OCTOBER 1991 £1·80

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

FREE MAGNIFYING LENS
PLUS COMPONENTS CATALOGUE

Choosing a Digital Multimeter
Adding a Scart Connector•DX-TV
Servicing the Saisho VR1200 VCR
The Photo CD Format•Camcorner
VCR Clinic•TV Fault Finding

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TELEVISION

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

this month

861 Leader

862 VCR Plus — *George Cole*
A VCR timer setting system, based on published codes and a handset with its own timer, that's about to be introduced in the UK.

864 Teletopics
News, comment and developments.

865 CD Player Casebook
Reports from Mike Leach and Philip Blundell, AMIEIE.

866 Adding a Scart Connector — *K. Wevill, B.Sc.*
An interface circuit that enables a scart connector to be added to sets employing common i.f., sound and PAL decoder chips.

870 In Baird's Footsteps — *J. LeJeune*
Reinventing the 30-line mechanical TV system to discover the problems that Baird had to deal with in the Twenties and early Thirties.

873 The Photo CD Format — *George Cole*
Specification of the Photo CD system, which stores photographic images in data form on a compact disc, and the way in which the system works.

876 VCR Clinic
Reports form Philip Blundell, AMIEIE, Ed Rowland, Roger Burchett, Brian Storm, Nick Beer, Chris Avis, J. Edwards and Mick Dutton.

878 What a Life! — *Donald Bullock*
The fault-finding process can go awry when prejudice intervenes.

879 Choosing a Digital Multimeter, Part 1 — *David Botto*
Features and types of DMM and their mode of operation.

882 The Ferguson Singapore Briefing — *Graham Exeter*
During a visit to Ferguson's new joint venture video plant in Singapore an outline of the firm's video marketing strategy was given.

883 Next Month in Television

884 Letters

886 Steve's Camcorner — *Steve Beeching, T.Eng.*
Camcorder servicing notes.

890 Servicing the Saisho VR1200/Matsui VX820 — *Ed Rowland*
A run-down on common faults with these popular VCRs.

892 A Video Nasty — *Nick Beer*
The problem with this Panasonic NV-FS1B was particularly difficult to sort out.

893 Long-distance Television — *Roger Bunney*
DX conditions and reception and news from abroad. Also a MOSFET Band I preamplifier circuit.

895 Service Briefs – Pioneer
Official notes on Pioneer Laservision and CD players.

896 TV Fault Finding
Reports from Brian Storm, Paul Hardy, Stephen Leatherbarrow, Michael Dranfield, J. Edwards, J.K. Potts and John C. Priest.

898 Test Case 346

OUR NEXT ISSUE DATED NOVEMBER WILL BE PUBLISHED ON OCTOBER 16

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
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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
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BC213	7p
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BC461	28p
BC477	18p
BC478	18p
BC479	18p
BC490	18p
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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	38p
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	30p
BD241A	40p
BD243A	50p
BD244	50p
BD245	50p
BD246A	50p
BD265	45p
BD267	65p
BD269	45p
BD278	50p
BD311	100p
BD312	100p
BD313	100p
BD314	100p
BD315	150p
BD317	150p
BD331	40p

BD332	40p
BD361	60p
BD362	60p
BD370	30p
BD371	30p
BD410	50p
BD433	28p
BD434	30p
BD435	31p
BD436	30p
BD437	28p
BD438	38p
BD439	40p
BD440	40p
BD441	40p
BD533	60p
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	55p
BDW94	55p
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	15p
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	18p
BF421	18p
BF422	21p
BF423	25p
BF450	20p
BF455	12p
BF458	19p
BF459	19p
BF462	20p
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BF472	28p
BF479	30p
BF494	16p
BF495	16p
BF506	25p
BF595	16p
BF596	16p
BF615	30p
BF617	38p
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	30p
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	16p
BFY64	20p
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	68p

BTY79	140p
BU100A	110p
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BU208D	80p
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BU536	100p
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BU807	70p
BU902	130p
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BU922	130p
BU930	130p
BUT11AF	70p
BUT12	80p
BUT56A	150p
BUX80	180p
BUX82	180p
BUX84	50p
BUX85	60p
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BUY71	300p
BUZ71	75p
C106D	28p
J174	38p
J300	60p
ME0411	38p
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ME4103	12p
ME6001	15p
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MJ15004	370p
MJ2501	110p
MJ2955	55p
MJ3000	115p
MJ3001	115p
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MJE30A	30p
MJE340	25p
MJE350	80p
MJE520	30p
MP8111	45p
MP8112	45p
MP8113	55p
MP8512	50p
MPS6571	20p
MPS9012	20p
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MPSA43	15p
MPSA70	15p
MPSA92	20p
MPSA93	20p
MR510	35p
MR856	38p
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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TIP33	50p
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TIP34	50p
TIP34C	60p
TIP35C	65p
TIP36C	65p
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TIP41C	22p
TIP42A	20p
TIP42C	22p
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TIP110	40p
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TIP116	45p

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TIP127	56p
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TIP142	90p
TIP145	65p
TIP146	90p
TIP147	100p
TIP150	90p
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TIP2955	42p
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TIP3055	42p
TIS44	40p
TIS61	15p
TIS90	15p
TIS91	18p
TIS93	18p
VK1010	88p
VN10KM	60p
VN66AF	100p
VN88AF	115p
ZTX107	11p
ZTX108	11p
ZTX109	12p
ZTX212	27p
ZTX300	13p
ZTX301	16p
ZTX302	16p
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	60p
2N2218A	24p
2N2219	24p
2N2221	23p
2N2222	23p
2N2369	15p
2N2484	20p
2N2646	40p
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2N2905	20p
2N2906	18p
2N2907	18p
2N2926	8p
2N3019	28p
2N3053	18p
2N3054	40p
2N3055	38p
2N3055H	50p
2N3440	55p
2N3442	85p
2N3585	120p
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2N3703	9p
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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	78p
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	260p
12.0	120p
14.0	125p
14.756	200p
15.0	160p
16.0	130p
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	80p
EBF80	60p
EBF89	60p
ECC82	90p
ECC83	120p
ECC84	80p
ECC85	90p
ECH81	100p
ECH84	90p
ECL80	85p
ECL82	80p
ECL84	100p
ECL85	90p
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	180p
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	180p
AN259	250p
AN262	140p
AN271	230p
AN274	250p
AN301	330p
AN303	280p
AN304	350p
AN305	320p
AN315	210p
AN316	360p
AN360	100p
AN362	140p
AN366	150p
AN503	450p
AN610	150p
AN612	150p
AN3215K	650p
AN3310	550p
AN3312	380p
AN3320K	800p
AN3331K	900p
AN3792	400p
AN3794	460p
AN3795	500p
AN3821	800p
AN3821K	800p
AN3822K	900p
AN3830K	800p
AN3990K	300p
AN3991K	400p
AN5010	450p
AN5011	450p
AN5015	350p
AN5020	250p
AN5025	250p
AN5030	550p
AN5033	500p
AN5034	600p
AN5111	550p
AN5132	250p
AN5135	400p
AN5138	450p
AN5150	600p
AN5151	600p
AN5215	100p
AN5250	150p
AN5256	150p
AN5260	350p
AN5262	175p
AN5265	150p
AN5352	600p
AN5355	400p
AN5410	375p
AN5411	450p
AN5421	150p
AN5429	420p
AN5431	300p
AN5440	400p
AN5510	400p
AN5512	250p
AN5515	200p
AN5520	550p
AN5521	250p
AN5612	400p
AN5613	200p
AN5615	300p
AN5620	330p
AN5622	350p
AN5625	400p
AN5712	350p
AN5722	140p
AN5730	160p
AN5732	160p
AN5753	170p
AN5763	480p
AN5790	300p
AN5791	350p
AN5836	350p
AN5862	200p
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	115p
AN7115	150p
AN7116	130p
AN7120	130p
AN7130	110p
AN7140	450p

AN7145	195p
AN7146	210p
AN7154	180p
AN7156	240p
AN7168	260p
AN7178	270p
AN7222	300p
AN7254	180p
AN7256	250p
AN7310	90p
AN7311	90p
AN7410	250p
AY3-1015	290p
AY3-1270	800p
AY3-1350	450p
AY3-8910	360p
AY3-8912	400p
BA301	65p
BA311	85p
BA313	60p
BA333	100p
BA340	150p
BA401	60p
BA402	50p
BA511	150p
BA514	160p
BA516	150p
BA521	160p
BA524	240p
BA526	180p
BA527	95p
BA532	140p
BA534	290p
BA536	180p
BA546	180p
BA612	160p
BA656	150p
BA658	380p
BA684	400p
BA685	400p
BA1310	160p
BA1320	110p
BA1330	160p
BA1360	160p
BA4403	220p
BA5101	400p
BA5102	220p
BA5204	200p
BA5402	230p
BA5406	280p
BA5408	180p
BA6104	250p
BA6208	250p
BA6209	260p
BA6304	190p
BA6305	200p
BA6309	125p
BA6410	220p
BA6411	250p
BA6993	150p
BA7001	150p
BA7004	200p
BA7007	200p
BA7021	180p
BA7022	350p
BA7751LS	150p
BA7752	250p
BA7755	150p
BA7767AS	200p
BA8500	800p
BA8504	600p
CA3011	110p
CA3012	150p
CA3028A	95p
CA3048	190p
CA3052	190p
CA3054	95p
CA3059	300p
CA3060	280p
CA3065	210p
CA3080E	60p
CA3085	135p
CA3088E	200p
CA3089E	150p
CA3090Q	250p
CA3130E	80p
CA3130S	100p
CA3134E	280p
CA3140E	38p
CA3160	85p
CA3661E	140p
CA3162E	450p
CA3189E	230p
CA3193E	230p
CA3240E	90p
CA3260E	170p
CA3290E	160p
CX108	950p
CX134A	950p
CX136	600p
CX139	1450p
CX139A	750p
CX141	750p
CX143	800p
CX143A	1250p
CX145	725p
CX150B	325p
CX158	825p
CX175	325p
CX186	750p
CX187	825p
CX804A	775p
CX832	825p
CX867	575p
CX868	525p
CX877	300p
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HA1137W	135p
HA1144	380p
HA1156	110p
HA1197	150p
HA1199	145p
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HA1338	300p
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HA1367	350p
HA1368	160p
HA1372	300p
HA1377	150p
HA1388	320p
HA1389	210p
HA1392	200p
HA1394	280p
HA1397	250p
HA1398	240p
HA1457	120p
HA11219	280p
HA11221	180p
HA11225	150p
HA11235	145p
HA11251	240p
HA11423	210p
HA12002	300p
HA12005	400p
HA12017	130p
HA13001	170p
HA13002	280p
HA13006	400p
HA13007	400p
HA13108	400p
HA13412	600p
HA13432	400p
HA17524	250p
HA17805	100p

ICL7106	650p
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ICL7660	240p
ICM7555	60p
ICM75556	80p
KA2101	100p
KA2102	150p
KA2130	150p
KA2206	150p
KA2209	125p
KA2210	230p
KA2212	80p
KA2213	130p
KA2214	150p
KA2261	100p
KA2263	100p
KA2264	100p
KA2284	100p
KA2401	150p
KA2412	350p
KA2912	125p
KA2914A	300p
LA1130	240p
LA1150	150p
LA1185	150p
LA1201	75p
LA1210	140p
LA1222	80p
LA1230	130p
LA1231	210p
LA1364	200p
LA1365	120p
LA1368	220p
LA1385	170p
LA1460	220p
LA2000	150p
LA2101	270p
LA2200	190p
LA3101	160p
LA3160	120p
LA3201	80p
LA3210	65p
LA3220	100p
LA3300	140p
LA3301	110p
LA3350	110p
LA3361	100p
LA3375	300p
LA4030	180p
LA4031	140p
LA4032	140p
LA4051	160p
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LA4112	120p
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LA4125	200p
LA4126	240p
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LA4190	300p
LA4192	160p
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LA4201	120p
LA4220	120p
LA4260	230p
LA4261	300p
LA4270	200p
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LA4430	130p
LA4440	230p
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LA4460	130p
LA4461	130p
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LA5523	150p
LA5527	150p
LA5700	300p
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LA6358	150p
LA7011	220p
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LA7040	280p
LA7042	280p
LA7046	300p
LA7224	150p
LA7505	250p
LA7507	250p
LA7520	200p
LA7620	500p
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LA7802	300p
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LA7808	250p
LA7820	250p
LA7823	280p
LA7830	150p
LA7940	200p
LC7131	260p
LC7132	400p
LC7137	450p
LF347	110p
LF351	45p
LF353	48p
LF355	60p
LF356	60p
LF357	70p
LF398	300p
LM301	26p
LM307	42p
LM311	35p
LM318	120p
LM319	165p
LM324	30p
LM335Z	120p
LM337	250p
LM339	35p
LM348	50p
LM358	45p
LM380	80p
LM381	160p
LM382	130p
LM384	130p
LM386	60p
LM387	100p
LM392	100p
LM393	45p
LM709DIL	30p
LM710	45p
LM723	40p
LM741DIL	18p
LM741MET	45p
LM747	55p
LM748	30p
LM1458	30p
LM1889	300p
LM3900	40p

LM3909	80p
LM3911	160p
LM3914	160p
LM3915	160p
LM3916	270p
M50115P	320p
M50117P	500p
M50119P	525p
M50120P	650p
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M50786	500p
M50790	600p
M51161	300p
M51355P	400p
M51381P	200p
M51387P	900p
M51392	600p
M51397	660p
M51544	150p
M51545P	300p
M51724	300p
M51724P	300p
M51848	150p
M53200P	100p
M53206P	100p
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M54537P	200p
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M54563P	200p
M54564P	200p
M54566P	200p
M54567P	200p
M58480P	480p
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M58487P	450p
M58635P	380p
M58655P	400p
M58657P	300p
M58659	450p
M58725P	500p
M51102	290p
M51516	260p
M51518	200p
MAB8400B	650p
MAB8420P	650p
MAB8440P	650p
MAB8441P	650p
MB3515	240p
MB3614	180p
MB3712	140p
MB3713	130p
MB3714	270p
MB3715	250p
MB3722	280p
MB3730	160p
MB3731	300p
MB3756	230p
MB3759	200p
MB8719	360p
MC1455	45p
MC1458	30p
MC1469	290p
MC1488	50p
MC1489	50p
MC1496	65p
MC3302	70p
MC3401	45p
MC3403	60p
NE555	20p
NE556	40p
NE565	110p
NE566	130p
NE567	115p
NE571	290p
NE592	85p
NE5532P	140p
SAS560	110p
SAS570	110p
SAA1006	300p
SAA1008	450p
SAA1010	400p
SAA1020	450p
SAA1024	250p
SAA1025	250p
SAA1961	400p
SAA1075	350p
SAA1124	200p
SAA1174	300p
SAA1220	400p
SAA1250	280p
SAA1251	380p
SAA1272	280p
SAA1274	280p
SAA3004	400p
SAA5000	200p
SAA5010	220p
SAA5012	400p
SAA5020	350p
SAA5030	440p
SAA5040A	280p
SAA5040B	400p
SAA5050	650p
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
STA471	210p
STA901M	280p
STA8012	260p
STK0025	420p
STK0029	360p
STK0039	380p
STK0040	520p
STK0049	510p
STK0050	440p
STK0059	620p
STK0060	820p
STK0070	1100p
STK0080	580p
STK011	370p
STK015	490p
STK016	800p
STK025	700p
STK043	900p
STK050	2200p
STK056	820p
STK077	600p
STK078	620p
STK080	600p
STK082	580p
STK084	660p
STK085	1050p
STK086	870p
STK420	400p
STK430	500p
STK433	490p
STK435	400p

STK436	490p
STK437	500p
STK439	560p
STK441	680p
STK443	740p
STK457	500p
STK459	560p
STK460	720p
STK461	620p
STK463	780p
STK465	720p
STK501	580p
STK561	550p
STK563	480p
STK583	600p
STK734B	510p
STK745	600p
STK760	600p
STK770	760p
STK772B	480p
STK780	650p
STK1039	550p
STK1040	700p
STK1049	800p
STK1050	700p
STK1060	760p
STK1070	940p
STK1080	990p
STK2025	700p
STK2028	560p
STK2029	480p
STK2038	900p
STK2048	960p
STK2110	680p
STK2120	820p
STK2125	650p
STK2129	610p
STK2139	800p
STK2155	950p
STK2230	470p
STK2240	820p
STK2250	780p
STK3041	460p
STK3042	490p
STK3044	575p
STK3062	600p
STK3082	700p
STK3083	550p
STK3102II	600p
STK3152II	990p
STK3156	560p
STK4017	450p
STK4019	600p
STK4021	425p
STK4025	600p
STK4026	600p
STK4028	620p
STK4032II	650p
STK4036	500p
STK4038	680p
STK4042II	900p
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STK4060	580p
STK4101	650p
STK4111	650p
STK4112	950p
STK4121	600p
STK4122	560p
STK4131	650p
STK4132II	750p
STK4141II	420p
STK4142	800p
STK4151	680p
STK4152	950p
STK4161	800p
STK4162	800p
STK4171	850p
STK4172II	800p
STK4181	820p
STK4182II	800p
STK4191	1000p
STK4192	1000p
STK4231II	990p
STK4272	720p
STK4273	680p
STK4301	700p
STK4311	800p
STK4332	410p
STK4352	640p
STK4362	600p
STK4372	570p
STK4392	690p
STK4432	900p
STK4773	900p
STK4793	1100p
STK4803	720p
STK4813	950p
STK4833	810p
STK4843	720p
STK4853	900p
STK4863	850p
STK4873	990p
STK4893	1400p
STK4913	1180p
STK5314	550p
STK5315	800p
STK5322	620p
STK5324	520p
STK5325	580p
STK5331	400p
STK5332	220p
STK5333	700p
STK5335	450p
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STK5342	300p
STK5361	420p
STK5372	300p
STK5412	650p
STK5421	625p
STK5422	600p
STK5431	650p
STK5434	660p
STK5436	600p
STK5441	500p
STK5451	480p
STK5457	425p
STK5461	700p
STK5462	500p
STK5466	850p
STK5467	500p
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STK6732	1500p
STK6822	1200p
STK6922	600p
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
STK8050	880p
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STK8260	1500p
STK8280	1850p
STK73410	550p
STR370	580p
STR371	600p
STR380	500p
STR381	490p
STR383	570p
STR384	570p
STR440	520p
STR441	440p
STR450	610p
STR541	380p
STR452	680p
STR453	700p
STR454	470p
STR455	500p
STR456	600p
STR457	680p
STR470	680p
STR1096	380p
STR1195	450p
STR1229	450p
STR2005	580p
STR2012	650p
STR2013	480p
STR2024	650p
STR2105	680p
STR3113	300p
STR3115	680p
STR3123	490p
STR3125	580p
STR3135	300p
STR3212	330p
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STR4512	450p
STR5015	600p
STR5100	650p
STR5214	550p
STR5315	700p
STR5412	450p
STR6020	450p
STR9005	600p
STR9012	650p
STR10006	600p
STR11006	550p
STR12006	600p
STR13006	650p
STR15006	650p
STR16006	650p
STR20005	550p
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STR50213	650p
STR53041	650p
STR53043	650p
STR54041	500p
STR55041	650p
STR58041	480p
STR59041	650p
STR60001	650p
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
TA7205	80p
TA7207	180p
TA7208	145p
TA7210	200p
TA7214	260p
TA7217	145p
TA7220	220p
TA7222	120p
TA7223	210p
TA7225	300p
TA7226	290p
TA7227	190p
TA7229	300p
TA7230	170p
TA7232	250p
TA7233	250p
TA7237	400p
TA7238	400p
TA7240	260p
TA7241	260p
TA7242	290p
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TA7245	450p
TA7267	290p
TA7269	850p
TA7270	250p
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
TA7336	250p
TA7341	250p
TA7343	250p
TA7357	400p
TA7358	200p
TA7401	400p
TA7607	270p
TA7608	360p
TA7609	270p
TA7611	280p
TA7612	360p
TA7614	230p
TA7616	400p
TA7621	520p
TA7622	420p
TA7628	240p
TA7629	420p
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
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TC5081AP	180p
TC5082P	170p
TC5501P	550p
TC8565P	2400p
TC9106	500p
TC9109	450p
TC9121P	650p
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
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TDA1028	220p
TDA1029	250p
TDA1035	120p
TDA1037	190p
TDA1044	250p
TDA1048	225p
TDA1053	400p
TDA1054	200p
TDA1059	80p
TDA1060	190p
TDA1062	200p
TDA1070	400p
TDA1072	300p
TDA1074	420p
TDA1082	290p
TDA1083	200p
TDA1085	400p
TDA1097	550p
TDA1151	60p
TDA1154	60p
TDA1170	85p
TDA1180	140p
TDA1190	90p
TDA1200B	80p
TDA1220	150p
TDA1235	300p
TDA1236	295p
TDA1270	150p
TDA1327	250p
TDA1330	150p
TDA1352	200p
TDA1410	219p
TDA1412	100p

LINEAR IC's — Cont.

Type	Price
TDA1420	200p
TDA1470	140p
TDA1510	380p
TDA1512	200p
TDA1514A	450p
TDA1515A	200p
TDA1516Q	350p
TDA1518	300p
TDA1520	350p
TDA1521	300p
TDA1522	200p
TDA1524	350p
TDA1540	420p
TDA1541	1600p
TDA1596	260p
TDA1670A	300p
TDA1675	250p
TDA1701	320p
TDA1770A	300p
TDA1870A	300p
TDA1872A	450p
TDA1904	120p
TDA1905	150p
TDA1908A	90p
TDA1940	280p
TDA1941	300p
TDA1950	280p
TDA2002	70p
TDA2003	80p
TDA2004	90p
TDA2005	90p
TDA2006	70p
TDA2007	180p
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2SD-850	260p
2SD-856	80p
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2SD-863	60p
2SD-864	200p
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2SJ-50	425p
2SJ-77	350p
2SK-19	45p
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2SK-68	100p
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2SK-135	415p
2SK-147	160p
2SK-192	45p
2SK-195	150p
2SK-197	140p
2SK-312	750p
2SK-323	130p
3SK-88	70p

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VK2436/2340	£6.50
VK2530/2532/2631/2541	£16.00
VK2632	£17.00
VK2637	£30.50
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VT65	£35.00
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HV4000/7000/8000	£6.50

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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	£8.50
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/V2005	£18.00
V110/V333	£20.00
V101/V102/V103/V112/V141/V142/ V200/V300/V3005/V300/V301/V302/ V350/V500	£7.00
V1205/V1215/V1235/V1245	£20.00
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

RANK

BV6900AS	£18.00
N830EA/RV300/RV310/RV320/RV330/ RV340/RV350/RV380	£7.00

REDSON

MR100	£17.00

SABA

2A10/2A70/2B20	£23.00
4A10/4B20	£33.50
6A10/6A70	£33.00
8A10/VR6038	£39.50
CVR6083/VR6006/VR6007/VR6008/ VR6009/VR7006/VR7007	£18.50
PVR6068/PVR6070/PVR8070/VR2000/ VR6000/VR6010/VR6012/VR7000/ VR9010	£7.00
VHR7000/VR5005	£15.00
VR6004/VR6005/VR6011/VR6013/ VR6014/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

6500/6600	£21.50

SAMSUNG

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

SANYO

VTC5000/VTC5400/VTC6000/VTC6500/ VPR5000/VTC1500/VTCM10/VTCM11/ VTCM20/VTCM21/VTCM25/VTC2000/ VTC5100/VTC5150/VTC5300/ VTC5400/VTC5350/VTC5370/ VTCNX10/VTCNX15/VTCNX20/ VTCNX30	£18.50
VTC5500/VTC5550/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
VC582/VC583/VC651/VC681/VC750/ VC780/VC781/VC683/VC684	£14.00
VC6000/VC6200/VC6300/VC7300/ VC7700/VC7750/VC8000/VC8300	£31.00

SONY

DSR-19R (FOR SL-T 9ME)	£39.00
DSR-35R (FOR C20/C30/C40/ SLF1UB/SLF1E) 2 PIN	£15.00
DSR-43R (FOR SLC7 RANGE/SL5000/ SL5100/SL3000) 1 PIN	£13.00
DSR-21R (FOR SLC8/C9)	£30.00

TOSHIBA

V21/V31/V33/V50/V51/V53/V9600	£14.50
V55/V57	£7.00
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	£2.50
VS201, VS301, VS303, VS304, VS603, VS606, VS607, VP58-P82	£2.50
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, VC581, 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,	£1.20
FVHP905, FVHP906, 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	£0.60
VT8500	£0.60
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
V9600	£0.85

SOLDERING IRON

ANTEX XS25W 240V Soldering Iron 240Vac	£6.50p
Spare Element for XS25W 240V	£3.40p
ANTEX C15W 240V Soldering Iron 240Vcm	£6.50p
Spare Element for C15W 240V	£3.40p

DESOLDERING PUMP

Desolder Pump	£3.50p
Spare Nozzle	£0.60p

SOLDER MOP	£0.65p

SOLDER

18 SWG	500g	£5.00p
20 SWG	500g	£6.50p

SOLDERING IRON STAND

Soldering Stand	£2.60p
Spare Sponge	£0.55p

FLOPPY DISCS

5¼ inch DSDD (10 in box) Branded Name	£6.00
5¼ inch DSDD (bulk pack) 25	£10.00
3½ inch DSDD (10 in box) Branded Name	£11.00
3 inch CF2 Branded Name	£2.10
3 inch CF2D Branded Name	£2.50

MOD KIT TAPE CREASING FOR AMSTRAD

VCR450, 4600, 4700 620p

SERVICE KITS

Each Kit Contains Belts Set, Pinch Roller, Tension Band & Idler Tyres

NATIONAL

NV300/NV340	£5.80p
NV7000/NV7200	£5.50p
NV2000	£6.25p

JVC & FERGUSON

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

HITACHI

VT11/VT33	£6.25p

FISHER

SERVICE KIT	£5.50

HITACHI T.V.

OUTPUT MODULE HM 6251 REF: 2370551	£6.50

SERVICE AIDS

SERVISOL PRODUCTS

V. HEAD CLEANER	125p
SWITCH CLEANER	130p
SILICONE GREASE	150p
FREEZE IT	140p
FOAM CLEANER	140p
ANTI-STATIC	140p
AEROKLEANE	125p
AERO DUSTER	140p
PLASTIC SEAL	130p
GLASS CLEANER	130p

If you purchase more than one Servisol product postage will be £2.00

UNIVERSAL TRIPLERS 450p

SONY ON/OFF SWITCHES 200p

SONY THYRISTOR SG264A 600p SG613 1000p

PHILIPS SWITCHES 150p

K30, K35, K40, KT3, KT4

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IDLERS & PULLEYS REPLACEMENTS

Model	Part	Reference	Price
AMSTRAD		**Reference**	
VCR7000		150280	£1.50
AKAI			
VS1-2, VS4-5, VS15	FF-REW IDLER	M1327773	£4.50
VS1-2, VS4-5, VS15	T-UP IDLER	BV327815	£6.00
V9700	IDLER	BV321979	£6.00
VS125, 126, 155, VS165, 240, 244, VS245, 247, 248, VS250, 512, 515, 516	IDLER ASSY	MZ366960J2	£11.00
FERGUSON			
3V16-22	T-UP IDLER	PU47752	£4.50
3V16-22	T-UP IDLER	PU49280	£6.30
3V23, 3V29-30, 3V31-32, 3V35	REEL IDLER	PU48967	£3.00
3V23	ROLLER ASSY	PU49042A	£4.00
3V29-30, 3V31-32, 3V35-36, 3V38-39, 3V49	T-UP IDLER	51402	£1.45
3V29-30,3V31-32	T-UP CLUTCH	PU51380	£2.60
3V35-36, 3V38-39, 3V49	REEL IDLER	PU55374	£2.85
3V35-36, 3V38-39, 3V49	T-UP CLUTCH	PU55373	£2.25
3V58-59, 3V64-65, FV10-11, FV12-13, FV14	IDLER ARM	PU58645	£2.50
3V42	CLUTCH ASSY	PU55822	£13.50
3V44	CLUTCH ASSY	PU57658	£11.50
3V42, 43, 48, 53, 56	T-UP CLUTCH	PU56043-1-4	£2.80
3V42, 43, 48, 53, 56	SUPPORT CLUTCH	PU56044-1-5	£2.80
FISHER			
FVHP520, FVHP530	FF-REW PULLEY	HI638531	£1.00
FVHP615	COMP. IDLER ASSY	FI1430420400300	£3.30
FVHP615	GEAR IDLER ASSY	FI1430490400900	£5.50
FVHP840	REEL T-UP ASSY	FI1430410400900	£6.50
FVHP905, 906, 908, FVHP910, 916	GEAR IDLER ASSY	FI1430490402400	£6.20
FVHP975, 990, 999, FVHP5000, 5100	IDLER	FI1430420400700	£5.20
GOLDSTAR			
	IDLER	435038A	£2.50
HITACHI			
	FF-REW IDLER	6886971	£1.50
	PLAY IDLER	V-6861482	£3.20
VT11-33, VT63-64, VT14, 17, 19, 38, 57, VT86, 88	CLUTCH ASSY	6879515	£7.50
VT120-220	CLUTCH ASSY	6886824	£7.50
VT8000-8300, VT8500-8700	FF-REW IDLER	6413663	£2.80
VT8000-8300, VT8500-8700	PLAY IDLER	6414221	£3.60
VT8000-8300 VT8500-8700	FF-REW PULLEY	6383531	£0.80
VT9300-9500	FF-REW IDLER	8681471	£3.30
VT9300-9500	PLAY IDLER	6861482	£3.20
VT9300-9500	IDLER	681505	£3.00
	IDLER	687043	£3.80
VT11-33, VT63-64	FF-REW IDLER	6886971	£1.50
HINARI			
VXL3, VXL20	REEL IDLER	40000009	£1.50
ITT			
VR3905, VR3906	T-UP IDLER	PU51402	£1.45
VR3906	REEL IDLER	PU55374	£2.85
VR3913, VR3943	REEL IDLER	PU48967	£3.00
JVC			
HR330, 3660, 4100	T-UP IDLER SML	PU49280	£6.00
HR7200, HR7600, HR7650, HR7655	T-UP CLUTCH	PU53462A	£3.00
HR7200, HR7600 HR7650, HR7655, HR7700	REEL IDLER	PU48967	£3.00
	ROLLER ASSY	PU49042A	£4.00
HR3300, 3660, 4100	T-UP IDLER LRG	PU47752	£4.50
HR7200, 7600, 7650 HR7655, HRD110, HRD120-121, HRD225	T-UP IDLER	PU51402A	£1.45
HRD110, HRD120-121, HRD225	T-UP CLUTCH	PU55373	£2.25
HRD110, HRD120-121, HRD225	IDLER ARM	PU55374-3-8	£2.85
MATSUI			
VX730, 735, 750, 755, VX810, 820, 880, 990	CLUTCH	850A00005	£6.50
MITSUBISHI		**Reference**	
HS306, 307, 318, 319, HS410, 710	GEAR ASSY	522P00201	£6.25

IDLERS & PULLEYS REPLACEMENTS — Cont.

Model	Part	Reference	Price
NATIONAL			
NV322, NV600, NV688, NV777, NV788	IDLER UNIT	VXP0463	£3.00
NV333	IDLER ARM	VXL0997	£3.60
NV333, NV366	IDLER UNIT	VXP0401	£0.75
NV333, NV366	PLAY IDLER	VXP0433	£3.00
NV333, NV3000	ACTION GEAR	VDG0016	£0.60
NV333, NV2000, NV3000 NV7800	LOADING GEAR	VXP0325	£2.00
NV333, NV2000, NV3000,	INTERMEDIATE GEAR	VXG0017	£0.65
NV333	CAM GEAR	VXG0158	£1.00
NV366	IOLER ARM	VXL0997	£3.60
NV370, NV430, NV730, NV830, NV850, NV870, NVG7, NVG10, NVG12, NVG18	IDLER ARM	VXP0521	£1.70
NV370, NV430, NV870, NV730, NV830, NV850	CAM GEAR	VDG0200	£1.20
NV730	IDLER UNIT	VXP0581	£2.50
NV2000, NV3000	IDLER UNIT	VXP0331	£1.20
NV2000, NV3000	IDLER UNIT	VXP0329	£1.20
NV2000, NV3000	CAM GEAR	VDG0069	£1.00
NV2000, NV3000	ACTION GEAR	VDG0016	£0.60
NV7000, 7200, 7800	IDLER UNIT	VXP0344	£1.00
NV7000, 7200, 7800	CLUTCH	VXP0343	£5.50
NV8400, NV8600, NV8610, NV8620	IDLER UNIT	VXP0245	£1.20
NV8600, NV8610, NV8620	PLAY IDLER	VXP0243	£1.20
NV8620	CLUTCH	VXP0343	£5.50
NV600	IDLER	VXP0488	£3.50
NVG21-25, NVG40-45	PULLEY UNIT	VXP0767	£5.80
ORION			
VH200-201	IDLER	850A200004	£3.50
VH555-700, VH844-900, VH1000-1500, VH1800, VP200, VH530 VH535-630, VH635-640, VH893-1440, VH2500-2600, VH2700-4010, VH5010	IDLER	850A200005	£6.50
PHILIPS			
DV464, VR6462, VR6463, VR6660, VR6860	IDLER	52220334	£2.50
VR6460, VR6520, 6920	IDLER ARM	40340162	£1.70
DB532, VR6542, VR6843	REEL IDLER		£7.50
SANYO			
VHR110, VHR1300, VHR1500	IDLER	1430662T14730	£5.00
VTC5000, VTC5150	FF-REW IDLER	1430741T20001	£3.00
VTC9100, VTC9300	IDLER	1430551T01400	£1.20
VTC9300	FF ROLLER ASSY	1430547T00200	£2.20
VTCM10-20	REEL DRIVE PULLEY	1430662T10350	£5.00
VHR2100, VHR2300	IDLER	6130374899	£5.00
VTC5000, VTC5150	PULLEY	143-0-662T-01201	£5.20
VTCM10	PULLEY	143-0-662T-10350	£5.50
SHARP			
VC651, VC681, VC685	IDLER ASSY	NPLYV0107GEZZ	£6.15
VC7300, VC7700	PLAY IDLER KIT	NPLYV0041+ NDA1V1007	£5.00
VC381, VC383, VC386, VC8381, VC9100, VC9300, VC9500, VC9700	IDLER	NIDL0005GEZZ	£1.50
VC300, VC387, VC481, VC482, VC483, VC496, VC571, VC585	IDLER	NIDL0006GEZZ	£1.50
VC780-781, VC785-787, VC793-VCT72	REEL IDLER	NPLTV0111GEZZ	£7.00
SAISHO			
VR1100, VR1200, VR1200HQ, VR1600, VR2500, VR3300, VR3500, VR3600	CLUTCH	850A20000	£6.50
SAMSUNG			
VT510-511, VT520-610, VT611-616, VT620-621-626	IDLER WHEEL	65224704220	£1.50
VT510-511, VT520-610, VT611-616, VT620,621, 626	IDLER COMPLETE	69000250330	£4.50
SONY			
C6	IDLER KIT ASSY	A 6706391	£3.50
C7	IDLER ASSY	X 36533100	£3.80
SL-C5, SL-C7	REW PULLEY	A-6706-348-B	£4.00
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Models	Part	Price
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VCR 7000	REEL MOTOR	£17.00
FERGUSON & JVC		
PU 45979, 3V16, 3V22, HR3300, HR3660	CAPSTAN MOTOR	£21.00
PU 55371V, 3V35, 3V36, 3V38, 3V39, 8943, 8944, HRD110, HRD120, HRD121, HRD225	CAPSTAN MOTOR	£19.50
PU 46414, 8904, 8922, HR3300, HR3320, HR3330, HR3360, HR3600, HR3660	ORUM MOTOR	£19.50
PU 51381V, 3V39, 3V30, 8930, HR7200, HR7300	REEL MOTOR	£26.50
PU 58635V, 3V58, 3V59, 3V64, 3V65, 8950, 8951, FV10B, FV11R, FV12L, FV13H, FV20B, FV21R, FV22L, HRD170, HRD180, HRD230, HRD370, HRD430	CAPSTAN MOTOR	£29.00
PU 58636W, 3V58, 3V59, 3V64, 3V65, 8950, 8951, FV10B, FV11R, FV12L, FV13H, FV14T, FV20B, FV21R, FV22L, HRD170, HRD180, HRD230, HRD370, HRD430, HRD530	REEL MOTOR	£18.00
3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 8945, 8947 8948, HRD140, HRD150, HRD455, HRD565, HRD725, HRD755, HRP50, R73AF	LOADING MOTOR	£8.00
MITSUBISHI		
288P02801, HS300, 301, 302, 310	MOTOR REEL SPOOLING	£33.50
288P02806, HS303, 304, 320, 330, 700	MOTOR REEL SPOOLING	£31.50
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MYN 135V5L, NV332, NV333, NV340, NV366	REEL MOTOR	£13.50
VEM0212, NV730/NV770	MOTOR REEL GEN	£30.00
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RMOTV 1008GEZZ, VC200, VC381, VC384, VC385, VC386, VC483, VC3300, VC8381, VC9100, VC9300, VC9500, VC9700	REEL MOTOR	£13.50
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BHF 1100D, SLC7	CAPSTAN MOTDR	£25.00

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Models	Price
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3V42, 3V43, 3V44, 3V45, 8945, 8947, HRD140, HRD141, HRD150, HRD455, HRD725	£24.00
8948, 8950, FV10B, FV12L, FV13H, FV14T, FV20B, FV21R, FV22L, HRD230, HRD430, HRD530	£24.00
3V58, 3V59, 3V64, 3V65, FV11R, HRD170, HRD180, HRD370	£24.00

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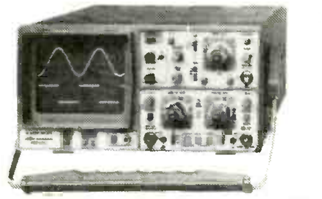
HM203-7 20MHz STANDARD

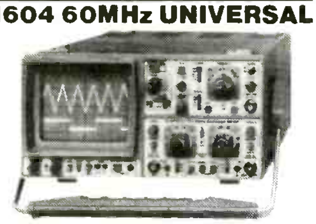


SPECIFICATION
* 2 Channels
* Bandwidth: DC - 20MHz
* Sens: Ch.!, Ch.2, 1mV/cm
* Timebase: 0.1s - 20ns/cm
* Triggering: DC - 40MHz
* Active TV - Sync - Separator
* Variable hold-off
* Trigger LED Indicator
* Calibrator: 1KHz Square wave
* Component tester
* Plus many features

Price £338.00 + £59.15 V.A.T. **FREE Specialist Carrier Delivery**

HM604 60MHz UNIVERSAL

SPECIFICATIONS
* 2 Channels
* Bandwidth: DC - 60 MHz
* Sens: Ch.1, Ch.2, 1mV/cm
* Timebase : 2.5s - 5ns/cm
* Triggering: DC - 80MHz
* Active TV - Sync - Separator
* After delay trigger
* Sweep delay
* Delay line
* Trigger LED Indicator
* Calibrator: 1KHz & 1MHz Sq. Wave
* Component tester



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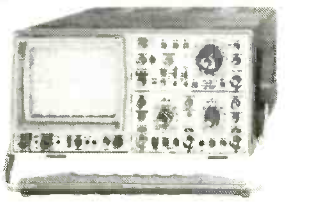
3 CHANNELS - UP TO 6 TRACES



SPECIFICATION
* 3 Channels
* Bandwidth: DC - 100MHz
* Sens: Ch.1, Ch.2, Ch.3, 1mV/cm
* Timebase A: 2.5s - 5ns/cm
* Timebase B: 0.2s - 5ns/cm
* Triggering DC - 130MHz
* After delay trigger
* Delay line
* Trigger LED Indicator
* Overscan LED Indicator
* Active TV - Sync - Separator
* Calibrator: 1KHz & 1MHz Sq. Wave

Price £792.00 + £138.60 V.A.T. **FREE Specialist Carrier Delivery**

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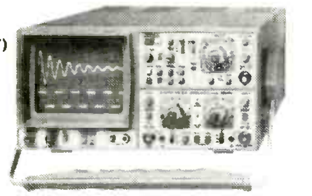
SPECIFICATION
* Digital Storage
* Analogue real time (Same as 203-7)
* Bandwidth: DC - 20MHz
* Sens: Ch.1, Ch.2, 1mV/cm
* Timebase Digital: 5s-1μs/cm
* Triggering DC - 40MHz
* Active TV - Sync - Sampling
* Max sampling rate: 2 x 20MHz
* Memory: 2 x 2048 x 8 Bit
* Dot joiner
* Printer/plotter output



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Tests and rejuvenates blue, green and red guns separately. Fitted with delta and P.I.L. sockets. Compact size 120 x 65 x 60mm. Supply 240V AC

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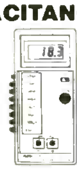
* LCD display.
* 8 ranges.
* Accuracy +/- 0.5%. Full scale +/- 1 digit.
* Inc. protective case.

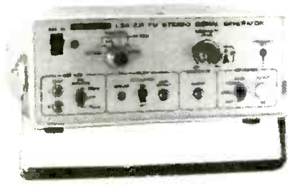


Price £38.00 + £6.65 V.A.T.

LEADER FM STEREO SIGNAL GENERATOR

At last! A generator specifically designed for testing and fault finding on FM stereo and monaural VHF receivers including stereo multiplex circuits.

FEATURES
* Carrier frequency 100 +/- 1MHz (adjustable).
* Output level 0.1mV - 10mV.
* Pilot signal 19KHz +/- 2Hz.
* L & R separation over 50dB.
* External Modulation 50Hz - 15KHz.
* Pre-emphasis 50μs, 75μs & off.
* Comprehensive test lead set included.
* Mains powered.
* Size: 80 x 200 x 250mm.



Price £299.00 + £52.33 V.A.T.

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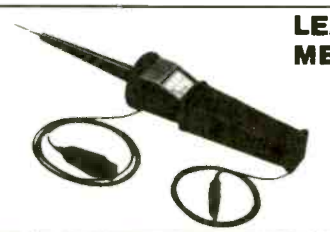

Light weight, easy-to-grip high-impact plastic handle with arc-over protection and no need of extra equipment. An indispensible item in your TV service kit. Measures up to 40kV DC with safety and the greatest of ease. Entirely self-contained. Connect the lead clip to chassis and probe tip to the check point, read the meter for voltage.
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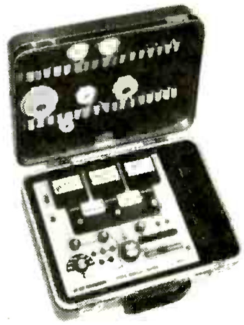

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Prices

Model 490 Tri-dynamic three meter instrument inc. 6 common adaptors	£446.00 + £78.05 V.A.T.
Without adaptors	£393.00 + £68.77 V.A.T.
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TC402-C VHF & UHF

FEATURES
* Three bands:
  Low VHF: 45-110MHz
  High VHF: 110-300MHz
  UHF : 470-862MHz
* Digital display for direct frequency readout.
* Built-in monitor loudspeaker AM/FM.
* Signal measurement from 20μV to 100mV.
* Powered by eight 1.5 AA batteries.
* Fully portable with sturdy carrying case.

Price 259.00 + £45.33 V.A.T.

TC90 VHF-UHF- SAT.

FEATURES
* Five bands:
  Low VHF : 45-110MHz
  High VHF : 110-300MHz
  Hyper VHF : 300-470MHz
  VHF : 470-862MHz
  Satellite : 950-1750MHz.
* Digital display for direct frequency readout.
* Signal measurement VHF/UHF 20μV to 3V.
* Signal measurement satellite -70dBm to -10dBm.
* Audible Indication of satellite signal level.
* Built-in-monitor loudspeaker AM/FM (not satellite).
* Powered by rechargable battery (complete with charger 220/240V AC).
* Fully portable with sturdy carry case.

Price £470.00 + £82.25 V.A.T.

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PAL VHF/UHF - PAL VIDEO COMPOSITE - R.G.B.

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In addition to a switchable sound carrier facility which allows use with the majority of PAL TV systems, the Orion provides highly flexible RGB outputs, ensuring compatibility with most video monitors.

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Just some of the features making the Orion Pattern Generator an indispensible tool in the manufacture, test, and servicing of televisions, and computer and video monitors.

FEATURES
* Colour bars, purity, greyscale, crosshatch, dots, focus, etc.
* VHF/UHF Channels.
* 5.5MHz, 6.0MHz, 6.5MHz Sound Carriers.
* Internal/External Sound.
* External Video Output.
* Trigger Output.
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* Separate R, G, B and sync. O/P's.
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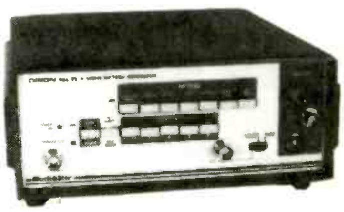
* Composite Video Output.
* Variable RF/Video Output.
* Switchable Video Polarity.
* Mains powered 220/240V AC 50/60Hz.
* Size: 98 x 219 x 240mm.



Price £209.00 + £36.58 V.A.T.

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EDITOR
John A. Reddihough

Please note that the telephone numbers below are for contact with the advertisement departments only. Editorial enquiries should be sent to the editor at the address given on page 849 or faxed to 081-661 8965.

EDITORIAL ASSISTANT
Tessa Winford

ADVERTISEMENT MANAGER
Jan Thorpe
081-661 8114

DISPLAY SALES MANAGER
Shona Finnie
081-661 8115

CLASSIFIED ADVERTISEMENTS
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ADVERTISING ADMINISTRATION
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Brian Chapman
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Robert Marcus
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Over at Last?

The recession of 1990/1 has turned out to be one of the most exasperating on record. First we were told that it wasn't going to be. Then that it would be a comparatively mild affair. Then, through the period from late last year to the middle of this year, it took a real hold and turned out to be one of the deepest recessions since the war. It has been devastating for many small firms – and many not so small ones. In the second quarter of this year the number of business failures was 82 per cent higher than a year ago: some 1,970 firms are on record as having failed. We've now reached the point however where commentators are beginning to suggest that it's at last at an end. The Bank of England has talked of "bumping along the bottom"; the Organisation for Economic Co-operation and Development suggests that the "worst of the recession may be over"; the National Institute of Economic and Social Research speaks of a "slow and hesitant" recovery; while the Confederation of British Industry reports "widespread if modest optimism throughout British Industry". The Treasury and, of course, the government have been making optimistic noises, and commentators are now beginning to concern themselves with assessing exactly when the upturn will be, how strong it will be, and how lasting.

We're not wanting for advice and comment! Yet those who monitor events and issue forecasts have a very poor record. You'd think, with all the effort that's gone into the subject in recent years, that forecasters, including the Treasury and the Bank of England, would by now be rather better at it. Yet they keep getting caught out. Badly. It's of course difficult if you are using old figures and economic models, with only the past to act as a guide to an uncertain future. Maybe we should all ignore the economic forecasters. Yet it's their views and assessments that lead to interest rates hikes and, subsequently, all those business failures. One could make out an excuse for the forecasters by saying that economic activity in the UK since the mid-Eighties has been exceptionally volatile. It's relatively easy in hindsight to see what happened and what went wrong. Harder to suggest how things could have been managed better.

The history of recent economic events in the UK starts with deregulation of the banking system in the early Eighties. It was felt that the banks were a sort of cosy cartel and were not making their full contribution to the economy. Deregulate them, let others – the building societies, Continental banks and associated newcomers – compete with the major banks and all should be better. Well, at least we get some interest on our current accounts now. And yes the banks did respond and in consequence lent money hand over fist to all and sundry with few questions asked. Bank managers were ordered to increase their lending since if they didn't the business would go elsewhere. There was another mechanism that came into operation in the late Eighties and helped matters to get out of hand. Excessive lending led to excessively rising asset values – in particular rocketing house prices. This then provided the collateral for further lending. The whole thing began to bubble over and threatened to lead to collapse. Eventually the government, which had been slow to cotton on to what was happening, largely because of all those misleading forecasters, was forced to act. But following deregulation it had virtually no means of doing so save a savage hoist in interest rates. This works – eventually. Lowering interest rates takes a long time to have any appreciable effect and, as we saw late last year and earlier this year, raising them does too. There's an analogy about pulling a brick across a tabletop using a piece of elastic. Nothing happens for a long time, then wham!

We've now had our period of repressive interest rates and the recession they eventually created. We've heard all about the light at the end of the tunnel – it's been a rather long tunnel though. But at last there have been some genuine signs of reviving confidence. And confidence is the basis of economic activity in a market economy. Without it people stop buying and ordering. Businesses start to run down their stocks rather than replace them. Banks get edgy as bad debts mount and then start to curtail new lending and call in old. There was talk a few months ago of the possibility of economic collapse because of banks' unwillingness to make new loans. At the time that seemed to be a rather excessively pessimistic view. It may have been a major contributor to the depression in the early Thirties, but some lessons at least have been learnt since then. However that may be there comes a time when borrowing falls or is stabilised, savings rise and people start to think about new ventures and new purchases. It's this that gets things started again.

If the CBI is right about reviving confidence we should be grateful. It's a good sign: the CBI has been rather more accurate in its assessments and forecasts than more academically based organisations. It seems unlikely that we shall experience another full-bodied boom of the type we had in the late Eighties: too many people burnt their fingers. The question that is now being asked is whether the excesses that followed deregulation were a once-off adjustment to a new situation?

The effect of the recession on the radio and TV trade has been a curious one. As a result of market saturation, conditions in the consumer electronics field were already soft before the recession started. What the latter has done is to delay any uplift, despite the advent of new products like satellite TV. There are a lot of new products in the pipeline: if they come along at a time of renewed consumer confidence there will be good business to be done.

VCR Plus

George Cole

Many people have problems with VCR timers. Users complain that programming systems are over complex, with the result that the wrong programme at the wrong time is recorded – or the VCR fails to record anything at all. Some users simply ignore the timer, or leave programming to the resident "timer expert" (often the youngest member of the household). A fair number of service calls for "faults" are simply the result of incorrect programming.

It's fair to say that many timers seem to be more suitable for use by computer programmers than ordinary members of the public. In recent years however various companies have developed new, simpler systems. Examples are Panasonic's bar-code programming, Akai's on-screen displays, Hitachi's LCD remote programming and the teletext-based systems. There are even talking handsets (Sharp) that guide the user through the programming sequence. Despite these innovations, research carried out by Ferguson revealed that a third of adults have problems with setting the timer: some in the trade feel that the figure is much higher.

A new system called VCR Plus could make programming as simple as making a phone call. It was developed by a US company, Gemstar, and was launched in the USA last November. Since then it has sold remarkably well.

VCR Plus consists of a handset that looks like a basic VCR remote control unit and Plus codes. The latter are four- or five-digit numbers that are printed next to the TV programme details in newspapers and TV guides. The VCR Plus handset contains its own timer. To set this the user simply punches in the Plus code number. The handset is then left in sight of the VCR. At the relevant time it sends an IR command to the VCR to tell it to switch on. The Plus Codes contain details of the programme's date and time, the channel number and also the stop time. Thus the handset is able to switch the VCR off once the recording has been made. An alternative arrangement, adopted by Thomson for its US models, is to incorporate the VCR Plus system in the VCR and use a simplified handset to control it.

The Plus codes are now included in over a hundred newspapers and magazines in the USA. A VCR Plus handset costs around £37 there.

The system is to be launched in the UK this autumn or early next year. *TV Times* has already signed up with Gemstar to publish Plus codes. Meanwhile Gemstar is developing the handset to suit UK and European requirements – for example American date displays show the month first, then the day, while the US system has a heavy emphasis on cable channels.

The VCR Plus handsets are powered by four AA batteries, with in addition a lithium battery that acts as a backup. Layout of the handset (see the accompanying photograph) is clear and neat, with large keys and an LC display panel. Current handsets can store up to 14 events, which is more than most VCRs offer. It seems that the handsets store a number of IR command codes, enabling them to be used with the majority of remote-control VCRs.

Installation will be very straightforward if the instructions for the US handsets are anything to go by. A pull-up flap at the top conceals eight buttons. To set up the unit a table of two-digit installation codes printed at the back of the instruction book is first consulted. One of these should match the VCR make – for example Panasonic is 03, Sony 13. The VCR is set to channel three or four and is then switched off. Pointing the VCR Plus handset at the VCR and pressing the enter button transmits a test code to it. If the VCR switches on and turns to channel nine the save button is pressed and the system is installed. If nothing happens you try other codes. The next procedure is to set the clock.

The LC display tells you the date and time and provides programming details. It uses time bars – a series of dashes – to tell the user how much tape is required to record a particular programme. Each dash represents an hour or less. There's also a low-battery indication. Another indication is a warning of programme clash – when programmes overlap. In this event the user can opt to cancel one of the programmes or instruct the VCR Plus to tell the VCR to record the first programme to the end then switch over to the second one. The system will record a programme once, daily or weekly.

Other handy features include a review button that lets you check your programming and a cancel button. The recording time can be extended by pressing a button that continues the recording after the preset stop time: it works in increments of a quarter of an hour and is useful for programmes that tend to overrun, such as sports events.

Once the user has entered the Plus codes he requires, the handset is placed in its caddy pointing at the VCR – the system will work at a range of up to fifteen feet. As the system in its usual form is independent of the clock in the VCR, mains failure doesn't affect its operation.

When recording is about to start, a small red light at the end of the handset flashes to provide a reminder to load a blank tape.

United Media is acting as Gemstar's European agent. Price of the handsets in the UK is expected to be around £50. The system's simplicity could make it a winner. Though it doesn't have the advantage of the teletext-based PDC (programme delivery control) system, which identifies the programmes rather then their scheduled times, it's easier to use. The only problem is that the public is likely to be confused by the multiplicity of systems on offer, especially now that PDC has been given yet another name, Startex – which is all right so long as you realise that it's start-tex and not star-tex . . .

The VCR Plus handset in its caddy.

Teletopics

PHILIPS' LINKS

A joint venture, D2B Systems, set up by Philips and Matsushita to pool electronics standardisation know-how has been given provisional approval by the EC Commission. The two companies had asked the Commission a year ago for exemption from EC competition rules. In its initial finding the Commission states that though the venture limits competition it will yield technological advances and benefit consumers. It has taken a "favourable position" but asks for comments from others. The venture is 75 per cent owned by Philips, 25 per cent by Matsushita.

Meanwhile Philips and Sony have been holding talks on cross-licensing their new audio recording systems – the Philips DCC and Sony Mini Disc. Both are due to be launched next year.

TV SETS

Ferguson has decided to postpone the launch of its 16:9 wide-screen TV set that was demonstrated at the trade shows earlier this year. It was expected to be launched this autumn at a price of around £3,500. Launch will now be early next year. Ferguson puts the blame for the delay on the continuing recession.

Grundig launched two 16:9 sets at the Berlin Funkaustellung. The 36in. model is fitted with a conventional tube while the 46in. model uses a projection system. Both models are due for launch in the UK this month, the smaller-screen one at a price of around £3,000 and the projection set at around £5,000.

Ferguson has added a 10in. colour portable, Model A10R, to its range. It's fitted with the new TX80 chassis (see Teletopics August). Features include 40-programme direct access tuning, on-screen graphics, child lock and a menu control system that provides simple operation via the remote control handset. A sleep timer puts the set into standby half an hour after pressing a button and provides auto switch-off that's variable between a quarter of an hour and two hours. A 12V battery adaptor and an optional swivel bracket for mounting the set under shelves or cupboards are available.

The latest addition to the JVC range, Model AV25FX11, features a 25in. Blackline Invar-mask tube, colour transient improvement and video noise reduction circuitry, simulated surround and Nicam sound, comprehensive on-screen menus, Fastext, an S-video socket, 100 station presets and the ability to detect 16:9 MAC/D-MAC signals and display them letterbox style. Suggested price is £729.

SATELLITE TV

The latest satellite TV receiver packages from Amstrad feature a dual-output LNB than enables the user to run two receivers from a single dish.

Electronic Mailorder, 62 Bridge Street, Ramsbottom, Bury, Lancs has introduced a tunable satellite audio module that enables more radio stations, including the ITN news channel and many pop stations, to be received. It can be fixed to the front, back or side of a satellite TV receiver with only three connections being required. Price is £18 in kit form, £24 assembled, plus £1 post and packing.

BSkyB is actively monitoring the promotion of pirate Filmnet decoders and will withdraw Authorised Sky Agent status from any dealers who continue to sell, advertise or display these decoders. BSkyB is at present losing £1·6m a week, a dramatic reduction on the losses being made at the time of the Sky/BSB merger.

A booklet entitled *A Householder's Planning Guide for the Installation of Satellite Television Dishes* is available from the Department of the Environment, PO Box 135, Bradford, West Yorkshire BD9 4HU.

TRADE NEWS

Pace Micro Technology Ltd. has appointed CPC plc, 180-200 North Road, Preston PR1 1YP (0772 555 034) official spares distributor for Pace satellite receivers. Pace is the largest satellite receiver manufacturer in Europe – total production has now passed the half million mark.

Spares for ITT products continue to be available from Hoopwell Ltd., Unit B9, Larkfield Trading Estate, Larkfield, Maidstone, Kent ME20 6SW (0622 882 285) – but not for current in-guarantee ITT Nokia products. A new, expanded catalogue is in preparation.

Two firms are in talks with Loewe Opta on the distribution of spares in the UK.

Pioneer is moving production of stereo radio tuners from Belgium to its new plant in Wakefield, West Yorkshire. The plant will also make CD players.

DEVELOPMENTS

The BBC held the first UK demonstration of its Digital Audio Broadcasting (DAB) system in Birmingham at the end of July. DAB offers CD quality reception from simple push-button radios at home or on the move and is highly efficient in frequency use – up to twelve stereo radio channels occupy the space normally taken by just two. A coach was used to demonstrate the ruggedness of the system in a city-centre environment. The BBC has been carrying out research on DAB for several years.

A method of transmitting full-colour pictures from one PC to another via the cellular radio network has been developed by software company Origin Technology in Business, Redhill, Surrey. Transmission takes less than half a minute. The technique is based on a fractal transform process – the transmitting PC scans the picture looking for parts that are the same as images held in memory. When identifiction is made the system transmits the formula representing the pattern, not the pattern itself. The formula is compressed for transmission. Special software is required for decoding at the receiver end. Since this requires little memory space it can be sent along with the picture.

Panasonic has opened an R and D centre at Langen, Germany. Its main activities will be to gather information on the standardisation of TV specifications and to undertake research into European HD-TV systems.

VIDEO NEWS

Sony has launched three new Video 8 camcorders. Model CCD-F455 has a ×8 zoom and costs £800; Model CCD-F555 at £900 has a ×10 zoom and hi-fi stereo sound; Model CCD-V600 at £1,000 has Hi-8 picture quality, hi-fi stereo sound and a ×8 zoom.

Philips has introduced a low-price, three-head VHS VCR at £299, Model VR312. Features include remote control, a one month/six event timer, still frame and slow motion. Also from Philips comes a portable TV/VHS recorder, Model PVR200, at £1,000. Features include a PAL I and B/G tuner, a 24-hour timer and a 4in. LCD screen. Weight is 3·9kg including batteries.

Ferguson's new budget-priced VCR, Model FV50B at around £279, features remote control, a one year/eight event timer, four-speed variable picture search, assemble edit control and a full digital servo system.

NEW PUBLICATIONS

Various new publications from Mauritron Technical Services, 8 Cherry Tree Road, Chinnor, Oxfordshire OX9 4QY (0844 51694) should make life easier in the service department. They include books containing VCR equivalents listings, TV models/chassis listings and trade addresses. The latter includes TV, video, test equipment and computer firms and is revised and reprinted approximately every three months.

Infotech, 76 Church Street, Larkhall, Lanarkshire ML9 1HE (0698 883 334) has available a wide range of practical VCR fault-finding guides. The latest, by John Coombes, covers the Panasonic 700 series. The company also publishes TV/Audio/Radio repair and servicing yearbooks that contain numerous adjustment details and fault lists for particular models/chassis. They are intended for use with the company's large-scale circuit diagram collections.

Tandy's 1991/2 electronics catalogue is now available free of charge from over 500 Tandy stores and authorised dealers throughout the UK. There are 135 full-colour pages featuring 2,400 products of which 380 are new.

PHILIPS' LATEST PATTERN GENERATOR

Philips Test and Measurement, Colonial Way, Watford, Herts WD2 4TT (0923 240 511) has introduced a new top-of-the-range TV pattern generator that offers just about every feature likely to be required for testing the latest TV sets, monitors and VCRs, including those with Nicam and teletext facilities. The PM5518TNI even has an optional built-in IEEE interface to allow its outputs to be selected remotely with IEEE-based automated test systems. There are over seventy patterns, including special test patterns for VCRs, teletext and video programming. Up to 55 different sound test signals are available for Nicam stereo, standard f.m. stereo and dual/mono sound channels. An RGB option is available. The 5518 is a multi-standard generator for use with PAL, SECAM and NTSC systems.

All PM5515/5518 teletext versions now offer extended test facilities with a selection of teletext pages including standard, FLOF, TOP, VPT and VPS.

CD Player Casebook

Reports from Mike Leach and Philip Blundell, AMIEIE

Philips CD104

This player wouldn't read discs. When a disc was loaded it immediately span very fast and wouldn't stop. The laser whistled a bit and the error light on the front panel came on. I started by checking the earth-through connections on the servo and decoder panels, but for once they were all in order. My next checks were on the supplies, but again everything was o.k.

I then noticed that the turntable span fiercely with no disc inserted. This was a good indication that the fault lay somewhere in the turntable motor servo or its associated circuits. Voltage checks were made around the MC1458 chip IC6209 on the servo board: this chip, along with transistors 6233 and 6234, provide the turntable motor drive. Apart from the supplies most of the voltages were incorrect. When I moved back to the LM339 chip IC6205 I found that the voltages were again wrong. With a working machine pin 13 should be at 0V in the stop mode and at 4V when play is selected. It was high at 4·6V in the stop mode and fell to 2·1V when play was selected. As a result the turntable servo became unstable, causing the reported fault. A new LM339 chip cured the problem. The machine then performed quite well – all that was now needed was a quick laser lens clean and a soak test for possible intermittencies with regard to those earth-through connections. **M.L.**

Goodmans GCD550 Multiplay

This player first came in about a year ago. The trouble seemed to be quite straightforward. When the disc magazine was inserted and the play button was pressed a very loud rattling noise could be heard as the disc tried to load. Fortunately the disc wasn't damaged, but it sounded as if the mechanism was suffering. I found that the magazine would load all right if pressure was applied to the top of the mechanism. After much stripping down, with modifications and grease everywhere, I gave up and used a complete mechanism from a scrap machine (cheat!). The customer was happy however and so was I. The machine worked correctly for many months then a few weeks ago came back again. The note on the job ticket suggested that the fault symptom was the same as before. Sure enough the player rattled fiercely while trying to load a disc.

My first thought was that the cause of the trouble was to do with the magazine itself, but the same thing happened with a different one. So that ruled the magazine out. When the disc loading motor, on the left-hand side, has been removed you can turn the feeding gear by hand. At the point where the disc is loaded into the mechanism the gear became very tight and started to slip against the feeding rack. I lifted the feeding gear from the chassis at this point, exposing the rack. The teeth on both were badly worn and it was this that caused failure of the disc to load and the rattling. The part numbers are as follows: feeding rack 21W8135, feeding gear 21W8141. **M.L.**

Denon DCD800

This machine read the TOC all right and played the first few tracks normally. Occasionally however it would skip and jump at the outer edge of the disc. With many players this fault is often caused by a worn or faulty laser unit. Turntable motor problems or mechanical failure are other causes. Not this time though. As with all cases of tracking problems I went through the setting-up procedure. The PLL adjustment was slightly off: correcting this cured the tracking problem with all discs. This is a fault condition I've not come across before. **M.L.**

Philips CD350

This machine wouldn't read the TOC. Focus was obtained and the h.f. signal was present, but the disc rotated much too fast. The motor control signal (MCES) should be present even in standby. In this case it was missing. Checks around the SAA7020 chip showed that the chassis pin (38) was at 5V. The earth return is via C2362's negative lead, which is soldered on both sides of the board. Not in this case however – there was a dry-joint on the underside. **P.B.**

Adding a Scart Connector

K. Wevill, B.Sc.

The scart connector is nowadays a standard fitting in most current TV sets, satellite TV receivers and VCRs, enabling video and audio signals to be fed in and taken out directly instead of having to go through a u.h.f. modulation/ demodulation process. This results in improved quality and permits RGB inputs and stereo sound, both inputs and outputs, to be used. RGB inputs enable a TV set to be employed as a computer monitor or, with a MAC decoder, to obtain better resolution than is possible with a composite PAL signal, with no cross-colour effects. The stereo audio outputs can be used with an external stereo amplifier or hi-fi system.

The interface described in this article enables many older TV chassis, without video and audio input or output facilities, to be fitted with a scart connector. It was designed primarily for chassis that use a TDA2540 i.f. chip, a TDA1035 intercarrier sound/audio chip and a TDA3560 PAL decoder chip. It could however be adapted for use with chassis that employ similar i.c.s. The chassis with which it was developed was an ITT CVC800. Examples of other chassis that use the same chips are the Ferguson TX9 and TX10: these are equally suitable for the modifications described here.

Fig. 2 shows the scart connector, which is also known as a Peritel connector or Euroconnector. The signal levels and impedances expected at each pin are listed in Table 1. The function switching, blanking and RGB signals are inputs with a TV set and outputs with a VCR, computer or satellite receiver. As yet the communication lines are undefined.

Safety

The most important aspect of the modification process is to ensure that the TV chassis used is isolated from the mains. Many chassis that are suitable for the modification have a non-isolated switch-mode power supply and a bridge rectifier that's fed straight from the mains supply. This means that the chassis will be live at all times, irrespective of which way the mains plug is wired. To overcome the problem, an isolating transformer must be used. It must be a toroidal type, as this has a negligible external magnetic field and thus avoids magnetic interference to the c.r.t. The transformer should be rated to cope with the TV set's power requirements: 120VA is adequate for the TX9 and CVC800 chassis and should be suitable for most, but it's as well to check the set's power consumption before obtaining the transformer. Transformers rated at 80VA and 120VA are available from Jaytee Electronic Services, 143 Reculver Road, Herne Bay, Kent CT6 6PL. Many modern TV chassis are designed with mains isolation in mind and thus don't call for the use of an isolation transformer. Examples are the Ferguson TX10 and TX100.

Mode of Operation

Fig. 1 shows a block diagram of the interface, which consists of a video input amplifier, a video output buffer, a stereo audio switch, audio output buffers, RGB interfacing and switching circuits.

The external 1V composite video (CVBS) signal is fed to the video input amplifier which has a gain of 2·5 times. Its output is similar to that produced by a TDA2540 i.f. chip. The video output (CVBS) is taken from the same point, making loop-through of the video signal possible.

The audio circuit is a little more complex, as the inputs and outputs are stereo while the set's internal audio amplifier is mono. In the internal off-air mode audio from the intercarrier sound i.f. section is fed via the input buffer and two of the switches in IC1 (4053) to the left and right output buffers. When the external mode is selected, the left and right output buffers are fed with left and right inputs via the switching. The left and right inputs are also summed and fed to the TV set's internal audio amplifier as a mono signal. Thus if a stereo signal from for example a stereo VCR is fed into the interface the TV set's output will be in mono but the stereo signals will also be available to feed to an external hi-fi system. There's provision to adjust the signal levels to and from the TV audio amplifier to maintain the same volume control settings for both internal and external use.

The RGB inputs go straight through to the TDA3560 PAL decoder chip along with the fast blanking input. Note that when RGB inputs are used a sync signal must be provided and fed into the external video (CVBS) input, otherwise the picture will be unlocked.

Switching between internal and external signal sources is achieved by using one or more of three methods: (1) control by pin 8 of the scart socket; (2) control by external switching; (3) control from the channel selector.

When the internal mode is selected, the video amplifier is turned off and the external input to the TV audio

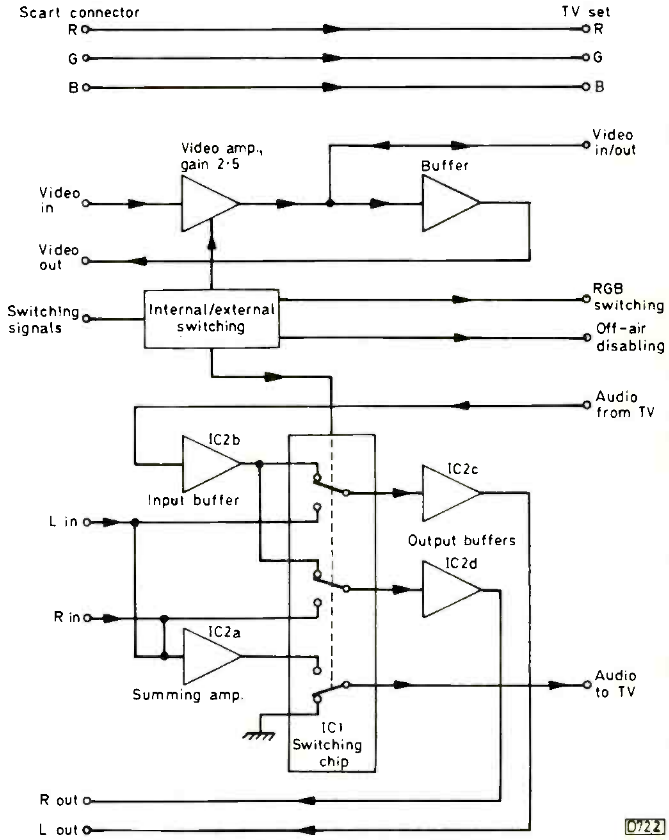


Fig. 1: Block diagram of the Scart interface system.

amplifier is earthed to avoid interference problems.

In the external mode the i.f. amplifier and intercarrier sound i.f. are disabled to avoid interference problems. The time-constant for the line sync is also changed. The audio and video output buffers remain active in both modes. RGB switching is normally done by the fast blanking input at pin 16 of the scart connector, but a switch is provided to override this if no such signal is available.

Circuit Description

Fig. 3 shows the full circuit of the scart interface. The video input amplifier consists of TR3/4, with TR5 forming the output buffer. The amplifier is switched on and off by TR2 which either connects or disconnects the bias to TR3.

Audio switching is done by IC1, which is a triple, two-way CMOS switch. IC2c/d are the output buffers, IC2a is the summing amplifier/buffer that generates the mono signal for the set's internal audio amplifier while IC2b acts as a buffer for the internal audio signal from the intercarrier sound circuit. Use of these two input buffers enables the signal levels to be altered easily to match the internal and external signal levels. To alter the output level, increase the value of R30 to raise the level or decrease its value to reduce the level. Alter the value of R29 similarly to increase or decrease the volume from the TV set's loudspeaker. The levels should be such that the volume is the same in both the internal and external modes.

Switching between the internal and external mode is achieved by TR1/2. When the external input is required, either pin 8 of the scart socket is taken to 12V or switch SW1 is set to the Ext position (12V). This switches TR1 and in turn TR2 on, enabling the video input amplifier. The i.f. amplifier is turned off by taking pin 14 of the TDA2540 chip low via D6, while the TDA1035's intercarrier section is turned off by taking pin 2 high via D7 and R21. The line generator chip's time-constant is changed by applying 12V to the selector pin via D8.

The RGB inputs are much easier to implement, as the TDA3560 PAL decoder chip is designed to accept analogue RGB video signals – these inputs are normally used for teletext. RGB selection is done by setting the blanking signal input to 5V. The RGB inputs must be a.c. coupled: C1/2/3 and the terminating resistors R1/2/3 are included for this purpose. Some TV chassis may already have these components fitted, or there may be provision to incorporate them. In this case they need not be fitted on the interface PCB.

Construction

Construction is not unduly critical – the circuit can be built on Veroboard. The leads to the video amplifier should be kept short however. It's best to use a socket for IC1 as this is a CMOS device. Fit it after all the other components. Layout depends on the space available for the interface and which of the facilities are required. For example it's not necessary to include the RGB interface if this is not required or the set's colour decoder chip has no provision for RGB inputs.

Interfacing with the Set

The interface circuit requires a 12V supply, which can usually be obtained from the PAL decoder supply or some other convenient point in the set. The video input/output must be connected to the TDA2540 chip's output (pin 12) after the intercarrier sound take-off point. In many sets this is contained within an i.f. module, so connection can be made at the module's video output pin.

With the Ferguson TX9 and TX10 chassis the relevant point is pin 8 of the i.f. module, at PL4: in the ITT CVC800 it's at pin 23 of the tuner/i.f. module.

The i.f. disable output is connected to pin 14 of the TDA2540 chip, via the a.g.c. time-constant circuit. With the TX9/10, make the connection at pin 9 of PL4; with the CVC800, make it at pin 22 of the i.f. module.

If there's no module, make the connections to the TDA2540's video output (pin 12) after the intercarrier sound take-off and to pin 14 (i.f. disable) via a 100Ω resistor.

Audio input and output connections to the TDA1035 chip are made at pins 7 and 3 respectively. In some versions of the TX9 pin 3 is available at PL21. In others and in the CVC800 pin 3 is connected to chassis. In this case the PCB track will have to be cut and a 4·7kΩ resistor and 10nF capacitor in parallel will have to be added between pin 3 and chassis.

The a.f. disable can be connected directly to pin 2 of the TDA1035 or, if the chip is in a module, as in the CVC800, the connection can be made to the relevant module pin (29 with the CVC800).

With other chassis check the circuit diagram for suitable points to connect the interface.

Connect the AV time-constant line to the line generator chip's VCR select input. The pin to use depends on the chip. With the CVC800 it's available at TC6. In the TX9 it's at PL23. An alternative point is the set's VCR time-

Table 1: Scart pin connections.

Pin	Function	Level/impedance
1	R audio out	0·5V/<1kΩ
2	R audio in	0·5V/>10kΩ
3	L audio out	0·5V/<1kΩ
4	Audio earth	–
5	B video earth	–
6	L audio in	0·5V/>10kΩ
7	B video in	0·7V/75Ω
8	Source switching	Internal mode 0-2V, external mode 9·5-12V/ >10kΩ
9	G video earth	–
10	Communication data 2	–
11	G video in	0·7V/75Ω
12	Communication data 1	–
13	R video earth	–
14	Communication data earth	–
15	R video in	0·7V/75Ω
16	Blanking	Composite video source 0V-0·4V; ext. RGB 1-3V/75Ω
17	Composite video earth	–
18	Blanking earth	–
19	Composite video (CVBS) out	1V/75Ω
20	Composite video (CVBS) in	1V/75Ω
21	Common earth (shell)	–

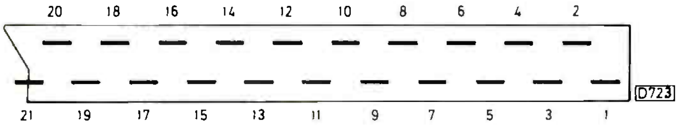


Fig. 2: Scart connector pin layout.

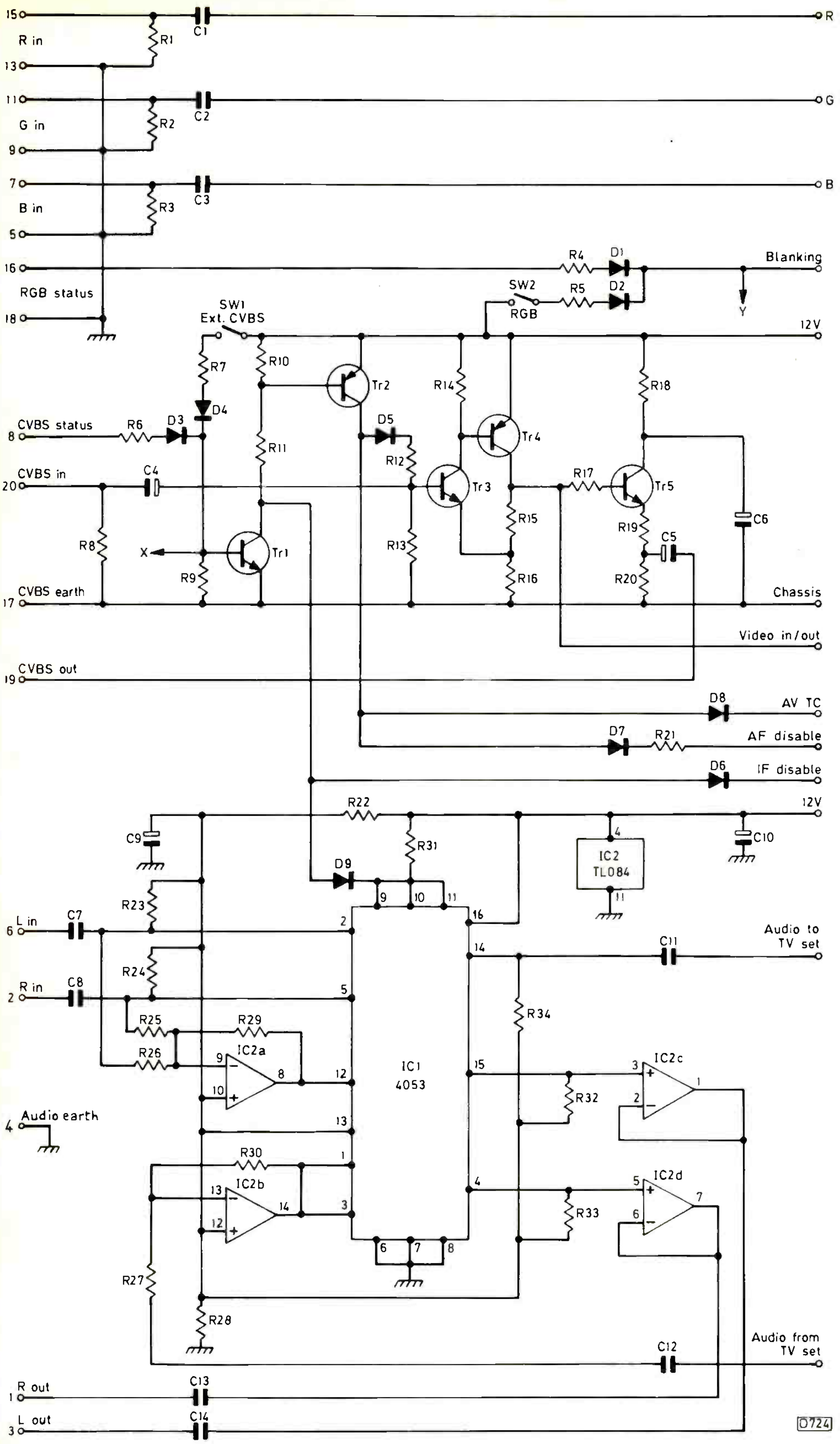


Fig. 3: Circuit diagram of the Scart interface system.

Components list

Resistors:

R1	82Ω	R18	100Ω
R2	82Ω	R19	68Ω
R3	82Ω	R20	220Ω
R4	100Ω	R21	18k
R5	680Ω	R22	4·7k
R6	12k	R23	100k
R7	12k	R24	100k
R8	75Ω	R25	100k
R9	10k	R26	100k
R10	15k	R27	100k
R11	47k	R28	4·7k
R12	8·2k	R29	100k
R13	2·7k	R30	100k
R14	5·6k	R31	47k
R15	1·5k	R32	1M
R16	1k	R33	1M
R17	100Ω	R34	1M
		All 0-25W	

Capacitors:

C1	100n
C2	100n
C3	100n
C4	47μF 16V
C5	220μF 16V
C6	22μF 16V
C7	220n
C8	220n
C9	22μF 16V
C10	47μF 16V
C11	220n
C12	220n
C13	470n
C14	470n

Semiconductor devices:

D1-9	All 1N4148
IC1	4053
IC2	TL084
Tr1	BC548
Tr2	BC558
Tr3	BC548
Tr4	BC558

Remote control interface:

R35	100
R36	10k
R37	10k
D10-12	1N4148
IC3	4028
Tr6	BC548
Resistors 0·25W	

Miscellaneous:
Scart connector, i.c. socket, Veroboard. Toroidal isolating transformer.

constant control line, usually found on the channel selector or the remote control receiver/decoder.

Installation

The first step in carrying out the installation is to fit the isolation transformer (where required). Space can be found in most sets. Keep it as far as possible from the c.r.t. Some experimentation to find the best compromise position will usually be necessary, and a bracket may have to be made to fix it in place. In most sets it can be wired up immediately after the mains on/off switch, but in chassis with a remote control system that uses a relay to switch the set on and off the transformer should be wired after the relay contacts. The TX9 is an example of the former arrangement, the CVC800 an example of the latter. Ensure that the position chosen doesn't cause any magnetic interference to the c.r.t.

Once the position of the transformer has been decided, find a suitable place to fit the scart connector and the interface board. It will be necessary to make up a bracket to support the connector, the switches and the board and to cut a hole in the case. The board and connector should be mounted close together, with the connections to the TV circuitry kept as short as possible. Use screened cable for the audio leads.

Remote Control

It's possible to control the interface switching from the TV set's remote control system, where fitted. This can be done without affecting the normal off-air channel selection as many systems are actually capable of 16-channel operation but use only eight. If this is the case, connect the four channel select outputs A, B, C and D to a 4028 decoder chip as shown in Fig. 4. Also connect the D output to the D input of the channel number display decoder. This input is usually earthed, so the track may have to be cut. Output 8 of the 4028 is connected to the base of TR1 via R37 and D12. Then, when channel 9 is pressed on the remote control unit, the scart interface is selected and 9 is displayed by the channel indicator.

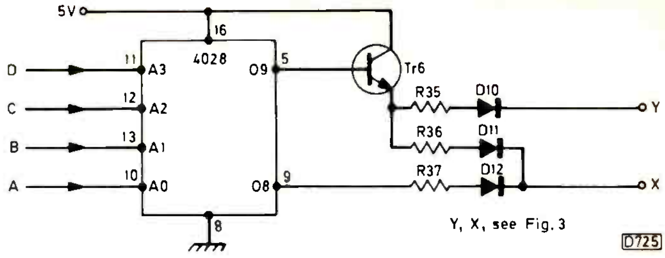


Fig. 4: Remote control interface system.

Fig. 4 also shows how RGB selection can be made via the remote control so that when input ten is selected the RGB input is enabled and zero is displayed by the channel selector. Note that the interface is switched to the external mode so a sync signal must be fed into the video (CVBS) input to provide sync pulses.

In Baird's Footsteps

J. LeJeune

It's easy to be blasé about the achievements of those who first developed television. Not so long since I began to wonder what went on in the mind of J.L. Baird in those early days of mechanical television in the early Thirties. Just what problems did he face? There seemed to be only one way to find out: to recreate the situation by reinventing the 30-line system. Much of my effort was done on paper only, as a sort of mental exercise, saving a lot of time that would otherwise have had to be spent on trial-and-error experiments.

Basic Decisions

I'll begin by saying that the exercise was not as easy as you might think. Basic decisions had to be taken then subsequently altered, mainly about the size of major items like the scanning disc. This affects the picture size and curvature. Following logically, the next decision concerned the size of the scanned aperture. This affects the amount of light needed at the transmitter and the brightness of the received image. All this had to be considered before a sketch of a workable system could be made.

There's probably nothing simpler than the idea of a spinning disc with holes around the perimeter, arranged so that they scan a subject with a spot-beam of light. The main problem was to get enough light through the holes then reflected with sufficient intensity from the subject to the pick-up photocells. Compromise was necessary right at the start. I'd neither the room nor the spare cash to make a sizeable disc so that largish holes that would allow significant light through them could be used, and eventually settled on a 23·6cm diameter disc.

Baird must have considered scanning photographic negatives at some stage, but live television was his real goal and this was more difficult. I chose a 24 × 30mm aperture, behind which a 24 × 36mm (35mm) transparency could be placed. This would cut about 3mm from the top and bottom of the transparency, not enough seriously to impair the picture obtained from the scanned slide. The light source was to be a 300W slide projector, focused on the aperture, with the scanned slide on the far side of the disc, away from the intense heat of the focused light. The idea of scanning an object and picking up the reflected light was abandoned. Fig. 1 shows the arrangement adopted.

I decided to use interlacing, which is easy enough to arrange with a mechanical system. A subsidiary lamp and photocell would be used to generate field sync pulses via another hole in the disc placed in a convenient position. Why didn't Baird think of interlacing? It would have made even the 30-line system more acceptable! Synchronisation was another of his troubles – it was more a matter of luck than lock!

On the receiver side I decided to use a modern servo system, unashamedly copied from VCR technology, to synchronise the disc. In fact the motors used to drive the rotating discs were rescued from the scrap bin, having been pronounced too noisy for a couple of Ferguson 3V35s. A drop of 3-in-1 oil at the base of the shaft quietened things down a bit – don't try this on your VCR, as the motor operates shaft-down and the oil will thus run out on to the pulley and belt.

The remainder of the video system looked simple enough and was left till last. How different that would have been in Baird's day! Servo techniques were in their infancy

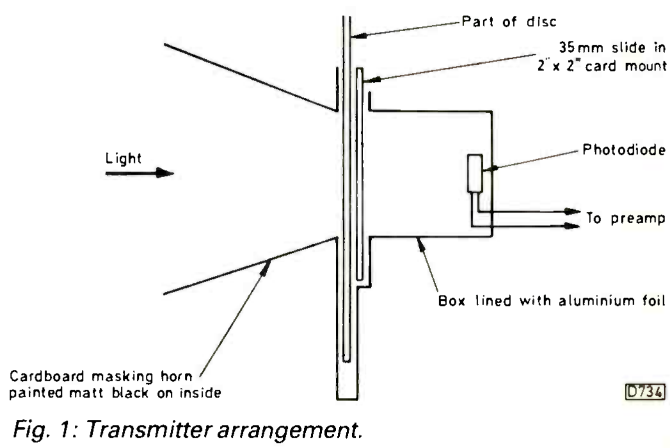


Fig. 1: Transmitter arrangement.

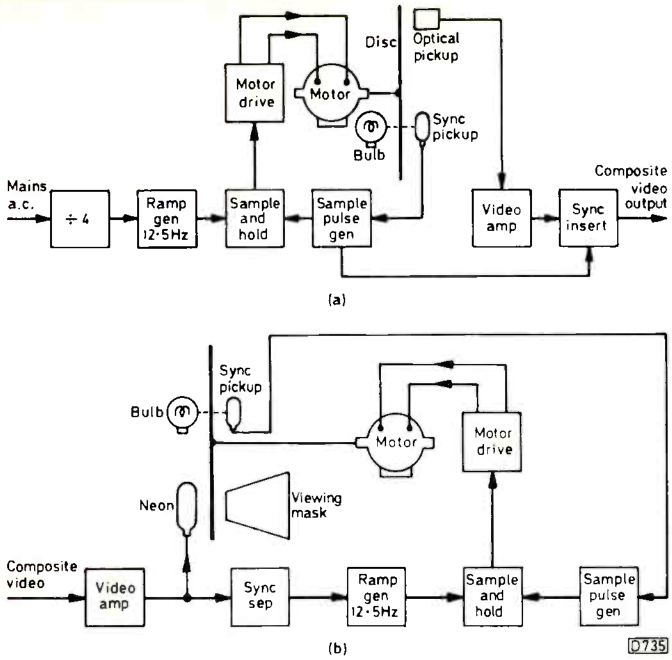


Fig. 2: Block diagrams of the transmitter (a) and the receiver (b).

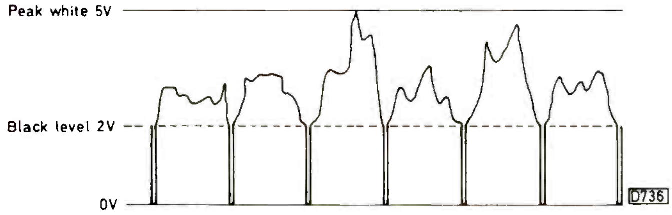


Fig. 3: The composite video waveform.

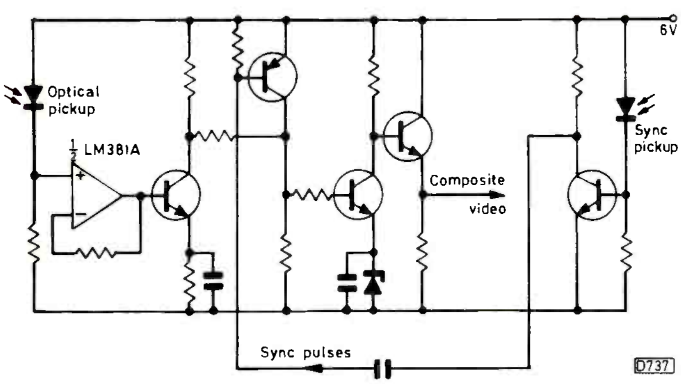


Fig. 4: The transmitter video amplifier circuit.

in the late Twenties and early Thirites. Valves were crude, noisy devices until the mid-Thirties, with a limited high-frequency performance.

The discs rotate at 750 r.p.m. to give a 30-line, 12·5 frames per second scanning rate. Line frequency is therefore 12·5 × 30 = 375Hz. With the 4:5 format of the picture, the highest video frequency to be handled would be around 100kHz for a good squarewave response. Thus a good, low-noise video amplifier could be devised with very little trouble. I decided to use semiconductor devices wherever possible. Although trouble was anticipated with the receiver light source it was not experienced. At the start I thought that a solid-state light source could be used, but this had to be abandoned because of inadequate size and intensity. So it was back to the neon lamp. Unfortunately a neon lamp's response is somewhat slower than that of a solid-state light emitter, but it was the most practical and cheapest light source available. Photodiodes were used at the transmitter to convert the light from the scanner into a video signal.

Mechanical Parts

In due course the scanning disc was made. You can get the rigidity required by using a thick duralumin disc, but the light has to travel through a tunnel-like hole. The diameter of the latter was 1mm – and the disc was 1mm deep! To get round this problem the holes were countersunk on the illumination source side of the disc. This worked extremely well.

With a 24 × 30mm aperture there's considerable curvature of the scanning lines. Horizontal scanning is used, with the narrower side of the picture uppermost. The disc rotates clockwise viewed from the light source/viewing side. Overall diameter of the disc is 235mm and the radius of the outermost scanning hole is 114mm. Line one is scanned by the innermost hole.

Disc drilling must be done very precisely and shouldn't be undertaken lightly. A friend with a good sheet-metal working facility is a valuable asset! Both discs were made simultaneously by employing the simple expedient of bolting them together. Countersinking of the holes was done with a stand drill set up to permit only 0.8mm penetration of the bit.

Disc Drive

Making the disc is the hardest part, but as this is a mechanical operation it's straightforward for an experienced sheet-metal worker. Fig. 2 shows a block diagram of the transmitter and the receiver. I decided to lock the transmitter to the mains frequency: the servo used was pinched directly from modern VCR technology. The incoming 50Hz is divided by four to obtain a 12·5Hz reference. Locking to the mains was decided upon because of the use of an a.c.-powered lamp, though the 300W mains-voltage projector lamp didn't produce any noticeable flicker-beat when free-running.

The disc shouldn't be eccentric, though this gives rise to some quite comic effects. Disc mass is sufficient to give some flywheel action to the servo systems: phase locking was necessary only to keep the synchronism steady. Because of their mass, the discs take a time to run up to speed. They are steady and reliable when the servo is in full operation at 750 r.p.m.

The Electronics

The 30-line system electronics are simple, and one is left wondering what sort of system Baird would have developed had transistors been available in the early Thirites.

Phase-controlled servos are used to synchronise the discs, mains locking is used at the transmitter, and a sync pulse is generated by a subsidiary hole in the transmitter disc. This pulse is used to synchronise the disc servo at the receiver directly. There are no line sync pulses. The disc sync pulse is inserted at the end of each frame and is negative-going. The video signal is positive-going, the transmitter producing 3V of it. Sync pulse amplitude is 2V, so the composite video waveform is as shown in Fig. 3, with a peak-to-peak amplitude of 5V.

The transmitter amplifier (see Fig. 4) uses conventional a.f. techniques and commonly available low-noise devices. D.C. stabilisation is incorporated. The black level is 2V: this is the d.c. pedestal on which the video waveform sits.

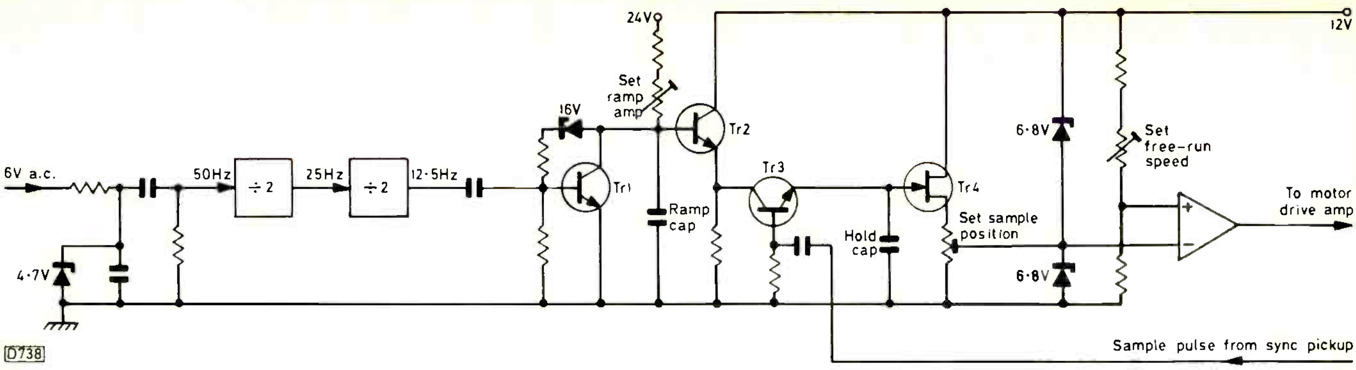


Fig. 5: The transmitter servo circuit.

The disc sync pulse is inserted into this 2V pedestal by taking it to chassis potential. When you consider the simple circuit shown, one's thoughts must again be with Baird, working as he did with selenium cells and thermionic devices for amplification. Think of triodes with the Miller effect crunching the h.f. response and pentodes with their noise contributing snowflakes to the hot shade of pink provided by the neon discharge.

At the receiver the incoming video signal is amplified to a level of approximately 85V peak-to-peak to modulate the neon lamp. Although I had a kind offer from Thorn Lighting in the form of a specially-made neon, I decided to forgo this in favour of a lamp that could be purchased at an electrical retailer anywhere and could be easily modified for the purpose. The modification is necessary to remove the series resistor incorporated in the lamp cap for 240V operation. You can remove the cap by desoldering the contacts, with the help of a pump and wick, then sawing off the end of the cap using a junior hacksaw judiciously either on the insulator or on the cap itself very close to the insulator. Any attempt to remove the cap in its entirety will end with breakage of the bulb.

I must emphasise that neon lamps don't give out a lot of light. So the resultant image at the receiver is very dim. Darkness is necessary to view the "picture".

Baird would have loved the LED. When I read about his demonstrations of large-screen TV using arrays of incandescent bulbs I'm tempted to think "if only the poor man could have had some LEDs"!

Mirror-drum Alternative

On the face of it the mirror-drum system appears to be a better way of getting adequate light, but a word of warning is necessary here for the amateur experimenter. If anything, the allowable error in the construction of a mirror-drum scanner is even less than that with a disc, while a remarkably good adhesive is required to fix the individual mirror sections to the drum. The adhesive must be very strong and mustn't attack the mirror backing. Attaining even a passable assembly of this type is not easy for the amateur working on the kitchen table. Remember that a fragment of mirror flung from a drum rotating at 750 r.p.m. can hurt. This is a hazard even with today's modern adhesives: when Baird was attempting such things in the Thirties danger money should have been paid to people operating the equipment!.

Servo Systems

A servo system is used to maintain the correct disc speed and position (phase). As previously mentioned, mains-frequency locking is used to keep the rotational (angular) velocity of the transmitter disc constant. Fig. 5 shows the servo circuit. A.c. from a secondary winding on the mains transformer is clipped and differentiated. Division by four is then performed by two bistables within a chip. The output from the second bistable, at 12·5Hz, is again differentiated. The negative-going pulse is discarded while the positive-going pulse is used to trigger the discharge transistor (Tr1) in a ramp generator stage. This ramp forms the reference signal. The sample signal is derived directly from the frame sync hole in the disc, via a lamp and photodiode that are on opposite sides of the disc and 180° away from the scanning aperture. The photocell sees the lamp as line thirty's hole is leaving the aperture and line one's hole is about to scan it. As a result, the sample pulse occurs roughly half way up the ramp. It closes a switch (Tr3) momentarily, charging the hold capacitor via a current amplifier (Tr2) to the voltage attained by the ramp at that instant – this is the famous sample-and-hold circuit used in the early second-generation VCRs like the Ferguson 3V00. The voltage produced by this arrangement is used to control the disc motor's speed via its drive system.

Simple circuitry is used throughout: the "televisor" is sufficiently lacking in sophistication to allow it. A similar servo arrangement holds the receiver disc in sync. The reference signal is generated by the frame sync pulse which triggers a ramp generator, the sample pulse being provided by a lamp, a photodiode and a hole in the disc. A similar sample-and-hold circuit is used, but the sample pulse is arranged to occur between lines fifteen and two – half way through one frame scan and half way through one complete revolution of the receiving disc.

In Conclusion

There are better ways of displaying the received picture – a small c.r.t., an array of LEDs, and so on – but superior displays call for the insertion of line sync pulses in the video waveform. If anyone is tempted to try such improvements, line sync is the first requirement. It's easy enough to generate and insert, but is unnecessary with the original disc system. Incidentally you'll need over 1,100 LEDs to obtain a display with equal vertical and horizontal resolution.

The results obtained with this Baird-type system were of barely entertainment quality. Its achievement sixty years ago would have been considerable, but today it's of curiosity interest only. Once I'd got it working I discarded the equipment: it had served its purpose. What it showed was that Baird, working in an entirely new sphere with only the efforts of Campbell-Swinton and Paul Nipkow before him to act as starting points, must have had a terrible time trying to get his crude apparatus to work.

The Photo CD Format

George Cole

The Photo CD format has been jointly developed by Philips and photographic giant Kodak. It enables up to a hundred photographic images to be stored on a compact disc, with playback via a TV set acting as a monitor. The system employs a mixture of film, video, compact disc and computer technologies and is aimed at both the consumer and business markets.

This is not the first time that photography and video have converged as a single system. In 1985 Fuji offered Japanese consumers a TV-Photo system that enabled the user to view his shots in video form and select the best ones for development on film. There's also still video, which records video images on a floppy disc or SRAM card for TV viewing. Neither of these formats has proved to be popular with consumers. Kodak is nevertheless confident that Photo CD will be a success. It points out that systems like still video suffer from poor image quality, and that users want hard copy prints as well as TV images. Photo CD can provide high-quality pictures with a resolution sixteen times better than current TV systems and four times better than any proposed HD-TV system. Users can get the usual prints and negatives from their film, and high-quality prints can be produced from a Photo CD disc.

According to Kodak some 300 million 35mm cameras are in use worldwide: around sixty billion photographs are taken each year. Thus the potential market is enormous. Photo CD discs will be available anywhere in the world, though the players will have to be produced to suit the NTSC/PAL/SECAM markets. An advantage is that as the images are stored in digital form it's possible to perform effects such as cropping, panning and zooming, also colour correction.

Basic Principles

The basic idea is that camera users will be able to take their film to a photofinishing retail outlet that will supply them with a recorded Photo CD disc and/or film negatives/prints. Disc playback can be via a Photo CD, a CD-I or a CD-ROM-XA player. The former two use a standard TV set as a monitor while the later can be connected to a desk-top computer with a monitor. The Photo CD format is also suitable for use as an image store for computers. While the format was originally designed for use with 35mm film, it can now be used with other types of film such as 120 rolls.

Photofinishers will use a £60,000 Photo CD (PCD) processing system produced by Kodak. The disc production system is as follows. First a human operator checks the film orientation. The Kodak PCD scanner then scans the slides or negatives using 2,048 lines with 3,072 pixels each and twelve bits for each of the primary-colour (red, green and blue) components. A PCD Data Manager 100, which contains a Sun SPARCstation computer, then performs colour correction. After this a PCD writer stores the processed data on the disc. Index prints for a Photo CD "jewel case" and standard prints and enlargements can then be produced by a Kodak Index Printer. A CD-ROM-XA reader will be used for producing image copies, prints and enlargements.

Photo CD Images

The colour encoding system used by Photo CD is known as Photo YCC: each colour pixel is represented by an eight-bit luminance (Y) component and two eight-bit chrominance (C) components. YCC is converted back to RGB form for display purposes.

Each Photo CD image is stored on the disc as a hierarchy of components: this enables various options from a relatively low-resolution image with 128 lines by 192 pixels to a high-resolution image with 2,048 lines by 3,072 pixels to be obtained. The low-resolution images are used for index prints and PIP effects, and are uncompressed. A Base image, also uncompressed, is used for TV and computer displays. The high-resolution images are used for HD-TV displays and hard copy enlargements.

The image hierarchy is arranged as an Image Pac which has an average size of 4·5Mbytes – Image Pacs can consist of anything from three to six Mbytes. Since a compact disc has a storage capacity of around 600Mbytes, it follows that a hundred or so Photo CD images can be stored on a single disc.

Each Image Pac is stored on the disc as a standard CD-ROM file known as ISO 9660. It can therefore be read by a computer. Additional data such as Microcontroller Readable Sectors (MRS) are included so that the Image Pacs can be read by consumer (Photo CD and CD-I) players as well.

Encoding Process

The first step in Photo YCC encoding is to scan the slide or negative. An initial problem is that the light and colour vary from scene to scene and film to film. In addition, the image quality with a hard copy print is quite different to that obtained from a video display system. For these reasons the Photo YCC system assumes that the light level in the original scene conforms to an international standard for luminance. The scanner is also calibrated to meet CCIR recommendations for colour phosphor displays. Photo YCC also includes colours outside the CCIR's recommendations however.

The RGB signal components obtained by image scanning are converted into YCC form in three stages. First, a non-linear transformation is applied to maintain compatibility with the most popular display systems. After this the non-linear values are converted into one Y and two C components. The final step is to convert the three YCC components into 8-bit data for storage on the disc.

Image Structure

To improve access time and increase the storage capacity, the Photo CD images are stored on the disc in a compressed form. The need for this is apparent when you consider that a full-resolution 2,048 × 3,072 × 24-bit colour image uses 18Mbytes of data: since the transfer rate of a CD player is 150kbytes/sec, it would take two minutes to call up such a high-resolution image while the disc would be able to store only some thirty images. Compression takes the following form. High-resolution components are removed from a standard base image, compressed and stored as data in residual files. Table 1 shows the various forms of image in the hierarchy: base, base/4 and base/16 are not compressed while base 4 and base 16 employ compression. In addition the chrominance data is subsampled twice in the horizontal and vertical directions.

Table 1: Forms of Photo CD image.

Image	*Lines*	*Pixels/line*
Base/16	128	192
Base/4	256	384
Base	512	768
Base 4	1,024	1,536
Base 16	2,048	3,072

These processes reduce the image to around 9Mbytes. Further reduction is achieved by compressing the highest-resolution elements. This is done by using a data compression algorithm known as Huffman encoding.

Forming a High-resolution Image

So how is a high-resolution image produced? Let's take conversion of a 512 × 768 lines/pixels base image into a 1,024 × 1,536 base 4 image. Interpolation is used to convert the base image to 1,024 × 1,536 form. The residual base 4 data is then decoded, decompressed and added to the pixels to increase the resolution. The same process is used to convert from a base 4 to a base 16 image, except that this time the process is also applied to the chrominance data. Figs. 1 and 2 show the processing steps.

Image Pacs

Fig. 3 shows the structure of an Image Pac. The first section, the Image Pac Attribute (IPA), stores information such as where and when it was produced. The various base sections are shown to the right, with increasing resolution: between each there's a Microcontroller Readable Sector (MRS). The final section, Image Pac Extension (IPE), is currently undefined – it could be used for features such as audio recording or obtaining even higher resolution.

Fig. 4 shows the arrangement used for base, base/4 and base/16. The ICA sector, which is microcontroller readable, contains attribute information on the image, such as its rotation (in 90° increments), highest resolution and whether there's an IPE. ICD stands for the image data.

The base 4 and base 16 data structure is different, see Fig. 5. Line pointers (LPT) in player and computer-

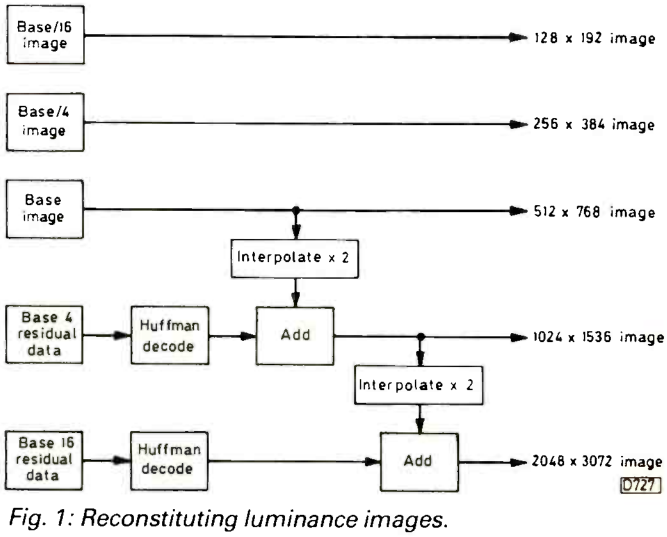


Fig. 1: Reconstituting luminance images.

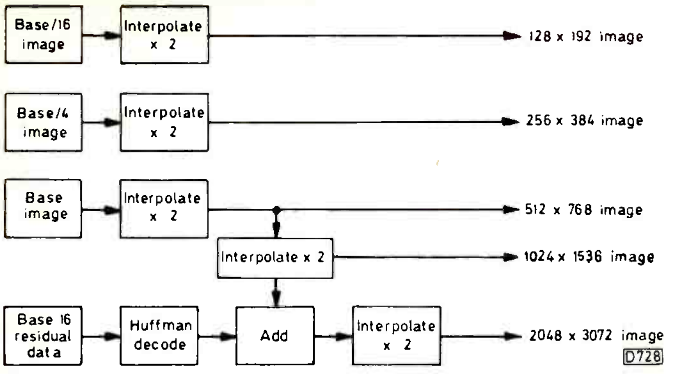


Fig. 2: Reconstituting the chrominance information.

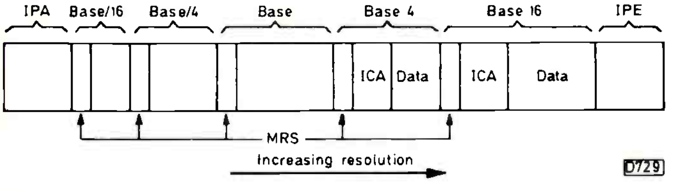


Fig. 3: Image Pac structure.

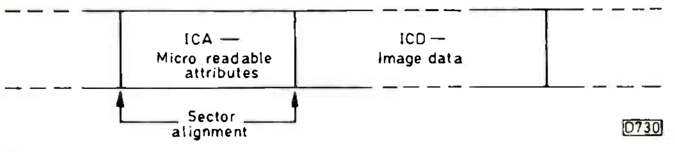


Fig. 4: Base, base/4 and base/16 data structure. The length of the ICD sector depends on the image type.

readable formats are included to give the location of the last lead-out track. The Huffman Quantiser Table (HQT) is used for residual file decoding.

The base/16 images are all stored as an Overview Pac (see Fig. 6), forming a central information store. There are two OPAs (Overview Pac Attributes), one for computer reading and the other (MRS) for consumer player reading.

File System

Photo CD uses a hierarchical directory system for computer search to find the relevant data and instructions. On each disc there's a directory (list of files) that contains in turn an image directory, overview file and other files. The image directory contains a file for each image. The other files are Photo CD Information, which is used for computer applications, and CD-I for CD-I players.

Disc Format

The Photo CD disc format is an extension of the CD-ROM-XA (XA = extended architecture) format known as the Mode 2, Form 1 sector structure. It enables the discs to be used with CD-ROM-XA drives and CD-I players. Fig. 7 shows the layout of a sector. First comes sector sync, with twelve bytes, for synchronisation. The header part contains the file name and additional file information. At present the subheader part is unused. After the user data part there are the error detection code (EDC) and the error correction code (ECC) sections. The latter has 172 bytes for P parity and 104 bytes for Q parity.

Photo CD uses a "hybrid disc", the standard being laid down in the Sony/Philips Orange Book for recordable compact discs. The discs are referred to as hybrid because they contain elements of the audio CD, CD-I, CD-ROM and CD-R systems.

The discs contain multiple program areas called

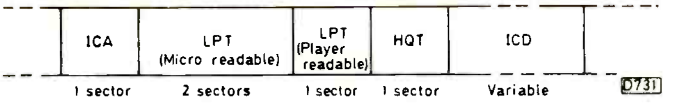


Fig. 5: Base 4 and base 16 data structure.

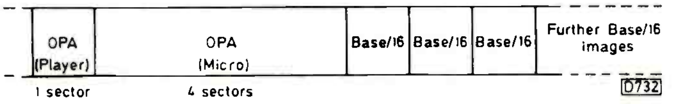


Fig. 6: Base/16 images stored as an Overview Pac.

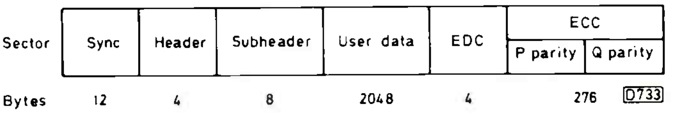


Fig. 7: Layout of a Mode 2, Form 1 sector.

"sessions" that allow additional recordings to be made on a disc (there's normally only a write-once facility with recordable discs). These enable the user to take a partly-filed disc to a photofinisher for additional images to be recorded. When this feature was first announced there was some puzzlement as to how it could be done. Audio discs have a table of contents (TOC) that stores details of the tracks and timings on the disc. Since this is written only once, any additional recordings wouldn't be listed in the TOC and would, as far as the player is concerned, not be there. Likewise anything beyond the lead-out track would normally be ignored by a CD-ROM drive. The answer is to incorporate additional software that instructs the player/drive to look beyond the last lead-out track to see whether any additional tracks are present.

Future Developments

Photo CD can offer two extensions to image resolution, currently unused. The format can also incorporate audio recording to add words to pictures.

Marketing

Finalisation of the CD Photo standard is expected by the end of this month (October). The European launch is due later next year, with Photo CD players costing around £300 – they will also play conventional audio compact discs. Upon finalisation of the standard by Philips and Kodak the specifications will be released to manufacturers worldwide, the hope being that they will start to include Photo CD in some of their models. The Photo CD facility adds around £100 to the price of a CD player. CD-I decks will play Photo CD discs and when the price of CD-I hardware falls it seems likely that dedicated Photo CD players will cease to be produced.

According to Kodak the Photo CD service should cost the user around £12-£13 for a Photo CD disc plus prints and negatives (the price is for 24 exposures). Additional Photo CD recordings will cost around 45 pence per exposure.

As we go to press there are conflicting claims as to whether Photo CD will be available with Commodore's CD-TV format, which is a rival to the CD-I system.

Acknowledgement

Acknowledgement is due to Scott Brownstein, manager of advanced development at the Eastman Kodak company, for his help in the preparation of this article.

VCR Clinic

Reports from Philip Blundell, AMIEIE, Ed Rowland, Roger Burchett, Brian Storm, Nick Beer, Chris Avis, J. Edwards and Mick Dutton

Philips VR6463

This machine was dead with no 5V output from the power supply because of a short to chassis. If plug P12 was removed the short disappeared, so the search continued on the P603 module. There are quite a lot of decoupling capacitors here. Fortunately the second one I tried was the cause of the short – C2919 (47μF, 16V). **P.B.**

JVC HRD520

For mechanical malfunctions such as the tape being ejected while still laced up try changing the control cam, part no. PQ32413. The latest type is made of grey plastic instead of white. **P.B.**

Philips VR2022

For a dead machine with a rattling deck solenoid check for dry-joints on bridge rectifier 6005 in the power supply. **P.B.**

Grundig VS200/220

If the machine is completely dead check whether D410 (ZD16) is short-circuit. While you have the panel out look at the centre pin of C407. When this electrolytic capacitor begins to swell it pushes the positive pin through the board, cracking the solder. **P.B.**

Osaki VCR31

There were no E-E signals with this machine as the 12V supply to the tuner/i.f. section was absent. The cause of the trouble was failure of the 2SA966A transistor Q410 which is on the bottom PCB. As we didn't have this type of transistor in stock we fitted a TIP32. This restored normal operation. **E.R.**

Ferguson 3V23/JVC HR7700

Destruction of F3 (1·6AT) at switch on proved to be the result of a faulty d.c.-d.c. converter on the display control PCB. **E.R.**

Alba VCR4000X

As reported by others in these pages, the Nikkai chassis used in this and similar models can cause confusion when the reset fails to work. In this one the machine appeared to be in the timer record mode, with the operate and record LEDs on and no display. When a cassette was inserted the machine set itself to record. To stop it the plug had to be pulled out. When this was refitted the cassette was ejected. All very confusing! **R.B.**

Panasonic NV-L25B

This unit was inoperative with just the timer flashing zeros. There was no power up. When offered a tape the machine loaded it and kept it. The dealer who had brought this one in had changed the systems and servo control chip IC2001 and the operation and timer chip IC7501.

I started by carefully checking all the supply lines. Everything here was fine. Something was inhibiting IC2001 and IC7501 however, but what? I decided to scope the serial clock and data lines between these two chips – this can sometimes show up problems. To my surprise there was 5V on both lines. I disconnected the serial clock and data feeds to the front panel. The 5V remained on the main PCB. Where else do the clock and data lines go? Well on this model there's an additional subsystems circuit for control of the audio dub and insert edit operations. It's undertaken by the MN15522VMS chip IC6801. A quick check showed that it was short-circuit between the 5V line and the data and clock lines. When these lines were disconnected the machine powered up and returned my test tape. Replacing IC6801 restored normal operation. **B.S.**

Ferguson FV41R

This new machine was pretty inactive. The clock display showed " 3: 7" but otherwise it wouldn't do anything. Checks on the power supply showed that everything was all right here. Next step was over to the system microcomputer chip on the front panel. The supplies were o.k., as were the reset line and the main oscillator. SCL wasn't being generated however. As there was no excessive loading on this line it seemed that the micro chip was at fault, which proved to be the case. The circuit for these machines isn't very good – there are few voltages, the connection notation is confusing and a high or low chip reset both have the simple label "reset". **N.B.**

Panasonic NV7200

There was a very loud knock from the mechanism when lacing or entering the cue mode – but not review. It suggested noisy loading motor bearings, but in fact the cause was a very worn capstan bearing. **N.B.**

Philips VR6180/6185/6285, Pye DV186

No fluorescent display was the complaint. I found that there was no −28V supply to the operation panel though it was present at the power supply output plug. The supply goes via the P90 panel, where it's fused by ICP1001 (80mA). This fuse was open-circuit, but no cause for its failure could be found. **N.B.**

Luxor 9272

The problem with this machine was tape path distortion: as the tape went around the entry guide it buckled cyclically. The frequency of the effect was the same as the rotational frequency of the guide pole sleeve, which provided a clue. When the pole was removed we saw that the sleeve had a very slight dig in it. This dig seemed quite disproportionate to the effect it created, but was the cause of the trouble. **N.B.**

Ferguson 3V53/5/7, JVC HRD755

The red LED was lit but there were no functions and no clock display. Integrated circuit protector CP3 in the power supply had failed, causing loss of the unswitched 12V supply. Failure of one or other of the four ICPs in the power supply circuit for no apparent reason is not uncommon. The engineer can be responsible however when the screening can is removed from the mechanism with the unit powered – switch off first. **N.B.**

Ferguson FV31R

The card said that this machine was dead. When checked on the bench the power supply was pumping and whistled at me. With the covers removed I switched back on at the mains to find that the machine started up all right. Now for a bit of highly technical fault-finding: I tapped the tuner/i.f./signals PCB that sits across the top of the machine. Doing this would stop and start the machine. In my experience this is very often the area in which the fault lies, however strange the symptoms. After looking at thousands of perfectly good joints I found an intermittent short in the tuner/r.f. amplifier. **N.B.**

Telefunken 1930i/Ferguson 3V35

No playback colour was quickly traced to the usual XB401 oscillator block. One was ordered and fitted, whereupon the machine refused to turn on! A gremlin in the waiting room had struck at the SW9V rail on the video board, shorting it out. As we expected, the cause was a short-circuit in the 4·7μF decoupling capacitor C419, which is of the dreaded blue tant variety. In the Ferguson version it's a 100μF, 10V type. **C.A.**

Saisho VR1200/Matsui VX820

"Recording problems" said the ticket. "Worn head" said the pictures on the monitor. So a replacement was ordered and fitted. This seemed to put matters right, and the machine was duly collected and paid for. Next day it was back again. "It's just the same" protested the owner, "it records for oniy five minutes, then nothing." As I'd given the machine a full three hour record/playback test this seemed unlikely, but I checked it again. After five minutes the f.m. luminance record signal disappeared in a snow storm.

I found that the signal could be restored or killed by flexing the luminance subpanel on the YC board. As the print side of the panel is inaccessible when in situ I solderwicked all 29 pins, removed the sub-panel then wired it temporarily to the print side of the YC board for detailed inspection. There are printed pads along the edges of several subassemblies on the luminance panel. These assemblies are inserted into the panel at right angles, then soldered. It's rather like a microscopic version of the old ITT CVC5 i.f. module. The assemblies suffer from the same problem too – hairline cracks across the thinly soldered junctions. When I'd resoldered actual and suspect cracks, using a fine tip, I found that the panel could be flexed without any faults arising. So it was refitted in the normal manner. This wire-looping technique may sound lengthy and laborious, but it's a useful aid to diagnosis with an inaccessible board. This particular job took less than an hour to complete. **C.A.**

Ferguson FV31R

It seemed that this machine had damaged heads, but a new drum produced no improvement. A look at the circuit showed that the outputs from the heads enter the TA7772P preamplifier chip IQ80 at pins 2 and 6, the output appearing at pin 10 where there should be an 0·3V peak-to-peak f.m. waveform. In fact the output from only one head was present, a straight line being displayed where the other head's output should have appeared. So we had a head switching problem or a lower drum fault.

The head drum flip-flop signal from the servo panel is connected to the signals panel at pin 8 of connector BW04. There's a test point, BW11, and the amplitude should be 3·6V peak-to-peak. The waveform was missing however. So it was back to the servo panel, where the drum FF squarewave is generated by the microcomputer chip IT01. The output, at pin 14, depends on pin 8 receiving a pulse from the drum optocoupler via IM01. As there was a signal at pin 8 but not at pin 14 we replaced IT01. To our relief this cured the trouble. Unfortunately the manual provides no details of the voltages or waveforms around this chip. Note also that two types have been fitted in these machines. If, as in this one, there are two small subpanels mounted vertically on the servo/power supply panel, use type ZC93168P. The other type is EF6801U4DTD243.

Conclusion: if a badly damaged head is suspected, check the drum FF signal. **J.E.**

Hinari VLX5

The E-E and playback pictures were unstable with very poor contrast. There was hardly any vertical or horizontal lock and no colour. A scope check at the video input pin on the r.f. in/out converter module showed that whilst the luminance signal was normal there were no field or line sync pulses. Tracing back from this point – we'd no manual – we came to a 47μF, 16V electrolytic capacitor (C354) which is connected to the collector of a transistor. At this transistor's base the video signal was correct. It was also correct at the collector once C354 had been disconnected. The capacitor checked out all right with our scope tester but we decided to fit a replacement. This restored normal operation. **J.E.**

Akai VS1

This machine would lace up but not run. The head drum rotated but the capstan motor didn't start. It's driven by the BA6209 chip IC7 which contains a logic circuit, preamplifier and the motor drive stage. Checks on the driver stage, after finding that the logic inputs were o.k., showed that the servo input was high at 24V instead of 1·4V. This input comes via an operational amplifier in IC11 which seemed to be o.k. when checked. We concluded that there was a short-circuit in IC7 and a replacement provided the cure. **M.D.**

Logik VR950/Samsung VI611

The complaint was of tape chewing. I thought I had an easy idler job, but when I ran the machine up it laced all right and started to play. Then the tape looped around the pinch wheel and stopped. In wind and rewind the tape moved, but very slowly. Further investigation showed that the operation of the reel motor was sluggish. Checks around the BA6209 driver chip IC0212 revealed that the supply at pin 8 was low at 9·2V instead of 12V. Also the chip was running warm. The 13V supply was correct and regulator Q0221 was o.k., but there was nearly 3V across R0282. The circuit gives the value of this resistor as 3·3Ω, but it read 12·6Ω when checked. A replacement of the correct value cured the problem. Incidentally this machine is of Samsung manufacture. **M.D.**

What a Life!

Donald Bullock

Comes on then dies said the report with Mrs Laird's Fidelity CTV140 colour portable. And so it did. At switch on there was sound, accompanied by the rustle of e.h.t., then the set expired. I figured that either the h.t. was decaying or a short was dragging it down. So I reached for my new Cirkit TM175 meter – and found that I'd left it switched on over the weekend. A little word looked up at me from the display: "Bat".

Expensive things these PP9s, as I've come to learn in the short time I've had the meter. I've had to buy several of them. They used to be ten pence – ten old pennies, four pence in today's joke money. Now they are a couple of quid. I'd had enough, so I set to work and knocked up a little 9V power pack. The meter is now mains driven.

I soon found that the trouble with the Fidelity CTV was that the h.t. faded away, which is not unusual in these little sets. So I disconnected the set from the mains supply, dived in and checked the bits and pieces that I suspected in the power supply. An hour later I was no further forward. It was then that Greeneyes breezed in.

"I bought an Elvis Presley CD record at the village hall sale" she announced. "Can't wait to hear it, but every time I put it in the Sony player and press the drawer in it comes back out. It's been doing this for quite a while."

"Perhaps the machine's got it's pride!" I said."It's been used to proper singers like Bing and Ella."

"What's wrong with the player though" she persisted.

"Can't imagine" I said, "at first it did it only occasionally but now it refuses to accept a disc at all – not even if I hold the drawer shut."

"Shall I take it to Snoddies then?"

I made a mental note to swot up on the machine as I switched the Fidelity set on again. It surged into power then died. Greeneyes gave it a look. "That set needs a new switch" she said before leaving.

I left it plugged in and checked a few voltages in the power supply. Only there weren't any. Then I moved over to the switch. There was a.c. at the input, nothing at the output. Why hadn't I tried the switch first? Prejudice of course.

McTurdey's TX100

Just as I'd finished it a builder's labourer bowled into the drive with a set in a wheelbarrow.

"Me name's McTurdey and it's driving me mad" he said. "In the first place there's a big bite outa each side of the picture, and even the bit I got left keeps cutin' out for an hour. Then it's o.k. for the evenin', only I'm not, it gets me all wound up."

The set was a Ferguson one fitted with the TX100 chassis, 110° version. As I put it on the bench McTurdey scooped up his wheelbarrow and waltzed off in a cloud of dust.

Sure enough there was no EW correction then, after a few minutes, the set reverted to standby with the channel indicator displaying only a dash. When the back was taken off the set started to work again and stayed on. So I refitted the back and got a repeat performance. After several minutes of this I took the chassis out and scanned the power supply and line output sections, hoping to see a dry-joint or two. As every joint looked perfect I plugged the set in again, connected the meter across the mains bridge rectifier's reservoir capacitor and discovered that the cause of the trouble was in the power supply. I then tried to locate it by using freezer and the workshop hairdryer. As this didn't do me any good I started to trace through the voltages, starting with the a.c. input. Now and again the set sprang to life, giving me moments to reflect upon the possibility of a different job ... Then suddenly it died again. I'd got as far as R134, a 1·2kΩ, 5W resistor that's part of the snubber circuit. There was lots of voltage at one end but nothing at the other. Waggling it not only produced the intermittent fault but allowed me to lift it clean out of the panel, leaving the joints underneath looking good and solid.

Cleaning off the resistor and resoldering it cleared the intermittent power failure fault. I then looked into the lack of EW correction and discovered that the little correction panel by the line output transformer was bathed in a pool of tacky brown liquid. A clean up put that right.

The Philips Saga

The next set, a Philips 21CE1250/05B (CP90 chassis), would provide only a snowy raster. It's owner, Mr Dropins, explained that it had been all right before his fortnight's holiday. This news filled me with pleasure. I smiled in anticipation of a fast buck and told him it would be ready in a couple of hours' time.

I found the orange battery or, since it's a condenser, I'd better call it a capacitor! It was at the front of the set. I then embarked on the problem of extracting the chassis board from its inscrutable plastic grip-runners. I couldn't find the bits to lift or depress, push or pull or squeeze and, try as I might, it wouldn't budge. As time went by my brain kept telling me to remain scientific and rational but my instinct was to yank it out by force. Eventually the panel was freed. I changed the battery and switched on. This time the set was dead. What had I done? Why hadn't I been gentler, and how was I going to get out of the mess I'd got myself into in the time I'd allowed?

I reached for my giant magnifier and scanned the panel at length for wicked breaks or disturbed joints, but found none. There was plenty of h.t., so I checked the line output transistor and several other items in this area. No good. Perhaps Philips Service could help?

I phoned through and a wonderfully relaxed and detached expert advised me to change diode D6665 (1N4148) and resistor R3665 (4·7Ω) then, if still no luck, to replace the CNX63 optocoupler. I had no CNX63 but the other items tested o.k. with both my meter and component tester. As the set remained as dead a doornail I wrote out an order for an optocoupler and wondered how I was going to tell the customer that the live set he'd brought in was now dead.

Handsets Galore

Then Mr. Dropins showed up, reached into his pocket and pulled out a remote control unit which he thrust into my hand. "Forgot to leave this with the set" he said, "see you later." He smiled and left.

I stood at the bench reflecting on how slowly the sets come off it these days compared to twenty-five years ago. Then I noticed the Magic Mirror IR detection card that had recently arrived. I stood it against the mirror at the back of the bench, picked up the remote control unit and fired it at the Magic Mirror. The set burst into life and frightened me no end. Recovering, I hurriedly plugged in the aerial and, since the set had no proper channel selector knobs, danced my fingers around the dreaded search-tune buttons. Up came a perfect picture with sound. My relief was enormous. Then I noticed that something else was wrong. There was no colour – on any channel.

The set had no colour control, nor much else, and no matter how I pummelled the remote control unit I couldn't get a trace of colour. So it was into the chroma circuitry. Checks here did no good. Time passed, and I was feeling weary. Then Mr. Dropins turned up again.

"I don't know what's the matter with me" he said. "I meant to leave this instruction booklet with you – oh, and you might as well have the right remote control unit. The one I brought in was for my father's old set. We use it because it's smaller and handier.

After he'd gone I read through the instruction book, hoping to find something under the heading "how to restore colour after giving the chassis a mauling"... No hints of course, so I returned to the house for tea and sympathy. Anyway, there was tea.

Back in the workshop I picked up the set's proper remote control unit, pointed it at the black-and-white picture and pressed colour control. Up came the colour.

Mr. Dropins was soon back on the scene. I tuned his set in, fitted the back, accepted his cheque and waved him and his set towards his car.

"I'm glad it didn't give you any trouble Mr. Bullock" he said. Then he was gone. I returned to my stool drained. How can all these things happen to just one person? And why does it have to be me?

Choosing a Digital Multimeter

Part 1

David Botto

Whether we like it or not, the old analogue multimeter is gradually disappearing from the workshop. This is simply because recent advances have made the digital multimeter today's most effective measuring instrument for TV/video work. In fact it used to take a whole stack of instruments and a lot of bench space to provide the range of tests that can be carried out with a modern DMM. The latest models use microcontroller technology to provide more features and functions than ever before. In addition to the traditional voltage, current and resistance ranges, many of today's DMMs can measure capacitance, frequency, duty cycles, min/max voltages, temperature and digital logic levels, make good/bad checks on diodes and transistors and measure transistor gain. With such a meter you've a portable test bench in your hand. This is especially helpful for the field service engineer.

Before buying a DMM it makes sense to study carefully what's available then decide on which instrument is best suited to your needs. A massive range of DMMs is on offer today, ranging from economy waistcoat pocket models to large bench instruments. The aim of this article is to help you cut your way through the DMM jungle in order to choose an instrument that best fits your particular requirements. Most readers will be familiar with DMM terminology, but Table 1 is included as a handy reference. We'll also be taking a brief look at the basic working principle of a simple DMM.

Why Digital?

Until quite recently there were certain things that an analogue meter could do but a digital meter couldn't. For example, many older DMMs couldn't check diode and semiconductor junctions.

The heart of an analogue multimeter is its delicate moving-coil meter movement. This is easily damaged by an overload. Connect one on one of its resistance ranges to the mains supply or to the 350V h.t. line in a TV set and you'll be rewarded with a cloud of smoke and a wrecked instrument. This is especially so with cheaper meters that don't have a cutout or fuse protection. The moving needle of an analogue meter did have one definite advantage however. This was when making null or peak adjustments with a TV set or VCR. With early DMMs, especially those that used a neon tube display, it was impossible to make such adjustments – if you tried, you were rewarded with a display resembling that of a fruit machine. Many DMMs now have electronic analogue pointers, known as bar graphs, to overcome this problem. A DMM of this type has the advantages of DMM accuracy and analogue convenience.

Since the circuitry in a DMM is more complex than that in an analogue multimeter there is in theory more to go wrong. In practice however a good-quality DMM is extremely reliable, failure being rare. One reason for this is the fact that the internal circuitry operates at low voltage levels.

An analogue voltmeter's input resistance is stated in ohms per volt – this is the meter's resistance multiplied by the full-scale voltage measurement. Thus a 20kΩ/V analogue meter set to its 1kV d.c. range presents a circuit load of 20MΩ (1,000 × 20,000). When the meter is switched to its 5V range however the circuit is loaded by only 100kΩ (5 × 20,000). This is much too heavy a load for much modern CTV and video work. In contrast a DMM normally has a minimum input impedance of 10MΩ on all its voltage ranges. Some special-purpose DMMs have an input impedance of 25MΩ.

If an analogue meter is accidentally dropped, or falls over the edge of the bench, its moving-coil meter may well be permanently put out of business. At best it will cost a lot of money to repair. In contrast a quality DMM is not only tough enough mechanically to stand up to rough treatment, it's also not easily damaged by overloads. It's not good policy to abuse your DMM however – good instruments deserve good treatment.

Perhaps the most popular analogue multimeter of all time was the finely engineered Avometer Model 8, which is protected by a safety cutout. Its price today is around £240 plus VAT. Not so long ago nearly every radio/TV workshop possessed one or more of these meters. Their accuracy on the d.c. ranges is ±1 per cent at full-scale deflection, which is pretty good for an analogue meter. The a.c. tolerance is 2 per cent of f.s.d., with the resistance ranges ±5 per cent at centre scale. To obtain this level of accuracy you have to peer carefully at the meter needle, making use of the mirror scale. Good as this accuracy is, a top-quality DMM has an accuracy of ±0·05 per cent or

Table 1: DMM terminology.

Accuracy: Measured as a percentage error (± per cent)

Annunciators: Display symbols that indicate range or function.

Autoranging: Automatic selection of the correct range to match the input being measured.

Bar graph: LCD analogue scale pointer.

Continuity test: Uses a piezo-electric beeper that sounds with resistance values below 100Ω.

Crest factor: The ratio of peak to r.m.s. a.c. waveform value.

Data hold: Function that freezes the measured value on the display.

Digits: DMM display numbers.

Display count: Maximum count readable on a DMM.

Frequency response: Band of a.c. frequencies the DMM will measure.

Functions: The kinds of measurement that can be made.

High ohms: A resistance range where the test voltage is high enough to forward bias diodes and transistor junctions.

Low ohms: A resistance range where the test voltage is too low for diodes and semiconductor junctions to become conductive.

Input impedance: A DMM's combined a.c. and d.c. input resistance.

LCD: Liquid-crystal display.

Min-max: Function that stores the highest and lowest readings.

Peak hold: Function that holds the highest value reached when changing voltages or currents are being measured.

Range hold: Locks an autoranging DMM to one range.

Resolution: The smallest change a DMM can measure.

Sensitivity: The lowest value a DMM will indicate.

Touch hold: Similar to data hold.

better over its entire d.c. ranges. Those intended for servicing work are usually accurate to ±0·5 per cent or better.

How a DMM Works

The basic elements of a DMM are shown in Fig. 1. It consists of an analogue-to-digital converter (ADC) followed by a decoder and display. AD conversion is carried out by an integrator followed by a counter. The input, on whichever range, must first be converted to a form suitable for integration, i.e. a chopped d.c. waveform that's proportional to the input being measured. Integration produces a ramp which is fed to a counter along with a clock pulse input. The number of clock pulses that occur during the ramp represents the AD converted signal, since ramp duration is proportional to signal input. The AD converted measurement is of no use on its own of course: it has to be decoded so that an appropriate voltage/current/resistance reading is displayed.

Older DMMs such as the Heathkit 2·5-digit Model IM1202 (an excellent instrument whose neon digits could be read at the other end of the workshop!) used a single-slope integration technique – see the waveform in Fig. 2. Today virtually all DMMs use dual-slope integration, in which the waveform is of the shape shown in Fig. 3.

A Basic DMM

A more detailed account of DMM operation will be given in a separate article at a later date. Meanwhile Fig. 4 provides an outline of a basic DMM that measures a.c. and d.c. voltage and current and resistance. Integration is carried out by the operational amplifier IC1, which produces a dual-slope output. This is fed to a quartz-crystal controlled counter/decoder where the duration of the ramp is checked. A 3·5-digit LC display provides the readout. When the user selects different ranges the decimal point in the display is automatically moved to its correct place.

The lowest voltage range with this design is 199·9mV (200mV range). Calibration control VR1 adjusts the reference voltage and is set so that the reading is 199·9mV when the input is the same.

SW1A/B/C is a ganged range selection switch: SW2A/B/C/D is a ganged function selection switch. When SW2 is set to read d.c. voltages, SW1A selects the appropriate range – 200mV, 20V, 200V, and 1kV. It also selects the a.c. voltage ranges, which are the same. In the a.c. positions an a.c.-d.c. converter is switched into circuit.

In the current measuring positions current is converted to voltage by passing the current through a series of precision resistors arranged in decade steps. When the resistance ranges are selected resistance is converted to d.c. voltage by using a constant-current source. For example in the 200Ω range the constant-current generator feeds a constant 1mA through the 1kΩ resistor and Rx. The resistance ranges of a DMM are much nicer to use than the ohms scales of an analogue meter. Unlike the majority of analogue meters, the resistance scales are

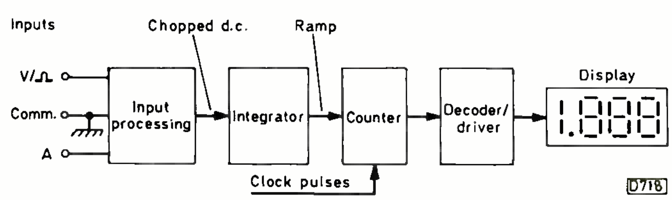
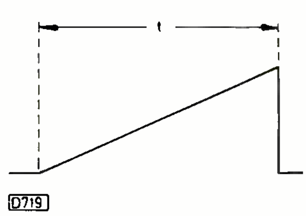


Fig. 1: Block diagram showing the elements of a digital multimeter.



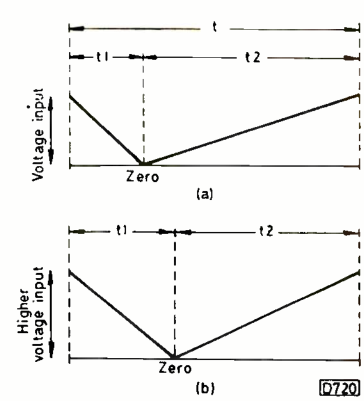


Fig. 2 (left): Single-slope integration waveform. Duration and slope of the ramp vary with the input voltage.

Fig. 3 (right): Waveforms with dual-slope integration; (a) and (b) show how different input voltages affect the slope timing.

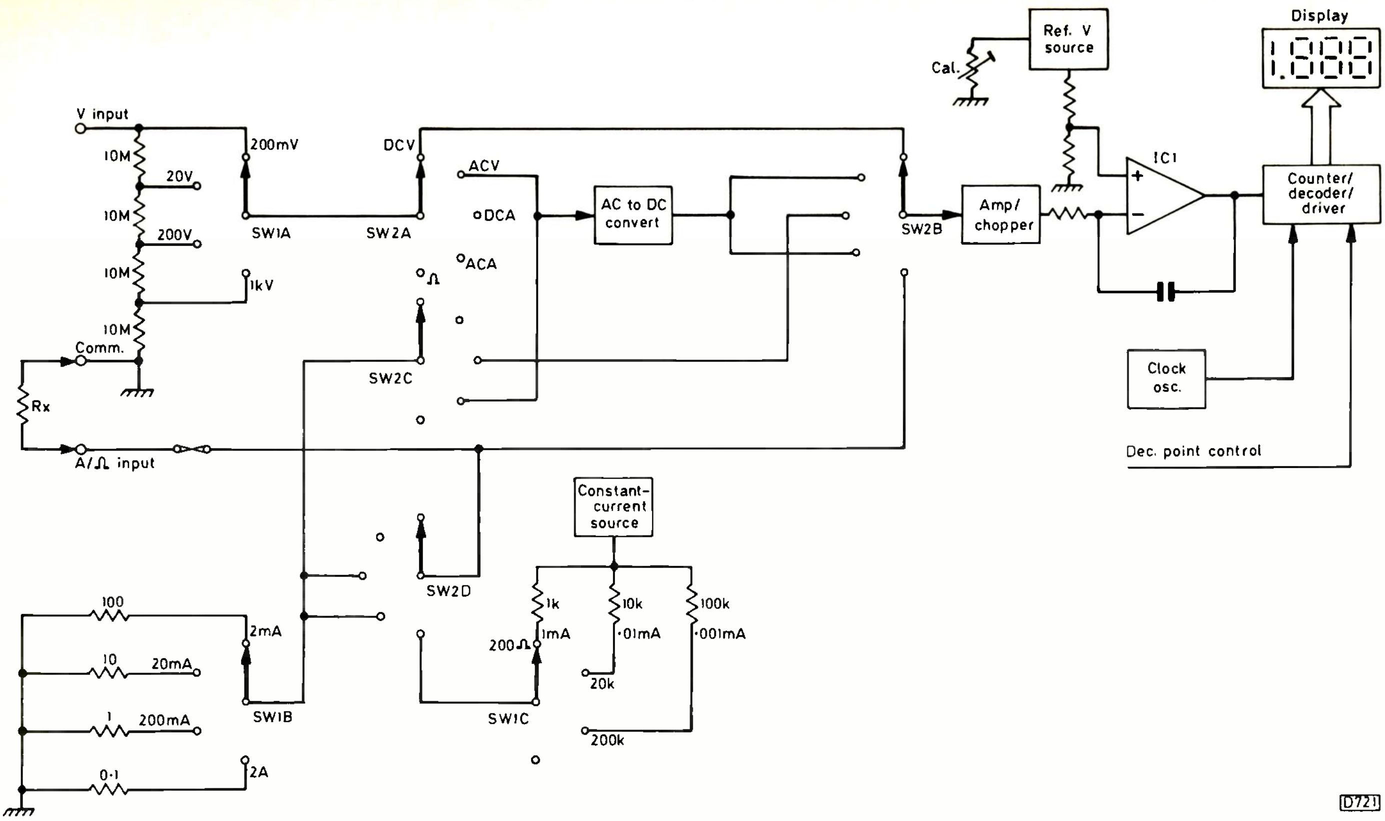


Fig. 4: Showing in simplified form the operation of a basic DMM.

linear. Thus 0·1Ω is just as easy to read accurately as 199·1Ω.

Points to Note

Many DMMs now have capacitance ranges. They use an internal constant-current source, as with the resistance ranges, but the integrating arrangement may not be employed as the counter can simply measure the time taken for the capacitor under test to charge to a given voltage level.

The counter/decoder system is sometimes used, together with input gates, to measure signal frequency.

While many DMMs continue to use manual range switching an increasing number of today's models use microcontroller technology to provide autoranging: the user selects the function then the microcontroller senses the input, decides on the correct range and switches in the appropriate circuitry.

Be warned however. DMMs are not all the same. Don't be tempted to buy the cheapest model. Especially for workshop use it pays to invest in a good-quality instrument. After all, you'll be using it for a good many years.

Types of DMM

Most of today's DMMs come in one of four forms – pocket type, probe type, hand-held or bench models. A brief note on each.

The pocket type is of much the same size and weight as a pocket calculator. Such meters generally have provision for making only a limited range of resistance and a.c. or d.c. voltage measurements. Accuracy on the lowest d.c. voltage range is typically about ±2 per cent. These meters are handy when installing equipment but are of little use for servicing work.

Probe-type instruments have everything, including function/range selection and the readout, in a single probe. Ranges and accuracy are similar to the pocket type.

The hand-held type is the most useful for TV/video/computer servicing work. A good-quality instrument will provide a wide range of measurements with a high degree of accuracy. These meters take up very little bench space, which is a big advantage, and are also handy for the outside engineer.

Bench models may be mains or battery operated or both. They are useful where a high degree of accuracy and stability are required – greater than are needed for most TV/video servicing work – but generally don't provide the wide range of functions available with hand-held models.

Switch Quality

Pay careful attention to switch construction when choosing a DMM. Many high-performance DMMs use good-quality push-button switches. It's often claimed that these are more reliable and have lower contact resistance than the rotary switches used in many less expensive models. A rotary switch is perfectly o.k. however provided it's of robust construction. With some cheaper models an economy is made by combining the switch with the meter's PCB, using printed tracks as part of the switch. This arrangement can give rise to trouble in time, especially should high contact resistance develop. You can usually tell a good-quality rotary switch by its nice, positive click feeling.

It's also vital that the DMM has a good-quality case that will stand up to workshop use. Many hand-held meters now have tough ABS plastic cases and protective holsters.

Next Month

In Part 2 next month we'll consider some other aspects of DMM technology and present a table to help in the selection of a suitable model.

The Ferguson Singapore Briefing

Graham Exeter

In late July Ferguson took a party of UK journalists to Singapore to hear about its new video strategy and to to see the Thomson video operations in the country – Thomson recently established a joint venture with Toshiba, called International Video Products. Thomson bought Ferguson from Thorn EMI in 1987 and owns a number of other brands including RCA, GE, Telefunken, Saba and NordMende. It claims to be number two internationally in the video field, after Matsushita (Panasonic).

A brief overview of the world video market in 1990 revealed that some 40 million VCRs and eight million camcorders were sold that year. Japanese companies manufactured 63 per cent of the VCRs and 98 per cent of the camcorders (the other two per cent were produced by Korean companies). It's felt that Europe can close the gap, though the Japanese have a strong grip on the supply and manufacture of i.c.s for video products. A series of major research and development projects have been started in Europe devoted to chip design and production.

UK Strategy

An initial seminar on Ferguson's UK strategy was given by Jay Chinnadorai, director of marketing, and Andrew Duncan, video and camcorder marketing manager. It began with a discussion on the BBC's decision to call Nicam "BBC Stereo", a move that has angered and dismayed manufacturers and retailers alike, since it's likely to add to consumer confusion. It seems that the BBC might now be having second thoughts about this. Incidentally Nicam services have recently started in Singapore, Spain, Hong Kong and the Scandinavian countries.

Except in Japan S-VHS is selling slowly. Ferguson plans to launch wide-screen (16:9) S-VHS software, which will make the wide-screen TV sets more attractive. The company has decided to delay the UK launch of its wide-screen TV sets until early 1992 however.

The company also plans to launch a laser disc player, as a joint venture with Pioneer. Unlike Pioneer's 1450 player it won't have NTSC playback capability. This is because of complaints by film companies about possible piracy. It's a shame as there are hundreds of NTSC titles but very few PAL laser discs. The general feeling amongst those who attended the seminar was that a PAL-only laser disc player stood little chance of being a success in the UK.

According to Ferguson, UK VCR penetration is now around 73 per cent. Sales for the current year are forecast at 2·15 million, giving the market a retail value of around £689 million. About 71 per cent of the VCRs sold in the UK cost less than £350, and 87 per cent are remote-control programmable. Ferguson has decided to concentrate on making its VCRs easy to use and programme. The company is not at present interested in picture enhancement systems like Akai's I-HQ and Nokia's ASO.

Timer Problems

A survey carried out for Ferguson found that 28 per cent of all adults admitted to having problems in setting the VCR timer: 35 per cent of women had problems and 50 per cent of adults over 45. Ferguson made the point that the 45-59 age group in the UK will rise from 6·5 million to 7·5 million by the year 2000. By that year 44 per cent of VCR buyers will be over 45, compared with 36 per cent in 1989. Hence the increasing need for user-friendly VCRs.

Two new Ferguson models, the FV51R and FV52L, feature Instant Help Programming (IHP) which gives on-screen help with timer programming. Both models come with two remote control handsets, a full-function unit and a basic one. The latter controls the VCR's major functions and has just nine large buttons. Sony has an ingenious reversible handset, with all the controls on one side and just the basic ones on the other. Ferguson claims that people still have problems with this complex-looking handset. The basic Ferguson unit can of course be used as a back-up handset, and the company plans to offer it separately for use with other models. The two new VCRs feature a one year/eight event timer, a 40-channel tuner and on-screen tape remaining indication. Model FV52L also features VISS, long play and trick features.

Around 80 per cent of large-screen sets at present on the market in the UK feature teletext, household penetration for teletext now standing at 34 per cent. Ferguson sees teletext becoming a major VCR feature for two reasons. First, there are around 7·5 million people with poor hearing in the UK. Many would like to be able to record subtitled programmes, preferrably in colour. Around ten per cent of UK TV programmes are at present subtitled, and there's pressure for an increase – in the USA legislation may force all programmes to be made with subtitles. The second reason is that teletext can be used for timer programming. As mentioned in Teletopics last month, Channel 4 is to launch Programme Delivery Control (PDC) later this year.

Teletext Timing – PDC

Teletext timing isn't new. A system called VPS (video programming system) has been in use in Germany for some years. It works by assigning to each programme a unique identification that's transmitted as a data signal on a spare teletext line. This enables a teletext-equipped VCR to identify programmes and their start and end times. Thus a recording can be started when the relevant identification is received and the user doesn't lose the end of a programme that starts late. PDC works on the same principle, but instead of using a whole teletext line for identification a hidden packet (26) is included in the advance listing pages. This reduces access time and doesn't waste teletext space.

In use the VCR's timer system stores the PDC codes of wanted programmes. PDC data is transmitted continuously and is constantly scanned by the VCR, which looks for matching codes. The start code occurs thirty seconds before the beginning of a programme. Likewise an end code occurs thirty seconds before the programme ends.

Ferguson has issued a guide that provides answers to some possible problems, such as what happens should a PDC-marked programme end after the start of the next timer event? The answer to this one is that the PDC programme would override the next event, even if this was also PDC marked. If there's a break in transmission whilst a PDC programme is being recorded the timer will continue. Should PDC signals fail to appear for some reason the VCR will automatically revert to the programmed start and stop times. PDC is robust, using a powerful Hamming Code error correction system. Ferguson pointed out that if the PDC data was so badly corrupted that it couldn't be read the picture quality would be extremely poor as well. Incidentally PDC has no effect on subtitling.

PDC has it weaknesses however. Users have to call up the teletext service, then dial the TV listing pages. Couldn't a user go to these directly? Apparently Ferguson is looking into this. Another question was whether the system could be combined with the VCR Plus system (see elsewhere in this issue)? This appears to be unlikely. Another problem is that teletext programming can be used only with TV programmes to be broadcast several days ahead, though timers are usually set several hours ahead. At present the PDC system can't follow programmes that move to another channel, for example when a sports programme is transferred from BBC-1 to BBC-2: later versions will have this capability however. In theory PDC could be used to record programmes of a particular type, e.g. sport or soap operas. It could even be used to eliminate the advertisements from a recording, though it's doubtful whether the public would ever be offered this feature.

Development of PDC

The basic PDC system was set out by BREMA and the UK broadcasters last February. Channel 4 began test transmissions in April. In the same month the European Broadcasting Union (EBU) finalised the PDC standard, which is known as 8/30 Format 2. Ferguson will be launching its first PDC VCR, Model FV54LX, this autumn. Features will include colour subtitle recording, VISS, long play and a one year/eight event timer. It will sell for about £400. The company points out that the original VPS concept was first patented by Telefunken in 1976. Thomson, which subsequently took over Telefunken, retains this patent in Germany and other countries.

BREMA has decided that PDC should be marketed under the name Startex, which it feels will be more meaningful to the public. According to Ferguson PDC will add around £50 to the price of a VCR. The company adds that although PDC has been standardised the operating software hasn't, so that various makes of PDC VCRs may operate differently.

The IVP Venture

The International Video Products venture is 51 per cent owned by Thomson, 49 per cent by Toshiba. It's Thomson's largest VCR operation and is involved in manufacturing, engineering and R and D work. The plant is massive, covering some 33,000 square metres, with the mechanical deck operation adding a further 6,000 square metres. By the end of the year the workforce is expected to have risen to 3,000. The plant seemed to be more labour-intensive than some Japanese factories I've visited, but there's little doubt that Japanese production standards can be met. Thomson expects IVP to account for 45 per cent of its VCR production by 1992. This year's VCR production figure is targetted at around 1·4 million. The plant produces VCRs, video players and video kits for the European, Far Eastern, US and Canadian markets.

next month in

TELEVISION

FREE CATALOGUE

Greenweld Electronics' new 1992 catalogue, worth £2, comes free with the November issue of *Television*. Includes components, test equipment, accessories, security items, audio and disco equipment, kits, power supplies, etc.

- **CHOPPER POWER SUPPLIES**

J. LeJeune looks at TV receiver switch-mode power supplies, in particular the type based on the TDA4600 series control chip. Circuit and regulation action are explained and advice given on fault finding.

- **SATELLITE SOUND IF ADAPTOR**

S. Pearson found that the sound panel used in the GEC C2110 series chassis can be put into service to obtain satellite TV sound where this has a different sound-vision spacing from the standard for which the main receiver is designed.

- **EW SCAN CORRECTION**

Design of the deflection yoke in a TV set has traditionally involved compromise between spot quality and raster geometry. Since the geometry can be corrected by external means, spot quality has been the main aim in yoke design. For many years large-screen, 110° sets have used a modulator circuit to provide EW correction, modulating the line scanning at field frequency. The operation of this type of circuit has been rather an obscure matter in the past. Next month Joe Cieszynski gives a clear explanation of the operation of the commonly used circuits, lists common problems and outlines fault diagnosis techniques.

- **WHICH DMM?**

In Part 2 of his article David Botto explains DMM characteristics and their relevance to servicing and provides details of the models available from the major manufacturers.

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Letters

REPLACING MAINS PLUGS

I've been reading the letters in recent months on whether or not to fit new shielded-pin, three-point plugs to equipment when the old-type plug is still in good condition. While I'm not in the TV trade, my business being portable industrial heaters, your readers may be interested in my experience.

The heaters that come into my workshop for service or repair can be anything from six months to twenty-five or more years old. I find that the plugs on the heaters brought in during the winter season fall into the following three groups. Out of say every hundred about fifty will be of the new type, in various states. If they are good, they stay on. If not, a new one is fitted. Of the remaining fifty, forty will be older-type plugs, again in various states. These I change for the new type regardless of condition, and the owner is charged for the replacement. The way I see it is that if the owner goes back and electrocutes himself on the old-type, unshielded plug the first thing that will be said is "you serviced the heater, why didn't you fit the new-type plug?" It's a situation I don't want to find myself in.

What about the remaining ten plugs? Well, this is the horror department – cracked tops, naked wires, live and negative wired the wrong way round, earth wire disconnected or even cut off.

Needless to say, the plug is the first thing I check before I even think of plugging in.

O. W. Rogers,
Bodmin, Cornwall.

GEC/GRANADA EQUIVALENTS

A correction is required to the equivalents information in my letter last month. The GEC equivalents of the Granada C20AA4 and C22AA4 are Models C2089H and C2289H respectively (Hitachi NP83CQ text chassis). The GEC C2087H and C2287H were fitted with the Hitachi NP81 series chassis.

S. McManus, Technical Dept. (GEC Radio & TV),
Hotpoint Ltd., Celta Road, Peterborough PE2 9JB.

With reference to the letter from S. McManus (GEC) last month, the GEC C1657/1658/2295 were sold by Granada as retail sets, quite simply that: they were not modified or customised, just manufacturer's models retailed by Granada. The codes listed are put on by Granada for its own purposes and are sometimes the only identification on the set. The C2295, although based on the Tatung 160/161 chassis, was still a GEC retailed set. The other models Mr. McManus lists are identifiable from the code charts provided.

Roy Baines,
Peterborough.

SATELLITE RECEIVER PROBLEM

Keith Cummins' letter (September) confirms my opinion on the Amstrad satellite TV receiver problem and raises the new point of capture effect. This is certainly an intersting thought. With the re-reflected signal delayed by forty feet of cable compared to the original forward signal, a delay of probably 60nsec is introduced. Because of the lag, the forward and re-reflected instantaneous f.m. spectra will not be identical, but for the spectra to be so different to appear to be two distinct signals (and therefore for the capture effect to apply) seems unlikely.

Mr. Glenton's letters refer to the quality of installations and indicate that the cable may not be a good fit, and therefore not a good match at the LNB. This adds weight to my theory. Perhaps Mr. Baker would like to check his cable at the LNB while the summer weather is with us? It seems that a good installation is essential before all the blame can be put on the receiver, even if it obviously isn't perfect. An important point to note at LNB output frequencies is that the wavelength in the cable is about one foot, which means that the distance between standing wave maxima and minima is about three inches. Discontinuities must be much less that one quarter wavelength in order not to cause impedance changes. Thus a cable flattened for half an inch of its length is possibly useless.

Another way of attempting to increase the Amstrad receiver's input impedance might be to place a small ferrite ring over the cable at the receiver end and slide it along the cable to obtain optimum results.

Ray Porter, M.Sc., C.Eng., M.I.E.E.,
Stourbridge, W. Midlands.

FILMNET RECEPTION

Most of your readers will probably be aware that Filmnet, the movie channel transmitted via the Astra satellite, has recently adopted digitised encoded sound. This is obviously a disadvantage to users of unauthorised Filmnet decoders. It's difficult to obtain any accurate information on Filmnet's sound encoding method. According to Astra technical information Filmnet is using Nicam sound. Would the use of a Nicam decoder such as the Maplin one, with the correct input filter for Filmnet's primary sound carrier, be successful? Perhaps one of your readers could supply information on this.

Brian Webb,
Havant, Hants.

TESTING IR HANDSETS

Until fairly recently I used to test IR handsets by hanging a scope across the handset's LEDs. There are physical difficulties in doing this however and I discovered that it's not reliable – one handset I tested in this way appeared to have pulses across the LED but still didn't work.

Having recently stripped down an old Rediffusion set I thought it would be a good idea to use the IR detector, which is neatly packaged in a tin box with a built-in preamplifier. So I set to work to add a few components – transistor, resistors and LED – to indicate the presence of IR pulses. Depending on the polarity of the pulse output from the preamplifier, one of the circuits shown in Fig. 1 should work. The additional components were built into the detector box and a 9V PP3 battery was strapped to the side. The results obtained are excellent. At normal handset to TV set distances the LED flashes at the repetition rate of the IR pulses. I now always carry this with me when I suspect a faulty remote control handset.

The other week I was called to check out an IR handset. Four of the channel buttons had stopped working. Guess which? Right, one to four, the most used ones. It was either a new handset (not easy to obtain with this particular make, and expensive too) or try to carry out a repair. The problem was with the carbon impregnated pads beneath the buttons. They seem to "dry up" and become non-conductive. What could be done? I couldn't put new pads

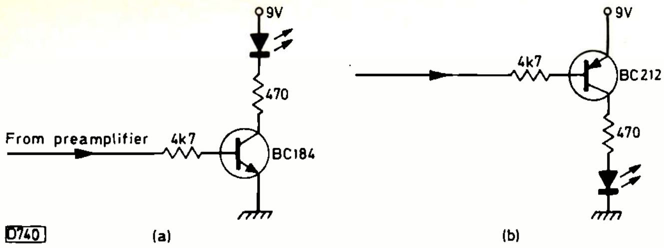


Fig. 1: LED driver circuits, (a) for positive-going pulses, (b) for negative-going pulses.

in as all the buttons are on the same mat.

A few minutes thought and to the kitchen I went to pinch a bit of the wife's cooking foil. Armed with a pair of scissors and a tube of super glue I stuck a button of foil to the underside of the faulty pads and, presto, repaired the unit. I'm not suggesting that all remote control faults are caused by dried-up pads, but armed with an IR tester, foil and super glue a great many handsets can be repaired!
Mel Davies,
Skelmersdale, Lancs.

As the manufacturer of the infra-red detector mirrors referred to in a letter in the August issue (page 712) we would like to comment on the suggestion that they are expensive. Electronic workshops today are full of expensive, high-tech test equipment – oscilloscopes, digital meters, frequency counters, the list is long. Our IR detector mirror on the other hand is a low-cost, reliable and extremely useful piece of equipment, costing only £9 including VAT with no post and packing charges. Component suppliers such as SEME Ltd., Willow Vale Electronics and Chas. Hyde and Son Ltd. stock the mirrors. One further point is that the mirrors last a long time and don't use batteries, making them environmentally friendly.
C. R. Dempster, Electronic Consultant Services,
6 Nethersole St., Polesworth, Warcs B78 1EE.

HELP WANTED

Can anyone supply a line output transformer and the four slider knobs used in the Grundig 1500GB/3010GB/717GB hybrid colour sets? New or used, name your price!
B. Lawler, 6 Chindit Close,
Formby, Lancs L37 2JH.
0704 832 625.

Can anyone supply a wire-type remote control or a front panel for the Tatung VRH8300TK VCR, also a front panel for the Ferguson 3V22?
Stephen Davies, Cwrt-y-Gorffwys, Golden Grove,
Carmarthen, Dyfed SA32 8NN.

I'm seeking a TV sound only tuner similar to the one that used to be marketed by Radio and TV Components Ltd. of Acton. Can anyone oblige?
A. L. Wragg,
29 Eastern Road, Sutton Coldfield, W. Midlands B73 5PA.
021 354 4265.

Would the two gentlemen from Antrim, N. Ireland who phoned in reply to my earlier letter (July) concerning a Condor Model VHS 8120 VCR please get in touch again – I didn't get your names etc. The manufacturer is Daewoo incidentally, in Co. Antrim. Many thanks for their help.

Can anyone supply a TDA1104 chip, or suggest a modification, for the Panasonic TC2205? Neither SEME nor Panasonic can help.
M.B. Wilson, 1 Playwell Court,
Glanton, Alnwick NE66 4BL.
0665 78 437.

Editorial note: There have been a number of calls for help wqith the TDA1104 chip used in the Panasonic U2 chassis. We understand that the NP1106, available from Panasonic or SEME, is a direct replacement. Our thanks to Nick Beer for this information.

Can anyone supply an M193CB1 chip for the Network Model NWC1402? Also I have a Universum FRC27915 TV/Radio/tape combo made by Quelle International. Trouble is that the sound is a.m. Does anyone have a circuit or manual or can suggest a way of converting the TV sound to f.m.?
C. E. Toms,
212 Teignmouth Road, Torquay, Devon TQ1 4RX.
0803 325 177.

Can anyone supply a line output transformer assembly for the Network Model 1402R, new or secondhand?
Sight and Sound, 1 Stonewall Cottage, Hill Top Farm,
Caythorpe Heath, Caythorpe, Lincs. NG32 3EU.
0400 73448.

Can anyone supply a Woodsdale Components plug-in module to replace the TDA2190, or information on it?
Fred Garland, Fernhill, St. Ives Road,
Carbis Bay, St. Ives, Cornwall TR26 2JT.
0736 795 620.

Can anyone suggest a source of a service sheet for the NordMende 1201M green-screen computer monitor? I assume that it's about 8-10 years old.
F. B. Greenhall,
24 Trelissick Road, Hayle, Cornwall TR27 4HY.

Can anyone supply a circuit diagram and c.r.t. base adaptor for the Video Circuits type V33 tube tester?
E.J. Edwards, 8 Anderson Court,
Plymyard Ave., Bromborough, Wirral,
Merseyside L62 6EF.
051 334 8733.

FOR DISPOSAL

I have for disposal a prototype dual-standard colour receiver chassis fitted with a round tube. It's free but would have to be collected.
H. H. Journeaux,
7 Blair Avenue, Poole, Dorset BH14 0DA.
0202 748 072.

IR RADIATION/COMMENTARY-FREE SOUND

Kevin Davies (Letters, August) asks how I discovered that a CCD camcorder sees IR radiation? The answer is simplicity itself: the Sony camcorder comes with a remote control unit that was pressed while it was in the camcorder's shot. I've recently been told that the ability of CCD camcorders to convert IR radiation to the visible spectrum is now being exploited in the security and photographic fields.

While on the subject of IR radiation, the universal, programmable remote control handsets currently being advertised are almost but not quite universal. One I tested copied all available remotes – including Peugeot and Renault car keys! – but failed with a Salora satellite TV receiver.

Back to commentary-free sound. My reason for raising the subject is that it's something about which most people, if they would care to admit it, have at some time or other had cause to complain then dismissed the thought on the grounds that it's just a part of life and can't be changed. But it can be! The technology is there, and while I accept Kevin Davies' findings on motor racing (they must apply to most speed/distance sports) I still feel that a selectable commentary/no commentary option is a very desirable feature that should be made available to viewers.

Gus Cusick,
Preston, Lancs.

Steve's Camcorner

Steve Beeching, T.Eng.

I'm becoming more reluctant to tackle intermittent faults on camcorders that are still under guarantee. Possibly it's because I'm being sent too many. Anyway, to the point.

Panasonic NV-M7

A Panasonic NV-M7 that came along recently wasn't actually under guarantee, but an estimate was requested. The fault symptom was a vertical blue area on the left-hand side of the picture, merging to red/orange on the right-hand side. This red/orange area covered about two-thirds of the picture. The fault was intermittent but was usually apparent. You can hear the dealer's subcontractor saying "sod that one – send it to Steve". Well thanks fellas!

It's not very easy to explain how I tracked down the cause, starting at the chroma output and working back thorugh the encoder and CCD delay lines to the luminance/chrominance signal processor IC304. I eventually found that the outputs from the B – Y and R – Y matrix had a large triangular waveform superimposed on them – this was the cause of the discolouration.

The main input at pin 41 of IC304 was o.k. So was the Y output at TP2. But pin 17 had this incorrect waveform. It didn't enter the chip with any d.c. supply or the white balance levels. I eventually discovered that its source was at pin 9. C323 which decouples this pin was cracked and was thus intermittently open-circuit.

JVC GRC7

Darren was struggling with a JVC GRC7 the other day. He came to the conclusion that the drum was running slow. I asked him why? His reply was to the effect that if you placed your finger on the drum then slowed it a bit more and let it go you got a momentary picture as the speed increased. The tracking control didn't work either.

When I checked the blank LC display I was able to tell him about changing C6 on the operation panel. That's the third time we've had the fault.

Mystery Cures

So many faults clear up for no apparent good reason while you're carrying out checks. One did on a Panasonic NV-MS1. The symptom was no capstan servo lock on playback.

There were no CTL pulses at IC2002. Nor did any noise come through when pin 11 of IC2001 was touched. C2025 had an effect when it was wiggled – the CTL pulses returned. I changed C2025 without much conviction and noted that if QR2005 unexpectedly turned on it would shut the CTL amplifier down. So D2013 was checked. But as the fault had now gone away there was not much else I could do.

A similar mystery cure occurred with a Panasonic NV-MC20. The owner complained that the dew light came on intermittently. Darren checked, agreed and sent me off at a tangent. In fact both the dew and the operate indicators flashed under the fault condition when, after a short forward wind in the play mode, the loading system failed to operate and lace up the tape.

No one at Panasonic seems sure what this emergency indication means. The fault had cleared however once the deck and connectors had been dismantled and checked.

A further note should perhaps be added. If the dew sensor is active the camcorder won't work at all and just the dew indicator flashes. It seems that if the dew sensor is activated after play has been selected the operate light also flashes, as an emergency indication. This may indicate a connector problem, or it may yet turn out to be a different software message. Who knows?

Ferguson 3C01

The Ferguson 3C01 strikes me as being a hybrid design consisting of a JVC camera head with a Panasonic deck and VTR circuitry, though the construction suggests NEC manufacture. Be that as it may, the fault report was no viewfinder image. In fact the camera section wasn't producing any signals and investigation showed that the camera tube's high-voltage supplies were absent.

They are produced by what is almost a mini version of a line output stage. A 2SD975 transistor, Q48, drives the high-voltage transformer. It was damaged, leaky in fact, and the thermal fuse TF1 in its collector circuit was open. Destruction of this transistor is usually caused by failure of the transformer. It's small and produces around 3kV, so it works hard. I replaced the transformer, the transistor and the fuse, ran the thing on the bench for a test recording, then sent it on its way.

To my surprise it came back a few weeks later with no 8V camera section supply. This time IC1, which controls and regulates the 5V and 8V camera supplies, was open-circuit at its 8V output. It's this supply that feeds the previously mentioned transistor Q48.

A new chip was fitted and the unit was left on soak test in the record mode – you can't leave it on in the monitor mode as the battery save circuit switches it to standby. I noticed occasional severe picture break up, and eventually it went off, blowing IC1 again.

An 8V supply link, across IC1, gives operation whilst the drive pulses and power lines are being checked. When the picture broke up there was disruption to the H sync pulses. So attention was turned to the sync generator chip IC31, which was checked for dry-joints. Then the oscillator crystal was replaced. This seemed to restore stability and as no further problems were seen during a soak test IC1 was replaced once more. The subcarrier control was checked and reset and after that the unit was returned to the dealer. So far so good.

Life being what it is however the camera bounced back almost immediately. A chat with the dealer revealed that, though he'd soak tested it and found it to be stable, when the owner tried it in the shop there was a loud clicking noise from the camera and it went off.

Back on the bench I found that the thermal fuse TF1 was once more open-circuit. When it was replaced the camera worked very well. Then a little light bulb glowed above me. What was the common factor previously overlooked? The battery! When this was connected the camera played up as its power supply fizzled on and off. When it was connected to the charger the battery fizzled for a short period then settled down to charge. It seems, though I don't have proof, that the battery had a poor internal connection that resulted in mistriggering of the camera tube's power supply and overheating of Q48. All this was in addition to the sync generator problem.

Panasonic NV-MS1

This fault was a real pig. A Panasonic NV-MS1 had no record or playback servo operation. Could we provide an estimate? The audio/control head was loose and the guide to the right of it was misadjusted. Not nice, but a fair enough job. The estimate was accepted, so a new head was fitted and aligned along with the guide. Super playback, into its case and away. Except for one small problem. When a record/playback soak test was carried out the original fault, no recording of the control track, became apparent. What's more, once the camcorder was in the record mode it could be stopped only by removing the power. This was the start of a very exasperating experience.

There was no record control pulse output at pin 11 of IC2001. All the other signals were correct except for the CTL duty signal at pin 36, and at that stage I wasn't sure whether this was an input or an output. There was no choice but to change IC2001, which is not an easy job – and proved to be fruitless. Super Gerald at Panasonic said that the main microcomputer chip IC6001 is often the cause of this fault, so it was changed. There were still no control pulses. Attention was then turned to IC2007, a micro chip

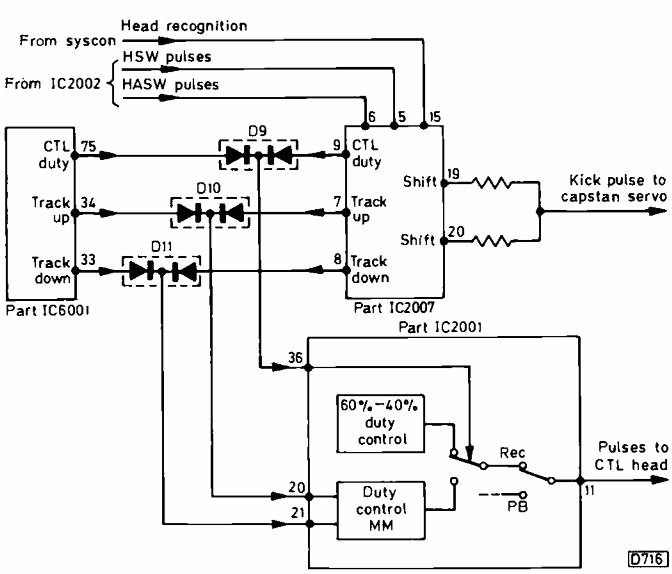


Fig. 1: Block diagram of the CTL pulse generation/head identification arrangement used in various Panasonic models.

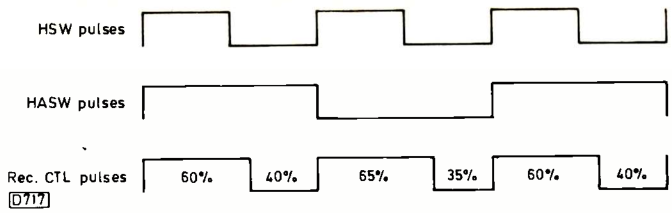


Fig. 2: Waveforms associated with Fig. 1.

with a reset pin and a clock crystal. But what did it do?

Perusal of various Panasonic technical guides brought me to one that provided the answer. It was for the NV-M7 and contained the block diagram shown in Fig. 1. The idea is to vary the duty cycle of the control track signal on alternate frames so that the machine can identify which head recorded a track. This is done to ensure that the head that records a track also plays it back. Thus an error called reverse tracking, when the head drum locks 180° out-of-phase during playback with respect to record, is prevented. Otherwise you can get differential picture wobble – the top and bottom sections wobble in different directions (S distortion).

The NV-M7 is a four-head machine with a small drum. Its video heads are designated A1, B1, A2, B2. Heads A1 and A2 are 180° apart, as are heads B1 and B2. Without a control system the drum could lock 180° out of phase, with head A1 playing back head A2's tracks and vice versa, and similarly with the B heads.

Head/track identification in the NV-M7 is effected by altering the mark/space ratio of the control track signal whilst recording, the sequence being 60/40, 65/35, 60/40, 65/35 etc. (see Fig. 2). During playback the control track pulses are compared with the 40msec head switching signal and the 80msec head amplifier signal. When reverse tracking is identified, the capstan servo is kicked back by 40msec so that correct tracking is restored.

So much for the theory, now back to the fault. With this new information I deduced that what was missing was the output at pin 9 of IC2007. Due to some peculiarity within IC2001 the result was no output at pin 11.

The input timing signals HSW and HASW at pins 5 and 6 of IC2007 were present, the clock was running, the supplies were present and correct and the reset was high. Obviously IC2007 was fault. Wrong again.

At this point desperation set in. I costed a new PCB, drank some more coffee, then phoned Gerald. Anything!! Anyway Gerald and I discussed the pros and cons of the situation and he philosophically mentioned that he didn't trust those little diodes with the boxes around them (D9, 10, 11, see Fig. 1). They are in pairs with a common encapsulation.

First I replaced D9. I then tested it with the Avo, after first mounting it on Blu-Tac to stop it running away. D9 tested o.k., so both D10 and D11 were removed and tested. As they were o.k. they were put back. Dejected and feeling suicidal I switched on to record. Lo and behold, to my surprise I now had control track pulses. My conclusion was that although D9 wasn't itself faulty there must have been leakage or a short between its pins, and that the low at pin 75 of IC6001 was holding pin 9 of IC2007 at chassis potential.

Some questions remain. First, why did the fault condition affect both the record start/stop, normal stop and inhibit power off? Secondly, why did a low at pin 9 of IC2007 completely remove the record control pulse output at pin 11 of IC2001? We may never know, unless some kind Japanese gentleman hears our plea.

Servicing the Saisho VR1200/Matsui VX820

Ed Rowland

The Saisho VR1200 and its Matsui equivalent, Model VX820, were released during the latter part of 1986. The Saisho VCR was sold through Dixons outlets and the Matsui version through Currys stores. They are identical units and the following notes therefore apply to both.

Although these machines were manufactured down to a price they have proved to be reasonably reliable apart from a few problems that can by now be classified as stock faults and some others that, though not as common, will no doubt be encountered by engineers who deal with these VCRs fairly regularly.

The power supply, see Fig. 1, is straightforward and in general doesn't give much trouble. There are a couple of fairly common faults however, not least of which is failure of the 2SD1207 12V regulator transistor Q2502. It lives directly in front of the STK5332 regulator chip. Note that this transistor is a safety component: although other types will work in this position, it's important that the correct replacement is used in order to comply with safety requirements. When Q2502 fails the result is no functions, often with the red "operate" LED lighting momentarily when the function button is pressed. A new transistor is usually all that's required to restore normal operation.

Another cause of no functions is failure of the STK5332 chip IC2501, in which case the display will usually be o.k. and the machine will accept a cassette, though no other functions are possible.

Failure of the machine to power up, with the display strobing, should lead to a check on diodes D501 and D502. Replace them both.

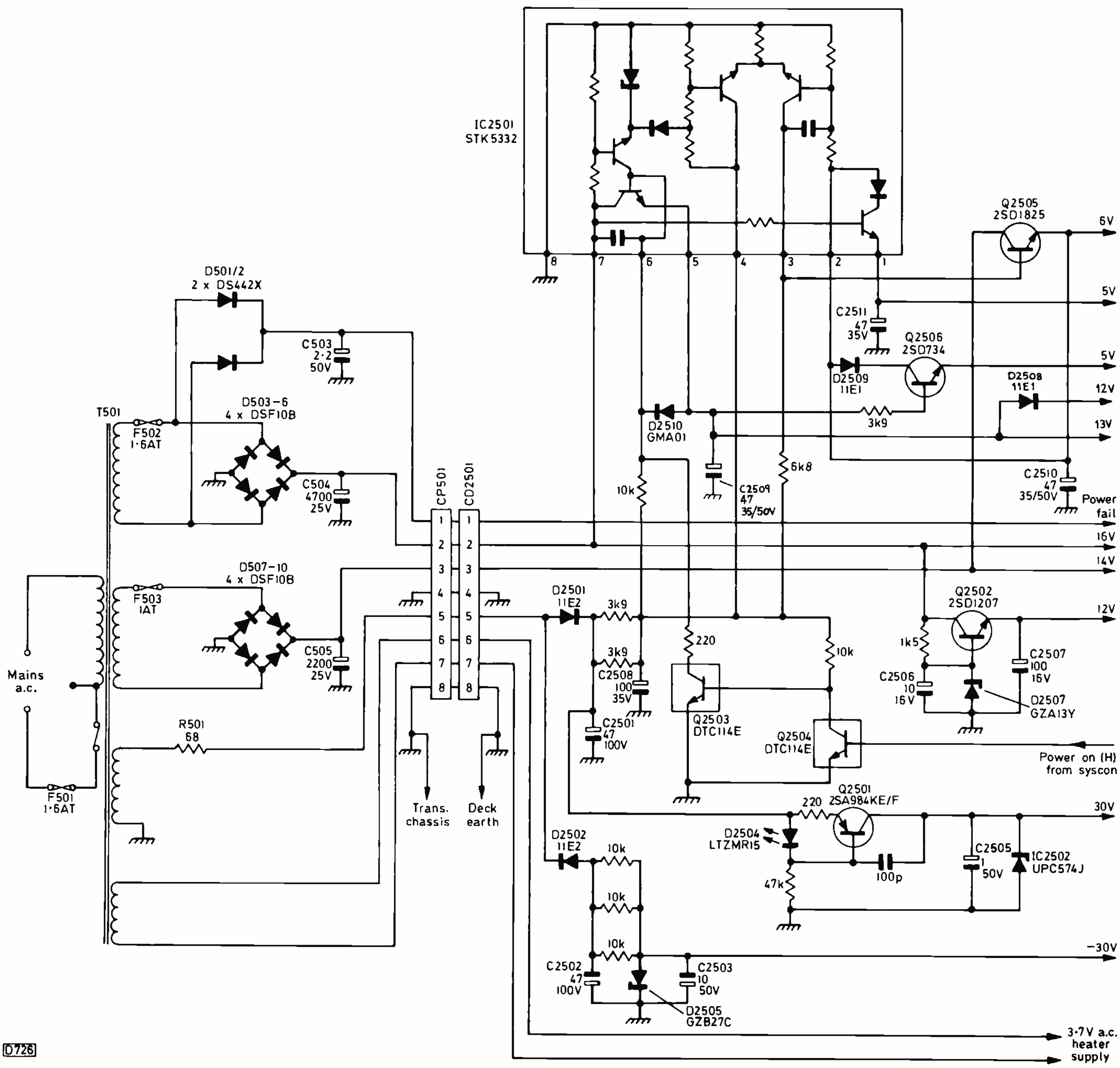


Fig. 1: Power supply circuit used in the Saisho VR1200/Matsui VX820.

We've never known the 6V regulator transistor Q2505 to fail. In general, as previously mentioned, we've found that the power supply is pretty reliable.

Fault Round-up

No functions can be the result of things other than the power supply going wrong. We've had trouble with the mode switch for example. It's located beneath the right-side of the carriage and can give rise to several symptoms, some of which are quite perplexing. They include switching off after the machine has ejected a cassette, intermittent stopping in the record or play mode, and no functions after accepting a cassette. The only sure way of providing a cure is to replace the switch – cleaning it usually doesn't produce any improvement.

Loss of functions can also occur when the BU2176S chip IC2001 fails. It's located on the main PCB and is fairly easy to replace. We've had this fault only once however, though we have had drum speed problems due to this i.c. on a few occasions.

We've had a number of these machine come into the workshop with a cracked front operations PCB, though goodness knows how users manage to do it! Depending on the severity of the damage the job can be a more or a less arduous undertaking, as there are literally dozens of fine tracks. These require very delicate microsurgery to effect a repair. In situations like this we find that the fibre pencils sold by SEME can be extremely useful for removing the etch-resist from the damaged print in order to expose the copper track.

One of the faults most frequently encountered is loss of the steel activating pin from the limiter post lever assembly, which is situated next to the pinch roller. What happens is that the nylon bush that holds the pin splits, with the result that it falls into the machine. The outcome is that when play is selected the machine laces up and then, after displaying for a few seconds a picture that looks as though the machine is in the pause mode, it unlaces. The pin can be refitted using Superglue, but a replacement lever is a better option.

To remove the old lever assembly simply ease back the nylon clip that holds it in place and, using long-nosed pliers, raise it above the clip. Then rotate the lever assembly anticlockwise and the limiter post arm clockwise until the pin on the arm disengages from the slot in the lever assembly, which can now be lifted clear. Don't forget to recover the old pin from within the machine: it could cause problems, though it quite often drops out through the ventilation holes when the machine is being transported.

Other faults that you could meet are as follows: failure to accept a cassette due to faulty end sensors or alternatively the BA6329A chip IC1003; no drum rotation because circuit protector CP209 is open-circuit; no E-E signals because C6017 (1,000pF) between pin 5 of IC6001 and chassis is leaky; and varying capstan speed accompanied by wide noise bars on the screen because of failure of the BA6305 chip IC2004.

In the event of there being no clock display, with everything else o.k., remove the back-up battery BT601 from the main PCB and refit it after 20-30 seconds.

Tape edge damage is usually caused by a faulty clutch and/or pinch roller. If in doubt replace them both.

If you find that it's necessary to replace the loading belt it is advisable to obtain the service manual before undertaking the operation. Its replacement involves dismantling the loading gear mechanism, a rather complex undertaking that's not too easy even with the manufacturer's instructions to hand. Fortunately very little trouble is experienced in this section of the machine.

Two tuners have been used in these machines, types TEEB1X032A and UE30-B03. They are interchangeable.

Spares for the Matsui/Saisho range are available from CPC, Chas. Hyde, HRS Electronics and Mastercare.

A Video Nasty

Nick Beer

A VCR fault I had recently could contend with some of Steve Beeching's and no doubt many others' for the video fault of the year title. The machine involved was a Panasonic NV-FS1B. It's a first-generation S-VHS VCR that uses the G mechanism, not that the mechanism had anything to do with the fault.

Symptoms

As the customer was an AV technician at a local school he had enough technical background to be able to give a fairly accurate description of the symptoms. The main symptom was a vertical bar about a inch wide at each side of the playback picture, approximately one and a quarter inches in from the side of the screen. When the playback picture had dark areas, falling to black level, at the edge the bars took the form of a blue cast. As the video level in these areas increased, the colour of the bars changed, becoming orange/yellow at white level. In addition, at or near black level a third bar could be seen about an inch from the left-hand one. This bar had no chroma content – it looked more like a parasitic oscillation. The fault was present on playback only: recordings made on the machine and played back via another one were perfect.

But this was only one of the symptoms! When a tape with high chroma content was played chroma phase inversion occurred, e.g. highly saturated reds/oranges became green. The saturation had to be high for this to happen: when the colour-bar section of the Panasonic test tape was played only slight errors were present – the chroma was smeary, shifted and weak but no inversion occurred. I used a known good machine to record the colour bars, with a high level of chroma, from our colour-bar generator. When these were played back there was chroma inversion.

The symptoms were worse when the machine was in the LP mode and worse still in S-VHS.

Fault Tracing

The cause of the fault was likely to lie in a common playback area, so large chunks of the circuitry could be ruled out as being unlikely to be involved. This done, there was still a large area for investigation. I decided that the symptoms probably had a common cause, and also that I would find it much more easily by concentrating on the first symptom. The luminance/chrominance signal processing circuitry in this model is extremely complex in block diagram form, let alone by reference to the circuit diagram. As a start, I played back a blank raster and scoped the chroma output from the head amplifier. The output was as expected: pretty inert and, most significantly, flat across the line period. The signal is buffered on the main PCB and is then fed to pin 32 of the YC module, where it goes to pin 13 of the hybrid chip IC801. Scope checks showed that the signal was o.k. up to this point.

The chroma signal output from the hybrid chip is at pin 11. At this point spikes could be seen on the line-frequency chroma display, corresponding with the bars on the picture. The circuit here becomes common to the record and playback signals – the record chroma passes through a 1kΩ resistor on the hybrid chip, leaving at pin 9. I disconnected pin 9 to eliminate any possible problems here. Now an optimist would check for such things as a noisy supply to the chip, then try a new chip. Being one I did just this, and of course it didn't make the slightest difference.

Checks around the hybrid chip failed to reveal anything new, so I came to the conclusion that a fault upstream was introducing an incorrect impedance in the chroma signal's path. One interesting factor I discovered, purely by chance, was that very slight pressure just behind the exit guide, effectively increasing the tape wrap length, removed the symptoms from the screen. This was presumably due to altered chroma signal level.

I was left pondering theoretical possibilities, and was also considering the second symptom – the phase problem. Before I wasted too many more hours I decided that consultation with Panasonic was a sensible step. The local branch hadn't experienced such a problem, but the engineer I spoke to was intrigued by the symptoms and offered to take the machine off my hands. That would have meant that I couldn't write about the fault when I did find its cause, so I declined the offer, at least temporarily!

Further thought led me to suspect delay line trouble, or a capacitor or inductor fault. Bridging or checking suspects proved only that they weren't at fault. A call was then made to Bracknell to enquire whether this fault had been experienced. The answer was no, but the engineer went away for ten minutes to consult with his colleagues. When he got back he confirmed my first suspicion, that the 2H delay line DL802 could be responsible.

Panasonic viewdata said that there was no such part number (EFDHR124A13S). Our storeman consulted Panasonic spares who consulted Japan. A delivery time in weeks was being talked about. While all this was going on I discovered that the same device is used in the Panasonic NV-G25. One was swiftly removed from a stock machine and fitted in the faulty one. Lo and behold, a complete cure! When the cover was removed from the faulty delay line a quarter inch crack could be seen in the glass. Very strange, as the device is mounted in a fairly central position and there was no suggestion that any shock had been applied.

Panasonic Comment

Shortly after this incident I attended a Panasonic seminar on camcorders. A point made was that one of two nasty problems with video equipment had been traced to damaged delay lines . . .

Salora J Chassis

On a different subject, Steve Cannon in his article "Gremlins and Gurus" in the July issue mentioned DB712 in the Salora J series chassis' power supply. In a previous article I mentioned that it can go short-circuit, which is the usual thing that happens. But like Steve I too have had it go open-circuit on occasion.

Long-distance Television

Roger Bunney

The 1991 Sporadic E season has turned out to be rather quiet. There have been numerous openings for those able to monitor Band I during the day, but for those of us whose time is limited reception has been infrequent. Tropospheric activity has been present but reception has been limited mainly to the south and east coast areas. The following SpE log looks respectable enough, but remember that it's a collated log based on a number of reports.

5/7/91 TSS (USSR) chs. R1, 2; SVT (Sweden) E2; NRK (Norway) E4; TVP (Poland) R1; RAI (Italy) IA; TVE (Spain) E2, 3, 4.
6/7/91 RAI IA; TVE E2, 3; NRK E2; TVP R1; DR (Denmark) E3; CST (Czechoslovakia) R2.
7/7/91 RAI IA; TVE E2, 3; TVE-2 E2; DR E3; C+ (France) L2.
8/7/91 SVT E2; RAI IA.
9/7/91 TVE E4.
11/7/91 SVT E2.
12/7/91 RAI IA, B; TVA (Italy) IA; TVE E2, 3, 4; TVE-2 E2; MTV (Hungary) R1; NRK E3; JRT/RTV (Yugoslavia) E3, 4.
14/7/91 TSS R1, 2; RAI IA; TVE E2, 3, 4; MTV R1, CST R1.
15/7/91 RAI IA, B; RTP (Portugal) E3; TVE E2, 3, 4; TVE-2 E2.
16/7/91 RAI IA, B; TVE E3; YLE (Finland) E3, 4; NRK E3; SVT E2, 3, 4; RUV (Iceland) E4; TSS R1, 2.
17/7/91 TVE E2.
18/7/91 RAI IA, B; EPT (Greece) E3; C+ L3.
19/7/91 RAI IA, B; TVE E2; MTV R1; JRT/HTV E3.
20/7/91 TVP R1; TSS R1, 2; TVE E3, 4; RAI IA.
21/7/91 TVP R1; TSS R1, 2, 3; SVT E2; NRK E2; CST R1; RAI IA; TVE E2, 3, 4; ORF (Austria) E2a.
22/7/91 ORF E2a; JRT/HTV E4; TSS R1; TVE E2, 3, 4; +PTT (Switzerland) E3; ARD (W. Germany) E2, 3.
23/7/91 RAI IA; TVE E2, 3, 4; C+ L3; TSS R1, 2, 3; CST R1.
25/7/91 TVE E2, 3, 4; +PTT E2; SVT E2.
26/7/91 TSS R1-5; YLE E3, 4; SVT E2; NRK E2, 3, 4; RUV E3; +PTT E2; TVP R1, 2, 3; MTV R1, 2; ORF E2a; RTSH (Albania) IC; TVE E2, 3, 4; ARD E2, 3; JRT E4.
27/7/91 RAI IA, B; +PTT E2; C+ L2, 4; TVE E2, 3, 4; ARD E2; CST R1: MTV R1; SVT E2; DR E4; RTP E3; TVE E2, 4; TSS R2.
28/7/91 RAI IA, B; TVE E2, 3, 4; C+ L2; TSS R1, 2; NRK E2, 3; SVT E2.
29/7/91 TVE E3; JRT/HTV E3.
30/7/91 RAI IA.
1/8/91 JRT/HTV E3, 4; TVE E2; RAI IA; CST R1.

Tropospheric lifts occurred on July 4/5th, with reception from Norway, Denmark and W. Germany; on July 10/11th with reception from W. Germany in the north east; on July 13-16th with reception from Denmark, Sweden, Norway and Germany along the east and south east coasts; on July 23rd with reception from the Benelux countries; and on the 28/29th with reception from Denmark, Germany the Benelux countries in the east and south east.

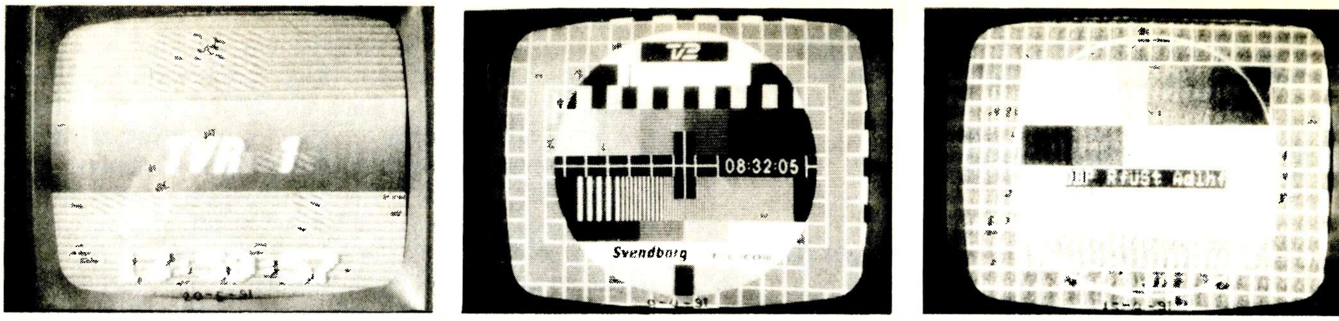
Thanks to Simon Hamer (Powys), Peter Schubert (Rainham), Roger Fussell (Torpoint), David Glenday (Arbroath) and Brian Williams (Penarth) for sending in reports to supplement my own log.

Veteran TV-DXer Nick Brown (Rugby) recently moved and has installed a new aerial system. At u.h.f. he is using two stacked Wolsey Colour King aerials with the outputs combined and fed to a Labgear CM7271 head amplifier. For Band III a wideband, eight-element Jaybeam ABM8 feeds a Fringe Electronics v.h.f. 1220-3 head amplifier with a gain of 20dB and a 1·8dB noise figure. Beneath this there's a combined Band I/II aerial for SpE reception. Indoors an HS Publications D100 unit converts the v.h.f. signals to u.h.f., feeding a Toshiba colour receiver. The aerials are four metres above the roof. Initial results indicate that the system is working well: with just a slight tropospheric lift low-level Band III/u.h.f. signals are received from Germany, France, Ireland and the Benelux countries.

The mystery 525-line ch. R1 signal that's been received several times in the UK during periods of intense F2 propagation and is thought to originate in the Far East has, it seems, now been received by Robert Copeman in Australia. He recorded a 525-line ch. R1 signal on May 5th and reports that its strength was such that it overrode other, simultaneous Chinese transmissions on ch. C1. Unfortunately only pictures were seen, with some writing in the lower right-hand corner. Clearly the signal is coming from somewhere in S.E. Asia. Does anyone have any suggestions as to its source?

News Items

Ireland: The 1990 Broadcast Act may be amended shortly. It was intended to redistribute advertising by imposing restrictions but simply seems to have led to losses by RTE and could affect the viability of the proposed TV3 commercial network. RTE is considering the possibility of distributing a programme consisting of RTE1/2 material to



Left: SpE reception of TVR 1 (Rumania) in Holland. Centre: New Danish TV2 network test pattern identification, received on ch. E32. Right: German test pattern, generally used by ex-DDR1 transmitters. Photos courtesy Ryn Muntijewerff.

cable systems in the UK via satellite. There could also be a dedicated Irish sports channel.

Denmark: The TV2 network has run into financial difficulties and might be forced to close this December. The government has refused to provide more funds.

Lithuania: A new independent TV service is called Nepriklausomos Lietuvos Televizija (NLTV), which translates as Independent Lithuanian Television. Satellite derived material from SAT-1, Tele 5, Childrens' Channel etc. plus a one-hour (1700-1800) CNN news programme is used. Currently the Vilnius service is on ch. R10. The USSR-based service continues on ch. R2 from 1800. Technical problems are common: the test card is type UT0167, rarely with any identification.

Ukraine: The CT-2 network transmitters are now broadcasting locally produced programmes with CT-2 in-filling.

Czechoslovakia: A new high-power transmitter is in operation at Chomutov, on ch. R52, near the German border. The Slovakian region now receives a service called TA3 via the former OK3 transmitters. Programme content is part satellite, part local with a CNN programme at night. The unlicensed indepedent NTV service has closed down but has applied for a licence to restart.

Hungary: The NAP-TV breakfast show (0600-0900) has moved to MTV-2.

Korea: An expansion of the TV services over the next nine years is planned. Another three channels are to be made available via satellite by 1994 while the US Forces' AFKN-2 service is to be taken over in 1993. By the end of the year six nation-wide TV networks will be in operation, including Seoul TV which opens this autumn.

New EBU Listing: Berlin Schaeferberg ch. E56, 100kW horizontal, carrying ARD-4 with directional aerial aimed at 70° into the eastern part of Germany.

50MHz Amateur Band

The following reports come by courtesy of *Six News*. At 1536GMT on April 29th, during an intense auroral event, Scottish amateur GM3WOJ contacted Jorge DeCastro, CX8BE, in Uruguay using s.s.b. The distance of 7,063 miles is a new world record for auroral operation. Actual frequency was 50·14MHz. It's possible that propagation was partially by TE/F2 into the auroral curtain, but anyway it was a very fine achievement.

Solar cycle 22 continues, but with the peak now passed and a slow decline. F2 and auroral activity should remain high during the rest of the year however. The sunspot minimum with this cycle will occur in 1996: the peak count was a smoothed 158·1 in July 1989.

Yugoslavia now allows amateur operation in the 50-50·9MHz band on a secondary user basis. Maximum output levels are 10dBW urban, 20dBW rural. Turkey also allows limited operation within the area 40°E to 40°N. Limited operation is to be allowed in Poland from next year, in areas where there are no Band I TV transmissions.

Satellite TV

New regulations for satellite TV aerials have been issued by the Department of the Environment (see Teletopics last month, page 799). The larger size of dish (90cm) can be used to the west and north of a line that runs approximately from Devon through West Glamorgan and Manchester to Humberside. If you are on the east/south side of this line planning permission will be required for a tracking dish of say 1m diameter mounted on a house. Provided a garden sited dish is not too obtrusive and isn't of over 2m height it should fall within permitted development under the terms of the Town and Country Planning Act, since sheds and fencing are permitted provided they don't exceed 2m.

The French company Clinvest has provided Super Channel with financial assistance worth over £20m to enable the services and presentation to be revamped.

Satellite Japan Corporation intends to launch two satellites by 1994 and offer carriage of domestic communications and TV services. It will be the third Japanese telecommunications company to enter this field. Each satellite will have 24 transponders operating at up to 50W output. The Japanese BS3a satellite has lost power due to solar panel faults. As a result only two of its three transponders, carrying NHK and JSB TV, are in operation – there will be no back-up until BS3b comes into operation.

A press statement has been issued by SES following rumours about possible solar panel problems with the Astra 1B satellite. It states that 1B has not lost a solar array and that no transponders have been switched off to save power – neither has Astra 1A lost the use of any of its back-up transponders.

Russia is to place a fourteen tonne space platform in orbit next year, carrying telecommunications equipment for TV relay. Another two platforms, each weighing eighteen tonnes, are to be placed in orbit by 1997, giving a total downlink capacity of thirty TV channels.

Telecom Eireann has opened an earth station at Elfordstown near Cork. More earth stations are coming into operation to work with the Eutelsat system, the latest being at Lario near Milan. Stations in Yugoslavia and Rumania are due to open during the coming year.

The Eutelsat II F5 craft will be launched in October 1992. The 13°E II series craft has been carrying HD-TV test transmissions between Thomson's Paris plant, Philips at Eindhoven and ITT Nokia in Finland.

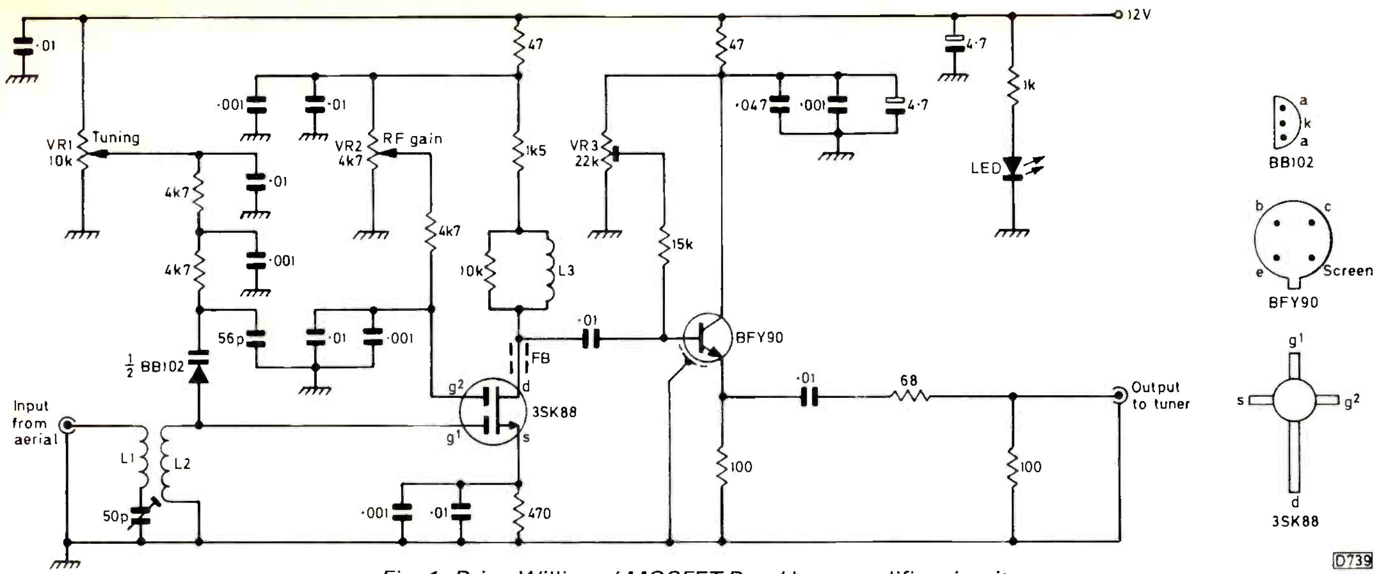


Fig. 1: Brian Williams' MOSFET Band I preamplifier circuit.

The European Commission is backing the Euronews project which will provide a centralised TV news service for the EBU region.

It's hoped that the Telecom 2A satellite, to replace the seven-year old 1A craft, will be launched by the end of the year in time for the winter Olympics. Funding is shared between France Telecom (60 per cent) and the French Defence Ministry (40 per cent).

Band I Preamplifier

Brian Williams has come up with the interesting Band I preamplifier circuit shown in Fig. 1, based on a tuned input MOSFET with a gain control. The advantage of having a tuned input is virtual elimination of cross-modulation (overload) problems from nearby transmissions. I've no performance figures but Brian comments that it's excellent in terms of optimum gain with minimum noise. He says that the absence of noise on the screen when the amplifier is tuned to resonance with the aerial removed is striking, and that the stability over the band is excellent – with the coil as specified, the coverage is 40-78MHz. The BYF90 transistor provides buffering and improved matching into the 75Ω output. The varicap diode used is one of a matched pair in a common encapsulation. Take the usual care over construction. The prototype was built inside a tobacco tin with an earthed screening strip across the MOSFET to maintain stability – the subminiature ceramic plate capacitors are soldered directly to this strip.

Coil L2 consists of eight and a half turns of 16 s.w.g. copper, air cored with a diameter of half an inch. The coupling coil L1 consists of one and a half turns of thin flex at the end of L2 (not over it). Two 25pF trimmers are used at the input where the circuit shows a single 50pF trimmer. L3 is an r.f. choke consisting of ten turns wound on the associated 10kΩ, 0·25W resistor. VR3 should be adjusted for the best signal/noise performance with a stable, weak signal. When correctly set the voltage at the emitter of the BFY90 transistor should be approximately 0·8V.

Service Briefs – Pioneer

The following repair tips and modification notes have been compiled from recent Pioneer service communications.

CDV/Laservision

Model CLD1450: To overcome analogue audio dropouts add a 1μF, 50V electrolytic capacitor between the 5V rail and the end of R828 nearest to connector CN10. Do this on the component side of panel ASCB, which is the lowest of the three PCBs. A wire link marked +5V will be seen just above and to the right of connector CN10. This is the supply connection point for the capacitor.

CD Players

Models PD4500/4550/5500: If the swing lever (item 105, page 11 in the service manual) is bent or has jumped out of the rack (item 7) the tray won't open. This tends to happen as a result of rough handling while being transported. If the lever can be reshaped or refitted this can be done, but there's an improved version (part no. PNB1225). When the repair has been completed, disconnect the mains supply with the tray open. Then gently push the tray shut. This leaves the swing lever in its lowest position where it's less liable to damage in transit.

Models PDX303/707/909, PD5010/6010/7010, M6: To cure intermittent skipping add a magnet (part no. PMF1001) adjacent to the shaft of the spindle motor. Glue the magnet in position as close as possible to the shaft without fouling it. If this problem is experienced with discs that last over an hour, add rubber sheets to the clamper holder arm – part nos. PEB336 (large) and PNM054 (small). If the problem is experienced in conjunction with mechanical sensitivity to vibration, fit modified floating mechanism cushions: replace the four existing PEB293 cushions with part no. PEB321 (grey colour) in the rear right-hand corner and part no. PEB320 (black) in the other three corners.

All models: When removing the operating bar or front panel it's important to take care of the mains switch. To remove the bar from the switch shaft, always have the switch in the off position, then lever the bar off gently using a flat bladed screwdriver – otherwise the switch latch will be damaged. Always remove the bar before removing the front of the machine.

TV Fault Finding

Reports from Brian Storm, Paul Hardy, Stephen Leatherbarrow, Michael Dranfield, J. Edwards, J.K. Potts and John C. Priest

Panasonic TC1485 (Z3 Chassis)

"Dead set" the job card said. Well not quite: the main h.t. rail was up and running, but there was not much else. The l.t. supply from the chopper transformer T801 was quite low. This usually indicates that the power supply is running at the wrong speed because of no line drive. A check at pin 15 (X-ray protection) of the M51407SP i.f./colour decoder/timebase generator chip IC101 confirmed that the protection circuit was in operation, as there was a voltage there. After disconnecting various feeds to the sensing circuit transistor Q502 was pronounced guilty. But why? After much voltage checking in the associated circuitry R560 (270kΩ) was found to be open-circuit. **B.S.**

Panasonic TX28A2 (Alpha 3 Chassis)

The complaint with this set was that it would go off after about three and a half hours. So I left it to run. Just as Graham Gooch came out to bat two and a half hours later the picture went black, the bottom third went white, the top third broke into white lines, the bottom half went green then the whole raster went bright white. The power supply next shut itself down with a scream of agony. I went across and switched the set back on as Graham Gooch watched the first ball of the day sail harmlessly over his head. Atherton went back to the pavillion, closely followed by Graeme Hick and Allan Lamb, then just as Robin Smith walked out to bat the set performed its pyrotechnics again and shut down.

I removed the back and gazed in awe at the congested inside of this monitor-style set. Where to start? The vertical circuit boards were all securely plugged into the main boards. Fortunately my eye was drawn to a large silver heatsink at the bottom of the set. The clip that should have been holding IC891 to its heatsink hung loosely across it. I gratefully refitted the clip, put the back on and left the set to run. It was still working perfectly later that afternoon as Robin Smith completed his century. **B.S.**

Panasonic TX21T1 (Alpha 2 Chassis)

There was no sound from this set. The voltages around IC253 seemed to be within reason but there was no life and the situation didn't feel like a faulty chip. As the voltage at pin 2 seemed to be slightly low I disconnected C269. Up came the sound. C269 (10nF, 50V) read about 3kΩ when checked with my meter. **B.S.**

Grundig C2402 (CUC51KT Chassis)

This set was dead – in fact the 124V line was low. No obvious shorts or leaks could be found. Eventually I discovered that D656 (BYW76) was going high forward resistance under load, though it read o.k. when tested with a meter. **P.H.**

NordMende SC7732

Bright flyback/teletext lines were present over the first couple of inches of the field scan. Much time was wasted making checks in the first anode and blanking circuits on the tube's base board, which proved to be blameless. The cause of the fault was eventually traced to C57 (1μF, 50V) in the field timebase module. It had gone low in value. Note that this capacitor is present with only certain modules – several different types were used in these sets. **P.H.**

Philips K35 Chassis

The complaint was that the set wouldn't lock to channels in the search tuning mode. What struck me immediately was that with no signal present the line oscillator sounded way off frequency. Changing the TDA3571BQ oscillator chip provided a cure. **P.H.**

Philips K40 Chassis

This set arrived with a blank raster. Advancing the setting of the first anode control showed that the cause was field collapse. The field output chip was short-circuit while its l.t. feed resistor R3186 was open-circuit. When these items were replaced we still had problems however. For the first ten minutes the lines at the top of the screen were expanded. Thereafter normal service was resumed. Freezer and a hairdryer brought us to C2107 (100μF, 50V) which was partially open-circuit. **S.L.**

Grundig CUC120 Chassis

Very severe patterning that varied with the brightness was soon traced to ripple on the 19V rail. C662 (470μF, 25V) was completely open-circuit. **S.L.**

Doric CU36502D

This set seemed to be fitted with a Sharp chassis of a type we've not seen before. The fault was field collapse. Checks showed that the voltages around the field output transistors were incorrect, with little bias applied to Q502. R513 (1·2kΩ, 1W) was found to be open-circuit. As a precaution we also replaced both output transistors (Q501/2). **S.L.**

Hitachi CPT2176 (G6P Chassis)

This set was dead with just a low-frequency whine from the power supply. We found that the voltage at the collector of the line output transistor Q781 was low. The cause was C909 (220μF, 160V) which smooths the output from the chopper power supply. **J.E.**

Hitachi CPT1474

This set greeted me with a very bright raster and no sound when I switched it on. Within three seconds the power supply tripped and screamed. When I next switched the set on I turned down the first anode control. This time the set remained on but still had an over-bright raster and no sound. A check at the collectors of the RGB output transistors showed that the voltages were only 40V, though there was 200V at the line output transformer. It seemed that the RGB output transistors were conducting heavily, so the drives from the TDA3565 colour decoder chip IC501 were disconnected. Up came the collector voltages and out boomed the sound. A new TDA3565 cured the problem. **J.E.**

Saisho CT141X/Matsui 1420A

This set was dead but the usual faulty bits were o.k. This time C508 (4·7μF, 50V) in the STR50103A's start circuit was found to be low in value. Replacing it restored normal operation. The fault can also be caused by R502 (100kΩ) or R503 (82kΩ) in the start supply. **M.Dr.**

Hitachi CPT1474/1646

No picture, no sound and no field scan is a simple fault. Not so when you don't have the manual! With a CPT1646 that came in the 12V supply was found to be missing in places. The cause was an open-circuit 0·47Ω safety resistor, R228. We've had the same problem with Model CPT1474, where the culprit was R222 (same value). **M.Dr.**

Ferguson ICC5 Chassis

The complaint was of random flashing lines on the screen, but we found that a signal fed in via the scart socket produced a perfect picture. As we've had similar faults caused by the tuner this was our first suspect. We hooked up a rotary tuner from an old monochrome set as a check. This cured the fault, so a new tuner was obtained and fitted – only to find that the fault remained as before. A check on the 11·5V supply to the tuner showed that it was stable and ripple-free. The voltage at the tuning pin was also stable but the scope showed that there was a low-frequency noise component at some 10-20mV peak-to-peak. My first thought was that this was audio noise, but decoupling various points in the audio output circuit made no difference. The surface-mounted capacitors CT01, C103, C105 and C109 in the tuning voltage supply were changed but this had no effect on the fault. What next? In desperation I cooled the U6316 PLL chip IT20. This provided a cure. When IT20 was then heated the fault was back again. A new PLL chip restored correct operation. **M.Dr.**

Saisho CT141X/Matsui 1420A

For no luminance with these sets check and replace as necessary D602, D603 and D613. Type 1N4148 diodes will do. Also check and/or replace the 2SA733 transistor Q601.

If you have to replace the 5·6Ω, 5W surge limiter resistor R501, as you will have to do if the chopper chip IC501 and the over-voltage zener diode D508 have gone short-circuit, use the Amstrad type AM1422138 from CPC of Preston. It's the same but cheaper. **M.Dr.**

Philips CTX Chassis

There was a very odd fault with this set, bad patterning on the screen. It was like CB radio interference. It went away when the colour was turned down, so something was affecting the chroma circuits. There was no ripple on the 12V supply to the TDA3560 colour decoder chip, and a replacement chip made no difference. While studying the fault over a cup of tea I noticed that the patterning seemed to change in sympathy as people in the picture talked. Something was amiss with the sound rejector trap. Shorting it out made no difference, proving that 6MHz sound was entering the colour decoder chip. A replacement obtained from a scrap set provided a complete cure. When the old one was examined the coil's continuity was found to be o.k. so I came to the conclusion that the internal series tuning capacitor was open-circuit. **M.Dr.**

Ferguson TX100 Chassis with Teletext

The problem was loss of memory: the set had to be retuned every time it was switched on. Visual inspection of the panel didn't reveal anything amiss and the i.c. voltages all appeared to be correct. The next logical thing to do seemed to be to replace the M293B1 tuning memory and control chip IC7. A new one provided a complete cure. **J.K.P.**

Some Quickies

Ferguson TX90 chassis: No field output was caused by dry-joints on TR105 (TIP112H) at the rear of the central heatsink.

Philips CTX-E chassis: No sound was caused by absence of the l.t. supply to the audio output chip. R3170 (3·3Ω) was open-circuit for no apparent reason.

Ferguson TX9 chassis: Intermittent operation was due to dry-joints at the collector of the line output transistor TR68, where the struts enter the PCB. **J.K.P.**

Bush 2114/2020

For fizzing or squealing from the chopper transformer at switch-on, possibly dying away after a few minutes or alternatively continuing for much longer, accompanied by fine tearing of verticals in the picture, replace C818 (1μF, 50V). It decouples the set-h.t. potentiometer.

If the set seems to be dead but the fuses are o.k. check R422 (1Ω, 1W safety type) in the line output stage. It feeds the 16V rectifier and in turn the LM7812 12V regulator, which supplies the TDA2579 chip where the line oscillator resides. TH801 and R817 (5·6kΩ, 0·5W) in the power supply start-up circuit are other possibilities. **J.C.P.**

NEC 3022E

Apart from a few cases of dry-joints where the 15-pin decoder input/output socket is soldered to the main PWB(B) these satellite TV receivers have proved to be pretty reliable. This is the first actual fault I've had. The complaint was of "flashing on the picture", and sure enough soon after the set was switched on from standby there was a white flash across the screen – a band about 1mm high, the full width of the screen. At the same instant there was a "tick" from the sound. The symptoms recurred at about two to three second intervals and were present on all channels, the effect being similar to that when an unsuppressed fridge or central heating thermostat switches off. The repetition rate ruled out this possibility of course.

The LNB supply was steady, so a spare receiver was used to check the LNB/dish/cable part of the installation. As expected, the results were perfect with no trace of flashing. We left the spare receiver and took the one that was clearly faulty back to the workshop. When it was connected to our own dish the fault was immediately visible, so after a quick check on the five main outputs from the power supply attention was turned to the tuner unit. We then noticed that on some channels there was a noticeable falling off in picture quality and an increase in picture noise during the half second or so before each flash, when the signal sprang back to normal before restarting its slow decline.

The tuner's supply voltages were stable and although there was a slight variation at the two a.g.c. terminals it was not until the a.f.c. was monitored that I struck gold: the voltage at this pin was swinging in time with the ticks and flashes. Tracing back from the a.f.c. pin took me via pin 7 of socket VC to the microcomputer chip IC1001 on Main PWB(A). The a.f.c voltage at pin 39 of this chip should be a steady 2·7V. In this case however it was swinging between zero and 3V in time with the flashes. Since the connection between the tuner and IC6001 is a direct path, pin 39 was isolated by disconnecting the link between the two boards (pin 7 of connector VC). The voltage at pin 39 continued to vary so a replacement μPD1700CU-520 chip was ordered from SEME. Fitting it provided a complete cure. **J.C.P.**

TEST CASE

346

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.

Most of the equipment that's featured in these Test Case items is middle-aged, simply because that's what we mainly see on the bench. This month's tale relates to a brand new machine however, though the point it illustrates is relevant to most makes and vintages of VCR. To solve this puzzle it's not necessary to have the service manual: the main thing is to know where to look!

The machine involved was a Sony SLV777, which is a VHS home deck with two speeds, hi-fi and editing facilities. It had been delivered to a customer new but had to be retrieved the very next day because of a colour problem. As there wasn't another of these machines in stock the repair had to be done pronto. The symptom showed up with the Eastenders recording that was still in the machine: the colour was very poor and grainy and was strewn with confetti. The underlying black-and-white picture was clean and noise-free however.

As the tape was the machine's own recording a known good tape was played back. The results were the same: luminance fine, colour saturation about correct, but grain and noise speckled the coloured areas of the picture. Head cleaning didn't improve the results obtained. The next step we took was to narrow down the field of search by checking as many modes of operation as possible.

A recording of colour bars was made in the SP and LP modes. The tape was rewound and then played back using another dual-speed machine. At both speeds the colour was bright and clear. Playback via the faulty machine gave noisy chroma in both modes. So the trouble was confined to playback and was present with both standard and long-play operation. Having established the exact symptom, it was time for diagnosis. It then emerged that almost everyone in the workshop had virtually no knowledge of VHS (or any other for that matter) colour signal processing. They all claimed that they'd never had a real colour fault before, which says much about the reliability of this part of a VCR but not much for the lads... The repair became a joint effort, a sort of community project.

Someone suggested that the heads might be responsible, but that was overruled on the grounds that recordings were o.k. and that separate heads were used for the SP and LP modes. Next it was decided that the quality of the output signal at the scart AV socket should be checked. When this was linked to a Sony set's scart port the results were no better. It was thus concluded that the fault lay in the chrominance processing circuitry. An oscilloscope was brought into use, along with a three-hour tape recorded throughout with a colour-bar signal. If the fault wasn't found in three hours we would get a five-minute break while the tape was rewound!

Investigation began on board YC-65, which is where the colour signal processing takes place. IC801 does most of the work here. The chroma signal goes into it and comes out several times, finally emerging at pin 21 after which it goes to the YC adder department. The waveform at pin 21 of IC801 was of correct amplitude but was ragged and noisy.

In which part of the processing circuitry was the fault most likely to lie, considering the symptom? Should we have gone upstream or downstream from IC801? See next month for the answer and another test case item.

ANSWER TO TEST CASE 345
– page 822 last month –

A surprising amount of fault diagnosis can be carried out successfully in TV sets and VCRs without detailed knowledge of circuit operation and theory. A bit of it would have helped with last month's bench session though! The symptom with the JVC HR-D140 was drum speed runaway, smartly followed by deck shutdown.

The drum servo has two loops, one digital and one analogue – the phase and speed control loops respectively. The relevant one here was the speed control loop, which maintains the motor speed at 1,500 r.p.m. using feedback from the FG (frequency generator) built into the motor. A frequency-to-voltage converter inside the servo chip maintains its input frequency at 1,500Hz, which corresponds with 1,500 r.p.m. If the converter sees no FG signal it drives the motor harder to try to find some.

This was what was happening, but no feedback ever appeared because the FG printed coil leadout had a badly soldered joint. A check with the scope at TP414 or at pin 6 of IC404 would have shown this, and a d.c. continuity check would have provided confirmation. Fortunately with this motor it's easy to remove and repair the FG PCB, which is bolted to the underside of the motor.

The loading mechanism service job would have had to be done sooner or later anyway!

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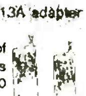

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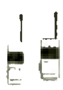

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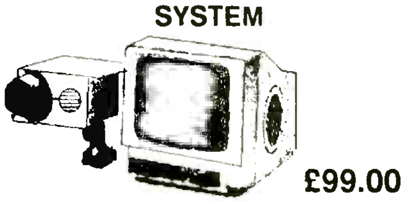

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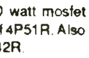

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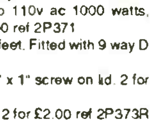

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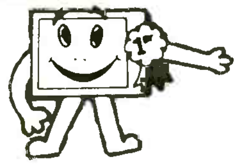

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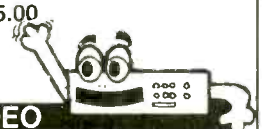

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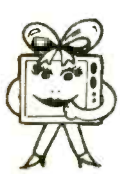

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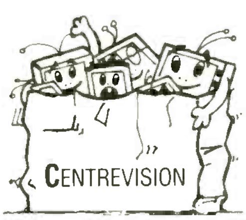

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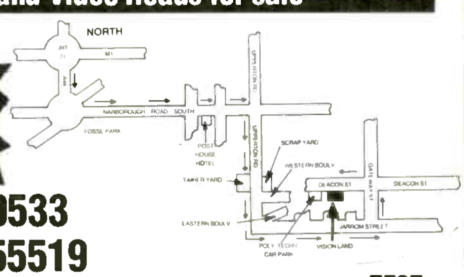

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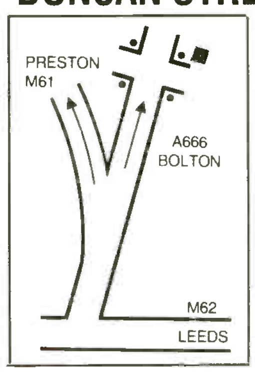

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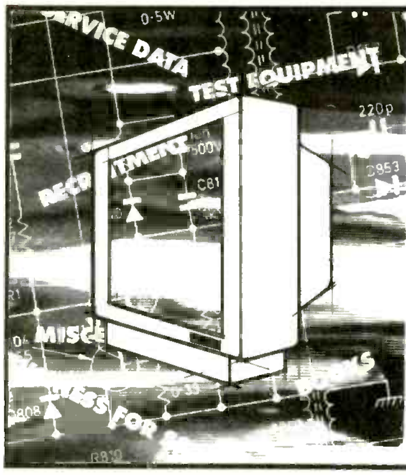

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