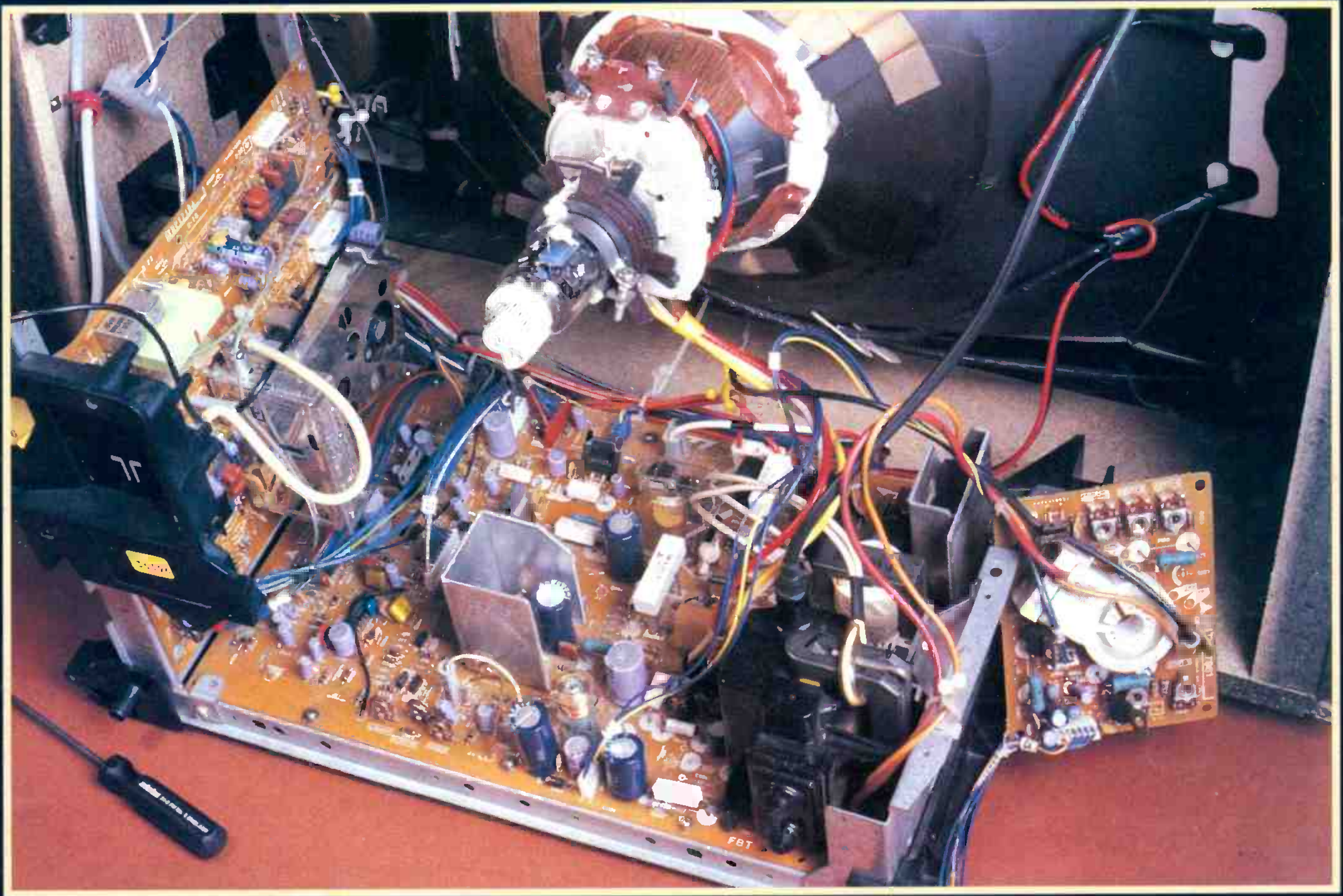
MARCH 1991 £1·80

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

FREE PVC INSULATING TAPE



Servicing the Panasonic U5 Chassis
Hall-effect VCR Motors•DX-TV
Ferguson Tips•Microwave Notebook
A Serviceman Looks at VCR PSUs
VCR Clinic•TV Fault Finding

03
9 770032 647023

Willow Vale Electronics Ltd

PARTS PROBLEM?

For
Sharp
Sansui

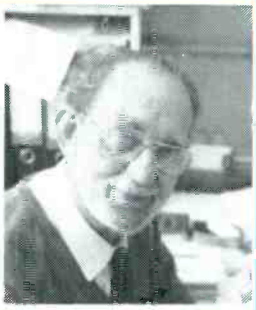
Phone David Allen
0734-876444

Grundig

Phone Stan Perkins
0734-876444

Philips/Pye
Whirlpool

Phone Frank Pratt
0734-876444



Ferguson
GEC
Fidelity

Phone Philip Pratt
0734-876444

Amstrad, Akai, Fisher, Mitsubishi, Moulinex, Goldstar, JVC, Nat Panasonic, Pioneer, Matsui, Saisho, Samsung, Salora, Sanyo, Sony, Toshiba, Yamaha and many others.

Phone Mike Curtis
0602-870789

COPS CATCHES THE PARTS THE OTHERS CANNOT REACH AT PRICES THE OTHERS CANNOT MATCH

VIEWDATA
PRESTEL
PHILIPS
MOVIES
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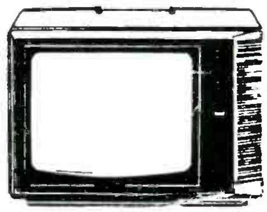
COPS



14in SCREEN
FULL KEYBOARD
BUILT IN MODEM
PRINTER PORT
RS232 PORT
FLOPPY DISC PORT
TAPE RECORDER
PLAYPORT
SECURITY KEY SWITCH
BRITISH MADE
BSI APPROVED
BT APPROVED

RECONDITIONED TERMINAL
£238
+ VAT

INTEREST FREE CREDIT SUBJECT TO %APR

This business terminal is a unique concept, it exploits the latest technology within a television receiver.

A microprocessor is used to guide you through a wide choice of features simply and quickly. Options are presented on the screen in the form of menus which invite you to select Teletext, Prestel or any computerised order processing facility for which you have access to, i.e. *Willow Vale* **COPS**, Philips MOVIES, Sharp VIEWDATA, National Panasonic, Hitachi, etc.

The system is open ended in that future facilities can be catered for in the programming of the micro-processor, such as cable TV, video disc and in house data systems.

A typewriter style keyboard is supplied and allows you full composition and editing facilities in LOCAL EDIT mode and pages of text can be transferred from the internal memory to cassette tape, to a printer, or downline at will. Clock display and timer, time out, stand by mode, security key with locking key, telephone number memory bank are all standard.

ACCESS 24 HOURS A DAY – 7 DAYS A WEEK

NO PROBLEM

WVE
The Parts Distributor who says YES

TELEVISION

March 1991

Vol. 41, No. 5
Issue 485

On sale February 20th

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

INDEXES AND BINDERS
Indexes to Vols. 36, 37 and 38 are available at £1 each from the Editorial Office (address above).

Binders that hold twelve issues of *Television* are available for £4·50 from Television Binders, 78 Whalley Road, Wilpshire, Blackburn BB1 9LF. Make cheques out to "Television Binders".

SUBSCRIPTIONS
An annual subscription costs £21·60 in the UK, £25·50 overseas (by surface mail – ask for airmail quote if required). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

BACK NUMBERS
Subject to availability, copies of issues published during the last 12 months are available at £1·80 each from Television, John Denton Services, Unit 13, Thornham Grove, Stratford, London E15 1DN. Please make cheques/postal orders payable to IPC Magazines Ltd.

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

this month

OUR NEXT ISSUE DATED APRIL WILL BE PUBLISHED ON MARCH 20

AA119	9p
AAY32	9p
AC107	40p
AC125	28p
AC126	25p
AC127	21p
AC128	21p
AC128K	26p
AC141K	30p
AC142K	30p
AC176	22p
AC176K	28p
AC187	21p
AC187K	28p
AC188	21p
AC188K	28p
ACY18	48p
ACY19	48p
AD142	100p
AD149	60p
AD161	35p
AD162	35p
AF124	50p
AF125	50p
AF126	50p
AF127	50p
AF139	30p
AF239	30p
AF379	45p
ASZ15	100p
ASZ17	100p
BA145	10p
BA148	10p
BA154	6p
BA157	12p
BA526	188p
BB105B	18p
BB205B	24p
BC107	8p
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BY210	22p
BY225	120p
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BY227	19p
BY228	32p
BY296	20p
BY298	26p
BY299	28p
BYX10	15p
BYX55/350	30p
BYX55/600	30p
BYX70/500	32p
BYX70/800	36p
OA47	6p
OA90	6p
OA91	8p
OA200	7p
OA202	7p
IN.914	2p
IN.4001	4p
IN.4002	4p
IN.4003	4p
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IN.5408	13p
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SKE4F2/08	70p
SKE4F2/10	90p
I.C. SOCKETS	
8pin	6p
14pin	8p
16pin	9p
18pin	12p
20pin	14p
22pin	16p
24pin	18p
28pin	20p
40pin	25p
ZENER	
400MV BYZ88 RANGE 2V7 to 39V	6p
1.3W BZX61 RANGE 2V7 to 39V	12p
CRYSTALS	
Freq in MHZ	
1.00	260p
2.00	200p
2.45670	180p
2.5	200p
3.276	115p
3.5795	95p
4.0	110p
4.194	130p
4.43	95p
4.9152	150p
5.0	130p
6.0	115p
8.0	125p
8.867	125p
10.0	140p
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DL92	60p
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PL500	110p
PL504	120p
PL508	200p
PL519	450p
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PY88	100p
PY500A	190p
L.E.D.'S	
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LED 3MM GRN	10p
LED 5MM RED	5p
LED 5MM YEL	10p
LED 5MM GRN	10p
RECTANG. L.E.D.'s	
RED	10p
GREEN	15p
YELLOW	15p
LINEAR IC'S	
AN-203	210p
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AN-262	140p
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AN-274	250p
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AN-303	250p
AN-304	380p
AN-305	320p
AN-315	210p
AN-316	350p
AN-318	460p
AN-360	100p
AN-362	140p
AN-366	150p
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AN-612	160p
AN-5151	600p
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AN-5712	350p
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AN-5730	160p
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AN-5753	170p
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AN-7420	250p
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AN-7178	270p
AY3-1015	290p
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AY3-1350	450p
AY3-8910	360p
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BA-402	60p
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BA-514	160p
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BA-527	95p
BA 532	140p
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BA 536	180p
BA-546	180p
BA-612	160p
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BA-658	380p
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LC-7137	450p
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LF-355	60p
LF-356	60p
LF-357	70p
LF-398	300p
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LM-307	42p
LM-308CN	70p
LM-311	35p
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LM-319	165p
LM-324	35p
LM-334Z	115p
LM-335Z	120p
LM-337	250p
LM-339	37p
LM-348	55p
LM-358	45p
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LM-381	150p
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LM-393	55p
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LM-711	85p
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TDA-2594	300p
TDA-2595	300p
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TDA-8190	280p
TDA-8440	380p
TDA-9403	250p
TDA-9503	200p
TDA-9513	350p

LINEAR IC'S — Cont.

TEA-1002	650p
TLO-61	40p
TLO-64	80p
TLO-71	38p
TLO-72	55p
TLO-74	92p
TLO-81	40p
TLO-82	46p
TLO-83	67p
TLO-84	80p
ULN-2002	70p
ULN-2003	69p
ULN-2004	69p
ULN-2068	270p
ULN-2803	130p
ULN-2804	170p
UPC-16C	160p
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UPC-566	60p
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ZN-459	190p
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ZN-1040	640p
ZNA-134H2	150p
ZNA-234E	920p

JAPANESE TRANSISTORS

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2SA-509	120p
2SA-550	150p
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2SD-613	70p
2SD-636	30p
2SD-637	40p
2SD-638	60p
2SD-639	60p
2SD-640	350p
2SD-642	50p
2SD-655	60p
2SD-661	60p
2SD-666	70p
2SD-667	70p
2SD-668	120p
2SD-669	40p
2SD-673	350p
2SD-676	250p
2SD-716	115p
2SD-717	180p
2SD-718	100p
2SD-722	240p
2SD-725	400p
2SD-734	60p
2SD-741	120p
2SD-743	130p
2SD-756	100p
2SD-757	120p
2SD-758	140p
2SD-762	140p
2SD-763	140p
2SD-768	180p
2SD-772	200p
2SD-773	40p
2SD-774	60p
2SD-777	400p
2SD-784	650p
2SD-786	100p
2SD-787	80p
2SD-788	100p

2SD-789	80p
2SD-792	400p
2SD-794	100p
2SD-795A	140p
2SD-811	450p
2SD-819	400p
2SD-820	450p
2SD-821	550p
2SD-822	400p
2SD-826	100p
2SD-836	150p
2SD-836A	200p
2SD-837	80p
2SD-838	400p
2SD-841	160p
2SD-844	200p
2SD-845	250p
2SD-850	260p
2SD-856	80p
2SD-858	250p
2SD-863	60p
2SD-864	200p
2SD-866	120p
2SD-866A	140p
2SD-868	450p
2SD-870	400p
2SD-871	450p
2SD-879	60p
2SD-880	40p
2SD-882	80p
2SD-892A	100p
2SD-894	120p
2SD-895	200p
2SD-896	200p
2SD-900	400p
2SD-905	600p
2SD-916	130p
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2SD-921	320p
2SD-923	360p
2SD-946	120p
2SD-947	100p
2SD-950	300p
2SD-951	350p
2SD-957A	520p
2SD-958	60p
2SD-965	100p
2SD-970	170p
2SD-973	60p
2SD-973A	70p
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2SD-1459	120p
2SD-1468	60p
2SD-1496	450p
2SD-1497	450p
2SD-1505	120p
2SD-1554	500p
2SD-1555	450p
2SD-1576	450p
2SD-1577	480p
2SD-1579	120p
2SD-1591	310p
2SD-1595	160p
2SD-1604	200p

2SD-1608	210p	2SD-1941	500p
2SD-1609	100p	2SD-1984	150p
2SD-1632	500p	2SJ-49	425p
2SD-1649	260p	2SJ-50	425p
2SD-1651	270p	2SJ-77	350p
2SD-1663	450p	2SK-19	45p
2SD-1666	120p	2SK-49	50p
2SD-1667	120p	2SK-55	100p
2SD-1668	120p	2SK-68	100p
2SD-1677	300p	2SK-134	415p
2SD-1739	450p	2SK-135	415p
2SD-1783	100p	2SK-147	160p
2SD-1815	100p	2SK-192	45p
2SD-1825	120p	2SK-195	150p
2SD-1843	100p	2SK-197	140p
2SD-1846	350p	2SK-312	750p
2SD-1884	300p	2SK-323	130p
2SD-1910	280p	3SK-88	70p

BRIDGE RECTIFIERS

W005	1A/50V	16p
WO1	1A/100V	18p
WO2	1A/200V	19p
WO4	1A/400V	21p
WO6	1A/600V	23p
WO8	1A/800V	28p
BR81D	2A/100V	33p
BR82D	2A/200V	33p
BR84D	2A/400V	37p
BR86D	2A/600V	43p
BR88D	2A/800V	43p
BR32	3A/200V	43p
BR34	3A/400V	43p
BR36	3A/600V	44p
BR62	6A/200V	80p
BR64	6A/400V	72p
BR251	25A/100V	150p
BR252	25A/200V	165p
BR254	25A/400V	185p
BR256	25A/600V	200p
BR258	25A/800V	240p
BR351	35A/100V	185p
BR352	35A/200V	200p
BR354	35A/400V	225p
BR356	35A/600V	230p
BR358	35A/800V	260p
BY164	1.5A/100V	40p
BY179	1.5A/800V	40p

TRIACS

TIC206D	— 4A/400V	60p
TIC225D	— 6A/400V	69p
TIC226D	— 8A/400V	68p
TIC236D	— 12A/400V	85p
TIC246D	— 16A/400V	105p
TIC253D	— 20A/400V	190p
TIC263D	— 25A/400V	205p
T2800D	— 8A/400V	52p

THYRISTORS (SCR's)

2N.5061	— 0.8A/60V	20p
2N.5062	— 0.8A/100V	28p
2N.5064	— 0.8A/200V	29p
C106D	4A/400V	28p
TIC116C	8A/300V	59p
TIC116D	8A/400V	70p
TIC116M	8A/600V	79p
TIC126D	12A/400V	75p
TIC126M	12A/600V	90p
2N.4444		76p
BR103		37p
BR303		85p
BT106		180p
BT116		80p
BT119		100p
OT121		120p
TIC44		22p
TIC45		27p
TIC47		32p
17088		200p
17089		200p
17127		200p
15/80H		230p
15/85R		230p
SG613		1000p

UHF TUNERS

U322LO	600p
U341	500p
U342	500p

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HITACHI

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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

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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 £1.50
3V16, 3V22, 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 £1.20
FVHP722, 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
VT9700 £0.60
VT14, VT17, VT19, VT35, VT38, VT88, VT52, VT62, VT64, VT65, VT86 £1.50

ITT

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

JVC

HR3300, HR3330 £1.50
HR3360, HR3660, 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

NATIONAL

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

VTC500 £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

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STK 5337	850p	STR 5214	650p
STK 5338	500p	STR 5314	650p
STK 5339	700p	STR 20005	550p
STK 5461	850p	STR 20013	550p
STK 5462	550p	STR 30110	330p
STK 5466	850p	STR 30112	330p
STK 5467	500p	STR 30118	330p
STK 5478	650p	STR 30120	330p
STK 5479	400p	STR 30125	550p
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		Reference	
AMSTRAD			
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
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FVHP840	REEL T-UP ASSY	FI1430410400900	£6.50
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FVHP975, 990, 999, FVHP5000, 5100	IDLER	FI1430420400700	£5.20
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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			
	IDLER ASSY	PU47752	£4.50
	T-UP IDLER	PU51402A	£1.45
	T-UP CLUTCH	PU55373	£2.25
	IDLER ARM	PU55374-3-8	£2.85
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HR7700	ROLLER ASSY	PU49042A	£4.00
HR7700, HR3300, 3660, 4100, HR7200, 7600, 7650	T-UP IDLER LRG	PU47752	£4.50
HR7655, HRD110, HRD120-121, HRD225	T-UP IDLER	PU51402A	£1.45
JVC			
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

IDLERS & PULLEYS REPLACEMENTS — Cont.

		Reference	
MITSUBISHI			
HS306, 307, 318, 319, HS410, 710	GEAR ASSY	522P00201	£6.25
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, NV7800, NV333, 2000, 3000	INTERMEDIATE GEAR	VXG0017	£0.65
NV333	CAM GEAR	VXG0158	£1.00
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NV370, NV430, NV730, NV830, NV850, NV870, NVG7, NVG10, NVG12, BVG18	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,	IDLER UNIT	VXP0245	£1.20
NV8600, NV8610, NV8670	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			
	IDLER	NIDL0005GEZZ	£1.60
	IDLER	NIDL0006GEZZ	£1.50
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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PU 46414, 8904, 8922, HR3300, HR3320, HR3330, HR3360, HR3600, HR3660	DRUM 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
MITSUBISHI		
288P02801, HS300, 301, 302, 310	MOTOR REEL SPOOLING	£33.50
288P02806, HS303, 304, 320, 330, 700	MOTOR REEL SPOOLING	£31.50
288P03401, HS303, 700	MOTOR REEL TAKE-UP GEN	£21.00
NATIONAL		
MYN 135V5L, NV332, NV333, NV340, NV366	REEL MOTOR	£13.50
VEM0212, NV730/NV770	MOTOR REEL GEN	£30.00
SANYO		
4-529V-10800 (RM11), VTC5000, VTC5150	REEL MOTOR	£6.30
SHARP		
RMDTV 1008GEZZ, VC200, VC381, VC384, VC385, VC386, VC483, VC3300, VC8381, VC9100, VC9300, VC9500, VC9700	REEL MOTOR	£13.50
RMDTV 1007GEZZ, VC387, VC483, VC486, VC585	REEL MOTOR	£16.50
RMOTV 1010GEZZ, VC300, VC402, VC471, VC477, VC481, VC482, VC488, VC496, VC500, VC571, VC581, VC582, VC583, VC584, VC5F3, VC8481, VC8581	REEL MOTOR	£16.00
SONY		
BHF 1100D, SLC7	CAPSTAN MOTOR	£25.00

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FERGUSON & JVC	
3V38, 3V39, 8943, 8944, 8951, 3V35, 3V36, HRD110, HRD120, HRD121, HRD225	£24.00
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
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1-439-332-21	KV-2756, 2730EC, 2730FE, 2764EC, 2752UB, 2752F	£30.00
1-439-333-00	KV-1882EC, 1882UB, 1882F, 1882CH, 1882AEB, 1882AM, KV-1882ME3, 1882HK, 1882AS, 16TR1, 882EC(PS), 1770R	£21.50
1-439-363-21	KV-19HT1A, 19FX1MT, 18G2, 1602M7, 1602GE, ADM-16B, KV-2092UB, 2096UB	£22.00

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GHV1248	£17.01
GHV1290	£17.01
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VHS-EY2	£14.27
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Model No.	Price
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VXL-11	£16.33
VXL-20	£13.61
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Model No.	Price
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VT-9	£32.65
VT-11	£13.50
VT-14	£13.50
VT-16	£13.50
VT-17	£19.73
VT-18	£19.73
VT-19	£19.73
VT-33	£13.50
VT-34	£13.50
VT-35	£27.90
VT-38	£27.90
VT-39	£27.90
VT-52	£20.40
VT-56	£32.65
VT-57	£32.65
VT-61	£20.40
VT-62	£20.40
VT-63	£20.40
VT-64	£20.40
VT-65	£30.61
VT-100	£22.45
VT-110	£22.45
VT-111	£22.45
VT-112	£22.45
VT-113	£22.45
VT-115	£22.45
VT-118	£22.45
VT-120	£22.45
VT-128	£22.45
VT-130	£25.85
VT-135	£25.85
VT-138	£25.85
VT-145	£25.85
VT-150	£37.50
VT-220	£22.45
VT-225	£22.45
VT-250	£25.85
VT-255	£25.85
VT-258	£25.85
VT-330	£13.50
VT-340	£13.50
VT-400	£22.45
VT-405	£22.45
VT-410	£22.45
VT-413	£22.45
VT-414	£22.45
VT-415	£22.45
VT-418	£22.45
VT-420	£25.85
VT-425	£25.85
VT-426	£25.85
VT-428	£25.85
VT-430	£25.85
VT-431	£25.85
VT-435	£25.85
VT-438	£25.85
VT-450	£P.O.A
VT-498	£P.O.A
VT-510	£P.O.A
VT-518	£P.O.A
VT-520	£P.O.A
VT-525	£P.O.A
VT-526	£P.O.A
VT-530	£P.O.A
VT-535	£P.O.A
VT-536	£P.O.A
VT-540	£P.O.A
VT-545	£P.O.A
VT-546	£P.O.A
VT-548	£P.O.A
VT-570	£P.O.A
VT-575	£P.O.A
VT-576	£P.O.A
VT-580	£P.O.A
VT-585	£P.O.A
VT-588	£P.O.A
VT-640	£P.O.A
VT-680	£13.50
VT-740	£P.O.A
VT-5000	£15.79
VT-6500	£13.50
VT-6800	£13.50
VT-7000	£13.50
VT-8000	£13.50
VT-8500	£13.50
VT-9300	£13.50
VT-9500	£13.50
VT-9700	£13.50
VT-9900	£13.50
VTL-80	£P.O.A
VT-M620	£P.O.A
VT-M625	£P.O.A
VT-M626	£P.O.A
VT-M630	£P.O.A
VT-M635	£P.O.A
VT-M636	£P.O.A
VT-M640	£P.O.A
VT-M645	£P.O.A

HITACHI Cont.
Model No.	Price
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VT-580	£P.O.A
VT-585	£P.O.A

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Model No.	Price
VR-3605	£6.50
VP-3826	£16.32
VR-3833	£6.50
VR-3905	£6.50
VR-3906	£16.32
VR-3907	£17.68
VR-3908	£17.68
VR-3912	£6.50
VR-3913	£6.50
VR-3914	£6.50
VR-3916	£16.32
VR-3917	£17.01
VR-3918	£18.35
VR-3919	£18.35
VR-3926	£16.32
VR-3927	£25.85
VR-3935	£6.50
VR-3938	£18.35
VR-3946	£16.32
VR-3948	£16.32
VR-3954	£6.50
VR-3963	£6.50
VR-3976	£19.05
VR-3937	£27.21
VR-3985	£6.50
VR-3986	£16.32
VR-3993	£6.50
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VR-3995	£31.96
VR-3997	£31.96
VR-6948	£16.32
VRP-3833	£6.50

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Model No.	Price
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HR-2650	£7.20
HR-3300	£6.50
HR-3330	£6.50
HR-3360	£6.50
HR-3600	£6.50
HR-3660	£6.50
HR-3750	£6.50
HR-7200	£7.20
HR-7300	£7.20
HR-7350	£7.20
HR-7600	£6.50
HR-7610	£6.50
HR-7650	£6.50
HR-7655	£19.05
HR-7700	£6.50
HRD-110	£6.50
HRD-111	£6.50
HRD-120	£6.50
HRD-121	£6.50
HRD-140	£16.32
HRD-141	£16.32
HRD-143	£16.32
HRD-150	£16.32
HRD-157	£16.32
HRD-158	£16.32
HRD-160	£16.32
HRD-170	£17.68
HRD-171	£17.68
HRD-180	£25.85
HRD-210	£17.68
HRD-211	£17.68
HRD-220	£6.50
HRD-225	£6.50
HRD-230	£25.85
HRD-250	£27.21
HRD-370	£27.21
HRD-400	£P.O.A
HRD-430	£27.21
HRD-455	£19.05
HRD-470	£27.21
HRD-510	£16.32
HRD-530	£P.O.A
HRD-560	£19.05
HRD-566	£19.05
HRD-725	£31.96
HRD-755	£31.96
HRP-50	£16.32
HRS-10	£16.32
HRS-100	£6.50

LOEWE
Model No.	Price
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OC-420M	£22.45
OC-440S	£22.45
OC-460	£22.45
OC-50M	£13.50
OC-55M	£13.50
OC-60M	£13.50
OC-65M	£13.50

LOGIC
Model No.	Price
VR-950	£17.68
VR-960	£14.97
VR-960A	£14.97

MATSUI
Model No.	Price
VX-500E	£13.61
VX-600A	£13.61
VX-730	£14.97
VX-735	£14.97
VX-735A	£17.01
VX-755	£14.97
VX-755A	£17.01
VX-765	£17.01
VX-770B	£13.61
VX-773B	£13.61
VX-800A	£13.61
VX-810A	£13.61
VX-820	£13.61
VX-850	£17.01
VX-880A	£13.61

MITSUBISHI
Model No.	Price
HS-200	£6.50
HS-300	£25.85
HS-301	£25.85
HS-302	£25.85
HS-303	£21.09
HS-304	£21.09
HS-306	£24.45
HS-307	£T.B.A
HS-310	£25.85
HS-318	£24.45
HS-319	£T.B.A.
HS-320	£21.09
HS-330	£T.B.A.
HS-337	£T.B.A.
HS-338	£T.B.A.
HS-347	£T.B.A.
HS-349	£T.B.A.
HS-400	£T.B.A.
HS-411	£T.B.A.
HS-412	£T.B.A
HS-421	£T.B.A.
HS-700	£T.B.A.
HS-710	£T.B.A.

NEC
Model No.	Price
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N-9012	£20.40
N-9013	£20.40
N-9014	£20.40
N-9015	£20.40
N-9016	£20.40
N-9033	£20.40
N-9034	£20.40
N-9053	£20.40
N-9054	£20.40
N-9055	£20.40
N-9066	£20.40
N-901A	£20.40
N-902A	£20.40
N-906A	£20.40
N-911A	£27.21
N-915A	£27.21
N-917	£27.21

ORION
Model No.	Price
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VC-180	£13.61
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VH-1000	£13.61
VH-1204	£13.61
VH-1440	£13.61
VH-1500	£13.61
VH-1660	£13.61
VH-1800	£13.61
VH-2A	£6.50
VH-200	£13.61
VH-2007	£13.61
VH-205	£13.61
VH-212	£13.61
VH-2500	£13.61
VH-254	£13.61
VH-2600	£13.61
VH-2700	£13.61
VH-288	£13.61
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VH-300F	£13.61
VH-303	£13.61
VH-3030	£13.61
VH-3050	£13.61
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VH-312	£13.61
VH-33	£13.61
VH-3312	£13.61
VH-400	£13.61
VH-4010	£13.61
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VH-404	£13.61
VH-412	£13.61
VH-5010	£13.61
VH-5015	£13.61
VH-512	£13.61
VH-530	£13.61
VH-535	£13.61
VH-555	£13.61
VH-600	£13.61
VH-630	£13.61
VH-635	£13.61
VH-640	£13.61
VH-666	£13.61
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VH-7008	£T.B.A.
VH-704	£13.61
VH-708	£13.61
VH-712	£13.61
VH-730	£13.61
VH-744	£13.61
VH-770	£13.61
VH-774	£13.61
VH-780	£13.61
VH-790	£13.61
VH-800	£13.61
VH-820	£13.61
VH-844	£13.61
VH-888	£13.61
VH-893	£13.61
VH-900	£13.61
VH-974	£13.61
VH-F2	£13.61
VP-200	£13.61
VP-2948	£13.61
VP-2949	£13.61
VP-2966	£13.61
VP-821	£13.61

PANASONIC
Model No.	Price
AG-6800	£23.13
AG-6810	£23.13
AG-6	£23.13
NV-100	£8.64
NV-180	£25.85
NV-200	£8.64
NV-220	£40.09

PANASONIC
Model No.	Price
NV-230	£14.27
NV-250	£17.01
NV-260	£14.27
NV-280	£17.01
NV-300	£6.50
NV-333	£6.50
NV-340	£6.50
NV-366	£19.06
NV-370	£8.64
NV-430	£14.27
NV-450	£17.01
NV-460	£17.01
NV-465	£17.01
NV-600	£T.B.A.
NV-630	£30.61
NV-650	£T.B.A.
NV-688	£34.10
NV-730	£19.06
NV-770	£19.06
NV-777	£17.01
NV-780	£30.61
NV-788	£43.56
NV-810	£35.38
NV-830	£35.38
NV-850	£58.65
NV-870	£37.42
NV-890	£37.42
NV-950	£58.65
NV-970	£37.42
NV-2000	£6.50
NV-2010	£6.50
NV-3000	£6.50
NV-7000	£6.50
NV-7200	£6.50
NV-7800	£6.50
NV-8400	£6.50
NV-8600	£6.50
NV-8610	£6.50
NV-8620	£6.50
NV-D48	£25.85
NV-D80	£T.B.A.
NV-F70	£T.B.A.
NV-FS1	£T.B.A.
NV-FS100	£T.B.A.
NV-G10	£17.01
NV-G11	£17.01
NV-G12	£17.01
NV-G14	£17.01
NV-G15	£17.01
NV-G16	£17.01
NV-G18	£25.85
NV-G19	£T.B.A.
NV-G20	£25.85
NV-G21	£25.85
NV-G22	£25.85
NV-G25	£25.85
NV-G28	£25.85
NV-G30	£20.62
NV-G31	£20.62
NV-G33	£40.09
NV-G40	£25.20
NV-G45	£25.85
NV-G46	£25.85
NV-G50	£25.85
NV-G7	£14.27
NV-G9	£14.27
NV-H65	£35.38
NV-H70	£37.42
NV-H75	£T.B.A.
NV-H77	£T.B.A.
NV-L20	£25.20
NV-L25	£T.B.A.
NV-L28	£T.B.A.
NV-M1	£41.07
NV-M3	£41.07
NV-M5	£41.07
NV-M7	£47.28
NV-MC10	£T.B.A.
NV-MC30	£T.B.A.
NV-MC5	£T.B.A.
NV-MC6	£T.B.A.
NV-MS1	£T.B.A.
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PHILIPS
Model No.	Price
VR-6420	£8.64
VR-6440	£58.65
VR-6441	£32.17
VR-6460	£8.64
VR-6540	£32.17
VR-6541	£14.27
VR-6640	£14.27
VR-6642	£14.27
VR-6920	£58.65

SAISHO
Model No.	Price
VR-100	£13.61
VR-605	£13.61
VR-705	£13.61
VR-805S	£13.61
VR-905S	£13.61
VH-1200HQ	£13.61
VH-1600	£13.61
VR-1000	£13.61
VR-1100	£13.61
VR-1200	£13.61
VR-1600	£13.61
VR-3200	£14.97
VR-3300	£14.97
VR-3500	£14.97
VR-3600	£14.97
VR-3650	£17.01
VR-3800	£13.61

SALORA
Model No.	Price
SV-6500	£17.01
SV-6600	£17.01
SV-6600IR	£17.01
SV-6700	£18.35
SV-7300	£21.09
SV-7400	£24.45
SV-8100	£13.50
SV-8200	£21.09
SV-8300	£21.09
SV-8400	£24.45
SV-8710	£18.35

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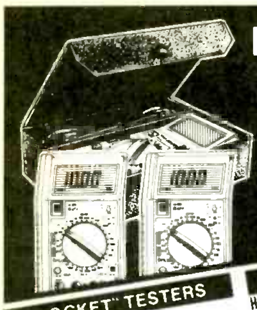

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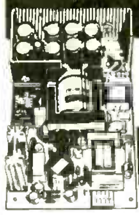

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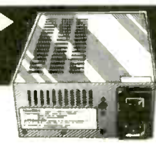

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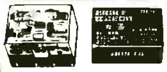

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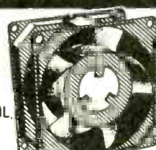

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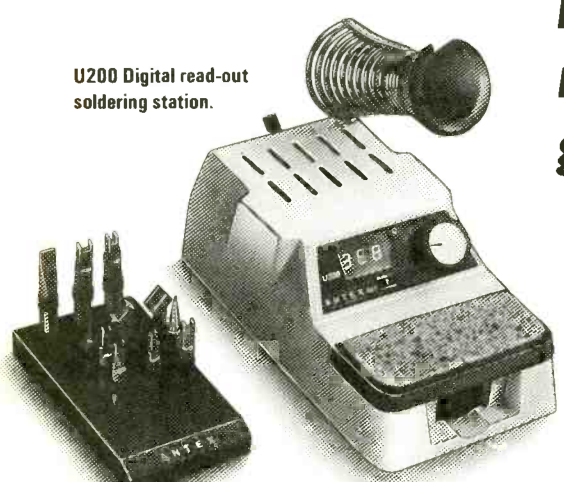

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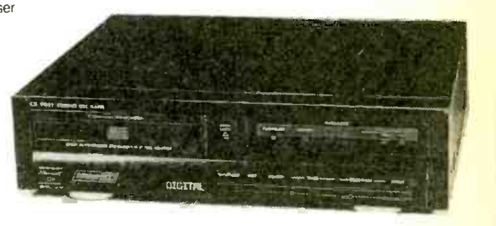

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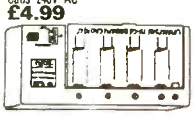

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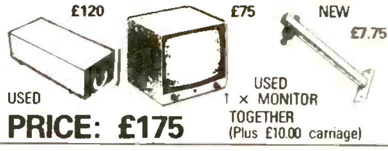

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TELEVISION

How it all began and almost ended

History is not an easy subject to study or to write. With early history there's the problem of little evidence being available, so that a great deal of interpretative guesswork is necessary. Who did what and when, and more interestingly why? There's great scope for debate on the latter score. When it comes to more recent times the problem is the opposite – too much information. The easier it becomes to record events and store data, the more there is to hand. Pity the poor historian dealing with recent affairs, awash in a vast ocean of information that has to be digested, assessed and its significance considered before the job of trying to make sense of the course of events is started. It is in this light that one has to admire the achievement of Keith Geddes and Gordon Bussey in producing *The Setmakers*, just published by BREMA (The British Radio and Electronic Equipment Manufacturers' Association). It sets out clearly, authoritatively and very readably the story of the UK's setmakers from the earliest days right up to the present – events in 1990 are included. It's not only readable, it's a visual feast, with lavish use of both colour and monochrome photographs to illustrate the sets themselves, the advertising campaigns, the personalities, the plants and the high street shops of the various periods.

It would have been so easy to have made this a rather dull record of events, just piling on the facts as the history unfolds and listing the all too numerous successes and failures. Somehow, the authors have contrived to present the history with considerable flair. Anyone who has been involved with the industry will find it a riveting tale.

It starts right at the beginning, with crystal sets, the indifference of the authorities to the possibilities of broadcasting, home construction and the primitive, very small-scale production of the early Twenties. Since the initial stirrings in around 1922 there have been two distinct periods, the radio era which lasted for four decades up to the early Fifties and the TV era that succeeded it. This is a perhaps slightly inaccurate way of looking at it. Radio continues to be an important medium, while TV's antecedents go back to the Twenties when, amongst other things, Baird demonstrated mechanical television and Zworykin invented the electronic camera tube. But from the viewpoint of the public's nightly home entertainment, it was radio till the early Fifties then, quite rapidly as a result of the Coronation, the coming of ITV and better, more reliable sets, there came the decisive switch to TV.

The authors of *The Setmakers* give us the facts of the UK's radio and television industry as it developed. It's a story that's strong in personalities. This was perhaps inevitable when you consider the risks that had to be taken. The early days have a particular fascination, and I was surprised to discover the important role that Plessey played from a very early date, including of course the manufacture of Baird's televisors. It was the only major firm that decided to remain as a production subcontractor, never marketing its own products in the domestic electronics market. The firm's position was a decidedly awkward one, with production varying, we are told, from 5,000 sets in one week to hardly any in the following week during the Fifties when, at one time, it was producing sets that were sold under seventeen different brand names. One was the Co-op's Defiant brand, and the origin of this rather unusual name was something new to me. It seems that in the early Thirties the Radio Manufacturers' Association and the British Radio Valve Manufacturers' Association felt that the Co-op should not be supplied with sets because the famous divi was regarded as a form of price cutting. Plessey accepted an order and Ediswan supplied the valves: the Co-op thumbed its nose at the RMA/BVA by selling the sets under the Defiant name.

That's just one snippet to add to the interest. Everything of importance seems to be in the book, including the full story of EMI and the development of high-definition television. The book contains many fascinating revelations, but the story becomes rather sombre as we get closer to the present time. It seems that in the Fifties and Sixties the industry was something of a shambles. It never got its act together, and by the time that the big Japanese manufacturers decided to take an interest in the UK's TV market in the Seventies, when our unique 405-line system was on its way out, it was in an appallingly weak condition. The sagas of Rank-Toshiba and GEC-Hitachi are recorded in full. By 1984, when Toshiba Consumer Products had taken over the plant, the percentage of products not right off the line had fallen from 40 per cent to seven per cent and output per person per year had increased from 93 receivers to 250. The best output achieved by the joint GEC-Hitachi plant at Hirwaun was in 1981 when 1,750 TV sets were produced in a day by a staff of 2,200. By 1986 when Hitachi was running the plant on its own daily production was running at 2,400 TV sets, 500 hi-fi units and 500 VCRs, with 1,000 employees. In 1979 an international study that had been commissioned by the National Economic Development Office found that the direct labour cost of a set made in the UK was almost double that of one made in Japan despite the Japanese hourly rate of pay being 72 per cent higher: a Japanese set took 1.9 man-hours to make while a British one took 6.1 man-hours. Automatic component insertion was 65 per cent in Japanese plants, 15 per cent in UK factories. And of course the quality of the components used by the Japanese manufacturers was far higher. The writing was on the wall and everyone knew it.

And so, today, BREMA's members are largely Japanese. We can't complain. As some figures given in Teletopics (page 338) show, they have saved TV manufacture in the UK and made a considerable success of it.

The Setmakers is a fascinating book and, with its 464 pages and almost 500 photographs, is excellent value at £12·45 plus £2·50 post and packing. It can be obtained from BREMA at Landseer House, 19 Charing Cross Road, London WC2H 0ES.

EDITOR
John A. Reddihough

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COVER PHOTO
This month's cover photograph shows the Panasonic U5 chassis (Model TC2253A). See servicing article on pages 336-7.

CORRECTIONS
In the article on Toshiba VCRs last month, under Model V93B, the circuit protector should have been identified as ZL62, not 2L62 (bottom of page 261). The acknowledgement at the end of the Test Report on page 258 should have been to Ahmed Parekh (not Patel).

Service Briefs – Ferguson

The following information originally appeared in *Ferguson Feedback*. It has been collated under chassis numbers for ease of reference. The F chassis are used in NordMende models.

VCRs

Erratic audio erase and record: Lazy full erase/audio bias oscillator – applies to Models 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57, 3V58, 3V59, 3V64E, 3V65, FV10B, FV11R, FV12L, FV13T and FV14T. To cure, add a mylar capacitor between pin 2 of the oscillator transformer and the base of the oscillator transistor – value 5.6nF for models up to 3V57, 8.2nF in the case of the 3V58 and later models.

TX9 Chassis

Insufficient height: Field scan current sensing resistor R287 (1.2Ω) had increased in value by over 40 per cent. Applies to all versions.

High h.t.: The 115V rail was at 135V and couldn't be reduced by adjusting RV171. C147 (470μF) had drastically fallen in value. Could be misleading as C147 is in the 18V supply. Applies to the PC1044 version with chopper power supply.

TX10 Chassis

Intermittent tripping and line squegging: Set would trip from cold start; line squegging would begin at bottom of screen and roll upwards; the chopper transistor's heatsink was at a higher than normal temperature. R704 (27Ω, 1W) associated with the chopper transistor had risen in value to 150kΩ.

Rapid destruction of BU208A line output transistor: Caused by arcing between solder spills on the line scan yoke tagboard.

TX85 Chassis

Line output transistor failure: R61 in power supply error-sensing circuit dry-jointed.

Chopper transistor failure: R101 in snubber network open-circuit.

Repeated failure of efficiency diode D19: Use only specified device.

TX90 Chassis

Heavy line striations and low contrast: C195 (0.1μF), which provides beam-limiter decoupling, open-circuit.

Field collapse: R187 (6.2kΩ) in the upper field transistor's base bias network open-circuit.

TX100 Chassis

Field collapse: The MC7812CT 12V regulator IC8 had failed, giving an output of only 6V (the TDA2578A timebase generator chip takes its supply from the 12V line).

Stuck in standby: BC237B relay driver transistor TR9 faulty.

Random failure of line output transistor TR10: Replace line hold control RV9 – its wiper contact deteriorates with age. Fault sometimes occurs when the set is knocked or tapped in operation.

Intermittent loss of remote control function (panel PC1223): Replace ceramic resonator CR241 (500kHz).

F11B/ICC3 Chassis

Repeated failure of BU806 chopper transistor TP01: Replace set h.t. control PP01 with improved D-shape type. Older rectangular type goes intermittent, causing excessive h.t. voltage (U1 line 145V).

F15-01 Chassis

Excessive afterglow spot at switch-off: Increase value of CV82 on c.r.t. base board from 47μF to 100μF (250V).

F16/17 Chassis

Picture impurity: Demagnetise the c.r.t. in an east-west direction with an external degaussing coil.

ICC5/F15 Chassis

Line collapse to 2in.: Diode DL41 in EW modulator circuit open-circuit (large-screen models).

Standby LED flashing in standby mode: ROW1 and ROW2 lines shorted by a sliver of solder at connector BB02 on panel PC1256 (Model 51K7).

No field scan when switched on from cold: Field output thyristor DL21 may not operate. Reduce value of resistor RL21 to 180Ω and ensure that zener diode DP45 is a 9.1V type (not 8.2V).

Blank screen (no field scan) and smell of overheating: Field output thyristor DL21 and its parallel diode DL22 leaky.

Field collapse: RF01 (3MΩ) associated with the ramp generator in the TEA2029A chip IL14 high in value.

Picture visible in 1in. strip at left-hand side of screen, rest blanked: Replace the SAA5243 chip IV02 on the teletext panel.

No text or on-screen graphics: Zener diode DV03 (4.3V) in 5V regulator circuit on teletext panel leaky. The same fault can be caused by damage to CV05 (15pF) due to the end of the teletext panel's plastic retaining strut. The solution in this case is to refit CV05 and ensure that the end of the retainer is clear of it.

Failure to start up: Standby LED flashed at about 1Hz when the set was switched on at the mains. Cause was a dry-joint on RR30.

Random clicks with Nicam sound: Due to static build up on loudspeakers. Earth the grilles to the earthy loudspeaker tag connection.

Popping noise at switch-on (Nicam models): Add a 47kΩ, 0.5W resistor between pins 13 and 16 of IS08 (ADC2300) on Nicam panel PC1253.

P. V. TUBES

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Letters

SURVIVAL

While I sympathise with your many readers who are having difficulty finding employment, especially as I could well be joining them, it's hardly surprising given what has happened to the TV servicing industry in recent years.

Ten years ago I had a thriving TV business with two employees, three vans on the road and a telephone that rang incessantly. Now there's just me, with some part time help from my aerial rigger. I don't sell new sets because the profit margin doesn't make it worthwhile any more. My rental business has halved. It's only because of a drastic cost-cutting exercise and the fact that I've been established here for twenty years that I've survived at all. Several TV firms have started up in the area in recent years, but most have fallen by the wayside. There just isn't enough business to go round.

In the Fifties and Sixties the average TV set went wrong about twice a year. Thus if you sold a set you had, once it was out of guarantee, an assured income for the life of the set. If you sell a new set now you may not see the customer again for five years, if ever. At one time I knew all my customers personally, what sets they had and what the last fault was. Now I can't remember where some of them live.

The rot seemed to set in when a large proportion of the earlier valved sets had been replaced with the generally much more reliable solid-state types. One of the first sets of this type I came across was a GEC C2110. I had a call from a new customer who owned one. After repairs it didn't go wrong for about four years. I still think that it was one of the best chassis ever made for reliability and ease of servicing. Many are still in use.

The much improved reliability meant that you no longer had to have a service department in order to sell TV sets. Thus all and sundry could sell them over the counter, resulting in ridiculously low prices. As was once mentioned in *Television,* in 1967 a colour TV set was the same price as a Mini van. Work that out now.

Fortunately work is at present steady though slow. If I do have to give up, I'm afraid that I will not be looking for a job in the TV trade.

Peter Nutkins, G0HET,
Charmouth, Dorset.

Alastair J. Downes (Letters, February) has my sympathy regarding large-company recruitment policy. After ten successful and rewarding years as a TV/video engineer I decided to make a break and took a job with a large American semiconductor manufacturer who shall be nameless. During my time there I discovered that they do indeed hire a lot: I mean loads of duffers. The problem is that the personnel departments in such companies have the final say as to who is to be hired.

It seems that it doesn't matter how good an engineer you are. What's important is how well you adjust to their strange policies and whether you appear to be a trendy young graduate who wants to get to the top fast. When it came to pay review time my engineering abilities didn't count one bit. What did matter was how many useless paper projects one had done and who you kept in with. I'm now back in the trade, and took a substantial drop in income. But it was worth it to get away from the huge rat-race – psychometric tests, bimbos and all.

With the technology developing at the present rate it seems to me that very soon only the small dealers with a true base in servicing skills will be able to reap the rewards available, as it will be they who can meet the demands that camcorders, DAT, CD players and so on are bringing with them. Large organisations will be caught out because they impose unrealistic output quotas and provide their engineers with minimal training. I'm positive that Mr Downes' experience will get him a job soon, as many companies are now beginning to understand that they will go out of business unless they invest in people who can do the job.

James Corrigan,
Coatbridge, Lanarkshire.

PLASTIC CABINET SYNDROME

A recent letter about poor quality TV sound seemed to put the blame on the broadcasters. This may be partially true, but a good proportion of the blame lies with the setmakers. On numerous occasions now we've had call-outs to faults reported as distorted sound, speaker rattling or sound buzzing. They've all boiled down to the same thing, the dreaded "plastic TV cabinet syndrome". The cabinets resonate with Nicholas Witchell's voice, amongst others. This problem was bad enough with portables but we are now getting it with 21 and 24in. sets, simply because manufacturers are trying to make sets as cheaply as possible.

At least with a portable the set is usually a second, less expensive one, so the customer doesn't get too irate. But when the problem occurs with the household's main set the poor service engineer gets a right ear bashing. Just how do you tell a customer that the problem is caused by his new £400 21in. Fastext set having, to put it mildly, an inferior cabinet, and that there's nothing anyone can do about it? Here's one tip though. I've found that by using draught excluder foam to cushion the speaker you've a 25 per cent chance of alleviating the problem. But not only is this remedy not good enough, it shouldn't be necessary. I haven't any other suggestions to offer but if a service engineer or TLO from one of the major setmakers by chance reads this maybe he could enquire of the gods themselves and see if they can provide a solution.

Steve Cannon, H. Garlick Ltd.,
Barnoldswick, Lancs.

VIDEO AMPLIFIER DESIGN

I am writing in reply to M. Priestley's letter (February) concerning my satellite TV video amplifier/filter circuit. First, the input connections (pins 1 and 14) for the NE592 chip were correct as given in my article. Secondly the preceding stage in the Amstrad i.f. amplifier block in my receiver is an emitter-follower: the bias arrangement within the i.f. module results in approximately 6V being developed across R1, which is the emitter load. Thus the necessary bias for pins 1 and 14 of the NE592 chip is provided.

I didn't state the amplifier's output impedance in my article, but in view of the value given for the output coupling capacitors C5/6 it should be apparent that to obtain a -3dB point at less than 25Hz the impedance of the following stage needs to be greater than 6·3kΩ. As mentioned in the article I use an emitter-follower as a buffer after the amplifier.

When I developed the circuit the MAX450 chip was not generally available from the usual suppliers. The NE592 is cheap and readily obtainable. As for stability, it will even work quite well when breadboarded. Another device worth looking at is the EL2020/2030 from Elantec. It's capable of driving 75Ω loads, is cheap and is readily available (RS658-621 and RS658-637). While tantalum capacitors are good for decoupling, modern miniature electrolytics perform equally well and are considerably cheaper.

A single 12V supply was chosen for simplicity and convenience. The circuit was to some extent built around the filter, which has a characteristic impedance of 75Ω. This was convenient in view of the original application described in the article.

For anyone who found the original article misleading I'd like to add the following notes.

(1) R1 serves as the emitter load for the preceding stage. The quiescent current through R1 should be about 60mA. For some applications this may be excessive, so the values of R1 and R2 may need to be altered. Remember to take into account the filter's 75Ω input impedance and the output impedance of the preceding stage.

(2) The following stage should ideally have an input impedance of around 6kΩ. An emitter-follower makes a useful buffer when driving a low impedance, and is relatively easy to combine with a black-level clamp.

C.W. Murray,
Aldershot, Hants.

Editorial note: The editor was responsible for the suggestion that the input pin connections in the original circuit were incorrect, and apologises. Mr. Priestley had enclosed with his letter a circuit from a Signetics data book. It showed the input connections incorrectly and by the time this was spotted we'd gone to press.

SERVICING HIGH-TECH PRODUCTS

I'm not sure quite how to reply to the letter from C. Deus in the January issue as my original comments, to which he refers, were printed in another publication.

At present, most TV faults continue to be repetitive. Even with different chassis the symptoms, diagnosis and repair are frequently the same. After all, the design of many of the components used in TV sets (triplers, decoupling capacitors, line output transformers, etc.) has changed little in the past twenty years. Thus experience tends to count more than diagnostic skill and fault notes describing other people's experiences are valuable. But TV sets will change, and faults will become more random and obscure, as higher technology is introduced. This will call for a different approach to diagnosis.

I'm sorry to have to say that for many of you the writing is on the wall. Instant answers will not be available from either manufacturers or data bases, nor is it likely that my operation or at least twenty others (questioned in a poll of Grundig and JVC service centres) will sell information in any way other than by carrying out the actual repair. It will not be possible to rely on consultancies or data bases to provide an accurate answer when a problem requires that detailed tests are made.

The general TV/video repairer will continue to be able to carry out some servicing but will not be able to handle the high-technology domestic products. He may however have someone to turn to locally to undertake repairs when the fault is obscure or requires the use of expensive test equipment. Replacement PCBs don't necessarily provide an answer: with VCRs and camcorders for example a new PCB, even if available, may require careful alignment.

A problem with the new high-technology, mass-produced equipment is that the only defective units that get out of the factory are those that were not faulty when they were tested. Thus problems with new under-guarantee units tend to involve very obscure intermittent faults. Conventional diagnostic procedures are not likely to be effective in this situation. Only in this sort of case is it reasonable to demand from the manufacturer a replacement PCB to restore reliable operation.

Once the equipment is out of guarantee faults of this sort are less likely, unless there has been impact/shock damage. The sort of random component failure faults I spend so much time struggling with probably don't occur once the guarantee has expired.

What it boils down to is that the suggested consultancies would be independent regional service centres with at least equal experience of the product to that of the manufacturers. Such service specialists will back up general service people like C. Deus by undertaking repairs, not by selling experience or giving it away. Without actually doing the specialised repair no experience is gained.

What we do need is a cost-effective, reliable carrier service to transport the repairs around the specialist centres.

Steve Beeching, T.Eng., AMIEIE,
Newark, Notts.

VCRs TOO COMPLEX

I wonder whether other small dealers, or large ones for that matter, have the same problem that I have when selling new VCRs? About seven out of ten of my customers seem to be unable to cope with the high-tech facilities incorporated in the latest machines. As a result I have a backlog of orders from customers waiting for ex-rental machines such as the Sharp VC381 etc. to come in for resale. If only one manufacturer were to bring out a new basic model I'm sure he would capture a large part of the video market.

J.K. Potts,
Stockport, Cheshire.

THE BUSH DAC90

It's refreshing to read about the simpler things of life, like vintage radio receivers. I never thought I'd ever again see a Bush DAC90, but sure enough a customer brought one in the other day. Apparently he'd seen one for sale at £87 and felt he would like to spend a few bob on getting his own set working properly as "it kept going bang". It had died completely by the time I got it. The problem of course was arcing in the mains filter capacitor.

Having now had the opportunity to work on one of these sets I feel that I must take issue with Chas Miller concerning a.g.c. capacitor checks by measuring the current at the earthy end. The a.g.c. capacitors in my customer's set had leakages of 500kΩ and 200kΩ respectively. Nothing to worry about you might think, but theory tells us that leakages of this magnitude will damp the i.f. tuned circuit, reducing the gain and impairing the a.g.c. action.

I was not able to measure the overall gain but found that after replacing the offending capacitors the a.g.c. action, checked by monitoring the UF42's bias, was measurably improved. I'm inclined to favour Geoff Davies' approach, as evidenced by my denuded stock of tubular capacitors.
E.G. Kempshall,
Hove, East Sussex.

HELP WANTED

Can anyone supply a Sony SLC6 service manual? Could exchange for a C7 manual.
R. Barker, 17 Chapel Lane, Upwey,
Weymouth, Dorset DT3 5NA.

Can anyone help us to obtain a SECAM transcoder panel or circuit diagram supplement for an ITT Digivision TV set, chassis DIGI 3 (110°, PIP, Model ST38767 – 5430 07 10)?
Newall and Roberts, Marley Cottage, Bryn Celyn, Greenfield, Clwyd CH8 7QF.
Telephone 0352 710 928.

Can anyone supply an Orega 3165 line output transformer as used in the *Television* colour receiver project with thyristor line output stage? One from a scrapped set would do if necessary.
M.C. Matthews, B.Sc., Shirley Stables,
5a West Walks, Dorchester, Dorset DT1 1RE.
Telephone: 0305 264 464.

Can anyone supply an inverter transformer for a Nombrex CR bridge, any model? Also the complete front loader or parts of an Hitachi cassette recorder Model D850.
M. Edwards, 22 Channings, Kingsway,
Hove, East Sussex BN3 4FT.
Telephone 0273 737 838.

Can anyone supply a new tube for a Tektronix 60MHz dual-beam scope, Model 2213? The Tektronix part no. is 154-0838-00/T4652-31-2. Alternatively perhaps a new home can be found for it. It comes with service manual.
Russell J. Fletcher, 1 Jethan Drive,
West Park, Camborne.
Telephone 0209 715 751.

A while back I had great difficulty trying to obtain the main smoothing block electrolytics for the Thorn 1400 chassis. I can now supply a few of these new, at a very reasonable price, to anyone who wants them. I also have sealed e.h.t. trays for the Thorn 950 Mk. 1 chassis.

Can anyone identify mystery Thorn jelly-pot line output transformer type T0604-005, marked TXB8, with pins J and G missing (spare pins supplied separately). It's not from the 1400/1500/3000/3500 chassis. Also sound or field transformer 106D3006 TXB6-3673.
R. Bailey, 51 Robin Gardens, Waterlooville,
Portsmouth, Hants. PO8 9XF.

Can anyone supply a mains transformer for a Gould Model OS253 12MHz scope? Also a line output transformer for a Toshiba portable, Model 12SE or B1202.
Tim O'Brien, Claureen Drive,
Ennis, Co. Clare, Ireland.
Telephone 065 28 512.

Can anyone supply a mains transformer for a 15MHz Solartron dual-beam scope, Model CX1443, Nato no. Z4-6255-99-105-4679? The transformer is labelled Parmeco F.M.A. Mk. II. Or does anyone know of a company that could rewind it?
A. Rogers, 2 Moreton Road, Owermoigne,
Dorchester, Dorset DT2 8HT.
Telephone 0305 852 751.

ENGINEERS' RESPONSIBILITY?

It's the engineer's responsibility to check that a repaired piece of equipment is safe before it is returned to the customer. I pay particular attention to the 13A plugtop, as well over fifty per cent are damaged, poorly wired or have an incorrectly rated fuse. But I have a query. If I've repaired a piece of equipment with a 13A plugtop that's in good condition and correctly wired but doesn't have insulated terminals, is it necessary to replace this? Any comments would be appreciated.
M.J. Bennett,
Romford, Essex.

SPARE PRICE QUOTES

As someone who is self-employed in the TV trade I'm constantly surprised by some of the spare price quotes I'm given. On one occasion I required a new video head drum for a Saisho VR3300. Once I'd found the Dixons spares department I was quoted a price of over £100. After recovering from the shock I did a bit of shopping around and contacted Omega Electronics. They were very helpful and supplied me with a drum for about £21. A bit better than £100! This made the job feasible: my price for replacing non-hifi video heads is on average £60, which includes a service.

Mastercare would probably comment that they supply only original parts, but at the end of the day the customer is the one who has to pay the huge bills. As long as he gets his VCR back in full working order with a smashing picture and a bill that won't give him cardiac arrest I'm happy. The conclusion is that before you order ridiculously priced parts, phone around. You'll keep your bank manager happy and your customers will come back with more work.
C. Barker,
Stoke-on-Trent, Staffs.

TV/VCR EQUIVALENTS

Does anyone have a list of Ferguson/Baird/DER/Multibroadcast etc. equivalents for TV sets and VCRs? Or for other brands/manufacturers for that matter. This would be extremely helpful in view of the thousands of ex-rental CTVs and VCRs around. Come on lads, one of you at least must have a list that would help!
Bernard Hunt,
Bromyard, Herefordshire.

Editorial note: Well does anyone? We've some lists but they are by no means complete. Any information welcome and anything published will be paid for.

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Servicing the Panasonic U5 Chassis

Nick Beer

The Panasonic U5 chassis was successor to the U4, which we dealt with in the August 1990 issue of *Television*. It's very similar to the U4, the only major differences relating to the microcomputer-based control panel M. This can only be an improvement. There are different versions of the U5 chassis depending on the tube size and the facilities incorporated, i.e. some sets have a teletext panel and an audio/video input/output panel. Models in the U5 series include the TC1651, TC1752, TX-C22, TC2051, TC2061, TC2110, TX2112, TC2253, TC2253A, TC2263, TX2450, TC2461, TX2656 and TX5500. Reliability is extremely good, so U5s are not frequent visitors to the workshop.

As with successive Panasonic designs, new features came along with the U5. FS tubes were first seen with U5s, and something else that was new was computer-controlled teletext (CCT) with added features such as store, list and initial. It's interesting that many models lacked a normalising feature. This was greatly missed by engineers and customers alike. It's a fact that sales were actually lost because of this. Where a CS button is present you can tune directly by using the handset to select the channel (21-68) then storing at the set. This is a major time-saver when a set is installed.

Microcomputer Circuits

Teletext reliability has been excellent and the microcomputer circuits have caused very few problems. In comparison with the rather complex circuitry used in the U4 chassis the control board M is much simplified. The microcomputer chip used is an MAB8440P or MAB8441P with suffix to denote the exact control arrangements. It operates in conjunction with a PCD8532P memory chip, a tiny eight-legged device that's been the cause of the few memory loss problems we've experienced.

When odd intermittent faults are present, such as intermittent muting or loss of sync with the on-screen channel display, check for tarnished plug and socket contacts on the microcomputer board M and associated boards as relevant.

Tubes

We've had one or two slightly unusual c.r.t. faults – not all with FST types. The complaints have been of purity errors and the usual sequence of events has been as follows. Initially a field engineer has cured the problem by degaussing the tube. The next steps, when further trouble has been reported, have been replacement of the posistor in the degaussing circuit along with a check for print breaks, dry-joints, coil continuity, etc. Finally the set – it's happened only three or four times – has been brought in for investigation and the tube has been found to be responsible with shadowmask problems. The time between these three procedures has been up to a year. All the sets have been 24 or 26in. models.

Power Supply

The chopper power supply circuit is basically the same as that used in the U4 chassis (see Fig. 1, page 773, August 1990). Varistors are used to provide protection at the output from the mains bridge rectifier and at the output from the chopper transformer to the h.t. rectifier(s) – there are two in series in some versions. A small but important change is that the transformer previously used to provide mains isolation in the pulse feed from the line output stage to the chopper transistor is omitted, the winding on the line output transformer being used to provide mains isolation.

The power supply can be disconnected from the line output stage by lifting R551 (the h.t. supply to the line driver stage remains intact when this is done). After lifting R551 fit a dummy load. This will enable you to decide quickly whether the power supply is in order and whether to concentrate on the power supply or the line output stage. It's a simple test that saves much time.

General Servicing

When you encounter odd faults it's as well to remember that, as with previous Panasonic chassis, the purple electrolytics can cause trouble.

Later models have a smoked door that covers the front panel controls. It looks smashing but the hinges, made of moulded plastic, are weak. They thus break off. Replacement doors are cheap enough. It's a point to bear in mind however. The latch is very subtle and when you carry a set against your chest the door can open. Put the set down and the door tends to catch on your arm or clothing and snaps off.

Layout

Those who are used to Panasonic sets will find the layout familiar – see front cover photograph. The main PCB across the bottom carries the power and timebase circuits, with the line output transformer on the right. The c.r.t.'s base panel is of fair size, containing its drive circuitry. To the left are upright panels stacked on top of each other, not back-to-back as in the U4. Signals panel B, which carries the tuner, the i.f. strip, the TDA3562A colour decoder chip and the SAB3035 CITAC chip, is the larger, lower one. The smaller teletext panel, when fitted, is above it. To the rear of the signals panel, near the top below green plug B10, there's an open-circuit wire link, circuit reference JBK. If this is shorted across the vision bypasses the teletext panel. It's a quick way of establishing whether the cause of a video fault is on the teletext panel.

Audio/video In/out

When the U5 chassis was introduced there was great consumer interest in connecting extra items – VCRs, personal computers, advanced TV games and video disc players – to TV sets. Consumers wanted ways of plugging in more than just the aerial, and also to be able to improve the quality of the picture. Hi-fi stereo VHS machines were also making an impact, so for many people a stereo audio input was desirable. The U5 chassis fitted in some models had baseband connections therefore, usually via phono and BNC sockets. In this respect the monitor-style TX-C22 was the best equipped.

You may thus encounter input switching circuitry. The principle of operation is simple: a voltage applied to one pin of a chip opens or closes the connection between two other pins. With a lot of switching the circuit can be difficult to follow, but Panasonic diagrams are quite helpful, showing the internal connections of the switching chips so that tracing an absent sound or vision signal is not too difficult. Don't overlook switches inside sockets.

The Citac Chip

As in the U4 chassis the CITAC chip is an SAB3035 (IC171). It's very much more reliable in this chassis but can be the cause of a number of symptoms – line type noise/interference, particularly when tuning, is quite a common fault. When fault-finding in this area be careful about connecting scope and frequency counter probes across the crystal circuit – crystal X171 in particular. Excessive loading from the probe will kill the crystal and sometimes the chip.

Remote Control

If you're used to Panasonic handsets you'll find that there's nothing unusual about the units used with the U5 chassis. They are pretty simple. Look for broken ceramic resonator legs and dirty battery contacts. If the complaint is intermittent check whether Duracell type batteries are used – their rounded ends can lead to poor contact. The most common handset complaint is no go. It's usually because the TV/VCR switch in the top left-hand corner (larger handsets) is in the VCR position – this occurs even with customers who've had the set for years.

You often find that handset spares are not listed in the service manual. It's often worth checking in the manuals for older sets, where the part numbers are given. If semiconductor devices such as the MN6030B are required use the type number as the part number.

Faults List

We'll round off with the usual list of faults encountered. Because of differences between models the model concerned is in some cases shown in brackets, though most of the faults can occur on any of these sets. Many U4 chassis faults also apply, with component reference numbers and values changed as appropriate.

(1) Intermittent loss of line sync. The TDA2579 timebase generator chip IC501 faulty.

(2) Purity problems. First check that the degaussing circuit works. Then ensure that the tube is all right – see previous comments. Finally check the TDA3562A colour decoder chip IC601.

(3) Black lines across the picture after a few minutes. The SAB3035 CITAC chip IC171 faulty.

(4) Intermittently dead set. Check for dry-joints on the scan-coil plug.

(5) Set won't tune (tuning position didn't move). Dry-joint on crystal X171 (Model TC2051).

(6) Intermittent loss of picture, fault on teletext panel. IC5002 (SAA5240) faulty.

(7) Dead set. Line output transistor Q551 short-circuit and TDA2579 timebase generator chip IC501 faulty.

(8) Intermittently overbright raster with flyback lines. Tube's first anode voltage rose when fault was present, due to faulty line output transformer (T551). (Model TC2051)

(9) No raster, sound o.k. Tube's heaters low or out due to defective/open-circuit winding on line output transformer T551.

(10) Field collapse (no raster). Damaged print around connector E7. (Model TC2051.)

(11) Stuck on standby. Momentary contacts on mains switch worked but no output from the microcomputer chip IC1203 on panel M. (Model TC2051.)

(12) No picture. Tube cut off because of incorrect outputs from the TDA3562A colour decoder chip IC601 which was faulty.

(13) Drifting off tune. Carry out external d.c. checks to eliminate the tuner then suspect the SAB3035 CITAC chip IC171.

(14) No channel LEDs and won't tune. C1214 on board M faulty. (Model TX5500.)

(15) No sound or vision, channel LEDs working. IC171 (SAB3035) faulty.

(16) H.T. voltage varies. Zener diode D806 (RD6·2EB2) in power supply faulty.

(17) Intermittent bowing in from sides. Dry-joints on all legs of the 2SD1265P EW modulator driver transistor Q753, mounted on the centre heatsink on the main panel E towards the rear edge of the chassis. Fault can be permanent if the dry-joints are very bad or the transistor is open-circuit. Applies to large-screen sets fitted with the U5W version of the chassis.

(18) Intermittently or permanently the screen flares red/blue/green/white with flyback lines and/or the set trips off and the power supply whines. On the few occasions we've had this fault, never twice with the same model, the cause has been shorting in the c.r.t. Prove this by disconnecting the appropriate drive to ensure that the c.r.t. is definitely at fault before replacing it. As we haven't had this with a set that's out of guarantee we haven't tried removing shorts with the B and K tester, but I have done this successfully with older models even when the short has not been of the type that the B and K says it can remove. Reactivating the affected gun with gentle tapping on the c.r.t.'s neck often works wonders.

(19) No go, scream from the power supply. Disconnecting R551 and monitoring the h.t. will prove whether the power supply or its load (the line output stage) is at fault. The fault is usually in the line output stage. Check the line output transistor Q551 and, in large-screen models (U5W chassis), the EW modulator diodes D557 (C2715) and D558 (RU2AM or C2406M) – it's usually the upper diode that fails. In rare cases you may find that the line output transformer has shorted turns.

Conclusion

In conclusion, the U5 uses conventional circuitry and is very reliable. It's a great advert for Panasonic but perhaps a bit boring when you have one of these sets on the bench!

Teletopics

SATELLITE TV

The merger of Sky Television and BSB to form BSkyB has not so far had any positive effect on satellite TV business, which remains decidely flat. The number of dishes installed in January is understood to have been around 40,000, a considerable fall from the estimated 75,000 in December. The present economic climate doesn't help of course. Hopes are that the start of transmissions from the second Astra satellite 1B will increase interest. Services from 1B are expected to start in April.

Two further Astra satellites, 1C and 1D, have been ordered. 1C will increase the number of channels to 48 and is expected to be launched in January 1993. 1D, due for launch a year later, will be somewhat different with four high-power transponders operating in the DBS band, enabling it to carry HD-TV transmissions. The original WARC 1977 European DBS channel/orbital position plan did not envisage DBS broadcasting to Europe from orbital positions farther east than 5° because of eclipse blackouts. Battery developments have since made this an unnecessary restriction. All four Astra satellites will be co-sited in an 80km box at 19.2°E.

Up to 300,000 pirate decoders are thought to be in use in the UK to receive the Filmnet channel from Astra 1A. BSkyB and the Brussels-based Filmnet have initiated an advertising campaign warning the public that the scrambling system is being continually altered prior to the introduction of a completely new encryption system this summer. The aim is to render pirate decoders useless. Filmnet does not have the rights to transmit films to the UK, its service being intended for subscribers in the Scandinavian and Benelux markets.

Current low-noise LNBs use GaAs HEMTs (high electron-mobility transistors). A new range of even lower noise GaAs devices described as HyperFETs has been announced. The RHF1203CL is intended for use in the first stage. It has a typical noise figure of 0.85dB at 12GHz and a gain of 10.5dB. For use in subsequent stages the RHF1252CL and RHF1251CL have noise figures of 1.12dB and 1.2dB respectively.

TRADE SCENE

According to BREMA 1990 could see a record surplus in the UK's CTV trade. During the first ten months of the year exports came to £307m while imports were £156m, a surplus of £151m compared to one of £58m for the whole of 1989. VCRs continued to show a deficit however, the figure for the January-October period being £44.6m. This was well down on the deficit of £95m for 1989.

The European Commission has imposed anti-dumping duties on small-screen CTV imports from China and Hong Kong. These range from 2.1 to 4.8 per cent for imports from Hong Kong and from 7.5 to 17.4 per cent for imports from China. While BREMA describes this as "a success story" it comes rather late in the day. The EC started its investigation in November 1988 following a complaint from EACEM (the European Association of Consumer Electronic Manufacturers). It found that imports to Europe from China and Hong Kong rose from 88,000 in 1985 to 1.28m in 1988, their market share rising from 1.2 to 16.9 per cent. It seems however that the economic situation and the threat of duties had already led to a fall in such imports. Maybe importers will consider India next as a source. A recent report comments that due to a slump in the market current CTV production is one million sets annually while production capacity exists for two million sets. Colour sets produced by BPL, which is based in south India, are sold in the UK under the Crown label. China appears to producing around seven million colour sets a year at present.

DCC UNVEILLED

The first public demonstration of the new DCC (digital compact cassette) format developed by Philips and Matsushita was given at the Las Vegas Consumer Electronics Show at the beginning of January. Brief details of the new format were listed in our December 1990 issue, on page 106. It puts high-quality digital sound on a conventional compact cassette and has compatibility with existing analogue cassettes. DCC equipment is due to go on sale in early 1992. At present the playing time is limited to one and a half hours with a fraction of a second gap in the middle while the tape direction is automatically reversed. Two-hour cassettes using thinner tapes are expected to be introduced later.

Commodore's CD-TV system (see Teletopics August 1990) was also on show.

SERVICING AND SPARES

Thorn EMI Home Electronics Ltd., Glaisdale Drive, Bilborough, Nottingham NG8 4LA tell us that they have extensive stocks, with good off the shelf availability, for a number of Osaki products as follows: P22C, P50G-PC-04X and P60G-PC-04X TV chassis; MTV1200/TV2500 TV sets; VCR31/2/3 VCRs; AV104 mini TV plus radio; MS103 hi-fi (no CD); and the following microwave ovens MW0530 (no turntable), MW0653, MW0654, MW01065, MW06532 and MW06540. Spares are also stocked for the GoldStar GHV1232I VCR. Some spares are held for the Funai VCR4000 and Siemens FM391 VCRs. Thorn EMI Home Electronics comment that they can advise on contacts in the trade for spares sources for other Osaki/GoldStar products. Trade enquiries only to the address above or to 0602 290 433/4 or fax 0602 295 899. Subject to availability and account facilities orders are despatched within 24 hours.

The company also holds at its Nottingham site a wide range of satellite TV equipment spares, including spares and accessories for the Ferguson SDA60, SDA60WM, SDA80; Maspro BSK65E; Grundig System 20; and ITT SAT1100 outside units; also receiver spares for the Ferguson SRA1, SRA1S and SRV1S, the ITT SAT1000/1100 and SRV1150S; Grundig STR20/20A/20B and Maspro SRE90. A large range of support accessories including fixings for walls, patios, floors and chimneys, amplifiers, splitters, tapes and sealers etc, is held. A catalogue is available on request.

Ampmace Ltd. has been taken over by AM Components Ltd. Telephone number (0203 471 241) and address remain the same. For a limited period all orders over £10 will be despatched post free. See advertisement elsewhere in this issue.

JP Micro Services, Unit 5, Churchward Trading Estate, Barrs Court Road, Hereford HR1 1EN (0432 56 353) has introduced a small (3 × 2 × 1in.) infra-red remote control unit tester, Model RXT-2. It also has a fuse/continuity test and an own battery test. It's intended for field/bench engineers and shop staff. An a.c. powered bench version, Model RTX-3, is also available.

With profit margins under pressure, those concerned with the management of service departments are having to think about their operations carefully. In view of this the IEEIE is holding a symposium entitled "Maintenance Management – How to Manage a Modern Service Department Effectively" on Friday, March 15th at the City Conference Centre, London EC3. The fully inclusive registration fee is £172.50 (special rates are available for members of associated bodies). Enquiries should be sent to the Conference Organiser, IEEIE, Savoy Hill House, Savoy Hill, London WC2R 0BS (telephone 071 836 3357, fax 071 497 9006). The problems of both brown and white goods servicing departments will be considered.

THE TV LICENCE

The colour TV licence will be increased by £6 to £77 from April 1st. The increase has been set at 3 per cent below the current inflation rate.

S to RGB TRANSCODERS

For those who don't have a TV receiver with S inputs Sony has introduced the YR1000 transcoder, which converts Y/C signals to RGB form for feeding to the TV set via a scart socket. To make connections simple all inputs are at the front of the transcoder along with controls for brightness, colour and contrast. In addition to S video inputs the YR1000 takes composite video and audio via phono jacks. The transcoder has a power consumption of 7W, measures just 196 × 65 × 184mm and is expected to sell at around £100.

The YR3000 at £299 includes a sharpness control and accepts three selectable inputs with two outputs, one via a scart socket to a TV set. It's intended as the heart of an AV system comprising a Hi-8 camcorder, two VCRs and a TV set.

SINGLE-CHIP VIDEO CAMERA

Researchers at the University of Edinburgh have developed a single-chip camera using CMOS technology. The chip incorporates an 84,000 pixel image sensor and all the signal processing and pulse generator circuitry required. A simple camera can be produced simply by glueing a lens on top of the photodiode array. Suggested applications include security surveillance, video toys and video telephones. A surveillance camera could cost as little as £25. At present the 1mm chip provides a monochrome picture, but a colour version is under development.

VIDEO NEWS

JVC has launched a VCR, Model HR-FC100EK, that accepts full-size and VHS-C cassettes without the need for an adaptor. It has four motors to control a tape loading tray with slots for both types of cassette – the tray slides in and out like the disc tray of a CD player. Other features include long-play recording, VISS, variable-speed picture search, on-screen displays, a one year/eight event timer and teletext with an optional decoder. The suggested price is £430.

Panasonic has launched two user-friendly VCRs that feature a "domino palette" control panel with the various control buttons grouped, e.g. for tape transport, timer, etc., and colour coded in accordance with their frequency of use. Model NV-F75 is a VHS edit deck with a jog/shuttle dial on both the VCR and the remote control handset, a Nicam decoder, hi-fi sound and an 'intelligent turbo' mechanism that allows the deck to be switched from stop to play in 0.7 seconds. A motor for mode switching

also raises the motor torque so that the FF/rewind time is reduced to 2.5 seconds. A new audio head-switching circuit reduces switching noise by 6dB in comparison with conventional systems while a high-speed limiter improves the dynamic range. Other features include a twin projection on the drum to reduce picture noise and jitter caused by tape slapping against it, VISS and trick play features. The suggested price is £599.99. The NV-FS90 is an S-VHS version with a suggested price of £799.95.

Hitachi has launched two Video-8 camcorders, Models VM-E10E and VM-E15E, that feature a new TL (thin and light) tape mechanism with a full-sized head drum. Use of a full-size drum – these are the first 8mm camcorders to do so – minimises jitter. A specially-designed aspherical lens replaces the usual lens array and is processed for optimum performance. There are built-in stereo microphones with a switchable wind filter. An auto-exposure system with manual override links the iris and the six shutter speeds. Prices are £849.99 and £899.99.

DVI CHIP SET

Intel has announced a low-cost (under £60 in volume quantities) chip set that gives personal computers the ability to produce and interact with digital full-motion video and sound. It's known as the i750 video processor and will give a boost to development of the DVI (digital video interactive) system (see Television December 1990, page 94). When Intel took over the DVI technology from General Electric in 1988 the video processor cost around £12,000 and occupied six computer boards.

The i750 chip set comprises an 82750PB pixel processor and an 82750DB display processor that interface with a video RAM to provide video compression/decompression. The video output can be in VGA, NTSC, PAL or SECAM form.

THE FIDELITY CASE

Caparo Industries, which took over Fidelity Radio in 1984, has won its fraud action against the former chairman and technical director in the High Court. Caparo claimed that a pre-tax profit of £1.3m shown in the accounts for the year to March 31st 1984 should have been shown as a loss of £400,000. The difference was due to fraudulent over-stated and over-valued stock and over-stated sales. Damages are still to be assessed. Fidelity had had problems with Citizen Band radios, cordless telephones and a colour receiver chassis that required modification. It was further affected by the flood of cheap small-screen CTVs from China and Hong Kong. With its losses still increasing, Caparo closed the factory in 1988 and sold the brand name to Amstrad.

VCR Clinic

Reports from Philip Blundell, AMIEIE, Eugene Trundle, Alfred Damp, Nick Beer, Steve Cannon, John Coombes and Donald Bullock

Philips VR6660

The sound from this machine was wowy: when the sound slowed a crunching noise could be heard coming from the capstan area. After removing the pinch roller we saw that there was rust on the shaft – the pinch roller bearing was breaking up. I'd never before noticed that there was a ball bearing inside the pinch roller – had taken it for granted that there was a plain bush. **P.B.**

Grundig VS510

The fault note said "pulsating picture". A tape that accompanied the machine showed the fault. The best way to describe it would be a jitter on vertical lines of the picture every two to three seconds. It was most noticeable with the machine's own recordings, though it could just be seen on playback of a prerecorded tape. The sound didn't seem to be affected. Following our usual practice with Grundig machines the first step was to check the supply lines for correct voltage and absence of ripple, but there was no fault here. The drum and capstan signals were rock steady.

To break the deadlock I made the ultimate sacrifice: brought in my VS510, that I'd won in the Engineer of the Year competition, and swapped over the decks. This proved that the fault was a mechanical one. A long screwdriver was then used as a stethoscope to listen to each moving part in turn. A noise could be heard coming from the right-hand rotating guide P3. So I fitted the one from my deck, but the noise was still present. Then I noticed that the speed of the impedance roller P1 was varying. If it was stopped, the noise and the jitter stopped. Dismantling the roller carefully and applying minimal lubrication cured the problem. The tape tension must have amplified the noise, making it appear to come from somewhere else!

Don't remove guide P3 unless it's absolutely necessary to do so. It has a marked effect on the tape path. I know as I had to set it up on both decks! The guide is not only adjustable up and down, as usual, but also from side to side. **P.B.**

Philips VR6291

Faulty display was the complaint. Cass, stop and pause showed correctly but wind gave bob, rewind gave rebob and play gave lect. Cause? The language option was set to French! **P.B.**

Akai VS765

We've had the same problem with three of these machines now, an intermittent quiet ticking noise in the play and record modes. In each case the cause has been the pinch roller assembly, which has an unusual forked support bracket. The replacement types now supplied are probably modified ones – we've had no trouble with them. The part number is BL387501J. **E.T.**

Alba VCR4000

Judging by the reaction from the spares order department at Alba this must be a common fault with the VCR4000X. The sound was very fluttery and jerky but the picture was virtually unaffected. The cause was rapid take-up torque fluctuations, sufficient to snatch the tape through the capstan/pinch roller interface. Examination of the rubber boss on the reel-drive motor showed that it was worn and eccentric. Replace it – it's available separately from the motor – and the reel idler. **E.T.**

Panasonic NV730

At switch-on very little happened with this machine, except that it switched itself off again after about five seconds. As with many VCRs this one's syscon pulses the deck motors at switch-on and looks for a response from the sensors as a condition of maintaining the power lines. In this case the motors didn't pulse because the "motor unreg" line was missing. There were dry-joints on the legs of transistor Q1501 on the power supply subpanel. **E.T.**

Sanyo VHR1300

This machine's problem was no deck functions. The loading motor had seized solid. Before ordering a replacement we decided to check for consequential damage. It's a good thing we did. The BA6238A drive chip IC3005 had died and as a result R3110 (3·3Ω, 1W) was open-circuit. **E.T.**

Toshiba V309

The complaint with this machine was tape chewing. Checks with a dummy cassette showed that everything went round correctly, but when a tape was inserted and play was selected the tape was damaged because of excessive take-up torque – in fact the play torque was nearer what you would expect for fast forward. We found that the voltage at the output pin of the reel-motor drive chip was 15V instead of 3·4V. The cause was traced to Q625 being short-circuit collector-to-emitter. **A.D.**

Panasonic NV-G10

There were white flashing lines and white bars that affected both playback and record. It seemed likely that the fault was in the luminance/chrominance section and as a start we replaced the hybrid luminance processing chip IC301. Fortunately this provided a speedy and complete cure. **S.C.**

Toshiba V86

This machine's playback picture gave the impression that the correct TV channel wasn't being used – there was pulling, and any movement in the picture produced a strobing effect. Replacing the video heads cured the problem. **S.C.**

Hitachi VT620

We've had a couple of these machines with the same symptoms, intermittent tape chewing and no playback sound or control pulses. In both cases the cause was the same. The sub-loading arm didn't take the tape up to the audio/control head. What was happening was that after eject the arm would stick on its return. The fault remained after we'd replaced the arm and its idler and greased them.

Adding a split washer on the shaft where the arm fits to the deck provided a cure by raising the arm sufficiently so that it didn't catch on the idler. **S.C.**

Hitachi VT520

When this machine had warmed up the capstan motor would stop about every second then restart a second later, as though someone was pressing the pause key at one-second intervals. This produced a very curious symptom. If a recording was made in the fault condition the playback picture would appear to jump and skip frames. When freezer was squirted on the chip on the capstan motor assembly the fault cleared. Fitting a replacement capstan motor assembly, part no. 5571454, provided a permanent cure. **S.C.**

Toshiba V81/V83

This is one that got omitted from my article in the February issue. If the tape keeps on being ejected, the machine going to standby with the cassette indicator flashing, suspect ICX01 (TMP47C410AN6775) of being faulty. Check it by replacement. **J.C.**

Amstrad VCR4600

The usual cause of no playback or record colour, possibly intermittent, is the chroma module HC1-201. First check for dry-joints. If the soldering is all right fit a replacement. **J.C.**

Panasonic NV730

This machine played and recorded normally but in the play mode the record display lit at random. Our first clue was that the clock was incorrect. Replacing the clock microcomputer chip IC7501 put that right but the other fault remained. It was caused by the clock crystal X7504 being open-circuit. **J.C.**

Saisho VR1200

There was no play or record. On inspection we saw that the machine loaded and went into play but a limiter post prevented the pinch wheel from moving the tape. The limiter post lever assembly is made of plastic and the pin will drop out if it's broken. **J.C.**

Ferguson 3V53/5/7

On a number of occasions we've found that intermittent failure to carry out mechanical operations such as rewind/play etc., even when the display shows that the command has been received, has been due to an intermittently open-circuit or very tight loading/mode motor. Attend to the usual regreasing at the same time. **N.B.**

Ferguson 3V44/5

At power on this machine would go into rewind with no cassette in, the capstan naturally also spinning backwards. After a few seconds this would stop and the machine would return to standby. This process would be repeated if the power button was pressed, though there was no red on LED indication. On investigation we found that none of the switched supplies were appearing because the switching line from the syscon, at pin 9 of connector CN3, was stuck at 1·7V. Pin 1 of the microcomputer chip IC601 went low when the unit was switched on but didn't rise to 5V when off. The microcomputer chip's 5V supply was correct.

Back in the power supply we found that the 3·9V switching zener diode D3 read 400Ω each way. Replacing it allowed the rail to rise to 3·9V. We then found that there was a short at its anode – Q10 (2SD637) was short-circuit base-to-emitter. The unit then wouldn't lace properly and got stuck in rewind and fast forward. This was simpler – the loading belt needed replacement. **N.B.**

Questor VR100C/Samsung VI510T

We've had the same trouble with two of these machines. Playback is all right with prerecorded tapes but the E-E vision is "liney", the entire picture having across it a series of white lines about an eighth of an inch apart. Recordings made on the machine are likewise affected of course. Unsmoothed ripple in the supply to the r.f. circuitry seemed a likely explanation, and in both cases we found that C7 in the power supply circuit was wide open. It's a 33μF electrolytic, rated at 100V. **D.B.**

Sentra VCRs

These machines are beginning to appear in our workshop. The complaint each time has been "dead" and each time we've found that the 0·1F "battery" has been the cause, its replacement restoring normal results. It's designated C821 and is located on the bottom panel, under the cassette housing. **D.B.**

Saisho VR1200

Another stock fault has appeared on these machines. They come in dead, with no clock display. Sometimes the cause is a failed back-up battery – C821, 0·1F. More often however Q02 has expired due to a heat stroke. It's type 2SD1207, but a BD131 runs cooler and is cheaper. It's wise to treat the printed circuitry in this area very gently – it looks as though it has been drawn by a gentle fairy with a mapping pen. Once it lifts reach for the Aspirins. **D.B.**

NEC PVC744E

After having "the chap across the road" clean the heads on this machine its owner found the unpredictable performance intolerable. He brought it to me and I soon understood his distress. It was used mainly for watching videos off the top shelf at his local tape library and during use it would spontaneously rewind – "always in the best bits" he said. I eventually found that the sensor sensitivity control VR1 showed signs of having been disturbed. Setting it up carefully enabled the customer to resume his pursuits in total bliss. **D.B.**

Logik VR955

Here's another common fault. The customer complains of no sound in the record mode and no erase. It's the bias oscillator of course, which is contained in can L0504, adjacent to the plug from the head. Although it's no doubt easier to replace the complete assembly it can be repaired on the bench. The culprit is the entombed 2SC1318 transistor. I replace it with a BC337, carefully reassemble the module and pack in some heatsink compound. This always works. **D.B.**

Long-distance Television

Roger Bunney

As far as DX-TV is concerned the final month of 1990 was relatively quiet. There was F2 layer propagation on just a few days, a good tropospheric spell on the 2nd/3rd and three days of moderate Sporadic E activity mid-month, the later a hopeful sign for SpE in the new year. For once the Geminids meteor shower produced TV signals. Tim Anderson for example logged many signal pings at St. Leonards during the mid-month period when the shower was at its peak (December 14th), the highest signal being on ch. E12 – Sweden was identified on ch. E8.

The good tropospheric spell in early December produced signals in Bands I/III and at u.h.f. from the Benelux countries, Denmark, Germany, Sweden and Norway. NRK (Norway) ch. E4 was received in north east England and north Wales. F2 reception was limited to three days – at least that's all we've heard about. Unidentified programming was seen in ch. E2 on the morning of the 6th; two ch. E2 signals were logged between 0845-0930 GMT on the 24th, suggesting Dubai and Iran; while on the 26th Iran ch. E2 was positively identified in Holland between 1003-1108.

The rather brief SpE log for December is as follows:

5/12/90 TVE (Spain) ch. E2.
6/12/90 TVE E2, 3.
7/12/90 TVE E2, 3.
9/12/90 TSS (USSR) R1.
10/12/90 TVE E2; SVT (Sweden) E2, 4; NRK (Norway) E3; YLE (Finland) E3, 4; TSS R1, 2.
11/12/90 TVE E2, 3; DR (Denmark) E3.
13/12/90 TVE E2, 3; NRK E2; SVT E3.
15/12/90 TVE E2, 3; TSS R1, 2; ARD (Germany) E2; TVP (Poland) R1, 2; CST (Czechoslovakia) R1; DR E3.
16-19th TVE E2, 3.
22/12/90 TVE E2.
24/12/90 TVE E2.
26/12/90 ARD E2, 3; SVT E2, 3; NRK E2, 3, 4.
28/12/90 DR E3; +PTT (Switzerland) E3.
29/12/90 TVE E4.

Robert Copeman (Victoria, Australia) writes that SpE reception declined from November to December, though activity picked up again during December. The general feeling there is that the 1990 season has been only mediocre to date, not unlike experience in the UK earlier in the year – the Australian SpE season is six-months later than the UK one of course. On November 27th at 1900-1910 Eastern Summer time (+11 hours GMT) Robert received a studio type show and logo on ch. E2. Checks with Ryn Muntjewerff in Holland and Anthony Mann in Perth, Western Australia have confirmed that the signal was from Dubai. Our congratulations to Robert on his achievement.

Mike Flatman of Lowestoft tells us that he's been DX-TVing since 1982. He originally used two BB u.h.f. grid aerials and a Salora multistandard TV set. More recently he's added Band I and III aerials, with excellent results. Mike (G0FDT) and another amateur compare reception over the air during SpE openings.

At the end of another year of DX-TVing, my thanks to the many enthusiasts who have written in with news and reception reports. I hope that 1991 will turn out to be a good year for us all.

News Items

France: Several DXers have reported receiving transmissions on ch. E35. It seems that they come from the Lille transmitter and comprise a terrestrial version of the satellite Channel J children's programme. Signal strength is similar to the La 5/M6 channels.

Belgium: The BRT-2 test patterns indicate that Egem ch. E46 and Schoten ch. E62 are now carrying NICAM-728 test transmissions. The tests are being conducted to confirm compatibility with the 7MHz cable channel allocations extensively used in Belgium. As system G sound (5·5MHz) is used UK system I receivers will not decode Belgian NICAM. Canal Plus has been a success in Belgium, with the 1990 target of 30,000 subscribers being achieved just ahead of the target date.

Gibraltar: The government wishes to discontinue its subsidy to GBC-TV. Four companies, two Spanish plus RTL and Central Television, are considering taking an interest in the service, which has run at a loss for several years. An attraction is broadcasting to the adjacent Spanish coastal region. This would call for an increase in transmitter powers – at present the main transmitter (ch. E6) operates at 2·5kW (500W into the aerial) while the relays around the Rock run at less than 1W.

New Zealand: TV3 has expressed anger at the "auction" of the u.h.f. channel allocations, most of which have been taken by NZBC and its commercial associate Sky Television. Sky reckons that it will gain over 70,000 subscribers for its scrambled off-air service during the present year.

Australia: Stereo transmissions are now being carried by the ORF-1 and -2 networks.

Satellite TV

Nik Powell of Palace Pictures heads a group that hopes to launch a new music channel to rival MTV. The as yet unnamed channel wants to take transponder space on Astra 1B, though the intense demand for this may mean that it has to wait for the 1C satellite to be launched. Astra 1B is expected to be operational in late April but 1C is unlikely to be transmitting for another year.

A Scandinavian channel, TV 10 Weekend, transmitting over the TV Ruta/Nor-Net downlink from Intelsat VA F10 (1°W) could soon be in operation with general entertainment and films. Proposed programme times are 2100-0200 Fridays, 2000-0100 Saturdays and 1320-0030 Sundays.

A Dutch TV-Plus is planned, the equivalent to BBC Europe, with transmissions via the Dutch PTT Telecom transponder (11·15GHz horizontal) on the Eutelsat craft at 13°E. On-air date is expected to be this October.

The three Scandinavian channels being downlinked via Intelsat VA F12 (1°W) have become sparkly in recent weeks, indicating a drop in signal strength. We understand that this is because Intelsat has slightly realigned the spot beam to favour the Scandinavian region, meaning a fall off in signal levels elsewhere.

The Kopernikus bird at 23·5°E (DFS-1) is now transmitting the Premiere/Teleclub channel with Nagravision scrambling at 12·59GHz vertical. Programming consists mainly of films, though live football coverage will be included this spring. DFS-2 at 28·5°E has dropped Ku band TV downlinking apart from occasional video circuits such as inter-studio and conference links.

Eutelsat is proceeding with the Europsat DBS plan, with at least 39 transponders running at 125W each into steerable spot beams covering the whole European area. On-air date is expected to be in 1996, though an interim service using the lower-power Eutelsat II craft at 19°W might be started in the Winter of 1993.

The two TV transponders on Tele-X, the Nordic DBS craft that has not been successful in attracting customers, are being used by Sweden and Norway for cable head links.

Early Fast-scan TV

The first high-definition TV service, or perhaps we should today call it medium-definition, was started at Alexandra Palace in 1936. The Americans, who had been experimenting with "fast-scan" TV since the early Thirties (RCA transmitted from atop the Empire State building in 1933) were not far behind however. What held them back was the economic situation and inability to agree on a standard.

RCA ran a service of sorts in 1939. Another interesting service (callsign W3XPF) operated from 1937 in Philadelphia with equipment largely devised by Philo Farnsworth. It was on the equivalent of ch. A3, with the vision varrier at 62·75MHz and the sound carrier at 66MHz, with 441 lines. The powers were 4kW video and 1kW audio into a stack of vertical dipoles atop a 150ft self-supporting lattice tower. Operations continued until 1943. Philo Farnsworth then moved to Indiana, where he opened a further station (W9XFT) at Fort Wayne. Transmissions were on ch. A4, with 6kW video and 4kW audio power.

It's interesting that some thirty TV stations were licensed by the FCC in 1930. This information has come from the US publication *Popular Communication*.

VHF Scatter

In a recent Technical Topics column in the RSGB magazine *Radio Communication* Pat Hawker included an interesting section on the mechanism and practice of v.h.f. scatter propagation. DXers will be familiar with the dramatic signal reflection possible from ionised parts of the E and F layers. It's also possible to achieve consistent distant low v.h.f. reception at times when the m.u.f. is very much lower than the v.h.f. channel in use. The technique employed is to use relatively high powers and rely on the signal scattering that occurs within the troposphere or the lower part of the E layer. Scattering relates to random variation in the refractive index of these layers. The technique will be familiar to those who live in deep fringe areas, receiving for example v.h.f. signals from Eire in the Western UK. There's always a low-level signal at up to 200 miles. As the troposopheric conditions improve the signal can rise to a high level. In the mid-50s this magazine described reception of the various high-powered BBC Band I transmitters in Eire, at distances of well over 200 miles, using this scattering technique.

Pat Hawker describes the various forms of v.h.f. scattering. Tropospheric forward scatter, applicable at v.h.f. and u.h.f., uses high-power transmitters, high-gain aerials and up-market receivers to achieve ranges of 6-700 miles. The signals suffer from cyclic fading (slow, deep fading that lasts up to fifteen minutes for a single cycle) and flutter fading (produced by phase differences with signals reflected from aircraft etc.). At times the signal variations can be from very strong to nil.

Ionospheric forward scatter is caused by lower layer ionospheric turbulence and can occur between 30-100MHz. In general this relates to high-powered transmissions only, giving for example reception of European TV in South Africa and Zimbabwe TV (ch. E2), in Europe at times (noon) when the m.u.f. is lower. Turbulences within the ionosphere can be dramatic, with rapid fading. The evening phase across the equator is known as transequatorial skip, when Band I TV can be received at up to 2,200 miles. A variation on this theme is ionospheric back scatter, when an F2 path is open and signals are received on a reversed path, e.g. Madrid ch. E2 being received in the South of France as the signal is reflected backwards.

Rain scatter, aircraft scatter and meteor scatter are well known to TV-DXers. Pat mentions a commercial system marketed by a South African firm, Salbu (Pty) Ltd. It exploits this scattering technique by transmitting high-speed data bursts when an ionised trail is present. Typical powers are 400W with four five-element Yagi arrays.

Our thanks to Pat for a very interesting article. If you live in a favourable location for DX-TV, aim your Band I array towards Holland. You should find that Lopik ch. E4 is there for much of the time, fading in and out of the noise level, even with just a two- or three-element array. The distance is some 150 miles. This is basic tropospheric scatter at work.

In those halcyon days in the early Sixties I recall seeing a vast lattice tower at St. Lawrence, Isle of Wight carrying at least six double bays of six-element Yagi arrays rising to nearly 200ft. It was a Ministry of Defence site atop the cliffs and was aimed due south into France. The frequencies used were in the mid 30MHz range. They played havoc with local TV i.f. strips. High-pass filters such as the PO's FS38A were the order of the day.

The Hall-effect Motor

Joe Cieszynski

Brushless d.c. motors that use the Hall-effect principle are now used in many different types of electronic equipment, not least the domestic VCR where their first application was as a direct-drive head drum motor. As VCR production steadily increased during the early Eighties the cost of these motors began to fall and they started to be used to provide capstan drive. They have since appeared in audio cassette machines, CD players and computer disc drives. At the same time, sensors that operate on the Hall principle have become common for providing feedback from a mechanism to its controller.

Hall-effect motors have proved to be extremely reliable. But, like anything else, they or their control circuits can fail. When this happens an understanding of their operating principle can be helpful. I've found that many engineers have only a vague idea of the Hall effect and its application to d.c. motors. So in this article we'll consider the Hall-effect principle, examine ways in which it's used, then look at practical fault-location techniques based on an understanding of the theory.

The Hall Effect

The Hall effect is not a recent discovery. It has for many years provided an effective method of measuring the band-gap value of different semiconductor materials. But only in more recent years, with developments in semiconductor technology, have Hall-effect devices become commonplace in electronic equipment. For those who like definitions, here's a suitable one for the Hall effect: when a current-carrying semiconductor is placed in a magnetic field normal to the direction of current flow, a transverse potential difference is created, normal to both the magnetic field and the current.

The Hall effect can be likened to electron beam deflection in a c.r.t., where an external magnetic field interacts with the magnetic field that surrounds the beam, resulting in movement (deflection) of the electrons. As shown in Fig. 1, if a current is passed through a piece of semiconductor material a magnetic field will be present around the current path. If, see Fig. 2, an external magnetic field is now passed through the semiconductor material, the two fields will interact and the flow of electrons within the material will be diverted. As a result, positive and negative regions are created – see Fig. 3. The potential between the positive and negative regions is called the Hall voltage (Vh). It can be tapped and applied to an external circuit by connecting terminals to the positive and negative regions.

Device Characteristics

It's clear from Fig. 3 that the degree of current deflection, and thus the value of Vh, depends on the external flux density B. When the electrons encounter the magnetic field they will be deflected to the point where the force from this field and the force from the electrostatic field produced by the deflected electrons are matched. Thus a change in flux density produces a change in Vh. The Hall voltage also depends on the value of the bias current Ic, since a change in Ic produces a change in the concentration of charges in the two areas.

Two other factors affect the value of Vh. First, the thickness (d) of the semiconductor material: the thicker the slab, the less the concentration of charges will be. Secondly there's the Hall coefficient (Rh), which is defined as the electrostatic field (Ey) divided by the current density multiplied by the external magnetic field (B). All these variable factors that affect Vh are brought together in one simple expression:

$$Vh = \frac{Rh \times Ic \times B}{d}$$

With any given device d and Rh will be constants. Thus the value of Vh will depend on the bias current Ic and the external flux density B. In practice with a Hall motor Ic is usually kept at a constant value using a source voltage of around 2V. A Vh value in the region of 0·5V is typical with this bias applied. We shall see shortly how motor speed can be controlled by varying the value of B.

From consideration of Fig. 3 it will be appreciated that reversing either Ic or B will result in reversal of the polarity of Vh. This is another factor of importance in the operation of a Hall motor.

Advantages

In general the main advantage of the Hall-type over a brush-type motor is increased reliability, though the production cost is much greater. But the reliability factor was not the only consideration when manufacturers began to use Hall-effect motors in domestic VCRs.

For two reasons early VCRs that used brush-type d.c. motors to drive the head drum were unable to employ direct drive. First, the radiated noise from the commutator would be picked up by the highly-sensitive preamplifiers, the result being interference on the screen. Secondly, smoothing out the jitter associated with brush-type motors

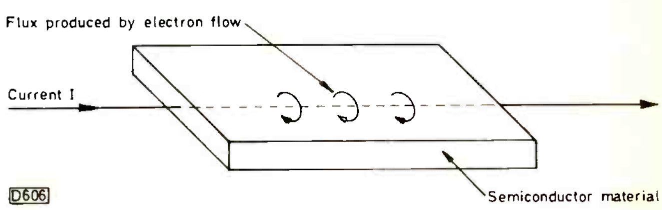


Fig. 1: Conventional current flowing through a slab of semiconductor material. An anticlockwise magnetic field surrounds the electron flow.

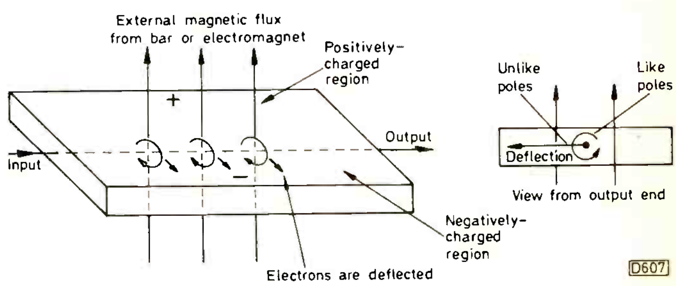


Fig. 2: When flux from an external magnetic field is present the electrons are deflected.

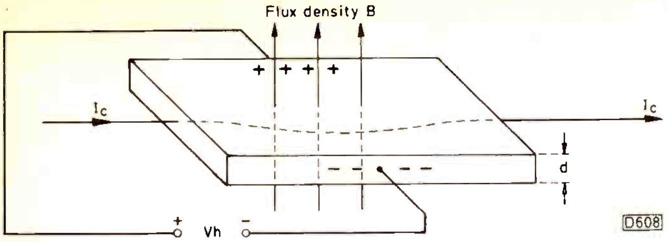


Fig. 3: An active Hall element. Ic is the bias current, B the external magnetic field, d the thickness of the material and Vh the resultant Hall voltage.

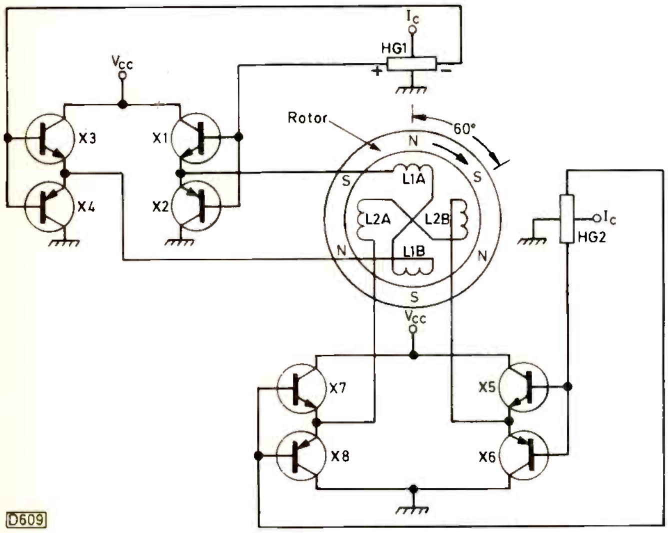


Fig. 4: How Hall elements can be used to provide motor commutation. The particular arrangement shown is the drum motor circuit in the JVC HR7200/Ferguson 3V29 VCRs.

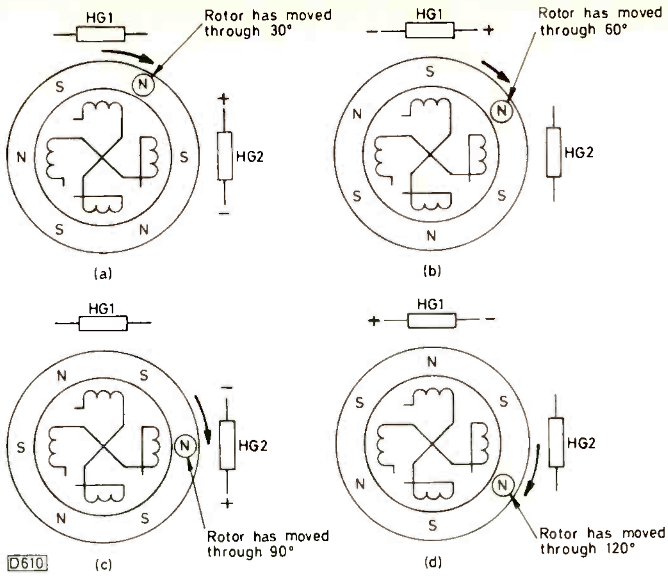


Fig. 5: Illustrating the way in which one cycle of commutation produces 120° of rotation.

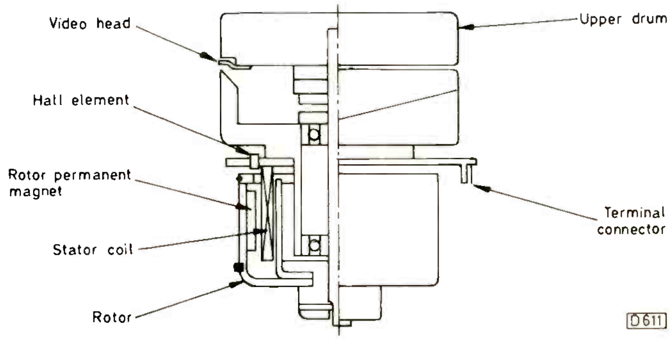


Fig. 6: Construction of the HR7200/3V29 drum motor. The drive transistors shown in Fig. 4 are mounted on a separate motor drive amplifier board.

would have been too difficult. Such jitter would result in incorrect line correlation, the effect produced being cogging of the sort you get when an anti-hunting capacitor in a flywheel line sync circuit is open-circuit. Because of these two factors the motor had to be coupled to the drum assembly via a belt, which of course reduced the reliability. The Hall motor overcomes these problems because it has no brush-and-commutator arrangement, i.e. it's a brushless d.c.motor. Absence of a commutator removed the interference problem since there's no sparking, and there's no mechanical jitter.

Motor Operation

In a Hall motor the brush-and-commutator arrangement is replaced by a couple (usually) of Hall elements which are sometimes referred to as diodes. A series of permanent magnets pass over these elements. As the motor rotates, the magnets activate the Hall elements which in turn control the motor drive currents that flow through the windings. The traditional mechanical coupling between the motor's rotor and stator is thus replaced by a magnetic couping, which is the reason for the Hall motor's smooth, noise-free operation and long life.

There are many variations in exact motor design, but the operating principle remains the same – see Fig. 4. The Hall elements in this diagram are HG1 and HG2. They are mounted on the stator, 90° apart, along with the main motor windings. Bias current Ic is derived from a common source – we'll return to this shortly. The rotor consists of a six-pole ring magnet: it spins over the Hall elements, with a clearance of about 1mm.

If we start with the motor in the position shown in Fig. 4, the north pole adjacent to HG1 will produce a Hall voltage (Vh) of about 0·5V. This is enough to forward bias drive transistors X1 and X4. As a result, current flows via X4, L1B, L1A and X1. The L1 windings are arranged so that they set up fields that are in opposition to those provided by the permanent magnets in close proximity with them. As a result of the repulsion effect, the rotor moves in a clockwise direction.

When the motor has moved through 30° the positions of the permanent magnets will be as shown in Fig. 5(a). HG1 will now produce zero output and X1/4 will be off. The south pole adjacent to HG2 will however produce a Hall voltage that forward biases X6 and X7. Current now flows via X6, L2B, L2A and X7. The rotor now moves through a further 30°, arriving at the position shown in Fig. 5(b). There's now a south pole adjacent to HG1. This time the Vh produced by HG1 has the polarity shown in Fig. 5(b), i.e. opposite to that shown in Fig. 4. As a result, transistors X2 and X3 are forward biased and the current flowing through L1's windings is reversed, producing a field that is again in opposition to that of the rotor magnets.

Fig. 5(c) shows the next position of the rotor, with HG2 forward biasing X8 and X5. After one cycle of commutation, i.e. 120°, the rotor's position is as shown in Fig. 5(d). We are back to the situation shown in Fig. 4.

The motor's speed can be controlled by adjusting the current that flows through the stator coils. Where, as in a VCR, the motor is servo controlled the supply Vcc is regulated by the phase and speed servos.

Fig. 6 shows a typical direct-drive head drum motor assembly.

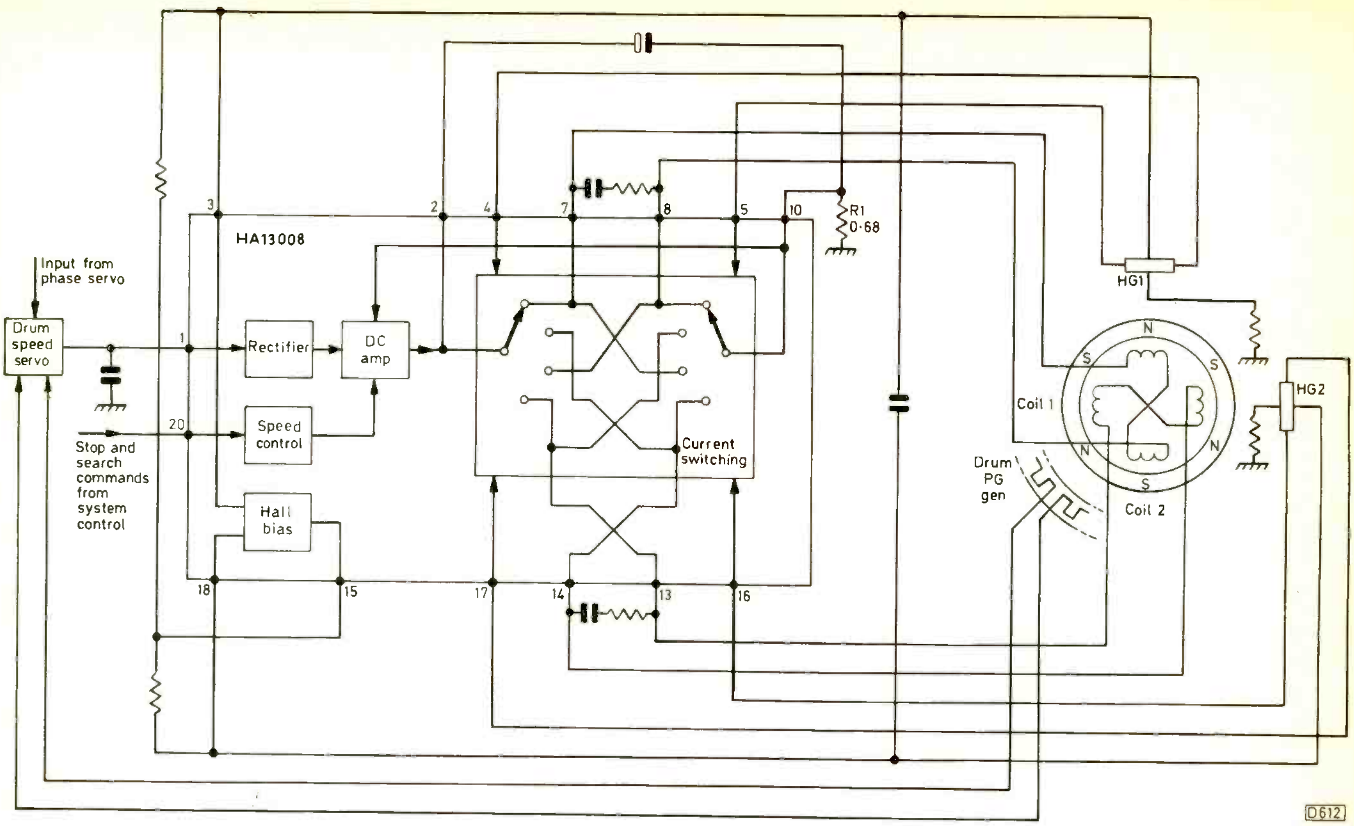


Fig. 7: Hall motor with i.c. drive amplifier. The current selector switches are activated by the Hall elements, the positions of these switches determining the windings that are energised and the direction of current flow. R1 provides an earth path for the motor current. The input from the drum speed servo is at pin 1. The speed control block overrides the servo action, being used for stop control and speed correction during visual search.

As we've seen, the magnitude of the Hall voltage produced is proportional to the bias current. So it's important that this bias current is regulated – otherwise the Vh bias applied to the motor drive transistors will tend to vary, resulting in speed and torque fluctuations. A stable supply of around 2-3V will provide a suitable bias current for the type of motor used in VCRs. A separate regulator is used for this purpose. In later machines it's part of the Hall-motor driver chip.

Circuitry

The HA13008 chip, see Fig. 7, was specifically designed to drive the type of Hall motor we've been discussing. Chips of this type are common in modern VCRs. In earlier VHS machines dating back to around 1980 you'll find a quite different motor drive amplifier (MDA). The circuit shown in Fig. 8 does exactly the same job as that in Fig. 7, but uses 26 transistors for the purpose. By comparing the two you can see that Q5-8 and Q15-18 are the current selector switches. The servo control signal is applied to Q22 while stop and search control are applied to Q21. The Hall bias is stabilised by Q11/12.

To run the motor forwards (clockwise in the illustration) the line marked A is held at 12V while line B is held at 5V. With HG1's output as shown, Q7 will switch on and Q3/4 will then conduct. Q3 in turn drives Q24. Thus motor current flows via R1, Q24, coil L1 and Q4. The bias applied to line B controls the motor current and is governed by the drum servo.

For the four possible outputs from the two Hall elements, notice that since line A is high the only switching transistors that can conduct will be Q7, Q8, Q17 and Q18. Thus the motor will run only clockwise (or anticlockwise when viewed from the top of the machine). This prevents the motor starting up in the wrong direction.

Where reverse motor rotation is required line A can be taken low and line B high. In this case Q5, Q6, Q15 and Q16 will be switched by the Hall elements. The direction of the currents flowing in the coils will now be in the opposite direction for the four Vh outputs. This reverse drive arrangement is used for braking in some machines.

Panasonic Motor

So far we've concentrated on JVC's Hall-effect motor. An alternative design is found in Panasonic VCRs. The operating principle remains the same but the Panasonic motor has three stator coils connected in a nine-pole arrangement while the rotor has twelve poles instead of six – see Fig. 9. The extra poles give smoother operation and better torque control. For a video head drive system, smooth running ensures good line correlation. Accurate torque control is important in the trick modes, where the tape may travel at different speeds in either the forward or reverse direction.

The interesting feature of the Panasonic motor is the pattern of the rotor's magnetic poles, see Fig. 10. The two Hall devices are positioned so that one of them is activated by the ring's outer magnetic pattern while the other is activated by the inner pattern. As a result, the mark-space ratio of the Vh output from the inner device is approximately 1:1 while the outer device produces an output with a mark-space ratio of around 5:1. This arrangement has three purposes. First, it enables the MDA chip to detect the rotor's position and in turn control the switching of the currents in the three stator coils. Secondly, an FG signal at 150Hz can be obtained by comparing the two different outputs (the JVC motor we described requires a separate ring of magnets to provide the FG

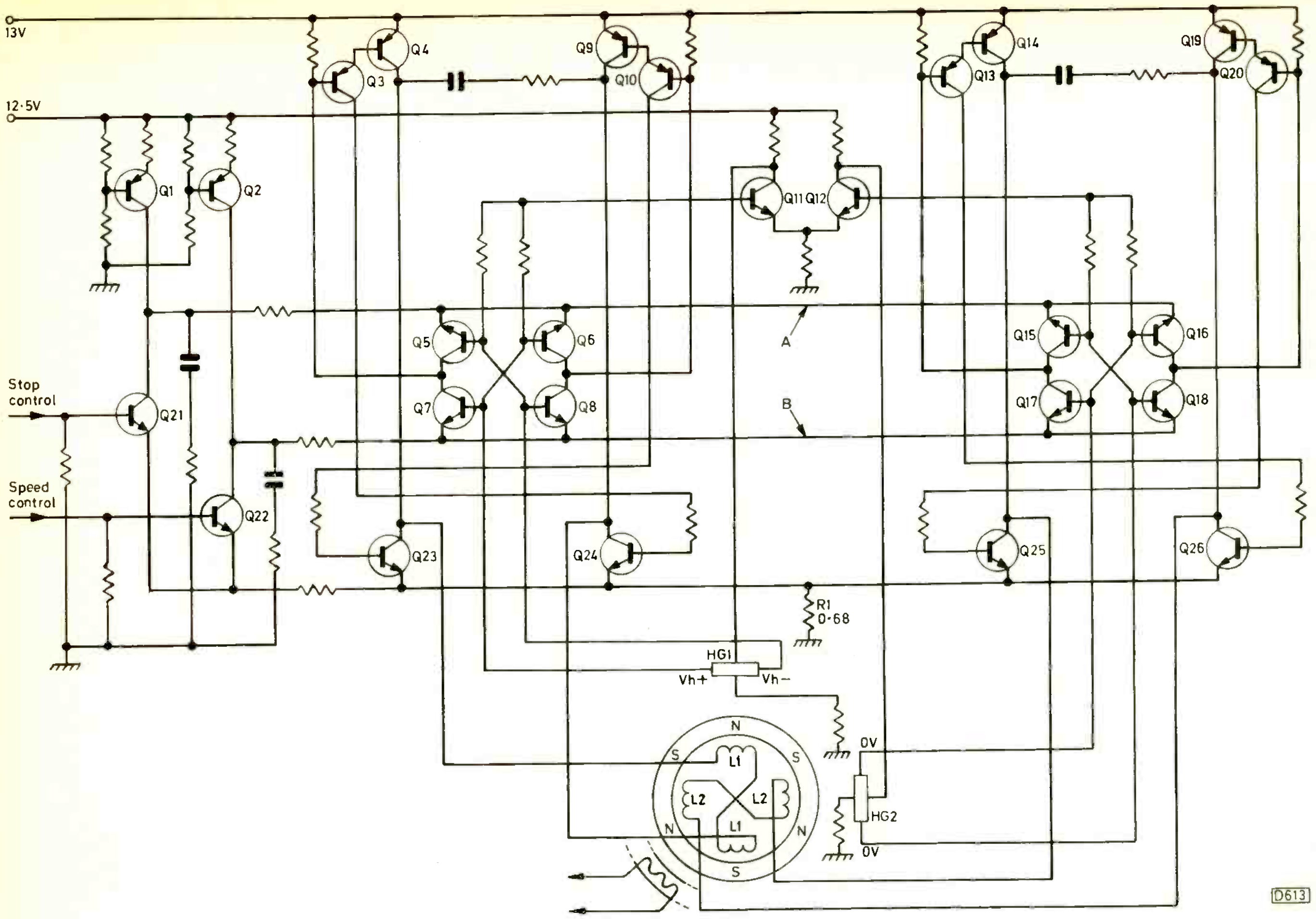


Fig. 8: Discrete motor drive circuit used in the earlier JVC HR7200 and similar models.

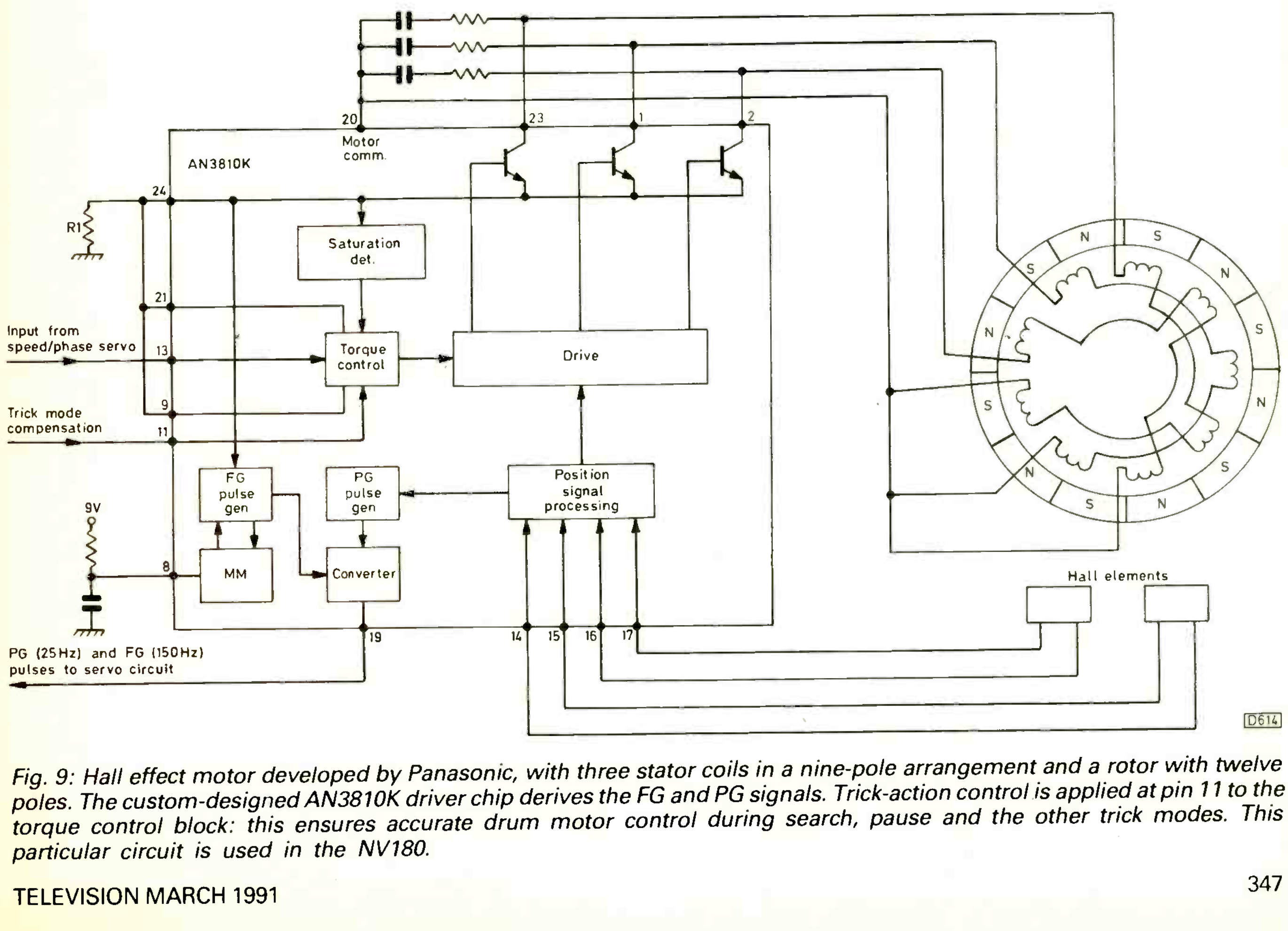


Fig. 9: Hall effect motor developed by Panasonic, with three stator coils in a nine-pole arrangement and a rotor with twelve poles. The custom-designed AN3810K driver chip derives the FG and PG signals. Trick-action control is applied at pin 11 to the torque control block: this ensures accurate drum motor control during search, pause and the other trick modes. This particular circuit is used in the NV180.

pulses). Thirdly, the tiny pair of poles at the inner edge of the ring provides a 25Hz PG signal.

Capstan Drive

Brushless d.c. motors are now commonly used in VCRs for capstan drive. The operating principles remain the same but the physical appearance of these motors is somewhat different. They are generally of flat build, the rotor serving as a flywheel.

Fault Finding

Failure of a Hall-effect motor to run correctly may be due to the motor or an external cause. If a correct diagnosis is not made expensive items may be bought and fitted to no avail. The following notes outline a logical approach to fault finding.

Power Supplies

First, power supplies. It should go without saying that the first step when faced with a motor that doesn't rotate should be to check that all relevant supplies to the MDA are present and correct. One supply that's often overlooked is the Hall bias. Remember that the Hall elements can't function in the absence of this bias current and that in many cases, especially with older machines, it's provided by a separate regulator circuit. If the bias voltage is low or missing the regulator is the prime suspect.

The motor may have difficulty in getting up to full speed if a supply voltage is low. A supply voltage that's too high is likely to lead to premature failure of the MDA. It's rare for the motor itself to be damaged, though this depends on its quality, i.e. the thickness of the windings. Where the MDA has suffered severe damage and you're unsure whether it's safe to connect the motor to the repaired circuit there are some static tests that can be carried out on the motor. We'll consider these in a moment.

Another cause of trouble is ripple on the supply or supply voltage fluctuations. When ripple is superimposed on the motor movement you can get some strange effects. High-frequency jitter on the supply to the drum motor can cause incorrect line sync timing, the result being peculiar cogging or rippling effects on the playback picture.

Supply voltage fluctuations are usually caused by a high-impedance supply rail, i.e. a defective regulator, a low-value or open-circuit decoupling capacitor or a supply resistor that has gone high in value. In such cases the motor may run slow continuously or it may hunt. I recall an interesting example some years ago with a Grundig SVR4004 (VCR format). Its Hall-type drum motor revved wildly. The cause was a resistor that had gone high in value on the power supply board. Each time the motor approached its normal speed the increased voltage drop across the resistor would reduce the motor's speed. Then as the supply voltage rose the motor would accelerate again.

Servo Operation

The second thing to consider is the possibility of a servo fault. The FG loop in the servo is responsible for maintaining the correct motor speed. If the motor's speed is slow the most effective check is to break the FG loop, when the motor should run up to full speed – which is much higher than its normal operating speed. If this happens one can assume that the fault lies in the servo FG loop. If the motor's speed is still slow the fault is either in the MDA, the power supply or the motor.

Motor Checks

Next the motor. Apart from checking for mechanical problems such as seized bearings there are several tests that can be carried out on a suspect Hall-effect motor.

It's possible for the motor to run even though one of the Hall elements is defective. One very useful check to make is to scope the waveform across the resistor in series with the motor's windings, on the earth side. In Figs. 7, 8 and 9 this resistor has been labelled R1. This waveform represents the current flowing through the motor. With a good motor and MDA a fairly even, almost d.c. signal should be seen at this point – see Fig. 11(a). In the event of a defective Hall element or an open-circuit winding the current through R1 will alter drastically. The current will be almost zero when the defective pole should have been energised. It will rise sharply when the remaining good pole(s) is/are energised, as the servo attempts to overcome the drag. Fig. 11(b) shows an example – the machine was a JVC HR7200 which had a motor with an open-circuit winding. Clearly however the waveform will differ with different faults and different models. But the point is that any spikes or major irregularities in what should be a largely d.c. waveform will confirm that there's a problem in either the motor or the MDA.

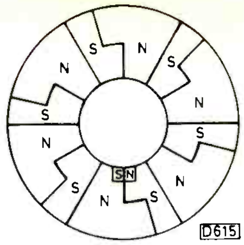
The next step is to decide whether the fault is in the motor or the MDA. This is easy to do by carrying out two simple checks on the motor. First check the continuity of the windings – remember to go all the way back through the wiring to the MDA circuit. Secondly, scope the Vh outputs from the Hall elements. The waveform should be sinusoidal as the rotor's magnetic poles move over the elements alternately. For a Hall bias of 2·5V a Vh sinewave of about 0·3-0·5V peak-to-peak should be seen, depending on the rotor's field strength. If an output is low or missing you've probably pinpointed the cause of the fault.

If the motor won't start you can't scope the waveform across R1, but you can check the Vh outputs. Ensure that the Hall bias is present, with the machine in the stop mode. If it isn't, provide an external bias. You can now scope the Vh outputs with the motor rotated by hand. Each Hall element should provide a sinusoidal output of about 0·3-0·5V peak-to-peak.

Another useful test when you have reason to suspect the motor or MDA is to scope the current waveform in each motor winding. If we take the circuit shown in Fig. 7 as an example, a scope check at pins 7, 8, 13 and 14 of the MDA chip will show the current flowing in each winding. Fig. 12 shows the waveforms that should be seen. With a good motor and MDA the waveforms should be more or less identical in amplitude. Again, the waveforms will alter drastically when there's a fault such as a defective Hall element or an open-circuit winding. Large spikes will occur via the good poles as the servo tries to compensate, while the current in the defective pole will be a much smaller sawtooth waveform which is the result of induction from the rotor's magnetic poles.

It may seem strange that a motor should work perfectly well when one pole has failed, but in practice this is very often the case. The tell-tale signs may be a slow lock-up after the servo loop has been interrupted – you would usually begin to look for the cause of a fault of this nature

Fig. 10: The magnetic pattern of the rotor used in the Panasonic Hall-effect rotor.



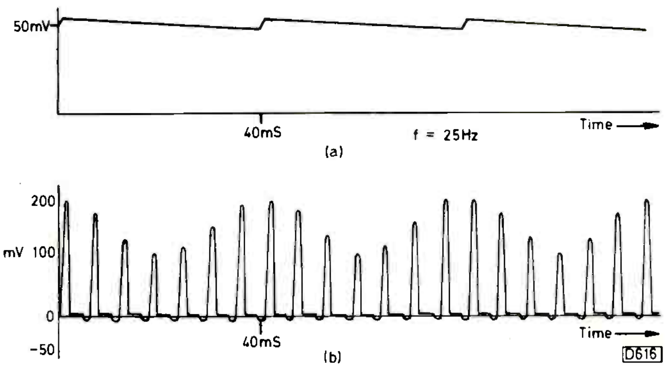


Fig. 11: The waveform shown at (a) represents the current through the motor, measured across the earthing resistor – R1 in Figs. 7, 8 and 9. A fault condition is shown at (b). The waveform is distorted because the current in one winding is missing: the pulses occur because the servo attempts to compensate for the drag caused by the defective pole.

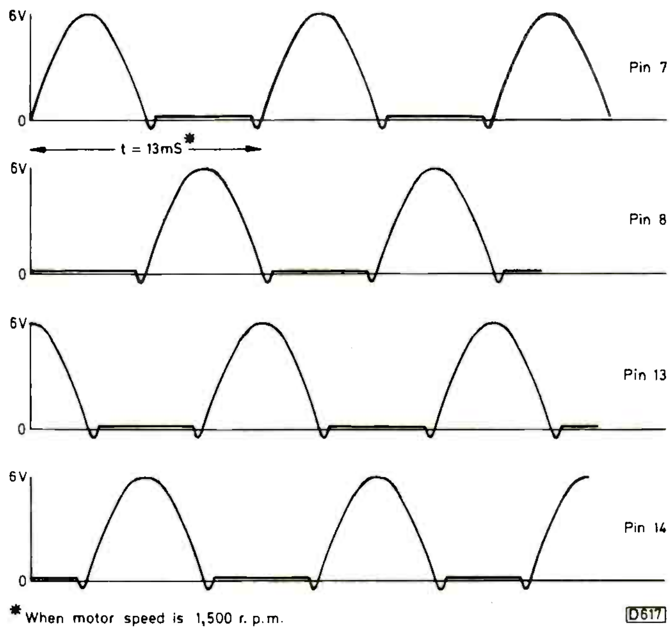


Fig. 12: Waveforms of the current in the windings of the Hall motor shown in Fig. 7. Each peak corresponds to an instant when a rotor magnetic pole is positioned directly above a Hall element, which thus produces maximum output. Note the 90° phase shift between each pole.

in the servo mechanism.

In view of what has been said so far, it should be clear that when faced with strange and possibly intermittent motor speed problems an early check should be made on the motor current waveform.

MDA Problems

MDA problems are generally straightforward since the bulk of the circuitry is usually within a single i.c. In fact in the majority of modern VCRs the MDA circuit is built on to the motor assembly. In many cases individual spare parts are unfortunately not available so that failure of

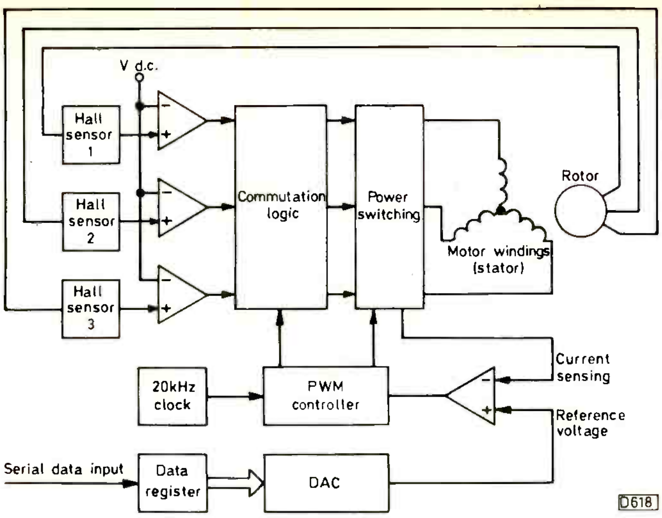


Fig. 13: Block diagram showing computer control of a PWM-driven three-phase Hall motor.

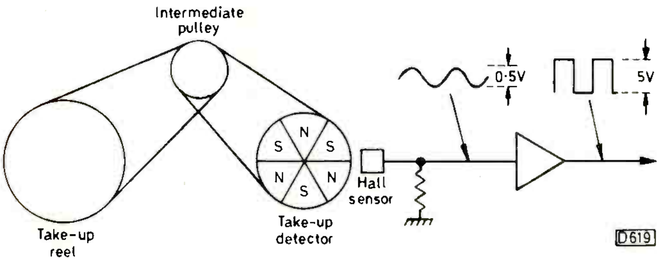


Fig. 14: Use of a Hall element to detect reel rotation. The element's output has to be squared for feeding to a syscon chip.

either the MDA or the motor will call for replacement of the complete assembly. But don't forget that it's often possible to make one good motor out of two if you happen to have the right combination of defective ones.

Servicing an MDA can be a problem where the circuit is like that shown in Fig. 8, which is used in the Ferguson 3V29. Here board replacement might be the simplest solution – plenty of serviceable boards are available from scrapped machines. If you do have to carry out fault-finding in a discrete component circuit I would recommend adopting the same approach to that you would use with a discrete component class B power amplifier. Carry out static checks on the transistors, keeping an eye out for slight reverse leakage, after removing the devices from the panel. If necessary replace groups of d.c.-coupled transistors rather than only the defective ones. Since the voltages shown on the circuit diagram apply only when the motor is running normally, most d.c. checks will not be of help.

Computer Control

A major Hall-effect motor advantage we've not so far considered is that it can be readily adapted to microcomputer control. At present this is more commonly used in industrial applications, but it's worth taking a brief look at the methods employed.

With computer control the motor is fed from a pulse-width modulated source. As a result the current in the windings is governed by the PWM signal's duty cycle. Speed can thus be controlled by varying the drive signal's mark-space ratio. For a typical motor the fundamental frequency of the source signal is of the order of 15-20kHz, this high frequency giving very precise motor control. The prime advantage of PWM drive is that accurate torque/speed control can be maintained under even constantly changing load conditions. A further advantage is the reduced power consumption. The one drawback is the added MDA complication. Whereas simple current regulators can be used to drive a d.c. Hall motor the MDA used with PWM drive must be able to switch at high speeds. Unless the motor is very small, this usually means that power MOSFET devices must be used.

Fig. 13 shows a typical arrangement. The motor current is monitored and compared with a reference voltage that's set by the input data. Any change in motor speed, as a result of say changed loading, will involve a change in the average current through the power switching stage. The current sensing operational amplifier monitors this average current. It's output is in turn used to adjust the duty cycle of the PWM signal. The servo loop consists of the operational amplifier, the PWM controller, the commutation logic and the power switching stage.

The next thing to consider is the effect of the input data on the servo. By writing a new word into the register a new reference level will be provided for the current-sensing operational amplifier and the motor's speed will alter accordingly. This gives us a degree of fine speed control. In addition, in some arrangements coarse speed control is provided by altering the clock frequency via the data input.

If a keypad or computer is connected to the data input the operator or computer will have full control of the motor and will be able to set the speed. Far more than just speed control is possible however. The input data may be used to provide motor on/off, direction of rotation and smooth braking control, also to lock the motor in a fixed position or disable the driver outputs.

The combination of the Hall motor's smooth operating characteristics and precision control via a microcomputer has made possible operations that were previously impossible. In an example I encountered recently a brushless motor in a piece of production plant equipment could accelerate to and from 1,800 r.p.m. in just under 35msec with an accuracy of ±0·5mm. As the cost of Hall motors continues to fall and dedicated microcomputer chips become more readily available we should expect to see this sort of technology finding its way into domestic electronic equipment.

Hall Sensors

Hall elements have also been used for many years for rotation detection and position sensing in mechanism control systems. My earliest experience of a Hall device was in 1976, when I encountered a Sony record deck that used what the service manual referred to as a "magneto diode" for auto-stop sensing. As the tone arm moved out across the lead-out track, a permanent magnet attached to the arm swung over a Hall device. The resulting signal from the Hall sensor was used to remove the power to the motor. In the late Seventies Hall elements came to be used as reel rotation sensors in audio cassette decks. But most engineers probably associate the Hall sensor with reel rotation detection in VCRs.

A classic example was used in the early Ferguson 3V00 and similar models where the tape counter drive also turned a six-pole circular magnet mounted adjacent to a Hall element – see Fig. 14. Despite its reliability, this arrangement has been superseded in later machines by the use of an optocoupler, the main reason for this being that optocouplers cost much less. The six-pole magnet is relatively expensive to manufacture.

Microwave Notebook

John Coombes

The latest Panasonic microwave ovens, Models NN3909 and NN3959, incorporate some new features.

First, the cavity has self-clean Teflon at the top and sides and a ceramic base. The latter helps to maintain a constant high temperature and is also easy to clean. There's also an extra door seal to ensure that the temperature remains constant.

Remember that it's very important to keep a microwave oven clean. Fat or splash marks in the cavity absorb energy, and if the cavity is dirty enough the cooking time will be affected. This may give the impression that the magnetron's output is low. Excessive fat or splash marks under or on the door seal can carbonise causing hot spots. These can damage the cavity so that replacement is necessary. The most effective cleaner is soap and warm water. If you have to deal with a stubborn stain, place a mug of water in the oven and allow it to boil. The steam will soften the dirt so that it can be wiped clean. The important thing is not to allow dirt to build up: it can cause trouble, even penetration of the steel cavity.

A common myth is that microwave ovens cook from the inside out. This is not so. The microwaves are at a set frequency, usually 2·45GHz. They enter the food to a depth of one to one and a half inches, then spread through the food. For this reason standing time is very important, to ensure that the food is evenly heated right through.

Another feature of the new Panasonic models is the weight sensor. The voltage at pin 44 of the MB89745 microcontroller chip can be in the low or high state. This determines whether the frequency at pin 46 is CW or CR. The combination of CW and CR tells the microcontroller the correct weight. When food is placed on the turntable the pressure it applies varies the capacitance of a built-in capacitor. This in turn varies the frequency, indicating weight. As a result the microcontroller can adjust the cooking time, depending of course on the food category. Remember that the cooking time can vary appreciably as a result of the adjustment produced by the weight sensor.

The ovens are fitted with a catalytic filter to dispel and remove unwanted smells.

Another new feature is the humidity sensor. The principle here is that when food is cooked steam is produced. The humidity sensor detects the steam, thus sensing the humidity level, and with the auto-programme determines the power level and cooking time. Note that the humidity sensor is on whenever the mains lead is plugged in. This is necessary because to give a correct reading the sensor has to be dry initially.

Note also that the oven won't operate unless both turntable trays are fitted in position.

An added bonus with these models is the bread making feature. Bread is made in the bread case, where the ingredients must be mixed in the correct order. The overall bread baking time is three and a half to four and a half hours.

Fault Finding

Here are some fault notes on these ovens, starting with the digital programmer PCB.

Loss of clock display: First check whether the filament voltage is present at pins 1 and 2 of the low-voltage transformer. If missing or incorrect, check the transformer for an open-circuit winding, also check R1/2 (200Ω). The next suspect is the display unit itself. If there's no voltage at pin 3 however check whether the 630mA fuse F2 is open-circuit, then check whether D1 is open-circuit.

Further checks may have to be carried out in the microcontroller circuit. Check for 5V at pin 64 of IC1 (MB89745). If missing check back to the BA1780S chip. If everything is in order here check for 5V at pin 33 of IC1. Suspect IC6 (MN1280) if the voltage is incorrect. Check the UN1211 transistor Q23 if necessary, and finally check for a faulty 4·19MHz clock crystal and IC1 itself.

Missing segment or a dim or not clear display: These problems can be caused by the display unit or the MB89745 microcontroller chip. Check by replacement.

No microwave oscillation: If the fault is on the digital programmer PCB, start by checking the voltage at pins 17 and 38 of IC1 on the high-power setting. If incorrect, check IC1 by replacement. If the voltages at both pins are correct suspect Q7 (A564), Q8 (D637) and Q9 (D639). Check by replacement if necessary. If the fault is still present, check IC12 and/or RY3 by replacement.

Weight-sensor faults: First ensure that both plates are correctly fitted. If only one is in position the unit will be inoperative. Note that the weight sensor protector plate can be damaged and short-circuit to the PCB if the oven has been transported and set down incorrectly. Removal of shorts and reassembly usually restores correct operation.

Further checks may need to be carried out in the microcontroller circuit. Check at pin 44: correct conditions are 5V for a short time then falling to zero. If incorrect check IC1 by replacement. The voltage at pin 46 of IC1 should be 2·3V. If incorrect suspect that the weight-sensor unit is faulty – the only check is by replacement. Finally, even if the voltage at pin 46 is correct, try replacing IC1.

Humidity-sensor faults: First check that the low-voltage transformer is working correctly, then check the d.c. continuity of the humidity sensor's heater. The voltage at pin 19 of IC1 should be 2·5V. If this is incorrect replace IC1. The voltage at pin 14 should be 1V. If incorrect check the humidity sensor unit by replacement. If the voltage at pin 14 is correct IC1 could still be faulty.

The Hitachi MR7985

We have had some experience of the Hitachi Model MR7985. For no results proceed as follows. If the 240V a.c. supply is not present at the primary winding of low-voltage transformer T2 check whether fuse F1 is open-circuit. Next check on the secondary side. If the transformer is o.k. check the l.t. lines individually – check for shorts and trace to source. Next check the voltage at pin 28 of the microcontroller chip. If it's above zero check the components in the initialising circuitry around Q5 for leakage or open-circuits. If the voltage is less than zero check the microcontroller chip and the crystal. Finally check the components around the crystal for open-circuits or dry-joints.

The cause of the fault could lie with the safety switches

S1/2/3. If so be safe and replace all three. If the fuse blows intermittently and the surge resistor R12 has discoloured to a slight blue S3 is suspect. Check by replacing all the switches.

A further possibility is a faulty fan motor or the fan may have dropped off. Protection against the magnetron overheating is provided by the thermal cutout S4. If S4 is faulty it should be replaced, but as a temporary measure while checking the cutout can be reset by freezing to zero°C.

Safety

Remember that there are vital safety considerations with microwave ovens. Those not familiar with their principles of operation should not meddle with them. Do not work on the secondary side of the high-voltage area with live voltage present – carry out cold resistance checks only. With the primary winding of the h.v. transformer disconnected the PCB and microcontroller circuitry can be worked on safely.

Correction

There was an error in the microwave oven circuit shown on page 46 of the November 1990 issue. The mains live/neutral connections were reversed: live goes to the fuse and safety switches. Our apologies – the original was drawn "upside down" and we had not noticed the brown/blue connection markings.

TEST CASE

339

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.

For several reasons TV servicing is no longer as straightforward as it was in the past. One reason is the increasing use of complex control systems, often with a microcomputer chip, to control the set's functions. Another is the increasing interdependence of the various stages and sections of a set. This muddies the water when it comes to fault diagnosis since it makes everything far less clear.

Our tale of woe this month relates to a newish Pye set, Model 27KE1112/05L, fitted with the G90 chassis. The fault seemed to be a straightforward one, simply no picture, though the most crucial sections of the set were working correctly. The e.h.t. rustled up at switch on, the tube's heaters were alight, and there was good sound – this made it possible to tell that the programme changed when the remote control unit was used. It looked like a five-minute job, probably loss of the tube's first anode supply. When this was checked however hundreds of volts were found to be present. So much for theory number one. The focus voltage was also present – indicated by a small spark from the proffered test probe. On to the c.r.t.'s cathodes then, where the voltages were way above the normal 130V. So this was the immediate cause of the lost display: the tube was biased off at its cathodes. Working back, the voltages at the bases of the RGB output transistors were found to be correspondingly low.

The bases and emitters of these transistors are returned to chassis via rather complex networks that include black-level presets. Investigation showed that these networks were in order and that the tube's cut-off state was caused by the conditions within the TDA3561A colour decoder chip IC7260. Once it had been established that the 12V supply was present and correct at pin 1 attention was turned to the device's input pins, starting with the luminance input at pin 10. A perfectly good luminance signal was present here. Correct conditions were also found at the brightness control pin 11 – the 1.5V here varied with operation of the brightness control. Contrast is controlled by the voltage at pin 7. Again this was correct, and varied with adjustment of preset 3944.

Maybe, the man on the job thought, the voltage at pin 9 is wrong? This is used to provide blanking for the RGB inputs. But the set doesn't have a teletext decoder, the only item connected to pin 9 being the 75Ω terminating resistor 3284. The voltage here was correct at zero. Help was sought from the other workshop worthies, who were immersed in their own problems. Check the auto grey-scale circuit someone said – it's fussy and can blank out the picture at the drop of a hat. Pin 18 is the relevant one. Our man looked at it in puzzlement. It's the entry point for one of the signals from the teletext decoder, which the set didn't have. His colleague had been thinking of sets with the TDA3562 chip of course. There's no auto grey-scale correction system with the TDA3561 used in this set.

Most of the rest of this chip is devoted to chroma signal decoding, so there seemed little point in carrying out checks on the peripheral components here. A check was made to ensure that pin 27 was firmly earthed, and as this point was in order a new chip was fitted. When this had been done however our technician was presented with the same blank screen. What fundamental point had he missed – one that you didn't have to worry about before the advent of single-chip colour decoders?

ANSWER TO TEST CASE 338

— page 275 last month —

Last month's story concerned the fruitless attempts of Real Technician (should we call him that under the circumstances?) to diagnose the cause of a problem with a JVC HRD170 VCR. There were two symptoms. First, at switch-on the take-up reel was driven clockwise with no cassette present. Secondly, when the cassette had been ejected the cassette motor continued to run. As RT proceeded the situation went from bad to whirrs (sorry), with two chips being unnecesarily replaced.

Instead of jumping to conclusions RT would have done better to take the two symptoms together at the outset and check the operation of the tape-end sensors. When he finally got around to doing this he found that pin 42 (start sensing) of IC601 remained high at all times, even with a half-wound cassette present in the machine. In fact the start-sensor photodiode Q1 was dry-jointed to its little PCB on the left-hand side of the cassette housing assembly. It was thus telling the control chip that it never saw any light. This confused the control chip to say the least. The effect would of course have been the same had Q1 been open-circuit.

With the benefit of hindsight RT could have got a further very definite clue to the identity of the culprit: had he wound the tape to its end, in the play or fast forward mode, he would have found that the auto-stop and auto-rewind didn't work.

There was a time when end sensing and cassette loading were separate matters. The Hitachi VT63 taught us to associate them!

CD Player Casebook

Reports from Mike Leach, Philip Blundell, AMIEIE and Nick Beer

Marantz CD56

This Philips-based machine came in with very distorted left-hand channel sound. It uses conventional Philips chips, the DA converters being type TDA1541 and the filters type SAA7220. Both chips in the left-hand channel proved to be o.k. The cause of the problem was C2236 (220nF), which is one of the decoupling capacitors associated with the left-hand channel DAC chip IC6305. The decouplers are surface-mounted components – if you have a scrap machine it's fairly easy to change them. To determine which capacitor is faulty it's often possible simply to bridge a standard type capacitor across each of the ones on the board in turn. When these capacitors go leaky you can sometimes achieve a positive test by applying a little heat: improved sound will identify the culprit. **M.L.**

Akai CDM515

This machine would work all right for a couple of hours after which the turntable motor would spin excessively fast and the sled would move the laser to the outermost part of the disc. Occasionally the tray would open and literally throw the disc out of the machine since it was spinning so fast. I thought that my chances of fixing this one without a circuit diagram were nil. The fault turned out to be in the power supply however. By switching the machine off and spraying D10, D11 and D12 with freezer I found that the fault didn't return for a full half hour. Replacing these three diodes cleared the problem – they feed the 5V and −5V regulators. **M.L.**

Philips CD371

When play was selected the disc ran up to speed but there was no TOC reading and ERR was displayed. Service modes up to 3 could be selected, but after a few seconds code 02 was displayed. This showed that the microcomputer had sensed the absence of /TL pulses. A scope check confirmed that there were no /TL pulses at pin 34 of IC6551 though there was a /TL pulse output at pin 18 of the photodiode signal processor IC6525. In this early production version a small sub-panel is fitted to delay the /TL pulses. The manual does not refer to this panel. With the aid of a CMOS data book however I soon found that the signal was being pulled down by a 4070 chip on this sub-panel. A new chip restored the signal but the player still didn't work – a 2.2Ω resistor in the supply to the 4070 chip was open-circuit. The sub-panel is fitted when the microcomputer chip is type 68HC05C4/SC93416. With the updated 68HC05C4/SC93486 chip it's not required. **P.B.**

Technics SL-P222A

The complaint was that discs didn't register and thus didn't play. My first thought was that the radial arm was sticking (see Casebook September 1990, page 836) but this trouble usually arises when the machine is warm. On test we found that a physical obstruction prevented the disc from spinning. The disc was still sitting on the tray liner, which had dropped correctly when the drawer was loaded. We removed the tray and ran up the unit with a disc and an external clamper. It worked all right this way. Incorrect turntable height was the cause of the problem – it was incorrect because the motor's bearing had collapsed. A new CDM unit was required. **N.B.**

Pioneer PDM435

This brand new machine was brought to us with the complaint that it would skip intermittently with all the discs tried. On test the fault showed up immediately – it was quite severe. I put the machine in the test mode and checked the alignment. As it's such a new model we don't yet have the manual, but because of the excellent built-in serviceability it was possible to do this. The test points and adjustments follow a standard pattern and are well labelled. If you know one model you pretty well know them all.

The offsets were set reasonably well, the focus was hardly perfect and the grating was way out. After resetting these the player seemed to work much better but its performance was by no means what I would have expected. Whilst testing, the unit started to work perfectly then began to fault again. In view of the facts it seemed that the laser unit was defective and that in manufacture the machine had been set up as well as possible to compensate. After fitting a new optical unit the machine worked correctly at all times. **N.B.**

Pioneer PDZ81

The complaint with this multiplayer was that it skipped when playing the discs that came with it, in a six-disc cartridge. When I examined them I found that they were filthy and marked in a haphazard manner. A closer examination of a couple of the discs showed that there were concentric rings on them – this looked like player caused damage.

When I dismantled the machine I found that there were a number of problems. First the turntable was covered with sticky dirt. As a result the discs weren't released properly and didn't return to their leaf in the cartridge. Next the turntable height was incorrect. This meant that there was a possibility of discs, particularly warped ones, fouling the surrounding metalwork. As the motor was pretty sluggish it was replaced. The felt pad that rubs against the disc was covered with grit and thus had to be replaced. Finally the front door had come off and had to be retrieved from behind the mains transformer. A new spring had to be ordered as we couldn't find it in the mechanism – it was likely to have been the cause of the disc scratching.

After carrying out these repairs and giving the machine a clean up it resembled its former self. The customer got one of our standard letters advising on the benefits of cleanliness, but I doubt whether the owners will change their lifestyle! **N.B.**

A Serviceman Looks at VCR PSUs

Jeff Herbert, G4JJH

The increasing use of switch-mode power supplies in VCRs has been commented upon by several readers following J. LeJeune's article on the power supply used in the Ferguson FV30 in the July 1990 issue of *Television*. I too can see little advantage in changing from the simple mains transformer, rectifier and regulator arrangement which is totally bomb-proof against mains transients and short-term interruptions.

The switch-mode power supply seems to be susceptible to failure as a result of transient mains spikes. Despite the many improvements in switch-mode power supply designs in TV sets over the years this still seems to be the main cause of failure. In our workshop we use the term "nuked PSU", which means that the chopper transistor, its driver, the feedback diodes, small capacitors etc. have all gone short-circuit.

The Ferguson FV31R

The discrete-component switch-mode power supply used in the Ferguson FV31R seems to be an over-complicated affair. When it fails you usually find that many components have been nuked. The excellent description of its operation by J. LeJuene has helped with diagnosis and explained many of its anomalies. It doesn't seem to be a state-of-the-art design to me. Surely a design with fewer components could have been adopted? Say with a chopper transistor and a single control chip to provide the drive and carry out excess current and voltage monitoring and shut-down. It would certainly be easier to service and, with fewer components, cheaper to produce. It would also take less space.

Current Philips Range

The VCRs in the current Philips range all use switch-mode power supplies. After only a few months' use we've found that with some of them there's overheating and PCB discoloration around several resistors, with the solder crystallised and cracking at component joints. This can only be the result of poor design and lack of soak testing during the development stage. A modification kit is available for one current Philips design, for fitting when the chopper transistor has failed because of "adverse mains supplies". Surely VCRs should all be designed to work with the conditions known to exist in the domestic mains supply, and should continue to work despite transient spikes etc. with no need for modification?

Panasonic Designs

Panasonic has used switch-mode power supplies for some years now in its VCRs. They have proved to be quite reliable. We've had occasional failure of the switching chip and a few of the diodes, but no multiple component failures. It's a simple design that most of us can understand and I would say is "simply years ahead" of the current Philips ones. I did manage to nuke one by inserting the figure-of-eight plug in the socket with the mains switched on: the plug visibly arced over as it went in, because of poor contact before the plug was pushed fully home. The bridge rectifier and switching chip failed, but this was my fault, not a design problem. Now I always start with the mains supply switched off, insert the lead into the socket then switch on at the wall socket. I've not nuked any more to date. Panasonic has kept to the basic design, making small changes as new models are released. No components overheat or seem to be underrated, which is a credit to its designers. When it has proved itself to be reliable it's sensible to keep a design in production. The G mechanism is another example. There were some initial problems with lost gear timing if the carriage jammed, but now that modifications have been made it must be one of the most reliable mechanisms around. It has been in use for several years. Some manufacturers change mechanisms completely every few years. This must be a very costly exercise, but I digress.

Akai Models

The Akai VS22/23/25 use what could be described as a hybrid design. Several low-voltage rails are derived from a mains transformer. Switch-mode circuits then produce various regulated supplies. These are poorly designed: we've had to replace several PCBs because burnt areas resulting from faults have made them unrepairable. A smoking dead unit is a regular occurrence. Repair involves replacing the switching transistors, the chokes that burn up and several of the small electrolytic capacitors. Some uprated transistors etc. have been suggested by Akai during the years that these models have been in production. The last PCBs we ordered came with a small sub-panel wired to them, presumably to improve reliability.

The later Akai VS427/467/485 series uses a conventional 50Hz supply with rectifiers and regulators. It has several low-value fusible resistors that seem to fail for no apparent reason. There's no external fuse on the primary side of the mains transformer, so we've had to replace several transformers because the internal fuse has gone open-circuit. On only one occasion was any reason found for the failure – a drum drive chip had gone short-circuit. I would have thought that a fusible resistor could have been fitted to provide protection in the event of this sort of fault, but everything just got very hot until the short was removed. The bridge rectifier diodes regularly fail, the result being hum bars on the screen when the deck motors draw current. There's a d.c.-to-d.c. converter, located inside a screening can on the main PCB at the front, that's used to provide the negative supply for the fluorescent display and heater. By switch-mode action it produces −30V from a 29V positive rail obtained from the mains transformer. If the diode connected to the transformer had been reversed there should have been an adequate supply without the need for the converter stage. The output diodes go open-circuit, the result being no fluorescent display. A modification sheet has now been issued by Akai, suggesting the use of different diodes and some circuit changes. Why didn't all this show up in the testing sage before full production?

JVC PSUs

For years JVC used 50Hz supplies. Failure of the

STK5481 regulator chip is fairly common, but it's easy to replace. The latest models use a switch-mode design which seems to be fairly simple. I've had a problem with only one of these. It would try to produce too much voltage, killing the output protection zener diode at switch on. The cause of this was a hairline crack in the print, as a result of which the feedback sample was lost. It was a one-off failure. Otherwise, reliability has been quite good.

Summary

Although I prefer the simpler mains transformer, rectifier, regulator design the switch-mode power supply seems to be here to stay. Some have already proved to be very reliable, but others are quite troublesome. It will be interesting to see how things develop over the next few years.

Mains Plugs

Finally, a few points about the mains plug. Customers buy nice new VCRs and don't bother to buy a plug. When they get home they fit an old plug that's been used for say five years on an electric iron and suffered from short-circuited leads. They don't seem to appreciate the need for good, clean mains connections. The attitude is that any old plug will do as long as the VCR lights up. You find loose fuseholders, loose screw terminals, screws that are clamped on the outer insulation when the wire has been pushed too far through the hole, and burnt pins where old plugs have been fitted. All these defects can cause arcing and short-term interruptions to the mains supply, which is bad news for many switch-mode circuits. If the power supply has failed I always check the conditions at the mains plug. Very often I find one of the above-mentioned faults.

Book Review

The Satellite Book – A Complete Guide to Satellite TV Theory and Practice, edited by John Breeds, published by Swift Television Publications.

With its 280 large (A4) pages and lavish presentation this is an impressive book to say the least. It serves several purposes. The theory of satellite TV – use of f.m.; dishes, feedhorns and polarisers; noise; scrambling and so on – is clearly and thoroughly covered. The practical aspects such as tools, safety with ladders and dish fixing arrangements are all dealt with in a way that leaves no doubt about what should be done. And in addition it serves as a general reference source, including sections on the scart connector, cables, the future of Eutelsat, the Astra satellites, etc. There are even sections on the role of British Telecom and customer care. A detailed section covers SMATV systems. There is lavish use of very clear diagrams and photographs throughout so that one can see exactly what is being discussed in the text. In addition to writing several sections himself John Breeds has gathered contributions from a number of authors with expert experience.

Anyone interested in or involved in satellite TV reception will find this a worthwhile and up-to-date book to have available as a guide and reference source. It's available from Swift Television Publications, 17 Pittsfield, Cricklade, Swindon, Wilts SN6 6AN at £27.95 including postage (add £5 for orders from Continental Europe). Enquiries can be phoned or faxed to 0793 750 620.

next month in TELEVISION

EXTRA NEXT MONTH

TV/VCR SPARES GUIDE
The 1991 edition of our annual Spares Guide, an essential reference source for spares for TV and video equipment, listing brands, manufacturers and major stockists.

ALSO 32-PAGE CATALOGUE
The 1991 East Cornwall Components spring catalogue supplement will be bound into our April issue.

● **SATELLITE TV AERIALS AND HEAD UNITS**
Start of a new series by Derek Stephenson, outlining the principles of satellite TV reception and the operation of the wide variety of aerials and head-end combinations that may be encountered.

● **ADDING NICAM SOUND**
A set doesn't have to be designed for Nicam operation to accept a decoder, but it does have to be suitable for the purpose. Keith Cummins decided to incorporate a Maplin Nicam decoder into his Sony KV-X2521U TV receiver. An account of the planning that went into the project, the interfacing that had to be done and the physical arrangements adopted.

● **THE DOWNMARKET END**
Life is not all camcorders and microcomputers. There is still a need to be able to repair older, simpler equipment, which calls for skills that differ from the ultra high-tech approach. E.G. Kempshall on the problems that arise with simpler items.

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Steve's Camcorner

Steve Beeching, T.Eng.

I thought I'd discuss connectors this time: the thought was prompted by a connection problem I had with an Hitachi VM600.

After repairs to the loading mechanism, which had been bent by a jammed cassette, the machine failed to produce colour when playing a known good test tape. Various tests showed that the reference subcarrier frequency was far from being correct, so the colour processing module was replaced. As this failed to cure the problem the camcorder was transferred to the test bench with the vectorscope for more detailed analysis. I was surprised to find that the colour had been restored: there was a stable vector display, with the correct subcarrier. Back on the standard bench the colour was absent and the subcarrier was incorrect. After some concentrated thought and a couple of cups of extra caffeinated coffee the cause of the problem was obvious to me. So the left-hand audio channel phono plug was disconnected from the Toshiba test TV/monitor, restoring the colour.

8-pin DIN AV Connections

All right, so this is not obvious without the rest of the information, which relates to the connections to the 8-pin miniature DIN connector used for AV connection with camcorders. Table 1 shows the connections for various camcorders. The astute reader will see straight away the relationship between colour and left-channel audio. My general stereo test bench has three 8-pin plugs on the same TV set. Which one is used depends on the make of camcorder being tested.

When I started doing camcorder repairs some four years ago the 8-pin connections for JVC, Panasonic, Hitachi, Akai, Sharp etc. models were all the same, as in the second column.The video and audio signals were at pins 1 and 6 respectively, with power for the r.f. converter at pin 3. With the advent of stereo camcorders the JVC and Panasonic connections began to differ from each other, as shown in columns three and four. JVC used pins 6 and 8 for the stereo sound signals while Panasonic used pins 7 and 8 with L + R/mono at pin 6. JVC added a stop/start trigger output at pin 5 for master edit control of the mains machine when it's used for copying, subject to a suitable external pause facility.

A problem occurs when users purchase 8-pin AV leads then change the camcorder, from JVC/clones to Panasonic/clones or vice versa. When a JVC stereo lead is connected to a Panasonic camcorder the left channel is very quiet. When a Panasonic lead is connected to a JVC/clone there's twin-channel audio but the left channel is actually L + R/mono.

Now to the business of the Hitachi VM600 (or VM500). If, as in my case, one of these machines is connected to a Panasonic stereo lead the left-hand channel audio input impedance is low enough to bring the "not MESECAM" circuit into operation. The camcorder's colour playback circuits switch to SECAM and the result with a PAL TV set is no colour.

The bench also has a parallel JVC stereo YC 8-pin connector lead that goes to the monitor's input. Unfortunately the JVC stereo test lead is connected to a scart plug, so pin 7 of the Hitachi 8-pin AV connector was connected to ground via the YC chroma circuit to pin 15 of the scart plug and to the TV set's scart socket red channel input, hence via 75Ω to ground. This also switched the MESECAM logic on.

Fortunately the more sophisticated test bench is wired for mono, so there's no problem.

Further Pitfalls

Further pitfalls can occur when the enthusiast (there are a lot of them in the "film your wedding" brigade) connects a camcorder to a JVC GFS1000's AV input. There's no problem when the correct JVC leads (VC-V83U and VC-V804E) are used as they have a metal plate to earth an external input logic line, only the signal wires being connected. But using an 8-pin to 8-pin lead, wired pin to pin, will blow the playback camcorder's circuit protectors because the 8V at pin 3 is connected to the 75Ω loading at pin 3 of the camcorder's AV input, thus increasing the 8V line loading by more than 100mA. In all probability the circuit protector will be taken out.

When S-VHS is used pin 1 becomes luminance (Y) and pin 7 chrominance (C), but not if it's used for audio when pin 3 might be used for chrominance. It seems more sensible to me to advise the owner to use the 4-pin YC S-connector and, if required, the 8-pin AV connector just for audio and stop/start.

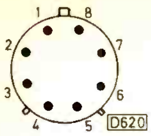
Scart AV Connections

Table 2 shows an example of scart connector wiring for camcorder AV use. One can deduce that an 8-pin to scart connector will be wired as 8-pin out to scart plug in. In this example 8V at pin 16 switches the TV set to RGB operation. Some sets may switch to scart input when the camcorder is powered up, others may require selection of the AV channel as well.

A scart plug-to-plug lead may be wired pin to pin or the video (pins 19 and 20) and audio pins (1-2, 3-6) may be

Table 1: Connections to miniature 8-pin DIN AV connectors.

Pin	*JVC and Panasonic*	*JVC stereo*	*Panasonic stereo*	*JVC AV input*	*Hitachi*
1	Video	Video	Video	Video/Y	Video
2	Video gnd	Video gnd	Video gnd	Video gnd	Video gnd
3	8V	8V	8V	Chroma	12V
4	Audio gnd	Audio gnd	Audio gnd	Audio gnd	Audio gnd
5	–	Stop/start	–	Video/Y	Stop/start
6	Mono audio	L ch.	L+R	YC gnd	Mono
7	–	Chroma	L ch.	L ch.	MESECAM
8	–	R ch.	R ch.	R ch.	Video



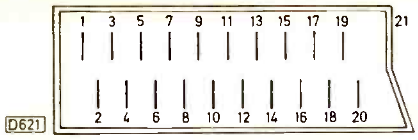


Fig. 1 (left): The 8-pin DIN AV connector.
Fig. 2 (right): Scart AV connector, from the solder side.

Table 2: Scart connections for camcorder AV use.

1 Audio R ch. output from equipment.
2 Audio R ch. input to equipment.
3 Audio L ch. output from equipment.
4 Audio ground.
5 RGB blue signal ground.
6 Audio L ch. input to equipment.
7 RGB blue signal.
8 12V 1kΩ to switch TV set to scart signals. VCR may provide play voltage. Connected to pin 3 of camcorder 8-pin connector.
9 RGB green signal ground.
10 Data bus 2.
11 RGB green signal.
12 Data bus 1.
13 RGB red signal ground.
14 Data ground.
15 RGB red signal. For S-VHS, chroma signal C.
16 Blanking signal or 12V via 470Ω to switch TV set to RGB.
17 Video ground.
18 Blanking signal ground. Can be used for video ground.
19 Composite video output or S-VHS Y signal output.
20 Composite video input or S-VHS Y signal input.
21 Metal shield – ground.

Table 3: 8-pin AV connector to scart plug wiring connections.

8-pin connector	*Scart plug*	*8-pin connector*	*Scart plug*
1	20	5	–
2	17	6	6
3	8	7	15
4	4	8	2

cross-connected. A cross-connected scart lead is the most common type for connecting video equipments to each other, to conform with the configuration of output to input. If the scart lead is wired one way only one end will conform with output and the other with input. Connecting it the wrong way round will result in no signals at all.

Table 3 shows typical pin-to-pin wiring for an S-VHS stereo 8-pin to scart AV connector lead.

A Warning

Serious damage can occur when an AV connector lead is plugged into a viewfinder's monitor output by mistake, particularly when the owner is trying to use a character generator. The viewfinder video drive signal from within the camcorder can be from a transistor without a collector load. It's intended for a viewfinder monitor with an impedance of about 1kΩ. If a 75Ω load is connected the transistor will burn up, possibly damaging the PCB print beyond repair. Models to watch out for are mainly the earlier ones, in particular the Panasonic NV-M1 and NV-M3, the Ferguson FC04 and the JVC GFS1000.

Fifty Years in Radio and TV

Part 3: The Day TV Took Off

Harold Peters

When Princess Elizabeth married Prince Philip the cameras were banned from Westminster Abbey. The reason for this was that the Duke of Norfolk, who arranges Royal events, had seen the heat from the studio lights pre-cook an egg during a Philip Harbens cookery demonstration. Thus when the BBC applied for permission to televise the Coronation of Queen Elizabeth II in 1952 they again got a flat refusal. This despite the fact that their current cameras could operate perfectly with the lighting already permitted for the newsreel cameras and the fact that they could be completely concealed. King George V's widow Queen Mary expressed a desire to see the ceremony however. Through failing health she was confined to her quarters. It seems that this fact tipped the scales, enabling the Coronation to be televised. The BBC worked flat out to make a success of it, using every bit of gear they could lay their hands on. Richard Dimbleby provided the commentary from within the Abbey. The programme was linked to the continent and several medium-power transmitters in the course of construction were pre-commisioned to give the widest possible audience. Inevitably there was a major boom in the sales of TV receivers.

The Philips range at the time included a projection set that used a folded optical unit with a 2½in. c.r.t. It could produce a four by three foot picture on a home movie style screen. On the great day yours truly was kept busy driving one of these sets in a local village hall packed with souls who had no TV of their own. These projection units needed "driving". The 25kV e.h.t. was provided by a separate module that consisted of a blocking oscillator and an output pentode which was transformer coupled to a tripler with three valve rectifiers. Regulation was abysmal, and you could tell that excess current was being drawn by a characteristic whine which drowned out the familiar 405-line 10kHz line whistle. It was a cold, wet day and the hall was draughty. I caught flu.

Televising the Coronation was a milestone in that for the first time more people watched than listened. And the audience balance, once having been tipped, stayed that way. Overnight radio had become "steam radio".

Among the top-line producers who had been moved from radio to TV was Barney Colehan. He lived round the corner and originated several indoor TV OBs from the Northern region. The most memorable of these were "Those Were the Days" and "Top Town". One problem he had was invited audiences who laughed in the wrong places because they watched what was going on rather than what was going out over the air. The projection sets we had used for the Coronation made ideal audience participation monitors, and thus earned their keep wherever Barney went. They also brought me as close as I ever got to my ambition to be in TV broadcasting.

Outside Broadcasts

Those who have spent their time on the retail or repair side of radio/TV would find the broadcast side another world entirely, with a different terminolgy, equipment and working habits. They had a chap who would be welcomed by all those electronics technicians who work for a non-technical boss. His title was the Sen Tels Eng OB. A tall man in a dark suit, he would go round asking everyone "getting everything you want?" A real Mr Fixit. But if some bright spark of a producer wanted to tip the whole bag of tricks upside for a few seconds in order to get a special effect he would lay a friendly hand on the producer's shoulder and say "can't be done old boy". And that was that. We could do with more like him.

Sets of the Period

By 1955 we had run out of fingers on which to count the number of Band I stations in operation. To cope with wide variations in signal level, setmakers had introduced a.g.c. It had long been in radio sets but the problem with TV is that the video signal doesn't have a.d.c. component to act as an indicator of signal strength. There were several ways of getting round this problem. The most sophisticated was to sample the signal during the back porch period when it's at black level. The simplest was to use the d.c. bias established at the grid of the sync separator valve since this provides a mean level that's proportional to signal amplitude. Naturally most sets adopted this approach. You don't get the problem with the 625-line system since with negative modulation the sync pulse tips represent maximum signal amplitude. Thus a simple peak detector will do.

Something else that was beginning to appear in TV sets was flywheel line sync. There were again various ways of going about this. One of the most sophisticated was used by Ferguson in the 203T series, see Fig.1. This was one of the first UK TV designs to use a sinewave oscillator to generate the line drive signal. The output from the flywheel sync detector circuit was applied to a reactance valve which controlled the oscillator's frequency. This introduced us to another phenomenon. An EF80 pentode was used as the reactance valve, turning a voltage change into a capacitance variation. For most of the time it was run at close to cut off and was therefore subject to cathode poisoning. Whenever we had one of these sets in for repair we swapped the EF80 reactance valve over with the hard-working EF80 used as the second i.f. amplifier valve. This immediately improved the sync performance and, as the greater anode current purged the cathode, the i.f. gain was soon fully restored.

By this time some of the smaller TV factories had fallen by the wayside and the home construction market had predictably run out of VCR97s. There were now enough genuine TV components on the market to enable constructors to build proper TV sets with magnetic deflection. The outstanding example was W.D. Flack's Viewmaster, which was within the capabilities of the majority of enthusiasts. Most of its coils were prealigned, but many a dealer was asked to apply the finishing touches to someone's home effort. We found that the soldering tended to err on the generous side and that most faults could be cured by running off the excess. The phrase "tune for maximum smoke" took on a very real meaning. . .

My own favourite sets of the period were those in the Bush TV22/24 series. They were well built, reliable but not all that sensitive. The Ekco T161 was popular, a nice

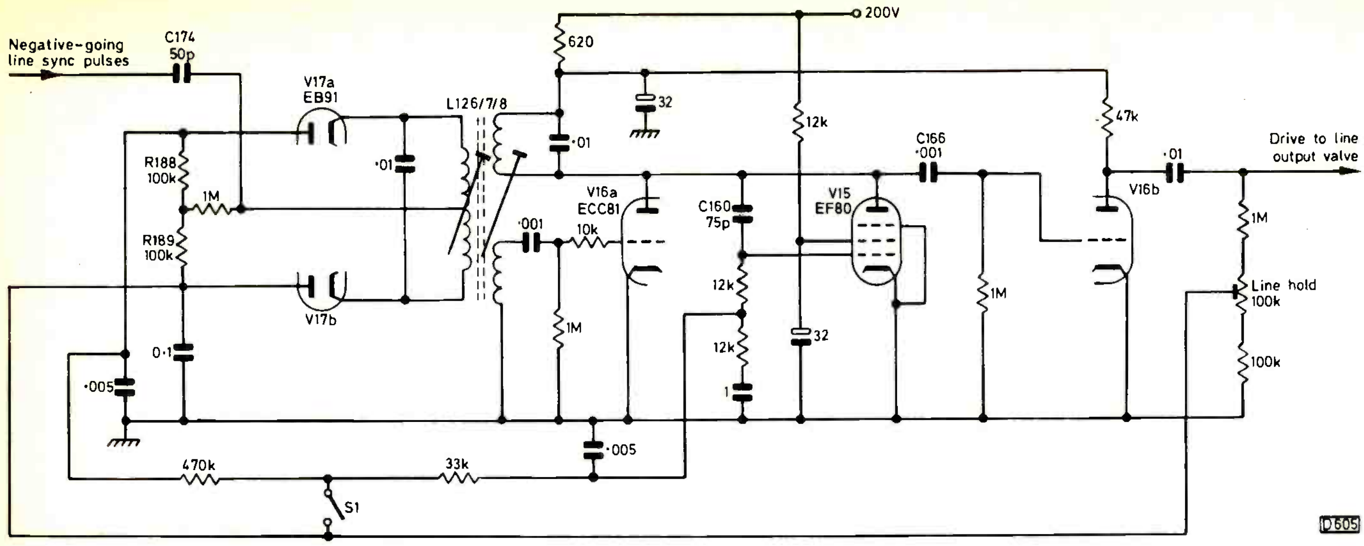


Fig. 1: The complex line drive waveform generator circuit used in the Ferguson 203T series released during 1955. The heart of the circuit is the sinewave oscillator V16a. A tertiary winding on the oscillator transformer L126/7/8 feeds the flywheel sync detector diodes V17a/b which are switched on to sample the sinewave signal by negative-going sync pulses fed to their cathodes via C174. The output should be zero – the sinewave passing through its zero point. If the phase of the sinewave is different at the instant of sampling an output is developed across the load resistors R188/9. This is filtered and used to bias the reactance valve V15, which acts as a variable capacitor connected across the oscillator's tuned circuit. The sinewave output is fed via C166 to V16b which converts the waveform to a squarewave for driving the PL81 line output valve. S1 closes when the line hold control is adjusted (push in and turn). To obtain a negative bias source the hold control is connected to a point in the line output pentode's control grid circuit.

straightforward set. Murphy, who started out well enough by extending its "baffle" theme from radio to TV, then went all arty-crafty with a circular chassis frame on which four wings carried various subchassis. Although less workmanlike Pye included everything in its basic Model V4, with a washboard front. The set had flywheel sync, a.g.c., noise suppression and interlace filtering. Though setmakers were turning sets out as fast as they could there were still many homes without TV and there were "TV parties" where people just dropped in to view.

Recollections

Talking of people dropping in, our workshop was often visited by a tall, white-haired gentleman with a strong voice. He was G.A. Briggs, the creator of Wharfedale Speakers, whose factory was not far off at Idle near Bradford. One day he invited us over to hear something new. It was a long-playing vinyl disc he'd brought back from a recent trip to the USA. As we listened to it being played via his special Leak amplifier, through two loudspeakers in brick enclosures, he remarked "it sounds as if the orchestra is here in the room with us". Being naive, I commented that we couldn't possibly have got the whole Philadelphia Orchestra under Stokowski into his little office. There was a horrible silence and my senior engineer gave me a withering look. After a while Mr Briggs said "you're dead right!"

And so it came pass that this acknowledged expert on speakers and sound reproduction went to the trouble of hiring the Royal Festival Hall in London, engaged a full orchestra and organ and had them play their recorded work for real so that a direct comparison could be made. That was and remains my sole contribution to hi-fi. But ever since, when dealing with customers who strive for perfection, I suggest to them that they are listening only to a bit of black paper flapping about or watching three little rapidly moving dots. If what they think they hear and what they think they see makes them happy it's doing its job and that's all that matters.

Those two projection sets we had were still earning their keep. They were used for a "Top Town" programme at the inauguration in 1955 of the recently acquired BBC Northern TV studios in Dickinson Road, Manchester. The building was a chapel that had already been used as a film studio and had been soundproofed. It seemed as though the whole BBC was there: me and my machine were sandwiched between S.J. Lobiniere and Violet Carson.

We had to provide further monitors for the four journalists who were judging the show in a separate room. This was mainly because the event coincided with the first night of Television News. Up till then it was Newsreel – a cinema-style review that was issued twice weekly and ran around three days late. That night my right hand got televised, the one and only time that any part of me has appeared in front of the camera! Northern TV had no OB unit of its own and used to borrow one from the Midlands or Scotland. The latter was used on this show, coming straight from an OB about the Forth Bridge. We collected quite a few coins from the roof of MCR11 during a break in rehearsals!

The next show in which use was made of our projection units was quite different. Apart from featuring, well down the bill, a young couple called Morecambe and Wise, we found that the unit was struggling to present the show with only half a crew. I ended up fulfilling my cherished ambition to be in broadcasting by becoming the dolly pusher for number two camera in addition to looking after my own gear. As the show closed I was asked to wind the "mangle" that rolled the captions. And the reason for all this? Well ITV had started up in London and had spirited a lot of the lads over to the "other side". The BBC's monopoly of broadcasting in the UK was at an end, and what some regard as the golden years of television were about to begin.

Once again I missed the opening. Secondary service areas were only just getting their first BBC transmitters, and were crying out for trained servicemen. So I moved to East Anglia, and from that unlikely area wrote my first contribution to *Practical Television*.

TV Fault Finding

Reports from Philip Blundell, AMIEIE, Eugene Trundle, Nick Beer, Mick Dutton, Steve Cannon, Ed Rowland, J.K. Potts and K.W. Saxon

Philips CP110 Chassis

The problem with this set was intermittent power supply shut down: the picture would go off for a split second, the display flickering in sympathy. A light tap on the panel would instigate the fault, which would occur even with the line output stage disconnected. I've had a similar fault caused by a faulty chopper (SOPS) transformer with loose foil windings, but the panel wasn't sensitive in that area. In fact the problem was nearer to the mains switch – the posistor in the degaussing circuit was arcing internally. **P.B.**

Philips GR1-AX Chassis

This set suffered from tuning drift. When it was hot the tuning would be just lost on channel change. As a bad batch of ZTK33 33V stabilisers was used in some other sets the 33V supply seemed a good place to start. It was stable, but I noticed that the feed resistors from the 95V line were of lower value than given in the manual (it turned out that my set was a version 2, manual 4822 727 18084). The fault was brought on when the tuner was heated, a replacement U743 curing it. **P.B.**

Panasonic TC2216 (U3W Chassis)

If you get one of these sets that emits a squealing sound, possibly accompanied by line tearing, serrations on the picture or a distorted raster, replace C809 (1μF, 250V) in the power supply. It's the reservoir capacitor for the supply derived from the chopper transformer for the chopper control circuitry. **E.T.**

Salora J Chassis/Hitachi CPT2250 etc

A ragged picture, or line tearing, is becoming a common fault with these sets. It will often be found after carrying out a repair in the power supply. The usual cause is dry-joints or breaks in the print at the snubber resistor associated with the Ipsalo transformer. Check this whenever you have one of these sets in for repair as repeated running with the snubber disconnected will lead to failure of the chopper transistors TB700/701. **N.B.**

Grundig CUC95 Chassis

There was no picture as the c.r.t. heaters were out and there was no e.h.t., indicating a fault in the line timebase. Checks showed that the TDA1950 timebase generator chip on the deflection panel wasn't providing a line drive output. The d.c. conditions here were also incorrect. A new TDA1950 restored the tube's heater supply but when I reconnected the tripler there was, a few minutes later, a loud crack followed by loss of sound and vision. The e.h.t. cap had fired over due to damp around the cavity. After kicking myself I cleaned the area around the cap and replaced the TDA1770 field timebase chip which had succumbed. This restored normal operation. **N.B.**

Panasonic TC2253 (U5 Chassis)

This set was in the overload condition, with a squeal coming from the back. We lifted the h.t. feed resistor to the line output stage, R551. The h.t. then came up, proving that the fault was due to excessive loading. A resistance check between the collector and emitter (ground) of the line output transistor produced a reading of 2-3Ω. The transistor read o.k. when removed but the short remained across the PCB lands. A new transformer restored normal operation – the faulty one had an internal short to ground via pins 5/6/8. **N.B.**

Panasonic TC2205 (U2 Chassis)

Severe picture disturbance in the form of wildly incorrect line and field sync was traced to one of those purple capacitors. C854 was open-circuit. **N.B.**

Ferguson TX10 Chassis

The problem with this set, which was fitted with a mechanical push-button unit, was that it would drift off tune very occasionally. We checked the 33V tuning line which was rock steady. Then we changed the tuner and the push-button unit. As none of these measures provided a cure we suspected a problem in the a.f.c. circuit. Sure enough replacing the i.f. subpanel solved the problem. But we could find nothing wrong with the old unit, which worked perfectly in another set. The problem has not returned in either set. **M.D.**

Philips CTX-S Chassis

It's easy to get caught out sometimes by missing the obvious. A customer brought in one of these sets with the complaint that there was no sound or picture. We'd just dealt with another one with field collapse, so we quickly advanced the first anode control and saw that there was a line across the centrè of the screen. New field output and timebase generator chips were fitted before we did what we should have done first, check the supply lines. The 12V supply was missing due to an open-circuit safety resistor. **M.D.**

Sony KV2000 Mk II

The complaint with this set was of a whistle from the back and corrugated verticals. These symptoms indicate a problem in the power supply. It didn't take us long to find that C612 (3·3μF, 25V) was the cause of the problem. C609 (0·47μF) and C610 (220μF) are worth checking as well as these also tend to dry up. **M.D.**

ITT 80-90° Chassis (CVC823 Power Panel)

The complaint was no results. When we checked the set we found that the power supply was heavily loaded. So we disconnected the feed to the line output stage and connected a 40W bulb instead as a dummy load. The power supply then behaved correctly. There was no obvious short across the 122V h.t. line, nor across any of the supplies derived from the line output transformer, so we suspected shorted turns within the latter. A new one was ordered and fitted but made no difference. Maybe the problem was in the scan coils or the scan coupling capacitor

C506? When C506 was disconnected the set was all right. On examination of the scan coils we found the cause of the problem: there's a pulse capacitor C1021 (270pF) across two tags, and its connections had been left too long. One of them was lying across two tags, shorting the line and field coils. Why this short had suddenly decided to show up remains a mystery, as the set had been working for several years.

The problem with another of these sets was a slight hum bar on the picture and very touchy tuning. It was caused by cracked print at the 90V supply reservoir capacitor C516 (10μF). **M.D.**

ITT Pico Chassis

The power supply wouldn't start. We suspected loading by the line output stage and this was confirmed by disconnecting the scan coil plug. As no obvious shorts could be found we ordered a new line output transformer. This cured the problem, but the customer was not exactly happy about the cost! **M.D.**

Decca/Tatung 160 Chassis

This set was dead. Our first check showed that there was h.t. at the collector of the chopper transistor. So we checked the 12kΩ start resistor R802, which is a common failure. It was o.k., and the voltages around the TDA4600/2D chopper control chip were also correct. Scope checks showed that the drive output was present at pin 7 of the chip but not at the base of the chopper transistor. L802 in the coupling circuit had gone open-circuit, a replacement putting matters right. **M.D.**

Philips 2A Chassis

We had three of these sets in one week with the 2A mains fuse blasted and the BUT11A chopper transistor T7686 short-circuit. D664 (BYD33J) was also faulty. The cause of all this was that C2664 in the snubber network had split in half. It's 1·5nF, rated at 1kV. Replacing these components restored the sets to normal operation. In sets that have come in for other faults we've seen this capacitor to be split or bulging. Obviously we change it before the chopper transistor fails. **S.C.**

Logik 4090 (Ferguson TX90 Chassis)

This set blew the 1·6A fuse at switch on. Resistance checks around the line output stage revealed a short-circuit between the collector of the line output transistor and chassis. When tested the transistor seemed to be o.k., so a new output transformer was fitted. This restored normal working. **E.R.**

JVC C140EKY

This 14in. colour portable came in dead with only the standby light coming on. As we didn't have a service manual it took us some time to locate the cause of the trouble, a barely perceptible dry-joint at the emitter of Q924 in the power supply. **E.R.**

Decca/Tatung 160 Chassis

This set had been in two weeks previously with field collapse. We'd replaced the TDA3651 field output chip to put that right. Now it was back in the workshop again, this time with the complaint that the sound and picture disappeared intermittently. The cause was a dry-joint at the emitter of the chopper transistor Q801. It would seem that replacing the field output chip had contributed to the problem as the chopper and line output transistors are mounted on the same heatsink as the chip. Thus flexing the panel during the first repair could have brought on the second fault. For good measure we resoldered the legs of both transistors. **E.R.**

Rediffusion Mk 4 Chassis

These sets have been very reliable over the years and still give good service. The symptoms with this one were low width and a burning smell. After resoldering the usual crop of dry-joints in the width and EW correction circuits the symptoms remained the same, with the parabola output transistor 3TR5 (a Darlington device, type BDW23C) getting extremely hot within seconds. Visual inspection showed that the culprit was 3C24 (3·3nF, 1kV) which had a pinprick hole through its casing. After replacing this capacitor the set performed normally. **J.K.P.**

Bush 2114/2020/2321

This set was completely dead though all the fuses were intact. On making checks in the power supply we found that the surge limiter resistor R816 (4·7Ω, 5W) was open-circuit because the BU508A chopper transistor Q801 was short-circuit. As so often with power supplies that use a TDA4600 type chopper control chip (TDA4601 in this case) the cause of the trouble was the resistor connected to pin 4. In this chassis it's R808 (270kΩ, ⅛W): it had gone open-circuit. **J.K.P.**

Philips KT3 Chassis

We've had several interesting faults on these sets recently. The problem with the first one was pulling at the bottom of the text display. Dry-joints on plug V2 on the text panel were the cause. When we removed the panel we found that all the joints on it were in an appalling condition.

Another set would trip intermittently. We eventually found that the chopper transformer T465 was faulty. **K.W.S.**

Ferguson TX90 Chassis

The problem with this set was low gain. We found that the cause was the SL431 i.f. preamplifier chip – a squirt of freezer would restore the signals for a couple of minutes. **K.W.S.**

Ferguson TX9 Chassis

There were several problems with this set – intermittently going into standby, volume variations, and scrambled teletext. The cause was a number of dry-joints around the mains transformer on the standby subpanel. When these were made good normal operation was restored. **K.W.S.**

Ferguson TX10 Chassis

A faulty first anode control was the cause of intermittent brightness fluctuations with this set. Out of curiosity I dismantled the control and found that the track had a large, burnt, cracked area. I've since had the same fault with two more of these sets. **K.W.S.**

What a Life

Donald Bullock

"It's time we got a new car" said Greeneyes, surveying a local paper. "Ours is old-fashioned, makes too much noise and I don't like the radio."

"Well that's it!" I replied. "If you don't like the radio the car's just got to go."

"Cousin Stanley in Stroud would buy it" she continued. "His car blew up last week and he needs another. He's getting a lift into town tomorrow to do a bit of shopping. If we let him use our car he's bound to ask again if we're ready to sell it. Then we can have this Jaguar."

"What Jaguar?" I asked.

"This one here in the paper. We always used to have a Jaguar. The silencer on our car is noisy, and don't forget that you stranded yourself twice last week because of that sticky petrol guage. What if I got stranded? Someone might kidnap me!"

"I'd probably give him a bounty" I said. "It could go towards your new car, and to all the parking tickets he'd collect while chauffeuring you around Gloucester on your shopping trips. He wouldn't have the experience I have of avoiding the traffic wardens. If you could only make a shopping list I could drop you off once a week instead of having to run you into town two or three times in a day then having to crawl round till you come out of the shop."

Time to beat a hasty retreat to the workshop, there to find a shadowy figure struggling with a Ferguson teletext portable. "What's your trouble then?" I asked, unlocking the door.

When he got the set to the bench he jerked a convex thumb towards it. "It worked very nicely then suddenly it started banging" he said. "Now it shuts its mouth and gives me channel 4 even when I don't want it."

The Explosion

Once he'd gone I plugged it in, switched on and engaged the back in a bout of unarmed combat. The works looked like the TX9, but there was a large, black, irregularly-shaped plastic box fixed to the left-hand side of the cabinet. I wondered what demons lay in wait inside while spinning the set round to see what it's front would tell me. There was a crunching sound and an explosion, accompanied by acrid smoke. This was followed by a bang as the lights went out and after that there were the sounds of bits of debris dropping.

I hurried from the workshop having found, during a troubled lifetime, that fleetness of foot is a sound remedy for many of life's ills and a temporary relief at least for most of the rest.

As I emerged I almost collided with the ample form of Dr. Boney. He's an orthopaedic surgeon and we're both members of a certain association. He just managed to avoid me and shook his head. "Still rushing around! Time you took things more slowly. Flinging yourself around like that plays havoc with your joints. I've left a club circular in your porch."

As the smoke cleared I inched back in and found that the Ferguson set's 13A plug was still in the bench socket but was now minus its top. That was the debris I'd heard. Looking into the plug I saw that the fuse had been replaced with a shorter and slimmer one wrapped around with several thicknesses of aluminium foil. The plug had been of the cheaper type, with a badly fitting self-tapping screw to secure the top and no effective cable grip. Someone had shortened the lead and the resultant tension had brought the badly fitted bare conductors close together. My turning the set around on the bench had triggered the explosion and my fuses had declined to supply any more current.

I replaced the mains lead and plug, cleaned up the mess, mended the workshop fuses and wrote 'get bench tripper and aspirins' on the workshop notice board. Then I connected the set once more and started again. There was no digital display, just a pair of closely-spaced, glinting eyes, one red and one green. They were marked 'standby' and 'mute'. The channel-change button had no effect, there was no sound and no colour on channel 4, to which I assumed the set had defaulted. What with the explosion and this set of symptoms I began to wish my customer upon the competition. But not to panic. Becoming almost resolute, I reached for the giant magnifying glass and searched for dry-joints and cracks. Having found none it was time for deeper thought. I sought a way into the black box and soon found a couple of lugs that enabled me to separate it into two halves. Inside there was a printed panel whose connector, PL101, was loose on its pins. I pressed it home and tried again. Still no joy. Fuse F101 looked new but a paranoid tendency forced me to check it for continuity. It was open-circuit. When I'd fitted a replacement the set was almost back to normal. There was just the problem of no Channel 4 colour, and that was put right by fine tuning.

A Shopping Trip

Back to the house for some strong tea. There I found Greeneyes waiting to be taken on a shopping trip. I dropped her at Debenhams and waited outside on the yards of yellow lines, with the engine running and the clutch in, my eyes scanning both pavements as well as the wing mirrors and the one on the windscreen. Five minutes passed, then ten. Suddenly I saw in the mirror a hostile, wasp-like figure bearing down on me. I pulled away in the nick of time, leaving her standing with her arm in the air where my driver's door had been.

Once out of her sight I slowed down to kill time, then returned to pick up Greeneyes. Next stop was the Co-op. No sooner had she left than a pinheaded wasp came into view. He spotted me on the yellow paint and his pace quickened. Another close encounter. I sped round the block, picked up Greeneyes and then returned home.

The JVC HR7350

Back at the bench a JVC HR7350 was waiting for attention. The complaint was no tape movement. I slipped in a cassette and sure enough there wasn't any tape movement though the machine whirred away and did its best. After fitting an idler kit I thanked my lucky stars that some easy jobs still come my way. Then I tried the cassette again. It played perfectly. But there was no tape movement in the rewind and fast forward modes.

I took out the cassette, managed to fool the mechanism into working (something I can't always do), tried rewind and fast forward once more and saw that the motor wasn't turning. After removing the bottom I connected a meter across the motor and tried again. No voltage came the motor's way. As I'd a spare power board I fitted this but it made no difference. What manuals had we got? I pulled out a tattered one for a Ferguson lookalike and turned to the mechacon board. It contains about a dozen assorted chips, none of which I had, and some twenty transistors. With That Old Feeling (hopelessness) I switched on the scope's component tester and studied the board and the circuit diagram. Seeing a little circuit protector, CP2, disguised as a transistor I pounced and found that it was open-circuit. Since replacing the board is a lengthy business I thought I'd check CP1 whilst about it but couldn't find such a thing. I then applied the scope's probes to the area I now distrusted most and soon found that transistor Q16 was short-circuit base-to-collector. Replacing it cured the trouble.

A Vision

As I lifted the JVC from the bench the door opened and in came a strong smell of roses, violets and sweatpeas, followed by a heavenly vision. "I'm Cassandra Grant" she announced, "my boyfriend says you're very clever. Can you mend my set? Sometimes it won't start but when it does it works all day."

"Like me" I said, attempting to be amusing. It was a Ferguson TX10. When I switched it on the e.h.t. rustled up and the tube's heaters glowed, but there was no raster and no sound. I unhinged the back panel where the tuner lives and as I swung it down the set came to rights with a perfect picture and perfect sound. After a search for dry-joints I resoldered one or two and reassembled the set, then took it to the soak test bench. It worked happily for a couple of days then The Vision showed up again. We switched the set on and it worked for her too. I told her that I'd resoldered a couple of doubtful joints and that a tenner would cover it. Then carried the set out to her car.

"You are clever" the velvet voice said. "It's been in and out of Pudsey's shop half a dozen times and they couldn't put it right. It was they who told my boyfriend about you."

Mrs Runner and Clarence

As I returned to the workshop I encountered Stanley from Stroud. He was gazing at the car lovingly and listening to Greeneyes. Then the tiny form of Mrs. Runner appeared. She struggled in under the weight of a cardboard television box while her bulky, pot-bellied, wet-nursed son Clarence, who has everything and then some and whose set it was, ambled alongside.

"It went dead didn't it Clarence?" she asked.

Clarence made to speak but before he could manage anything Mrs. Runner continued.

"Yes it went dead. You don't use it much do you, Clarence?" Clarence shuffled a foot then she was off again.

"He doesn't use it much. It's only just out of a guarantee isn't it Clarence?" Clarence parted his lips but gave up.

"It's only just out of guarantee. Mend it for him please Mr. Bullock. Telephone me when its ready and I'll bring him along for it. That's what you want isn't it Clarence?"

Clarence managed to take in a little air.

"He'd like that Mr. Bullock. Only I do wish he'd speak up for himself."

The set was an Ingersoll XK51-2B, a 5½in. colour portable with v.h.f. and a.m. radio. There was a picture but no sound. I managed to obtain a photostat of the circuit but it was much reduced and far from legible. After making a few voltage checks I found that the AN7110 audio output chip IC201 had only the merest trace of d.c. at pins 7 and 8. Pin 2 should have received a supply voltage but didn't, so the hunt was on. It seemed to end at a hazy point marked U7 on the circuit diagram, but I couldn't match this up anywhere. Eventually I discovered that U7 was really J7 plus a bit of dirt, and after a search traced it on the circuit to pin 3 of IC800 from where 8V should have been supplied.

IC800 proved to be elusive. It took me a while to discover that it's stuck on the side of a transformer beneath the r.f. board. When I finally got to it I found that 15·5V went in but nothing came out. It's a uPC78M08H which the circuit refers to as a "video output buffer". This seemed odd! My data books had nothing to say about it but I found reference to an L7812CV and to my surprise this worked. Next I had to face the job of putting it together again, after which I phoned Mrs. Runner. She came along soon after, accompanied by Clarence.

"You're glad Mr. Bullock got it done aren't you Clarence?"

His upper lip quivered.

"He's glad you got it done Mr. Bullock. He doesn't say a lot you know. Dunno why."

Bounceback

As they left a weedy, pale little fellow drove up. He struggled to get the set out of his car then asked me for help. His voice was like that of a parrot with a cleft palate. The set looked familiar.

"It's my girlfriend's – Cassandra. She collected it from you earlier but when she got home it was the same. I've put our phone number on it so that you can ring when it's right." I put it on the bench, rather deflated by the thought of a tricky and unprofitable battle to come.

Devil Car

Just then Greeneyes came across with a cup of tea and Stanley drove into the drive.

"I've had a terrible time. That car's an agent of the devil. I pulled up outside the Co-op wondering where to park and a traffic warden jumped up and wrote me a parking ticket. Mentioned my come-uppance. Thin-faced woman I'd never seen before. After she'd finished the car spluttered to a halt outside Debenhams, as though out of petrol, though the petrol gauge said it was half full.

When I got out and opened the bonnet another warden came up, smiled and rubbed his hands. I thought he was cold and smiled back, but he wrote out another ticket and said I needed a clout. Found out I was out of petrol by taking off my belt and dropping one end into the tank. Then had to walk over a mile to get some petrol. When I got the thing going again the silencer fell off. Because of the one-way system I had to go through the town centre where I got booked for that. Wish I'd stayed in Stroud. If I were you I'd find a mug and unload that car. It's a curse."

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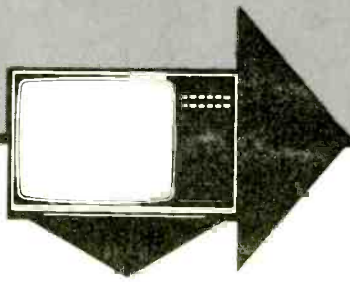


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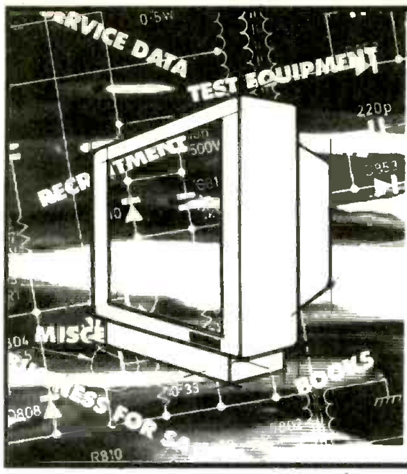

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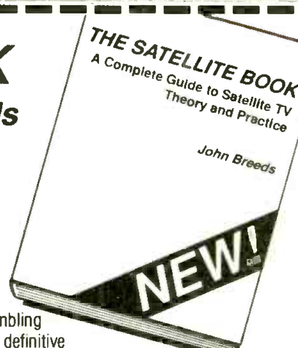

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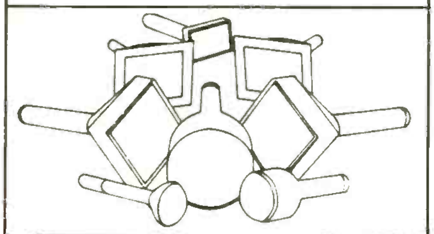

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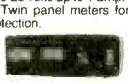

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KBP 04 30p
W02 15p
W004 15p
W005 20p
800V Bridges 2½ Amp 30p

G11 Drawer ASS 3 pots Mains Switch and Lead £2.00

K30 Drawer Ass with pots cable forme £1.00

TX10 Drawer with 8 way pots. ass £2.50

TX10 Ex. port with band switch (drawer) and U.H.F. only £2.50

Hills Meter for the car man, volts, amp, ohm with dwell and r.p.m. £35.00

Hills 9 piece tool kit in case £5.00

Abbey Security Smoke Alarm Model 101 £4.00

Philips Coaxial Cable Stripper SBC325 £7.50

Self adjusting cutter stripper £5.00

10 mixed tube bars £4.00

5000 Diodes-Resistors £3.00 pack

* D/P push mains switch 20p each

Mains lead & two pin socket for radio cassette 35p

T/V loop aerial 75p

Radio Telescope Aerial £1.00

Philips Silicon Grease £1.50 each

Freeze Philips £1.50 each

Foam Cleaner Philips £1.50 each

Contact Cleaner Philips £1.50 each

100 Coax Plugs 14p

De-solder pump + 2 nozzles Philips £4.00

Flat Red LED and Green 5p

500gm 60/40 Solder reel £6.00

Dual v/u meter −20 — +10db £1.00

K30 Thermistor 232266298009 75p

De-solder Pump £2.50

Portasol Flameless Gas Soldering Iron £16.00

Green & Red LED pack mixed 100 for £1.00

Hill Meter Leads, S/Rubber and Probes £4.00

CV 8617 10p
Y 716 10p
Y 729 30p
Y 730 10p
Y 827: 6A/1KV 20p
Y 860 30p
Y 933 5p
Y 969 50p
Y 997 30p
Min 12 volt Relays 75p
R 1038 40p
R 1039 40p
R 2009 80p
R 20106 £1.00
R 2029 50p
R 2210 60p
R 2257 60p
R 2265 50p
R 2305 50p
R 2306 30p
R 2322/2323 pair 80p
R 2323 15p
R 2396 50p
R 2461 80p
R 2030 50p
R 2433=BD124 30p
R 2540 £2.00
R 2737 40p
R 2738=TIP41 30p
R 2775=TIP41c 40p
R 3129=TIP47 40p
T 6068V 50p
R 4050 £1.00
S 2008b 80p
2SD898B £1.00
2SC1942 £1.00

Hitachi sets etc.

STR454 £2.00
STR6020 Kit £6.00
S 2000AF line o.p. £1.00
2SC940 £1.00
BU 105/04 80p
BU 108 £1.00
BU 124 50p
BU 126 80p
BU 180a 65p
BU 204 60p
BU 205 75p
BU 206 £1.00
BU 207 £1.00
BU 208 80p
BU 208A 75p
BU 208D 90p
BU 222 £1.00
BU 326 £1.00
BU 407 60p
BU 426A 45p
BU 500 £1.10
BU 500D £1.00
BU 508A 90p
BU 508D 80p
BU 508V £1.00
BU 705 £1.00
BU 806A £1.00
BU 807 £1.00
BU 824 50p
BUT 11 50p
BUT 13 600V-28A £1.00
BUW 11 50p
BUW 84 60p
BYW 20-08-9 £1.00
BYW 95 10p
BUX 39 25A-150V £1.00
BUX 84 50p
BUX 85 50p
BUY 49 20p
TIC 106a 30p
TIC 116m 30p
TIC 116n/Y 1003 30p
TIC 126N 30p
TIC 225S 30p
TIC 226E 30p
TIC 226m 30p
TIC 236m 30p
TAG 226/600 30p
TICV 106D (T09 case 2A/400V) 10p
TIP 29 25p
TIP 30 25p
TIP 30A 25p
TIP 30B 25p
TIP 30C 25p
TIP 31 25p
TIP 32 25p
TIP 33B 50p
TIP 33C 70p
TIP 34A 50p
TIP 34B 60p
TIP 34C 70p
TIP 35B 50p
TIP 35C 70p
TIP 35D 80p
TIP 36 50p
TIP 36C 70p
TIP 41 15p
TIP 41B 40p
TIP 41D 70p
TIP 42 10p
TIP 42/BRC 6109 10p
TIP 48 40p
TIP 49 30p
TIP 57 30p
TIP 100 30p
TIP 102 30p
TIP 110 20p
TIP 115 50p
TIP 117 50p
TIP 125 35p
TIP 126 40p
TIP 127 40p
TIP 130 30p
TIP 131 6p
TIP 136 30p
TIP 140 50p
TIP 142 80p
TIP 640 50p
TIP 2955 35p
TIP 1761A-1000V/4Amp 75p
T6032 30p
T6036 40p
T6040 40p
T6047 40p
T6049 40p
T6051 40p

Philips Handset IC £3.00
SAA3010P £3.00
MAB8461/WO63 £3.00

MAB 8420P-C031 £3.00
MAB 8400B-6 £3.00
MAB 8440P-D070 £3.00
MAB 8440P-D033 £3.00
MAB 8440P-D056 £3.00
MAB 8441P-T001 £3.00
MAB 8441P-T132 £2.00

M58484P £2.00

Hand Sets — Fidelity £15.00 to £35.00

ITT 8 and 6 Push Button £1.00
Pye 725 LOPTs £6.00
Pye 731 LOPTs £6.00
Thorn 8500 8800 LOPTs £5.00

CMC 301 front panel £5.00
CMC 303 front panel £5.00

CMC 302 Panel with TC mains switch etc £5.00

CMD 800 Decoder £8.00

C7 Hand Set £6.00

3 I.C. Power Supply G11 Full Remote Receiver Panel £3.00

Meters Hills 520 £17.00
Meters Hills 420 £10.00
Hills HD5000 Digital Meter 1000V DC 750AC 10 Amp 20 MRG Rangers £28.00

HT100 Multimeter £6.75
HT300 Multimeter £7.75
HT500 Multimeter £9.00
HT700 £15.00
HD1000 Digital £20.00
HD1200 Low Cost Digital £13.00
HD2500 £18.00
HD3000 Digital £25.00
HD5500 Digital £29.00
HD6000 Digital £32.00
HD8000 Digital £35.00
HD9500 Digital with capacity Temp Trans Volts Ohms and Amps ranges £60.00

Infra Red Hanset Tester
Works at 24 feet – Sound repeater. Works off 9 volt battery £8.00
Fits in top pocket.

Handset Tester with LED £4.50

Repaired Handsets
Philips K4-K35, RC5350-RC5300, RC5370, RC5375, repaired same day £10.00

RC4001 Full Remote KT3 K30 Teletext Handsets exchanged £15.00

NEW Type RC4001 9 CH not 12 £6.00

GEC Full Remote Infra-red, 1983 models £15.00

TOSHIBA HAND SETS
CT9185 CT9176 CT9133 CT938
CT995 CT9144 CT9185 CT9193
CT9383 CT9384 £4.00 each

Rediffusion MK3 £5.00

TOSHIBA HAND SETS
24 Button CT938 Fullremote £5.00
32 Button CT983 Videotext £6.00

THORN
VCR Front Display Panel £7.00

Large type ITT TV and V.C.R. Handset £15.00

GEC Ultrasonic 8CH Full Remote £10.00

G11 Full Remote Ultrasonic £10.00
G11 Ultrasonic Teletext Handset £10.00
8 C.H. Ultrasonic GEC Full Remote C2014H/C2219H £15.00
New Replacement for G11 Ultrasonic Full Remote £12.00
Thorn 4000 insert with 7 buttons £5.00
Decca RC 11 £14.00
Decca RC 12 £14.00
G11 Infra-red full teletext £20.00
Dynatron-Full remote CTV 62, 63, 64 £19.00
Hitachi infra red handset £18.00
Philips full remote KT3, 16C928/20C934; 7228/7324; K12 26C 797/1ST 66K 1826 £12.00
GEC infra red full remote 8 channel (I.C.SAA1250) £14.00
Philips infra red full remote 9 channel for 60 CP2605 £6.00
Philips infra red full remote 12 channel for 60 CP2605 £12.00
K35
KT3/K30 T/Text £12.50
KT3/K30 Full remote £15.00
KT3 Power supply £4.00
GEC infra-red 2236-2026 £4.00
GEC 8 button full remote £14.00
GEC push pad handset button blobs 10p each
Pye & Philips handset KT3-K30 chassis. No RC5150-RC5176-RC5171-RC5177.
Special Price £13.00
RC4001 KT3 and Teletex £14.00
IT CVC 32 handset repaired £15.00
CVC 32 Hand Set £15.00
CVC 45 3 and 2 Pin
TX10 Hand Set Text £12.50
TX9 with Text £12.50
TX9 & TX10 button print £2.00
TX10 Focus Pots £5.50

ITT
T/V & Video Processor, 1200 Type £10.00

PHILIPS
UNIVERSAL HAND SET £12.00 RC5 KT3 – K45

We have all parts for Philips Handsets

RC5353 £15.00
RC5300 £12.00
Philips RC5 £15.00

TEXT-TYPE
Replace Hand Set for Philips KT3-K30, K4 etc £12.30

THORN HAND SETS
9000 – 9600 – TX9 – TX10 – TX100
Text and Non-Text £10.00

PHILIPS
RC5171 £12.00

K35-K4 HAND SET
Repaired for £5.00