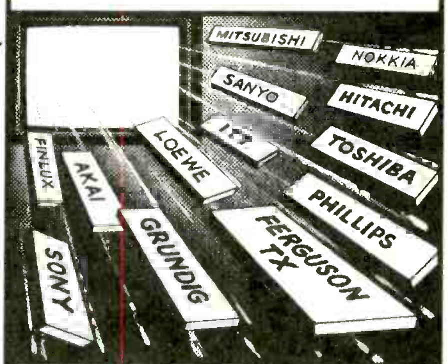

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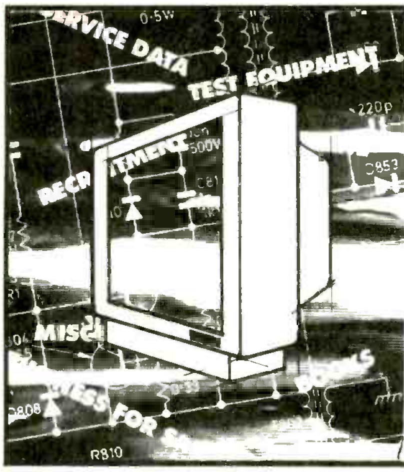

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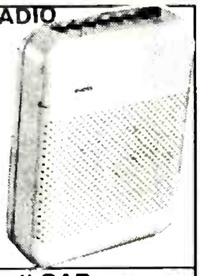

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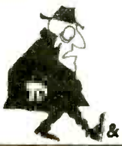

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