SEPTEMBER 1990 £1·60

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

FREE CASSETTE LABELS

NICAM Stereo Sound

The CD-TV System • DX-TV

Using a Vectorscope • Test Reports • TV Fault Finding

RGB Link for Satellite TV

VCR & CD Player Clinics

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A COMPLETELY NEW DIMENSION IN SOUND QUALITY!

NICAM

FULLY ASSEMBLED

DECODER

★ **Fully tested and aligned**
★ **Ready to install into almost any modern colour TV set**

The Maplin NICAM 728 Decoder converts the additional digital code present† in the TV signal to a high quality stereo soundtrack with a quality similar to that of Compact Disc.

This fully working system is based upon the Toshiba NICAM chip set, and comes ready assembled.

†Currently being transmitted from Crystal Palace, Emley Moor, *Wenvoe, **Winter Hill, **Mendip and ***Black Hill.

Upgrades almost any modern colour TV set – no need to purchase a new TV set or VCR!

** From April, **From May, ***From June according to IBA schedule.*

British Digital Stereo Sound for Television

The World's most advanced high quality stereo system for land-based television!

Features

★ Single +12V power requirement
★ Automatic audio switching (Mono-Stereo-Bilingual)
★ British Design
★ Reverts to FM audio if NICAM is not present
★ High Quality Optimum Performance without any additional IC's
★ NICAM mode indicators

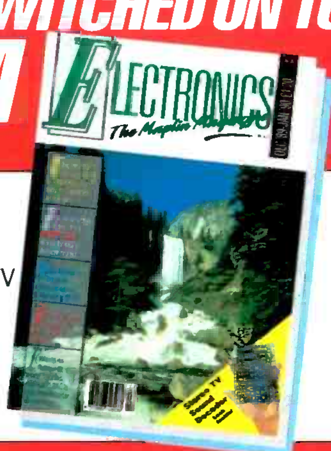
TELEVISION ENGINEERS

COMPLETELY ASSEMBLED FROM **£60*** PLUS VAT EACH

This price available to trade only, ring 0702 554171 and quote AM00A special 250 off deal reference: Television.
Trade: 1 off – £113, 10 off – £75, 50 off – £69.50, *250 off – £60 plus VAT each.
Normal Retail Price £129.95 (Inc. VAT) each (Order Code AM00A)

Initial availability limited – book your orders now!

ARE YOU SWITCHED ON TO NICAM



Issues 34, 35 & 36 of the Maplin Magazine contain full details of the NICAM decoder and the NICAM TV tuner projects.
Order codes:
XA34M price £1.00,
XA35Q price £1.20,
XA36P price £1.20.

★ Build-it-yourself NICAM decoder in kit form; order as LP02C £99.95

Maplin ELECTRONICS

CREDIT CARD HOTLINE

PHONE BEFORE 5PM FOR SAME DAY DESPATCH

0702 554161

ALL PRICES INCLUDE VAT.
All items subject to availability, all items will be on sale in our shops in Birmingham, Bristol, Leeds, Hammersmith, Edgware, Manchester, Nottingham, Newcastle-upon-Tyne, Reading, Southampton and Southend-on-Sea.

TELEVISION

September 1990

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Issue 479

On sale August 15th

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

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

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

SUBSCRIPTIONS
An annual subscription costs £20 in the UK, £24 overseas (by surface mail). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

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

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

this month

OUR NEXT ISSUE DATED OCTOBER WILL BE PUBLISHED ON SEPTEMBER 19

AA119 9p
AAY32 9p
AC107 40p
AC125 25p
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
BC108 8p
BC109 8p
BC109C 10p
BC115 10p
BC118 11p
BC140 20p
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BYX55/600 30p
BYX70/500 32p
BYX70/800 38p
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28pin 20p
40pin 25p

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BYZ88 RANGE
2V7 to 39V 6p
1.3W
BZX61 RANGE
2V7 to 39V 12p

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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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12.0 120p
14.0 125p
14.756 200p
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16.0 150p
18.0 130p
18.432 130p
24.0 250p
48.0 160p

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7805 35p
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7808 35p
7812 35p
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7906 40p
7908 40p
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78L08 28p
78L12 28p
78L15 28p
78L18 28p
78L24 28p
79L05 40p
79L08 40p
79L12 40p
79L15 40p
7818KC 100p
7824KC 100p
LM309K 100p
LM317K 220p
LM317T 180p
LM323K 420p
LM723 40p
78HGKC 570p
78HO5KC 800p
78H12KC 700p

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79GU1C 215p
79HGKC 800p

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DAF96 60p
DF96 50p
DL92 60p
DY86 50p
DY87 60p
DY802 75p
EABC80 60p
EB91 44p
EBF80 45p
EBF89 50p
ECC82 80p
ECC83 80p
ECC84 70p
ECC85 80p
ECH81 100p
ECH84 70p
ECL80 65p
ECL82 80p
ECL84 70p
ECL85 70p
ECL86 90p
EF80 65p
EF85 60p
EF89 85p
EF183 75p
EF184 85p
EL34 250p
EL36 90p
EL84 75p
EL95 85p
EL500 100p
EL504 130p
EY86 45p
EY87 45p
EY88 65p
EZ35 65p
EZ80 70p
EZ81 55p
GZ34 200p
PC97 100p
PCC85 60p
PCF80 80p
PCF200 135p
PCF801 110p
PCF802 80p
PCF806 115p
PCH200 100p
PCL81 62p
PCL82 80p
PCL84 80p
PCL85 80p
PCL86 80p
PCL805 80p
PFL200 110p
PL36 120p
PL82 60p
PL83 60p
PL84 80p
PL95 180p
PL500 110p
PL504 120p
PL508 200p
PL519 450p
PY81 90p
PY88 70p
PY500A 190p

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LED 3MM RED 5p
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LED 3MM GRN 10p
LED 5MM RED 5p
LED 5MM YEL 10p
LED 5MM GRN 10p

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GREEN 15p
YELLOW 15p

LINEAR IC'S

AN-203 210p
AN-210 165p
AN-214Q 170p
AN-228 280p
AN-236 235p
AN-240P 150p
AN-241 135p
AN-245 290p
AN-247 230p
AN-252 150p
AN-259 250p
AN-262 140p
AN-271 230p
AN-272 480p
AN-274 250p
AN-301 330p
AN-303 250p
AN-304 360p
AN-305 320p
AN-315 210p
AN-316 350p
AN-318 460p
AN-360 100p
AN-362 140p
AN-366 160p
AN-610 160p
AN-612 160p
AN-5151 600p
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AN-7168 260p

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AY3-1270 800p
AY3-1350 450p
AY3-8910 360p
AY3-8912 400p
BA-301 65p
BA-311 80p
BA-313 60p
BA-333 100p
BA-340 150p
BA-401 50p
BA-402 60p
BA-511 160p
BA-514 160p
BA-516 150p
BA-521 160p
BA-524 240p
BA-526 188p
BA-527 95p
BA-532 140p
BA-534 290p
BA-536 180p
BA-546 180p
BA-612 160p
BA-656 150p
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BA-684 400p
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BA-6411 250p
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BA-7004 200p
BA-7007 200p
BA-7021 180p
BA-7022 350p
BA-7752 250p
BA-7755 150p
BA-8420 350p
CA-3011 110p
CA-3012 150p
CA-3028A 95p
CA-3046 60p
CA-3048 190p
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CA-3054 96p
CA-3059 300p
CA-3060 280p
CA-3065 210p
CA-3080E 60p
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CA-3086 55p
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CA-3130S 100p
CA-3134E 280p
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HA-17524 250p
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LF-357 70p
LF-398 300p
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LM-307 42p
LM-308CN 70p
LM-311 35p
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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-380 100p
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LM-387 100p
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MB-3756 230p
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MC-1496 65p
MC-3302 70p
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MC-3403 60p
MC-3423 75p
NE-531 115p
NE-544 170p
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NE-5532P 140p
NE-5534P 110p
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TAA-661 100p
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TBA-560 120p
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TBA-810AS 60p
TBA-820 65p
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TBA-950 100p
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TCA-740 130p
TCA-830 90p
TCA-940 100p
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TDA-1001 200p
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TDA-2006 90p
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TDA-8170 320p
TDA-8190 280p
TDA-8440 380p
TDA-9403 250p
TDA-9503 240p
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
UPC-20C	220p
UPC-554	130p
UPC-555	60p
UPC-556H	80p
UPC-566	60p
UPC-571	220p
UPC-574	60p
UPC-575C2	90p
UPC-576	200p
UPC-577	64p
UPC-580	300p
UPC-592	95p
UPC-595	190p
UPC-596	190p
UPC-1001	220p
UPC-1018	170p
UPC-1020	200p
UPC-1023	60p
UPC-1025	230p
UPC-1026	95p
UPC-1028	90p
UPC-1031H2	180p
UPC-1032	60p
UPC-1158H2	70p
UPC-1167CL	170p
UPC-1181	110p
UPC-1182	110p
UPC-1183	200p
UPC-1185H2	230p
UPC-1186	80p
UPC-1187	150p
UPC-1188H	400p
UPC-1197	140p
UPC-1200	325p
UPC-1222	130p
UPC-1230	210p
UPC-1238	120p
UPC-1263	230p
UPC-1277	240p
UPC-1278	240p
UPC-1335V	320p
UPC-1350	115p
UPC-1353	160p
UPC-1363	190p
UPC-1365	320p
UPC-1368H	425p
UPC-1373	85p
UPC-1378	210p
UPC-1382	110p
UPC-1394	170p
UPC-1397	450p
UPC-1403CA	750p
UPC-1420CA	500p
UPC-1458	100p
UPC-1470	200p
UPC-1504C	400p
UPC-1505C	400p
UPC-1517CA	400p
UPC-1525C	400p
UPC-1536C	550p
UPC-1571C	300p
ZN-423	100p
ZN-424	100p
ZN-425	320p
ZN-426	260p
ZN-427	560p
ZN-428	425p
ZN-429	215p
ZN-435	340p
ZN-448	510p
ZN-459	190p
ZN-1034	170p
ZN-1040	640p
ZNA-134H	2160p
ZNA-234E	920p

JAPANESE TRANSISTORS

2SA-473	35p
2SA-490	60p
2SA-505	120p
2SA-509	120p
2SA-550	150p
2SA-562	50p
2SA-603	100p
2SA-606	300p
2SA-608	15p
2SA-634	50p
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2SD-1846	350p
2SD-1884	300p
2SD-1910	280p
2SD-1941	500p
2SD-1984	150p
2SJ-49	425p
2SJ-50	425p
2SJ-77	350p
2SK-19	45p
2SK-49	50p
2SK-55	100p
2SK-68	100p
2SK-134	415p
2SK-135	415p
2SK-147	160p
2SK-192	45p
2SK-195	150p
2SK-197	140p
2SK-312	750p
2SK-323	130p
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		850p

UHF TUNERS

U322LO	600p
U341	500p
U342	500p

VIDEO LAMPS

UNIVERSAL VIDEO LAMPS
12V.60 mA (300mm WIRES)
RED OR BLUE 30p

VIDEO LAMP FOR PANASONIC 60p

CASSETTE DC MOTORS

6V	240p
9V	240p
12V CW	240p
12V CCW	240p
13.2V CW	290p
13.2V CCW	290p

CASSETTE TAPE HEADS

MONO HEAD	90p
STEREO HEAD	150p
MINI HEAD	230p
AUTO REVERSE HEAD	260p

UNIVERSAL TRIPLERS	450p
SONY ON/OFF SWITCHES	200p
PHILIPS SWITCHES K30, K35, K40, KT3, KT4	150p

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AMSTRAD
VCR 4500/5200/9000 £14.50
VCR 7000 £18.00
VCR 6000/6100 £21.00
TVR2/TVR3/VCR4600/VCR4600 MKII/
VCR4700 £15.00

FUNAI
E11/VIP1000/VP1400/VCR4000 £20.00

FISHER
FVHP510/520/530/615/622/710/715/720/
721/722/910 £16.00
VBS7100/VBS7500/VBS9900 £29.00
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FVHP975 £32.00

GOLDSTAR
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VT120/VT220/VT225 £31.50
VT3000 £14.00
VT5000/VT5500 £19.00
VT6500/VT7000/VT8000/VT8300/VT8500/
VT8700/VT9300/VT9500/VT9700 £16.00
VT8/VT56 £41.00
VT65 £40.00
VT130/VT138/VT250/VT255 £29.50
VT61E/VT62E/VT63/VT64 £25.00

ITT
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VR3954/VR3963/VR3975/VR3985/VR3986 £8.80

JVC & FERGUSON
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(FOR ALL MODELS) £8.80

JVC 3HSS
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HR3750/HR3860/HR4100/HR7200/
HR7300/HR7350/HRD220 £8.80

FERGUSON 3HSS
3290/8903/8940/3V00/3V06/3V22/3V29/3V30 £8.80

JVC 3HSSL PIN
HR2200/HR3660/HR7600/HR7610/HR7650/HR7700/
HRD110/HRD111/HRD120/HRD121/HRD225 £8.80

FERGUSON 3HSSL PIN
8904/8924/8941/8943/8944/3V16/3V23/3V24/3V31/
3V35/3V36/3V38/3V29/3V49 £8.80

JVC 3HSSVA
HRD140/HRD141/HRD143/HRD150/HRD157/
HRD158/HRD160/HRD455/HRS10/HRS100 £18.50

FERGUSON
8945/8947/8948/3V42/3V44/3V45/3V46/
3V47/3V52/3V54/3V55/3V56/3V57 £18.50
8950/8951/3V64/FV10/FV11 £23.00
3V48 £30.00
3V43/3V53 £39.50

JVC
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HRD565 £30.00
HRD725/HRD755 £39.50

JVC & FERGUSON
3V32/8942/HR7655 £27.00
HRD180/3V59 £33.50
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LOGIK
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VX735A/VX755A/VX765/VX850 £20.50

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HS304/HS310/HS320/HS700	£26.00
HS306/HS710	£34.50
HS303	£26.00
HS301	£33.00

NATIONAL PANASONIC 4HSS-3HSSN

NV3000/NV300/NV7200/NV333/NV7500/NV7800/ NV7850/NV322/NV332/NV340/NV390/NV2000/ NV2010/NV7000/NV8170/NV8200/NV8400/ NV8600/NV8610/NV8620	£8.50

NATIONAL

NV777/NV330	£20.50
NV430/NV460	£18.00
NV730/NV770	£25.00
NV366	£25.00
NV180	£33.50
NV370/NV380	£11.00
NV788	£43.50
NV810	£42.00
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NV870	£50.00
NVG15	£41.50
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NVG40/NVG130	£28.00
NVG400	£42.00
NVG10/NVG11/NVG12/NVG14/ NVG16/NVG120EM	£28.00
NVG18	£41.25
NVG20/NVG21/NVG22/NVG25/NVG28	£38.00
NVG50	£36.00
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NVH70	£50.00
NVH65/NVD80	£50.00
NVG7/NVG9	£21.00
CAM CORDER VEH 0366	£60.00
CAM CORDER VEH 0292	£52.00

N.E.C.

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ORION

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PHILIPS

VR6460/VR6520/VR6920/64VR60	£11.00
VR6711 4 HEAD	£41.00
6920	£62.00

SAISHO

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VR3300X/VR3600X/VR3650/VR3800	£21.25
VR3200	£21.25
VR3300/VR3600	£21.25

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VTC9350/VTC9355	£28.80
VTC5500	£30.50
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VS1, VS2, VS3, VS4, VS5, VS6, VS9, VS10	360p
VS105, VS112, VS115, VS116, VS126, VS244, VS245, VS247, VS248, VS515, VS516	280p
VS201, VS301, VS303, VS304, VS603, VS606, VS607, VP58-P82	280p
VS125, VS155, VS165, VS220, VS240, VS250, VS512, VSX9	280p

AMSTRAD

VCR4500, VCR4600, VCR4600 MKII, VCR4700	280p
VCR5200	360p
VCR7000	360p

FERGUSON

3V00, 3V16, 3V22, 3V23	280p
3V29, 3V30, 3V31, 3V32	280p
3V35, 3V36, 3V38, 3V39, 3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 3V58, 3V59, 3V64, 3V65, FV10, FV11, FV12, FV14	280p

FISHER

FVHP420, FVHP520, FVHP530	360p
FVHP615, FVHP710, FVHP715, FVHP716, FVHP722, FVHP725, FVHP830	360p
FVHP905, FVHP970, FVHP980, FVHP990	360p

HITACHI

VT11, VT33	280p
VT61, VT62, VT63, VT64, VT65, VT86, VT88, VT110, VT122, VT120, VT128, VT130, VT135, VT138, VT150, VT168, VT220	280p
VT5000, VT8000, VT9300, VT9500	280p

ITT

VR3605, VR3905, VR3935, VR3985, VR3986, VR3993, VR3994	360p
VR3913, VR3914, VR3943, VR3954, VR3963, VR3984	360p

JVC

HR300, HR3330, HR3360, HR3660, HR4100, HR7700	280p
HR7200, HR7300, HR7600, HR7610, HR7650, HR7655	280p
HRD110, HRD111, HRD120, HRD121, HRD140, HRD150, HRD160, HRD225, HRD455, HRD565, HRD725	280p

MITSUBISHI

HS200, HS300, HS301, HS302, HS303, HS304, HS310, HS320, HS700	280p
HS306, HS307, HS400, HS710	280p

NATIONAL

NV100, NV180, NV300, NV333, NV340, NV366, NV600, NV688, NV777, NV788	280p
NV230, NV370, NV430, NV460, NV730, NV810, NV830, NV850, NV870, NV890, NV2000, NV2010, NV3000, NV7000, NV7200, NV7800, NV8600, NV8610, NV8620, NVG14	280p
NVG7, NVG19, NVG12, NVG18	360p
NVG21, NVG25, NVH65	360p

PHILIPS

VR6460	280p
VR2020, VR2021, VR2022, VR2023, VR2024	360p

SANYO

VHR1100, VHR1300, VHR1500, VHR2300	360p
VTC5000, VTC5150, VTC5500, VTC9300, VTCM10, VTCM20	280p

SHARP

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

SONY

SLC5, SLC6, SLC7	360p
SLC9, SLC20, SLC24, SLC30, SLC33, SLC44, SLHF100, SLF1, SLF11, SLF25, SLF30, SLF60, SLF100	360p

VCR BELT KITS

AKAI

VP-7100	180p
VS-1	150p
VS-2EG	100p
VS-4	120p
VS-5EG	100p
VS-9300	180p
VS-9500	155p
VS-9700	180p
VS-9800	155p

AMSTRAD

TVR-1-2-3	210p
VCR-4600 & MK2	210p
VCR-4700	210p
VCR-5200	210p
VCR-7000	80p

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FERGUSON

3292, 3V00, 3V01	150p
3V16, 3V22, 3V23	65p
3V29/30	120p
3V31/32	85p
3V35/36	80p
3V38-39	80p
3V42/43	65p
3V44/45	65p
3V34/54	65p
3V55	65p
3V58-59, 3V64-65, 8950-8951, FV10-11, FV12-13, FV14	140p

FISHER

VBS-7000	245p
VBS-9000	120p
FVHP520, FVHP530	80p
FVHP710, FVHP716, 722	120p
FVHP905, FVHP906, 907, 910	130p
FVHP615, 715, 725, 830	120p

GEC

4005	150p

HITACHI

VT-11, VT-33	100p
VT-5000	120p
VT-5500	130p
VT-8000	60p
VT-8500	60p
VT-9300	50p
VT-9500	50p
VT-9700	60p
VT-14-17-19-VT35, 38-88	120p
VT52-62, VT64-65-86	150p

ITT

VR3605, 3905, 3935, 3985	100p
VR3913, VR3914	100p

JVC

HR-3300, HR-3330, HR-3360, HR-3660	150p
HR-4100	180p
HR-7200	70p
HR-7600	80p
HR-7610	95p
HR-7650	75p
HR-7655	90p
HR-7700	77p
HRD-110, HRD-111, HRD-120, HRD-225	100p
HRD-250, HRD-455, HRD-565, HRD-566, HRD-725, HRD-755	100p
HRD-170, HRD-180, HRD-230, HRD-370, HRD-430, HRD-530	130p

MITSUBISHI

HS-200	200p

NATIONAL

NV-300	160p
NV-333	135p
NV-777	100p
NV-2000	150p
NV-3000	160p
NV-7000	95p
NV-7200	90p
NV-8600	160p
NV-7500, NV-7800	110p
NV-340, NV-366	140p
NV-600, NV-788	120p
NV-230, 250, 280, 370, 380, 430, 450, 460, 465, 600, 630, 730, 810, 830, 850, 870, 890	135p

PHILIPS

VR-6460	170p

SANYO

VTC-5000	75p
VTC-5300	100p
VTC-5500	95p
VTC-9300	220p
VHR-1100, 1300, 1500	100p

SHARP

VC-381/383/386	125p
VC-6300	150p
VC-7300/7700/7500	150p
VC-8300	150p
VC-8381, VC-9100	125p
VC-9300, VC-9500	135p

SONY

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

TOSHIBA

V-55/57	85p
V-5250/5280	230p
V-5480	210p
V-5475	160p
V-7540	160p
V-8600	150p
V-9600	85p

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AMSTRAD
★ VCR450, 4600, 4700 620p ★

CASSETTE HOUSING

FERGUSON

3V38-39	£24.00p
3V42-43, 3V44-45	£24.00p

JVC

HRD 110, HRD 120-121, HRD 225	£24.00p
HRD 140-141, HRD 455-725	£24.00p

VIDEO MOTORS

AMSTRAD

VCR-7000 REEL MOTOR	1700p

FERGUSON & JVC

CAPSTAN MOTOR PU-45979	2100p
CAPSTAN MOTOR PU-55371V	1950p
DRUM MOTOR PU-46414	1950p
REEL MOTOR PU-51381V	2650p

NATIONAL

REEL MOTOR MYN-135V5L FOR NV333, NV366	1350p

SANYO

REEL MOTOR 4-529V-10800	630p

SHARP

REEL MOTOR RMTOV 1008 GEZZ	1350p

SONY

CAPSTAN MOTOR A-6751131A FOR SLC6	700p
CAPSTAN MOTOR BHF 1100D FOR SLC7	2500p

VIDEO LAMPS

VIDEO LAMPS UNIVERSAL 12V60mA (300mm WIRES)	30p
PANASONIC VIDEO LAMPS	60p

IDLERS & PULLEYS REPLACEMENTS

HITACHI

FF REW IDLER 6886971	190p
PLAY IDLER V-6861482	320p

JVC

IDLER ASSEMBLY PU-47752	450p
TAKE UP IDLER PU-51402A	145p
TAKE CLUTCH PU-55373	225p
IDLER ARM PU-55373-3-8	285p
FAST FORWARD IDLER PU-45896C	210p

NATIONAL

IDLER	200p

SANYO

REEL PULLEY 143-0-662T-01201	520p

SHARP

IDLER NIDL0005 GEEZ	195p
IDLER NIDL0006 GEEZ	195p

SONY

REW. PULLEY A-6706-348-B	400p
REW. PULLEY A-6706-391-A/B	300p

SERVICE AIDS

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V. HEAD CLEANER	125p
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FOAM CLEANER	140p
ANTI-STATIC	140p
AEROKLEANE	125p
AERO DUSTER	140p
PLASTIC SEAL	130p
GLASS CLEANER	130p

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

UNIVERSAL TRIPLERS 450p

SONY ON/OFF SWITCHES 200p

SONY THYRISTOR SG264A 800p

PHILIPS SWITCHES 150p
K30, K35, K40, KT3, KT4

NEW PRODUCT

STK 085	1050p
STK 3102 II	600p
STK 3152 II	1150p
STK 4019	600p
STK 4032 II	650p
STK 4042 II	900p
STK 4132 II	750p
STK 4172 II	1050p
STK 4182 II	1100p
STK 4231 II	1650p
STK 4432	900p
STK 5331	500p
STK 5333	750p
STK 5335	500p
STK 5337	850p
STK 5338	500p
STK 5339	700p
STK 5461	850p
STK 5462	550p
STK 5466	850p
STK 5467	500p
STK 5478	650p
STK 5479	400p
STK 5725	600p
STK 5730	600p
STK 6732	1500p
STK 7226	800p
STR 3212	330p
STK 7310	650p
STK 7561	800p
STK 8280 II	1950p
STM 1240	600p
STR 1195	450p
STR 1229	550p
STR 3113	330p
STR 3135	330p
STR 3132	330p
STR 3214	330p
STR 3215	330p
STR 3315	330p
STR 4142	650p
STR 4512	500p
STR 5214	650p
STR 5314	650p
STR 20005	550p
STR 20013	550p
STR 30110	330p
STR 30112	330p
STR 30118	330p
STR 30120	330p
STR 30125	550p
STR 30134	330p
STR 50020	650p
STR 50213	650p
STR 56041	650p
STR 58401	600p

4000B SERIES CMOS IC's

4000	13p
4001	13p
4002	13p
4006	34p
4007	13p
4008	38p
4009	20p
4010	21p
4011	13p
4012	13p
4013	19p
4014	32p
4016	18p
4017	29p
4018	30p
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4020	33p
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4029	34p
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4031	90p
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4067	120p
4068	13p
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4073	13p
4075	13p
4076	42p
4077	13p
4078	13p
4081	13p
4082	13p
4085	36p
4086	30p
4089	75p
4093	18p
4094	44p
4095	58p
4098	50p
4099	42p
4501	27p
4502	36p
4503	30p
4504	55p
4505	180p
4506	58p
4507	30p
4508	67p
4510	32p
4511	30p
4512	38p
4513	80p
4514	65p
4515	65p
4516	36p
4517	100p
4518	36p
4519	28p
4520	36p
4521	86p
4522	43p
4526	38p
4527	41p
4528	38p
4529	65p
4532	48p
4551	75p
4553	140p
4555	29p
4556	36p
4557	140p
4583	60p
4584	30p
4585	40p
40100	120p
40101	78p
40102	150p
40103	120p
40104	80p
40105	140p
40106	35p
40107	50p
40108	260p
40109	74p
40110	170p
40114	180p
40117	180p
40147	240p
40160	55p
40161	55p
40162	55p
40163	55p
40174	48p
40175	60p
40181	170p
40182	70p
40192	48p
40193	48p
40194	58p
40208	240p
40257	120p

74 SERIES

7400	20p
7401	16p
7402	18p
7403	20p
7404	35p
7405	10p
7406	36p
7407	36p
7408	25p
7409	20p
7413	30p
7414	45p
7416	40p
7417	32p
7420	22p
7421	25p
7425	15p
7430	25p
7437	28p
7438	32p
7442	38p
7447	60p
7450	22p
7451	10p
7454	25p
7470	30p
7473	25p
7474	35p
7475	25p
7481	90p
7482	60p
7485	28p
7486	28p
7489	75p
7490	35p
7492	45p
7493	35p
7495	48p
7497	80p
74107	30p
74111	52p
74116	85p
74119	85p
74122	40p
74123	20p
74125	40p
74126	45p
74132	42p
74141	55p
74145	70p
74153	45p
74155	45p
74157	45p
74160	50p
74164	50p
74167	35p
74173	50p
74174	60p
74175	65p
74176	45p
74180	50p
74182	45p
74192	40p
74196	40p
74197	45p
74393	70p

74HC SERIES HIGH SPEED CMOS

74HC00	14p
74HC02	14p
74HC03	14p
74HC04	15p
74HC08	18p
74HC10	20p
74HC11	14p
74HC14	26p
74HC20	19p
74HC21	20p
74HC27	20p
74HC30	20p
74HC32	20p
74HC42	30p
74HC51	20p
74HC73	24p
74HC74	24p
74HC75	28p
74HC76	28p
74HC77	35p
74HC85	33p
74HC86	29p
74HC93	50p
74HC107	28p
74HC109	28p
74HC112	28p
74HC113	28p
74HC123	35p
74HC125	32p
74HC126	33p
74HC131	36p
74HC132	33p
74HC133	33p
74HC137	52p
74HC138	33p
74HC139	22p
74HC147	42p
74HC148	38p
74HC151	32p
74HC153	32p
74HC154	90p
74HC155	48p
74HC157	34p
74HC158	34p
74HC160	44p
74HC161	44p
74HC162	44p
74HC163	44p
74HC164	44p
74HC165	56p
74HC166	60p
74HC173	52p
74HC174	38p
74HC175	38p
74HC181	180p
74HC182	60p
74HC190	46p
74HC191	55p
74HC192	53p
74HC193	41p
74HC194	46p
74HC195	46p
74HC221	80p
74HC237	50p
74HC238	55p
74HC240	48p
74HC241	47p
74HC242	55p
74HC243	60p
74HC244	44p
74HC245	48p
74HC251	25p
74HC253	36p
74HC257	40p
74HC258	50p
74HC259	52p
74HC273	42p
74HC279	35p
74HC280	61p
74HC283	61p
74HC298	50p
74HC299	105p
74HC354	38p
74HC356	48p
74HC365	34p
74HC366	36p
74HC367	36p
74HC368	36p
74HC373	46p
74HC374	48p
74HC375	52p
74HC377	52p
74HC386	20p
74HC390	50p
74HC393	47p
74HC423	65p
74HC533	65p
74HC534	61p
74HC540	70p
74HC541	70p
74HC563	60p
74HC564	60p
74HC573	68p
74HC574	65p
74HC583	90p
74HC595	85p
74HC597	80p
74HC620	110p
74HC623	110p
74HC640	90p
74HC643	90p
74HC646	120p
74HC648	120p
74HC651	100p
74HC652	100p
74HC670	75p
74HC688	80p
74HC690	110p
74HC691	110p
74HC4002	25p
74HC4015	85p
74HC4016	75p
74HC4017	48p
74HC4020	50p
74HC4022	40p
74HC4024	34p
74HC4028	40p
74HC4040	34p
74HC4049	38p
74HC4050	38p
74HC4051	85p
74HC4052	85p
74HC4053	85p
74HC4059	85p
74HC4060	33p
74HC4066	33p
74HC4072	31p
74HC4075	26p
74HC4078	32p
74HC4094	50p
74HC4316	100p
74HC4351	110p
74HC4352	160p
74HC4510	120p
74HC4511	70p
74HC4514	120p
74HC4515	120p
74HC4516	125p
74HC4518	55p
74HC4520	60p
74HC4538	75p
74HC4543	75p
74HC7266	75p
74HC22106	580p
74HC40104	190p
74HC40105	250p

74LS SERIES LOW POWER SCHOTTKY T.T.L.

74LS00	12p
74LS01	12p
74LS02	12p
74LS03	12p
74LS04	12p
74LS05	12p
74LS08	12p
74LS09	14p
74LS10	12p
74LS11	12p
74LS12	12p
74LS13	20p
74LS14	24p
74LS15	14p
74LS20	14p
74LS21	14p
74LS22	14p
74LS24	35p
74LS26	14p
74LS27	14p
74LS28	14p
74LS30	14p
74LS32	15p
74LS33	15p
74LS31	15p
74LS38	15p
74LS40	15p
74LS42	25p
74LS47	52p
74LS48	48p
74LS51	13p
74LS54	13p
74LS55	15p
74LS73	24p
74LS74	18p
74LS75	24p
74LS76	24p
74LS78	24p
74LS83	37p
74LS85	37p
74LS86	25p
74LS90	26p
74LS91	55p
74LS92	32p
74LS93	26p
74LS95	41p
74LS96	52p
74LS107	28p
74LS109	28p
74LS112	28p
74LS113	28p
74LS114	28p
74LS122	35p
74LS123	35p
74LS124	85p
74LS125	30p
74LS126	30p
74LS132	30p
74LS133	30p
74LS136	30p
74LS138	28p
74LS139	28p
74LS145	65p
74LS147	90p
74LS148	75p
74LS151	27p
74LS153	31p
74LS154	78p
74LS155	36p
74LS156	36p
74LS157	22p
74LS158	27p
74LS160	38p
74LS161	38p
74LS162	38p
74LS163	36p
74LS164	36p
74LS165	50p
74LS166	55p
74LS168	60p
74LS169	55p
74LS170	68p
74LS174	30p
74LS175	32p
74LS190	47p
74LS191	43p
74LS192	41p
74LS193	41p
74LS194	41p
74LS195	44p
74LS196	45p
74LS197	42p
74LS221	45p
74LS240	45p
74LS241	42p
74LS242	43p
74LS243	50p
74LS244	40p
74LS245	40p
74LS247	40p
74LS248	40p
74LS249	70p
74LS251	24p
74LS253	36p
74LS256	52p
74LS257	32p
74LS258	35p
74LS259	50p
74LS260	30p
74LS266	22p
74LS273	44p
74LS279	33p
74LS280	88p
74LS283	51p
74LS290	26p
74LS293	26p
74LS365	26p
74LS366	31p
74LS367	28p
74LS368	30p
74LS373	45p
74LS374	45p
74LS375	46p
74LS390	42p
74LS393	37p
74LS399	68p
74LS629	95p
74LS641	88p
74LS642	105p
74LS644	105p
74LS645	105p
74LS670	62p
74LS674	310p
74LS687	250p

COMPUTER IC'S

2114	200p
2532	330p
2716	200p
2732	280p
2732A	300p
2764	240p
27C64	550p
27128	350p
26256-25	400p
41256-12	250p
256DRAM	250p
4116	75p
4164	150p
6116	180p
6264	270p
6502	300p
6502A	400p
65C02	930p
6503	570p
6520	170p
6522	330p
6530	1050p
6532	460p
6545	880p
6551	530p
6800	210p
6802	220p
6803	800p
6808	500p
6809	600p
6810	150p
6818	380p
6820	140p
6821	140p
6840	310p
6845	620p
6850	110p
8080A	400p
8085A	300p
8086	500p
8088	500p
8155	360p
8156	360p
81LS95	120p
81LS96	130p
81LS97	130p
81LS98	130p
8224	240p
8226	240p
8228	270p
8243	250p
8250	850p
8087	11000p
8251	270p
8253	230p
8255	200p
8256	1200p
8257	220p
8259	280p
8271	3400p
8272	1200p
8279	270p
8282	300p
8283	400p
8284	440p
8287	360p
8288	650p
8748	1100p
8755	1400p
AY3-1015	290p
SP0256AL2	500p
Z80ACPU	150p
Z80BCPU	400p
Z80ADMA	500p
Z80AP10	220p
Z80BP10	340p
Z80ACTC	200p
Z80BCTC	320p
Z80AS10	460p
Z80AS10-1	580p
Z80BP10-2	580p
Z80ADART	500p
74S289	180p
74S387	200p
75107	65p
75110	75p
75113	100p
75122	110p
75150	95p
75154	100p
75162	700p
75182	95p
75183	95p
75188	55p
75189	55p
75195	185p
75451	40p
75454	65p
75492	55p
8T26	95p
8T28	110p

OPTO COUPLERS

4N25	50p
4N26	50p
4N27	50p
4N28	50p
4N29	50p
4N30	90p
4N31	90p
4N32	100p
4N33	100p
4N36	58p
4N37	58p
4N38	58p

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MAN.74	115p
MAN.4640	180p
MAN.8910	230p
DL.747	160p

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ANTEX C15W 240V Soldering Iron 240Vcm	650p
Spare Element for C15W 240V	340p

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Spare Nozzle	60p
SOLDER MOP	65p

SOLDER

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47UF at 250V	.65
100UF at 250V	1.25
(All Single Ended PCB Type)	
1F 5.5V Cap	2.50

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TDA2541	2.70
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BC148	.10
BC307	.12
BC327	.11
BC328	.12
BC337	.11
BC338	.12
BC360	.35
BC546	.10
BC547	.10
BC548	.10
BC557	.10
BC558	.10
BC639	.25
BC640	.25
BD131	.50
BD132	.50
BD222	.50
BD225	.50
BD237	.40
BD238	.40
BD278A	.70
BD437	.40
BD438	.40
BD677	.65
BD701	.95
BD707	.95
BD807	.95
BF337	.28
BF338	.30
BF422	.35
BF423	.35
BF458	.35
BF460	.95
BF470	.50
BF757	.70
BF871	.80
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Cassette Housing	28.95
Loading Motor	8.95
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Video Head	24.95

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HM6232	5.95
HM6251	4.70
HM9032	5.95

VIDEO SPARES

V4000/VT8000	
Capstan Motor	31.95
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FF/Rew Pulley	.85
Pinch Roller	3.95
Play Idler	4.50
Video Head	19.95
V4001/VT9300/9500	
Capstan Motor	31.95
FF/Rew Idler	1.95
FF/Rew Pulley	.85
Pinch Roller	3.95
Play Idler	3.95
Video Head	19.95
V4100/VT11E/VT33E	
Capstan Motor (VT11E)	26.95
Capstan Motor (VT33E)	29.95
Clutch Assy	7.95
FF/Rew Idler (Genuine)	2.50
Pinch Roller	3.95
Video Head	19.95
V4005/VT63E	
Capstan Motor	15.95
End Sensors (Pair)	1.95
Pinch Roller	4.95
Video Head	43.50

PANASONIC VIDEO SPARES

NV333/366	
Complete Maintenance Kit (Genuine)	13.75
Cassette LED	1.95
Pinch Roller	3.95
Play Idler (Genuine)	4.95
Reel Idler (Genuine)	1.25
Reel Motor (Genuine)	14.95
Video Head (NV333)	14.00
NV370/380	
Complete Maintenance Kit (Genuine)	12.95
Pinch Roller	3.95
Reel Idler (Genuine)	2.95
Video Head	19.50
NV730/770	
Complete Maintenance Kit (Genuine)	12.95
NV2000/2010	
Complete Maintenance Kit (Genuine)	21.50
Cassette Lamp	.70
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Reel Idler (Genuine)	1.25
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Video Head	14.00

REMOTE CONTROLS

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REPAIR KITS

Philips KT3/30 N/Text	6.50
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SANYO/FISHER VIDEO SPARES

VTC5000/5300	
Loading Roller	1.25
Pinch Roller	8.50
Reel Idler (Genuine)	5.70
Reel Motor (Genuine)	7.95
Video Head	35.00
FVHP615	
Gear Idler Assembly	5.95
Pinch Roller	4.50
Reel Idler	5.95
Video Head	24.95

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Fidelity AVS2000	5.95
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Philips VR6542	6.50
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SHARP VIDEO SPARES

VC8300	
Cassette Lamp	.70
Channel Bank	7.95
Pinch Roller	3.95
Rewind Idler	3.50
VC9300/381	
Capstan Motor	29.95
Cassette Lamp	1.95
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Reel Motor (Genuine)	17.50
Video Head	23.95
VC481	
Capstan Motor	22.95
Reel Idler (Genuine)	3.95
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Video Head	23.95

SONY SPARES

Pinch Roller C5/6/7	3.95
Rewind Kit C5/7	4.65
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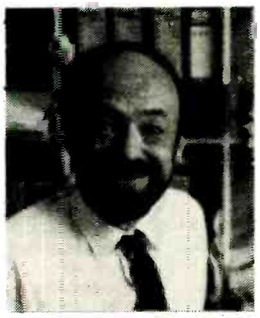

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HA11225	170p
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HA11423	210p
HA11724	800p
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LA4261	300p
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LA4445	260p
LA4460	170p
LA4461	170p
LA4465	425p
LA4466	425p
LA4500	230p
LA4505	260p
LA4507	360p
LA4508	260p
LA4520	230p
LA4700	425p
LA5512	130p
LA7800	180p
LM317T	80p
LM723	60p
LM741	20p
LM3914	250p
LM3915	250p
M293B1	600p
M51102L	325p
M51104L	400p
M545485	400p
MB3705	180p
MB3722	310p
MB3730	200p
MB3731	300p
MB3732	300p
NE555	25p
NE646	150p
STK433	490p
STK435	510p
STK439	550p
STK460	720p
STK461	720p
STK463	780p
STK465	800p
STK0029	500p
STK0040	560p
STK2029	500p
STK2125	650p
STK2129	900p
STK2250	920p
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STK7308	580p
STK7348	600p
STR451	480p
STR4090	650p
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TA7205	100p
TA7193	400p
TA7203	180p
TA7222	120p
TA7229	300p
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TA7240	260p
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TA7270	250p
TA7271	275p
TA7272	260p
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TDA1515	250p
TDA1670	300p
TDA1908A	100p
TDA2003	100p
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TDA2575	200p
TDA2577	250p
TDA2581	200p
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TDA3651	250p
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TDA4500	360p
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TDA4505	300p
TDA4600	200p
TDA7240	300p
TDA8180	500p
TDA9503	240p
UPC1031	180p
UPC1181	110p
UPC1182	110p
UPC1185	230p
UPC1188	275p
UPC1225P	200p
UPC1230	210p
UPC1263	230p
UPC1277	240p
UPC1278	240p
UPC1288	400p
UPC1318	400p
UPC1363	190p
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UPC1378	210p
UPC1470	200p
TRANSISTORS	
2SA-473	35p
2SA-489	55p
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2SA-608	15p
2SA-628	70p
2SA-672	30p
2SA-673	20p
2SA-677	60p
2SA-683	25p
2SA-684	40p
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2SA-715	35p
2SA-720	20p
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2SA-726	25p
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2SA-748	90p
2SA-765	300p
2SA-769	130p
2SA-771	130p
2SA-777	50p
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2SA-896	35p
2SA-899	60p
2SA-900	35p
2SA-905	20p
2SA-915	30p
2SA-916	30p
2SA-917	35p
2SA-921	10p
2SA-940	50p
2SA-950	25p
2SA-958	70p
2SA-962	60p
2SA-964	65p
2SA-965	25p
2SA-966	25p
2SA-968	70p
2SA-970	15p
2SA-984	30p
2SA-985	65p
2SA-992	30p
2SA-999	20p
2SA-1015	20p
2SA-1016	20p
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2SA-1048	20p
2SA-1060	90p
2SA-1062	125p
2SA-1094	190p
2SA-1095	275p
2SA-1102	180p
2SA-1104	200p
2SA-1106	200p
2SA-1110	60p
2SA-1123	40p
2SA-1141	200p
2SA-1142	65p
2SA-1145	60p
2SA-1146	190p
2SA-1147	190p
2SA-1156	60p
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2SA-1220	50p
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2SA-1262	65p
2SA-1265	150p
2SA-1282	35p
2SA-1386	275p
2SB-507	100p
2SB-509	100p
2SB-511	100p
2SB-511	100p
2SB-512	100p
2SB-514	100p
2SB-527	40p
2SB-528	40p
2SB-531	200p
2SB-534	200p
2SB-536	60p
2SB-537	60p
2SB-544	60p
2SB-545	150p
2SB-546	70p
2SB-548	40p
2SB-554	170p
2SB-557	150p
2SB-558	150p
2SB-560	35p
2SB-561	20p
2SB-562	35p
2SB-564	70p
2SB-566	110p
2SB-568	40p
2SB-595	80p
2SB-596	75p
2SB-618	325p
2SB-631	40p
2SB-632	40p
2SB-633	50p
2SB-641	20p
2SB-643	20p
2SB-644	15p
2SB-647	30p
2SB-648	55p
2SB-649	40p
2SB-673	80p
2SB-681	250p
2SB-686	120p
2SB-688	130p
2SB-695	325p
2SB-705	200p
2SB-716	30p
2SB-717	70p
2SB-718	70p
2SB-738	25p
2SB-744	25p
2SB-755	310p
2SB-757	350p
2SB-764	25p
2SB-772	45p
2SB-792	45p
2SB-793	35p
2SB-817	200p
2SB-837	60p
2SB-856	60p
2SB-857	60p
2SB-861	60p
2SB-886	65p
2SC-789	50p
2SC-790	80p
2SC-815	15p
2SC-828	25p
2SC-829	20p
2SC-839	25p
2SC-929	20p
2SC-941	25p
2SC-945	20p
2SC-959	65p
2SC-984	40p
2SC-998	300p
2SC-1162	35p
2SC-1172	150p
2SC-1173	45p
2SC-1195	200p
2SC-1212	60p
2SC-1213	60p
2SC-1214	40p
2SC-1222	20p
2SC-1226	75p
2SC-1306	75p
2SC-1317	25p
2SC-1318	25p
2SC-1327	20p
2SC-1328	25p
2SC-1344	30p
2SC-1345	30p
2SC-1359	20p
2SC-1368	40p
2SC-1382	40p
2SC-1383	35p
2SC-1384	35p
2SC-1393	30p
2SC-1398	70p
2SC-1399	60p
2SC-1403	250p
2SC-1413LA	240p
2SC-1417	20p
2SC-1445	250p
2SC-1446	60p
2SC-1447	75p
2SC-1454	320p
2SC-1473	30p
2SC-1474	45p
2SC-1475	45p
2SC-1507	50p
2SC-1509	45p
2SC-1514	40p
2SC-1520	85p
2SC-1550	60p
2SC-1567	60p
2SC-1568	60p
2SC-1573	40p
2SC-1577	800p
2SC-1584	600p
2SC-1627	30p
2SC-1667	150p
2SC-1669	85p
2SC-1670	85p
2SC-1675	20p
2SC-1677	80p
2SC-1708	20p
2SC-1722	60p
2SC-1756	40p
2SC-1758	30p
2SC-1760	85p
2SC-1775	20p
2SC-1815	15p
2SC-1819	50p
2SC-1845	20p
2SC-1846	45p
2SC-1848	45p
2SC-1875	260p
2SC-1890	20p
2SC-1906	30p
2SC-1909	250p
2SC-1913	100p
2SC-1914	30p
2SC-1922	275p
2SC-1923	20p
2SC-1941	40p
2SC-1942	190p
2SC-1945	250p
2SC-1969	160p
2SC-1980	25p
2SC-1986	60p
2SC-2003	25p
2SC-2009	60p
2SC-2022	60p
2SC-2026	45p
2SC-2057	25p
2SC-2068	50p
2SC-2073	50p
2SC-2120	15p
2SC-2153	40p
2SC-2229	25p
2SC-2230	30p
2SC-2236	30p
2SC-2238	60p
2SC-2240	25p
2SC-2274	30p
2SC-2275	50p
2SC-2278	75p
2SC-2320	25p
2SC-2335	120p
2SC-2371	45p
2SC-2427	80p
2SC-2440	70p
2SC-2458	30p
2SC-2482	40p
2SC-2500	30p
2SC-2501	85p
2SC-2502	90p
2SC-2537	450p
2SC-2546	20p
2SC-2550	70p
2SC-2555	150p
2SC-2564	230p
2SC-2565	260p
2SC-2570	50p
2SC-2575	25p
2SC-2577	125p
2SC-2579	130p
2SC-2580	175p
2SC-2581	200p
2SC-2582	40p
2SC-2603	20p
2SC-2611	40p
2SC-2631	40p
2SC-2634	40p
2SC-2660	85p
2SC-2688	50p
2SC-2753	50p
2SC-2781	50p
2SC-2785	50p
2SC-2791	325p
2SC-2792	275p
2SC-2944	175p
2SC-3078	40p
2SC-3156	325p
2SC-3179	200p
2SC-3182	250p
2SC-3284	175p
2SC-3298	120p
2SC-3506	250p
2SC-3519	150p
2SD-198	180p
2SD-200	210p
2SD-234	40p
2SD-235	40p
2SD-288	80p
2SD-299	160p
2SD-313	40p
2SD-315	75p
2SD-325	45p
2SD-331	80p
2SD-400	20p
2SD-401	50p
2SD-414	40p
2SD-421	60p
2SD-424	250p
2SD-426	150p
2SD-427	150p
2SD-428	150p
2SD-438	45p
2SD-461	100p
2SD-468	25p
2SD-471	30p
2SD-476	60p
2SD-478	100p
2SD-523	150p
2SD-525	70p
2SD-526	70p
2SD-560	50p
2SD-570	40p
2SD-571	30p
2SD-592	20p
2SD-600	80p
2SD-612	40p
2SD-613	70p
2SD-621L	450p
2SD-636	25p
2SD-637	20p
2SD-639	25p
2SD-641	310p
2SD-666	25p
2SD-667	25p
2SD-669	40p
2SD-687	60p
2SD-716	120p
2SD-718	130p
2SD-721	150p
2SD-725	350p
2SD-745	250p
2SD-748	150p
2SD-761	50p
2SD-773	30p
2SD-781	30p
2SD-788	30p
2SD-789	25p
2SD-792	340p
2SD-794	60p
2SD-822	400p
2SD-836	85p
2SD-837	80p
2SD-838K	475p
2SD-845	250p
2SD-850	260p
2SD-859	100p
2SD-863	70p
2SD-869	320p
2SD-870	320p
2SD-871	320p
2SD-880	40p
2SD-882	70p
2SD-898B	260p
2SD-917	180p
2SD-951	175p
2SD-982	80p
2SD-985	80p
2SD-1128	80p
2SD-1134	80p
2SD-1135	90p
2SD-1138	60p
2SD-1153	50p
2SD-1207	50p
2SD-1265	100p
2SD-1267	140p
2SD-1273	100p
2SD-1275	125p
2SD-1276	125p
2SD-1397	200p
2SD-1398	170p
2SD-1426	275p
2SD-1427	275p
2SD-1432	250p
2SD-1439	200p
2SD-1441	200p
2SD-1453	170p
2SD-1497-02	520p
2SD-1497-06	520p
2SJ-50	425p

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500gm REEL	1+	10+
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£85
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5 speed single phase, ⅛ hp motor drives 13mm chuck belt

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ONLY £18.50

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No. of contacts 2420
Contact material .... Silver plated nickel silver
Dims .... 243 × 195 × 20mm

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Normal price £8.99

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£18.75 Tips £5.50

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3-4, 5-6-7, 5-9-12V
300-A
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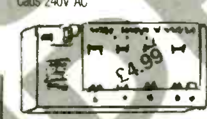
Post Packing £1.50 Unless Otherwise Stated

NI-CAD CHARGER

Charges AAA, AA, C, D & PP3 Ni-Cads 240V AC



NI-CAD RECHARGEABLE BATTERIES

	PRICE 1+	EACH 10+
AAA	£1.50	£1.30
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8-way splitter amplifier to supply 8 TV's from one antenna. White plastic box with aluminium panel. On/off switch with neon.

Band width	40MHz-860MHz
Gain	3dB per channel. Total 21dB
Impedance	75Ω
Max output	80mV (38dBmV)
	(signal/cross modulation = 6dB
Noise	6dB
Isolation between outputs	40dB min
Power	240Vac 50Hz
Dims	250 × 100 × 60mm

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BLACK — 6A 250V
1+85P 100+65P
(2 metres)

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J.V.C. HR2200/3300/3330/3660/4100/7700	£3.99
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VR 6560	£3.99
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SHARP. 200/381/384/385/386/388/390/3300/2300/6000/6200/6300/7300/7700/7750/8000/8300/9300/9500/9700	£3.99
SONY. SL-C5/6/7	£4.20
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A VHS video head tester for determining whether a video head is in good condition by detecting the wear state and displaying it on a meter. Complete with carrying case and leads.
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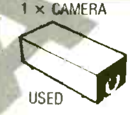

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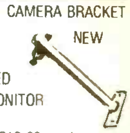
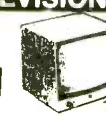
NEW



USED
1 × MONITOR



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VT9500	£29.99
VT9700	£29.99
VT9900	£29.99
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NV470	£42.50
NV480	£42.50
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NV3000	£19.99
NV7000	£19.99
NV7200	£19.99
NV7500	£19.99
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NV8600	£19.99
NV8610	£19.99
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SL-C6	£22.50
SL-C7	£22.50
SL-C9	£48.60
SL-C20	£34.50
SL-C24	£34.50
SL-C30	£34.50
SL-C33	£34.50
SL C44	£34.50
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SL-F30	£34.50
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SL-8000	£28.50
SL-8080	£28.50
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THOMSON	POA
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	NV2000/3000	2.75
	NV332/333/366	1.99
	NV8600/8610	3.75
SANYO	VTC5150/6000/5000	1.20
	VTC9100/9300	2.80
SHARP	2300/381/384/385/386/390/9300/9500	1.50
	VC7300/7700/7750	1.75
	VC6300	2.25
SONY	SLC5	2.05
	SL-C6	2.30
	SL-C8000	2.30
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SANYO	REEL DRIVE PULLEY VTC 5150 143-0-662T-01201	6.50
SHARP	NIDL 0005 GE22	1.90
SHARP	NIDL 0006 GE22	2.10
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RG305	£15.95
RG306	£15.95
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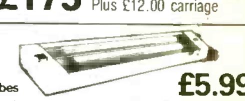

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ECC84	0.65	EY88	0.85	PY801	1.35
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ECL82	2.11	PCC89	0.85	6BA6	1.45
ECL83	3.80	PCC189	0.85	6BE6	2.20
ECL84	1.25	PCF80	1.35	6C4	1.20
ECL85	1.20	PCF82	0.75	6K7G	3.05
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COVER PHOTO
This month's cover photograph shows the AVTS retrofit NICAM board, between headphones. A series of articles on NICAM starts on page 846.

CORRECTIONS
The Panasonic machine mentioned under the heading "no picture" in VCR Clinic last month, page 768, should have been NV370, not NV730.

The Hitachi prototype dynamic RAM mentioned in last month's leader is a 64Mbit device.

Several readers have queried the 3kΩ linear potentiometer VR3 in the de luxe component tester (July issue). This value is no longer generally available. Use a 5kΩ control. A suitable type is available from RS Components under order code no. 173-221.

Added Value
A couple of letters in our correspondence pages this month raise interesting points about the design of modern consumer electronic equipment. In a particularly trenchant letter G.R. Darby queries the point of using a switch-mode power supply in a VCR. There seem to be no appreciable advantages in terms of efficiency, convenience or cost. As for servicing, the trying fault patterns to which such power supplies are prone make them much less easy to handle than the conventional series regulator.

This is all perfectly true and one sympathises with these arguments. Nevertheless one's feeling is that the switch-mode power supply will become the norm in this application come what may, simply because this type of power supply is becoming an electronics industry norm. Once that happens, other approaches come to be regarded as obsolete and designers tend to forget how to use them. The poor old service engineer has to live with the consequences, as usual.

There is in electronics, as in most other fields, a sort of fashion element. Once it becomes the accepted practice to do things in a certain way, e.g. to use a chopper to provide several regulated rails, then that's the approach that will tend to be used without more ado. There's a certain industrial logic in this, even if the use of a particular approach in a particular application may be questionable. The chopper is a brilliant approach to power supply design, efficient and economical. Having come to predominate in so many fields, designers probably don't give a second thought to using it. There's also the point that once you get chips that will take care of most of the design work, e.g. sophisticated chopper control chips at a reasonable price (for the setmaker), it's sensible to make use of them – though the particular switch-mode power supply design that was commented upon uses a discrete component circuit. Then again, it bears a close resemblance to the design used in certain Thomson CTV chassis. Obviously the Thomson engineers are used to it and like it. So it does seem to be a case of a design department adopting the same approach to different applications.

You could possibly regard this use of a chopper power supply as a benefit provided by the general march of progress in electronics. A case of value added derived from advances in electronic technology generally. This brings us to the heart of the matter. The success of the Japanese consumer electronics industry in recent years has stemmed largely from its willingness to keep design under continuous review and make optimum use of what becomes available to the industry. That's part of what all their R and D work achieves. You get a series of designs for say VCRs in which novel extras are continually being transformed into the norm. All right, so most owners never use many of these features, and in this respect it's wasteful to have all that extra circuitry sitting there in VCRs across the world, never being used. But that's probably not how a Japanese marketing man would see it. He'd say that if you don't incorporate as many features as you can your competitors will and your product won't sell. The customer can be sold extra gadgetry even if he never uses it. He'll certainly want it if it costs little or nothing extra. So maybe we have Japanese marketing to blame for all this added complication in the design of consumer electronics products. You won't find most users complaining however, and why should they when they're given added value?

This isn't the whole story of course. There are some developments – tuning and control arrangements for example – that are decidely user unfriendly and simply lead to distress and irritation. The great art in successful development and marketing of consumer electronic equipment is in getting this right. And here we have to acknowledge the achievement of Alan Sugar, who built up Amstrad on the basis of looking carefully at what could be offered the customer, selecting the features that would be beneficial and sell, then getting the package right. The story is told in a recent book, *Alan Sugar: The Amstrad Story*, by David Thomas, published by Centuary at £14·99. It seems that despite having negligible knowledge of electronics he has the knack of understanding systems clearly and being able to exploit their possibilities, giving customers what they want even before they know it. His success has been deserved, in seeking to offer the market easy-to-use, low-cost products that nevertheless contain high-technology features. It's amazing that he was able to leave so much of the rest of the industry standing.

He hasn't of course left the JVCs and Sonys of this world standing, as they power ahead with ever more new and sophisticated technology to offer the consumer. Their success derives from their famed R and D efforts. And therein of course lies the reason for the failure of the UK's consumer electronics industry. Could it have succeeded had the finance been available to fund such activity? – poor profitability was always the bane of the industry. It's hard to know. The one doesn't necessarily follow the other, as the poor financial results recorded by Philips show. Somewhere along the line it seems that there has to be a sort of Alan Sugar touch, provided in the case of Sony by the remarkable Akio Morita and by his less well known contemporaries in other Japanese firms.

The UK has not been short of innovation in TV technology. The IBA led the world in digital video technology through its work on digital standards converters. Other notable achievements have been teletext, MAC and NICAM. But it's interesting that these have all been on the transmission side, provided by the considerable R and D work undertaken by the BBC and the IBA. Over the years there has been a depressing inability of the domestic electronics industry to come up with equivalent advances, to exploit the technology available, or to show initiative on a world-wide scale. Unfortunately this is all now part of past history. For our added value consumer electronics products we shall have to rely on the Far East – and what Alan Sugar comes up with!

CD Player Casebook

Reports from Mike Leach, Nick Beer and Joe Cieszynski

Yamaha CDX-630E

This one came in with the usual CD symptom, skipping and jumping on the outside tracks. It played my Philips 5A test disc up to track 17 then jumped forward to track 19 or 20 and so on. Cleaning the lens made very little difference, though it did increase the peak-to-peak amplitude of the r.f. waveform. Setting up also made no difference to the fault symptom, so a new laser unit was ordered. When this was fitted and set up the machine played all discs normally. The original laser unit was a Sony K55-150A (see comments in the July Casebook). This time the replacement supplied was a K55-210A. It came without a modification sheet so I assume that it's a direct replacement. **M.L.**

Sanyo CP667

The complaint with this machine was no sound. When I tried it there were all the symptoms of an upset microcomputer control chip (CPU). The drawer wouldn't open. If it was operated manually it immediately closed and the laser came on for just a couple of seconds but the focus search routine didn't take place. These symptoms were intermittent in that the drawer would occasionally open at switch on but when a disc was loaded the TOC would not be read.

I began by checking the reset pulse, then the CPU clock. These were o.k. The scope showed that data reached the CPU when the open/close button was depressed, but the control logic output to the loading motor didn't alter. Finally I checked the logic level at pin 24 of IC301 – this pin is connected to the sled position switch. The voltage at this pin proved to be high when, after the initial switch-on, it should be low. The cause of all this trouble was that the sled assembly didn't quite return to the centre of the disc, due to a tiny piece of solder that was wedged in a tooth in the gear mechanism.

The player now functioned – but with no sound. The front display indicated that the disc was playing correctly, i.e. the time elapsed was being clocked, and the player obeyed track skip commands without difficulty. That chap in the recent CD player servicing series suggested that if this is the case the stages beyond the decoder are suspect. So I moved to the DA converter's input. Data was present, but was clearly not correct. Over to the RAM, IC402. Scope checks on the address lines showed that address data was present, but when I came to check the eight data ports I found that data was missing from one of them – pin 11. The cause of the trouble was a dry-joint at this pin. It's a surface-mounted chip, and the leg was laying on a dry solder bed. Strange: the chap who wrote that series said that RAM faults are usually associated with "rushing water" sounds. Well, you can't win every time! **J.C.**

Sony D50

Here's a word of warning for anyone who has to dismantle one of these personal CD players for the first time. Your initial step will be to remove the four screws that secure the cabinet bottom, and this is the correct thing to do. Next you'll probably remove the cabinet bottom itself. This might be where you make your big mistake. At the rear of the player, inside, there's a piece of flexible print that connects the two-axis device of the laser assembly to the main PCB. As you remove the cabinet bottom this piece of print can get snagged and tear. The sad news is that the print is not replaceable: the only cure is to fit an entire new laser assembly, at considerable expense.

The correct way of removing the case's bottom panel is to lift the front just slightly so that the lip clears the front panel, then gently slide the bottom back a little so that it doesn't snag the print. This method is not outlined clearly in the dismantling instructions given in the service manual.

If you have to remove the main PCB you must first unsolder the flexiprint from the board, otherwise it will certainly tear.

Many engineers have already come unstuck whilst handling these players. Here's an example. A telecom engineer brought me one of these machines. He said that it had worked all right but the control knob had become detached. He'd managed to dismantle the unit and fix the knob himself, but now it didn't seem to work at all. Cutting a long story short, the broken knob cost him over £100. **J.C.**

Technics SL-PJ11

The complaint with this machine was of poor playability, notably sticking and skipping. The procedure I use with all the machines in this range is first to check which type of laser unit is fitted. There's a later type, the 6P, that employs a tracking offset compensation PCB. You can identify this unit by the presence of a "6P" sticker on the optical flexiprint connector and on the main PCB beside the mechanism. In this case the unit was of the 6P type. I next check the condition of the laser assembly's guide shafts and ensure correct lubrication. I also clean the laser unit's objective lens. In this case I replaced the shafts, which is a quick job. The result was a slight improvement. Next I check all the alignment, notably the tangential and PD balance as these can give a very good idea of the laser unit's condition.

When it was set up correctly the machine performed much better, but it was still not up to specification as the laser was worn. Indications of this had been present throughout the alignment process: the r.f. waveform was low and mucky, the PD balance had to be set at one end for optimum alignment, and so on. As the customer accepted our estimate for a new laser unit I found myself fitting one – on the anti-static bench of course!

When it had been fitted I found that the linear traverse motor banged from one end of its travel to the other at high speed. The "potention unit" was working correctly, a worthwhile check as sometimes the fine contact fins can be bent during laser unit replacement. In fact the new unit was faulty, another one producing smashing results when set up.

In my experience the procedure outlined above works well with this type of fault in Technics players. Alignment may seem to be an unnecessary procedure when experience tells you that the laser unit is usually the basic cause, but experience also enables you to carry it out in just a few minutes – especially when you use the superb servo

gain adjuster, which is a delight. The benefit of alignment is that you may be able to keep the unit going for a few weeks or months more, giving the customer time to decide what to do next. If not approached in the correct manner however this "basic" repair can cause headaches. **N.B.**

Technics SLP – 222

This machine, like the SLP202 and the Panasonic SL-PJ24 and SL-PJ26 amongst others, uses the Philips radial arm mechanism interfaced with its own electronics. The result is very good. The only trouble I've had is that after a period of use the machine won't read the TOC or play. Its cause is that the radial arm physically sticks at the turntable end of its travel. This appears to be due to the rubber-type compound at this point becoming tacky when warm. When we first discovered this problem Panasonic was unaware of it. We gave their TLO a demonstration and the only suggestion he could make was to replace the laser assembly, a CMD4 drivative. Serial numbers of machines that subsequently exhibited this fault were sent to Panasonic and a small modification has now been introduced to overcome it. The part no. is RMQ0042. **N.B.**

Technics SLP-110

These machines were very popular and are relatively reliable. This one had the usual Technics FF1 affliction of poor playability. I say usual because we see a lot of Technics machines, really they are amongst the most reliable on the market. The machine was carefully set up and there was certainly no need for a new laser unit. Another dealer appeared to have lubricated the guide shafts but had overdone it – oil was dripping all over the place. This was attended to.

An interesting point was the customer's complaint that the machine would play all discs normally, skipping aside, but that one disc in a Vivaldi pair would not spin or read the TOC. We found that the reason for this was incorrect turntable height – it was appreciably on the low side. Confirmation was provided by the fact that the player wouldn't play when on its end. This is not an essential feature but is quite normal when an engineer is setting the turntable height and tangential adjustments.

My own SLP-310 skipped a few seconds as I was writing this report. The cause turned out to be a bit of dust on the traverse guide shafts. **N.B.**

Technics SLP-220

After going through the setting-up procedure with this machine acceptable performance was obtained though it needed a new laser unit to be perfect. I found that it was very sensitive to mechanical shock. As the customer had accepted the machine's condition and had agreed to pay for an hour's labour I resolved the problem by very slightly decreasing the tracking gain to compensate for the laser's performance. **N.B.**

Long-distance Television

Roger Bunney

Reception during June was patchy, though the SpE log for several days, particularly around the middle of the month, looks dramatic. Unfortunately I'm seldom able to monitor the bands during the day, but this is made up for by several other active DXers so we are able to get a reasonably accurate picture of conditions. On then to the rather extensive SpE log for the month:

6/6/90 TVE (Spain) chs. E2, 3, 4; TVE-2; RAI (Italy) IA; TDF (France) Canal Plus L2, 3, 4; JRT (Yugoslavia) E2; ARD (West Germany) E2; NRK (Norway) E2.

7/6/90 ARD E2; TVE E2; JRT E2, 3; RAI IA, B; +PTT (Switzerland) E2; CST (Czechoslovakia) R2.

8/6/90 RAI IA, B; TVE E2, 3, 4; +PTT E2; SVT (Sweden) E2, 3, 4; NRK E2, 3, 4; YLE (Finland) E4; RUV (Iceland) E4; CST R2; TSS (USSR) R1, 2, 3, 4, 5; TVP (Poland) R1, 2, 3; MTV (Hungary) R2; JRT E3, 4; ERT (Greece) E3.

9/6/90 +PTT E2; JRT E3, 4; TVE E2, 3, 4; RAI IA, B; ERT E3; TSS R2; SVT E2.

10/6/90 RAI IA.

11/6/90 NRK E2; TSS R1, 2; CST R1; RAI IA, B; +PTT E3; TVE E2, 3; TDF L2, 3; Cyril Willis noted Gwelo (Zimbabwe) ch. E2 at 1805.

12/6/90 TVE E2, 3, 4; TVE-2 E2; +PTT E2; RTP (Portugal) E2, 3; ARD E2; RAI IA; TSS R1, 2, 3; SVT E2, 3, 4; MTV R1.

13/6/90 TVE E2, 3, 4; RAI IA, B

14/6/90 TVE E2, 3, 4; RTP E3; TDF L3; RAI IA.

15/6/90 ARD E2, 3, 4; +PTT E2, 3; ORF (Austria) E2a, 4; RAI IA, B; Italian private 47MHz; RTSH (Albania) IC; RUV E3, 4; CST R1, 2, 4; TVP R1, 2, 4; TSS R1, 2, 3, 4; MTV R1, 2; JRT E4; NRK E2, 3, 4; YLE E4; TVE E2, 3, 4; TVE-2 E2; TDF L2, 3; RTP E3; DR (Denmark) E3; suspected NTA (Nigeria) E3; RUV E3,4.

16/6/90 TVP R1, 2, 3; CST R1, 2, 4; MTV R1, 2; TSS R1, 2, 3, 4, 5; SVT E2; RAI IA, B; JRT E3, 4; ORF E2a, 4; ARD E2; TDF L2; TVE E2, 3, 4; ERT E3; RTP E3.

17/6/90 TSS R1, 2; TVE E2, 3, 4; TVE-2 E2; RTP E2, 3; RAI IA,B; JRT E3, 4; TDF L2, 3; SVT E2; ARD E2; +PTT E3.

18/6/90 Short SpE skip noted from RTE ch. A (Eire); RTBF (Belgium) E3; NOS (Holland) E4; NRK E2, 3, 4; SVT E2, 3, 4; RUV E3, 4; ARD E2, 3, 4; TDF L2, 3, 4; JRT E3, 4; TVE E2, 3, 4; RAI IA, B; +PTT E2, 3, 4; DR E2; ERT E3; CST R1, 2; TSS R1, 2, 3; JTV (Jordan) E3; RTP E3; unidentified ch. A2 (system M) signal at 2030 BST.

19/6/90 TSS R1, 2, 3; TVP R1, 2, 3; DR E3; CST R1, 2; MTV R1; ERT E3; NRK E2, 3, 4; RUV E4; +PTT E2, 3; ORF E2a, 4; ARD E3, 4; TDF L2, 3; RTP E2, 3; JRT E3, 4; RAI IA, B; TVE E2, 3, 4; TVE-2 E2.

30/6/90 RSS R1; CST R1; NRK E2; SVT E2; YLE E3; RAI IA,B; TVE E2, 3, 4; ARD E3; +PTT E2, 3; TDF L2, 3, 4; RTP E2, 3; JRT E3.

21/6/90 MTV R1, 2; RAI IA, B; TVE E2, 4; +PTT E2, 3, 4; RTP E3; TSS R1, 2, 3; TVP R1, 2, 3; NRK E3.

22/6/90 RTP E2, 3; TVE E2, 3, 4; TVE-2 E2; RUV E3, 4; RAI IA; TDF L2, 4; ORF E2a, 4; DR E3; +PTT E2, 3; TSS R1; NRK E3; SVT E2; NTA (Nigeria) E3.

23/6/90 TSS R1, 2; +PTT E2, 3; SVT E3, 4; NRK E4; JRT E3.

24/6/90 TVE E2, 3; ARD E4; RTP E2, 3; RAI IA; MTV R1.

25/6/90 TVE E3.

26/6/90 TSS R1, 2, 3; NRK E2, 3, 4; SVT E2, 3, 4; +PTT E3; TVE E2, 3, 4; RTP E2, 3; CST R1.

17/6/90 RAI IA, B; ARD E2; MTV R1, 2; JRT E3, 4; TVE E2, 3, 4; TVE-2, E2; CST R1, 2, 4; TSS R1, 2, 3; TVP R1, 2, 3; JTV E3; TDF L3, 4.

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28/6/90 JRT E2, 3, 4; RTSH IC; ORF E2a, 4; ARD E2, 3, 4; RAI IA, B, C; TSS R1, 2; MTV R1, 2; CST R1, 2; unidentified Arabic ch. E3 station at 1835.
29/6/90 JRT E3, 4; MTV R2; TVE E2, 3; TSS R1, RAI IA.
30/6/90 RAI IA; JRT E3; TVE E2, 3, 4; ARD E2; TSS R1; CST R1.

During recent SpE openings Yugoslavia has been seen with corner logos such as TVZ and TVB. Simon Hamer (Powys) mentions that there was a high m.u.f. on the 3rd, giving him RTA (Algeria) ch. E7 and RTM (Morocco) ch. E4. An unidentified ch. A2 (system M) signal was seen during the same opening. It's interesting that activity seemed to peak towards the middle of the month, dying away gradually towards July.

An aurora was noted in Scotland on the 12th, from 2300 local time.

Tropospheric reception was a little above average from the 9th to the 13th, with signals from the Benelux countries, West Germany and Norway in Band III and at u.h.f. It became more intense over the 16-17th, with in addition signals from Denmark and Switzerland, the latter in Band III and at u.h.f.

Tim Anderson is looking into a system of achieving image enhancement with an Amiga computer. With the appropriate software poor quality video frames can be enhanced, with noise reduction. The effect is not unlike that obtained with long-exposure photography where much of the noise cancels out. It's thought that F2 signals, with their characteristic multiple image effect, could also be enhanced. We hope to be able to report further on this.

My thanks to the following for sending in reception reports this month: Simon Hamer (Powys), David Glenday (Arbroath), Roger Fussell (Torpoint), Peter Schubert (Rainham), Tim Anderson (St. Leonards), Cyril Willis (King's Lynn), Bill Cotterill (Tipton) and Iain Menzies (Aberdeen).

For Disposal

Roger Fussell has for disposal a large quantity of TV valves and several *Radio and Television Servicing* volumes dating from the late Fifties. Anyone interested should write to him at 55 Peacock Avenue, Torpoint, Cornwall including an SAE for details.

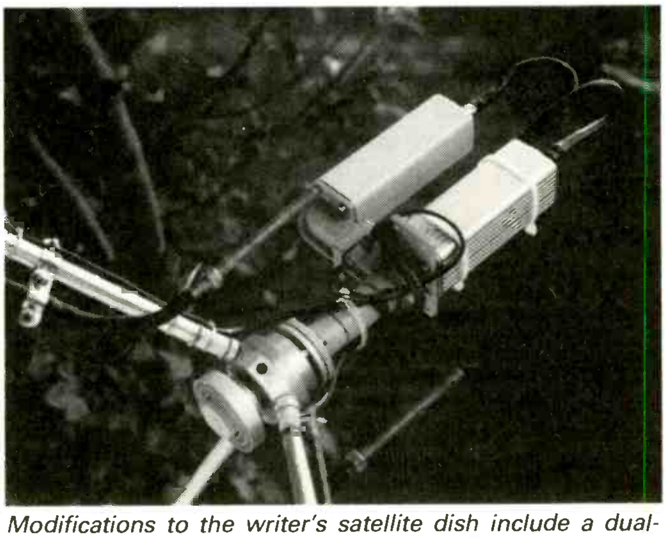
BSB Receiver Interference

After installing a Philips BSB receiver recently Iain Menzies noticed m.f. interference at each 30kHz extending from 5MHz through to the medium wave, e.g. at 3·65MHz, 3·68MHz and so on. The problem came from the LNB socket at the rear of the receiver, with radiation apparently from the outside of the coaxial braid. Ian solved it by winding the coaxial cable around two ferrite toroids, type FX1588 – these are available cheaply from J. Birkett, 25 The Straight, Lincoln LN2 1JF (0522 520 767). The cost was about £1.

News Items

Algeria: It's hoped that a commercial TV service will open by the end of 1991, with 100 per cent coverage obtained via a mixture of terrestrial and satellite transmissions.
Iceland: A third service called "TV One" is to start on October 1st in the Reykjavik area. Like "Channel 2" it will be a pay-TV service, requiring a $70 deposit for a decoder and a monthly payment of $30.

Hungary: Due to financial problems plans for an MTV-3 service have been dropped. It's possible that an independent network will be established following the success of the breakfast NAP-TV service, which goes out over the MTV-1 network.
Eastern Europe: Garry Smith reports that the OIRT countries are likely to go over to PAL during the next few years, starting with Poland and Czechoslovakia. This will simplify programme exchange. Many receivers made in East Europe now incorporate PAL/SECAM capability.
Radio Amateurs: Use of the 50 and 70MHz bands is now allowed in Southern Ireland by B as well as A operators.



Modifications to the writer's satellite dish include a dual-band Ku/Telecom LNB fitted on the new Chaparrel orthomode transducer/polariser.

Left: The Luxembourg PM5544 test pattern received via the Eutelsat craft at 13°E. Centre: A typical news feed, this one via Eutelsat at 7°E, with 525 lines. Right: The TeleMadrid test pattern seen via Eutelsat at 7°E.

Poland is likely to allow use of the 50MHz band for amateur communications, though not in areas served by ch. R1 transmitters. At he Region One conference in early April the IARU pushed the WARC for a world-wide allocation of at least 500kHz at 50MHz and for a 1·5MHz allocation in Region One (Europe). It's likely that at least two operators will be active at 50MHz in the Falklands by the end of the year. Over 500 West German amateurs have applied for 50MHz permits.

In brief: A Turkish programme is in operation in Greece on chs. E3 and E4, with the corner logo TV1 except during commercials and news. Turkey has started limited teletext experiments called Telegun. Though still on air, the New Zealand TV3 network is in the hands of the receiver. Launch of the Irish TV3 service in early 1991 is now in doubt. June 8th saw the first Canal Plus Espagne transmissions: full programming is to commence in September. MTV is now available in Kenya on ch. E62. Jordan has started a teletext service for two hours each afternoon. In Yugoslavia RTV Zagreb is to be renamed RTV Hrvatska while TV Ljublijana will become TV Slovenija. A private Yugoslavian station, Kanala, is expected to start transmissions on ch. E55 in November.

Satellite TV

Asiasat has been launched. It uses a modernised Westar 6 US satellite with 24 C-band transponders, providing TV transmission facilties in the Far East and West Pacific regions. Dishes as small as 1·5cm can be used.

There are plans to launch a USSR DBS craft called Gelikon next year to be followed by a series with three launches per year, each operating in the Ku band with 150W TWTs. They will be available for lease in the West. Another Ku-band craft called Luch is to operate at 53dBW. These craft will be at 15 and 160°W and 55°E.

Another Scandinavian channel, TV4, is due to start operations this month via Intelsat at 1°W and Tele-X at 5°E.

Tele 5, Discovery Channel, Disney and Super Channel are amongst the operators who have already leased facilities on the Astra 1B craft.

Beware of Filmnet scrambling changes if you are considering purchase of one of the pirate decoders on the market – tests with new encryption have already been carried out. Pirate Sky Movies decoders are on sale on the Continent.

The Spanish channel Antenna 3 is now on air via ECS-1 F2 at 7°E, at 11·658GHz.

Intelsat has positioned a new craft, type VI F2, at 24·5°W, replacing an elderly VA F10 satellite that's now on a drift west to a new position over the Pacific. A replacement is due to be positioned in the 27·5°W slot.

Sky News is being transmitted over the normal terrestrial networks in some parts of Yugoslavia.

The Eutelsat II F1 satellite at 13°E, due for launch on August 30th, will have a wide beam (46-48dBW) covering Europe, Turkey and the Canary Islands and two high-gain beams (50-52dBW) covering Europe, one with vertical and the other with horizontal polarisation. The present transponder plan is as follows:

High-gain beam Horiz.

Teleclub	10·972GHz
EBC or other	11·008GHz
3-Sat	11·055GHz
NL-PTT, TRT 5	11·135GHz
Middle East service	11·554GHz
Galavision/ECO	11·595GHz
Nordic channel	11·678GHz
BTI	12·521GHz
BTI	12·563GHz

High-gain beam Vert.

Eurosport	11·616GHz
Telecom 1C prog.	12·542GHz
Telecom 1C prog.	12·584GHz
Telecom 1C prog.	12·625GHz
Telecom 1C prog.	12·708GHz

Wide beam Vert.

Super Channel	10·997GHz
TV5 Europe/Worldnet	11·070GHz
Sat 1	11·153GHz

Czechoslovak Transmitter List

The CT-1 relays used for transmitting the Russian first programme for troops have been redesignated OK-3 relays. The list is as follows: Ruzomberok R22 1kW; Plezn R27 5kW; Kosice R27 1kW; Prague R41 17kW; Usti n. Lanem R42 1kW; Ceske Budejovice R49 28kW; Banska Bystrica R49 7kW; Bratislava R50 1kW; Ostrava R51 27kW; Zlin R51 1kW; Cheb R51 1kW; Brno R52 24kW; B. Stiavnica R52 1kW; Hr. Kralove R56 1kW.

UHF Aerials

Jaybeam, which recently ceased aerial manufacture, has licenced another company to continue production of certain models. The Multibeam X-director array is available in grouped versions as the JBX10 (ten bays) and JBX21 (21 bays), with peak gains of 13 and 14dBd respectively. The high-gain, full-wave system (DY range) is available in DY5/10/20/28 versions. The DY28 is a massive 28-element array some 4m long with a peak gain of 18·3dBd, in group A and W versions only. The other aerials are available in grouped or W versions. Contact your local aerial dealer for details.

TV Fault Finding

Reports from Philip Blundell, AMIEIE, J.S. Ruwala, Joe Cieszynski, Nick Beer, Mick Dutton, Ray Crockit, Hugh MacMullen and Stephen Leatherbarrow

Philips 27CE7593/43R (3A Chassis)

Versions of the 3A chassis with NICAM and PIP can suffer from spurious failure of the Wickman fuse 1624. Change it from an 800mAT type to one rated at 1·25AT, part no. 4822 253 10075. You may be lucky and find that it's in a socket! The fault symptom is no sound or vision: e.h.t. is present and a raster can be seen for a second at switch-off. **P.B.**

Mitsubishi CT2117TX

Versions that have the later teletext panel, with an SAA5241 chip, can suffer from faulty crystals. Usually you'll find that the text rolls round the screen horizontally. Adjusting the trimmer VC7701 may cure the problem temporarily: if it recurs, fit a new 6MHz crystal (X7702). **P.B.**

Amstrad CTV1400

This set had two faults, colour flickering and flyback lines at the top side of the screen. I found it difficult to associate these symptoms, but a colleague suggested that I looked for a fault in the field timebase. A check on the voltage at the collector of the field output transistor Q702 produced a reading of only 32V instead of 62V. C739 (100μF) was open-circuit, a replacement curing both faults. **J.S.R.**

Sony KV2200

This set would loose colour at random. The 12V supply to the chroma chip was low at 9V and D201 in the 12V regulator circuit was getting hot. After fitting a new 12V regulator transistor the fault had cleared and there was improved picture quality. This is similar to the fault we've all had on the Philips G11 chassis, when the 12V regulator chip gives low output. **J.S.R.**

Telefunken 615 Chassis

We had to replace the line output transformer in this set because of arcing, which had damaged the TBA120T intercarrier sound chip. The same fault occurred on another of these sets but this time replacing the TBA120T chip failed to restore the sound. A check at pin 8 of the sound module indicated that it was in the mute state. This took me back to the TDA1940 timebase generator chip, and when pin 7 was disconnected as a check sound burst from the speaker. **J.S.R.**

Grundig 8600 (CUC740 Chassis)

The sound couldn't be turned down and the display indicator was stuck on 88. When the MC144111 chip IC2335 on the tuning "sitonia" was replaced normal operation was restored. **J.S.R.**

Saisho CM145R

This set was dead with no a.c. supply to the main panel as the relay switch didn't operate. There was d.c. at both sides of the relay coil but the switching transistor failed to conduct because of the lack of drive at its base. The set came to life when the M491BB1 control chip was replaced.

I had a similar fault with an **ITT Model TX3447.** The relay didn't operate because the CCU-SEL-03C control chip had failed. In this set the BU508A line output transistor also had to be replaced as it had gone short-circuit. **J.S.R.**

Philips KT3/K30 Chassis

The trip action in these sets is very sensitive, reacting to the smallest disturbance on the 129V rail. As a result these sets are prone to momentary tripping when there's a sudden change in the beam current. Such changes may occur because of a sudden change in the picture content from dark to bright or because of a small e.h.t. flashover. The problem is due to negative spikes being generated on the current sensing line when there's an h.t. transition. These spikes appear at the input to the excess-current trip (at pin 6 of the TDA2581/2 chopper control chip) which then operates. As the trip recylces, the receiver comes back on after about a second.

To cure the problem Philips introduced a modification: fit a diode, BY206 or similar, between pin 6 of the chip and chassis, with its cathode to pin 6. The trip still functions under normal fault conditions. You can check this by touching the line output transistor's collector lead with an insulated screwdriver, when the set should trip once. E.H.T. flashover is a problem that should be dealt with at source, but I've had cases where intermittent tripping has persisted after fitting a new tripler or e.h.t. cable, with the arcing reduced to an undetectable level. In such cases adding the diode has provided a cure.

I could mention numerous incidents, like the case where a customer complained that his set tripped only when a particular advertisement was screened. The advertisement concerned was for Kodak cameras and showed a flash photograph being taken. Needless to say I didn't see this particular fault, but the complaints ended when the extra diode was fitted. **J.C.**

Ferguson TX10 Chassis

The complaint was of an intermittently dead set, but it was some time before I saw the fault condition. When it did finally appear the cause was traced to a hairline crack in the print next to the solder joint at the input to the 12V regulator IC621. I'd actually resoldered this joint in an earlier attempt to cure the problem but the crack was so close to the joint that it didn't show up. **J.C.**

Toshiba 285T8BZ

I'd been warned that this set intermittently failed to start from standby when hot. On the bench it wouldn't start at all. Checks revealed that there were about 1,000 back securing screws, also that the standby/on switching worked to the extent of the opto-isolator DR01 being turned on, but the power supply wasn't having any of it. The voltage at the collector of the phototransistor in DR01 was negative instead of 7·3V. A d.c. check at the other end of R814 brought the set to life. It wasn't the meter either, just the probe was enough to do it. So where's the open-circuit high-value resistor? R810 (270kΩ) checked high, a replacement putting matters right. **N.B.**

Ferguson 14M2

This brand new stock portable intermittently produced low signals. The fault could be instigated by tapping gently around the tuner. I couldn't find the dry-joint/break so a new tuner had to be fitted. **N.B.**

B and O MX3000 (314X Chassis)

Much of this chassis is similar to the Ferguson ICC5, though this one retains a lot of multi-standard capability. The fault was that from cold only the lower stations could be tuned in – up to ITV in fact, which around here is ch. 59. Above this, instability set in – severe hum producing black-and-white bars across the screen, with no sound. After a short while all channels would be affected. Disturbance on the tuning voltage rail seemed a likely explanation. I was going to confirm this by means of a meter check at pin 11 of the tuner, but this also cured the fault as there was a high-resistance connection here because the pin was tarnished. Cleaning and resoldering the pin cleared the fault. A clue to the cause of the fault was the fact that slight drift was also discernible when the fault occurred. **N.B.**

Radionette CM6

What am I doing looking at an ancient set like this? Not so: the set gave a sparkling performance before it went dead. Now I was never familiar with these sets but the cause of the problem was not hard to trace – it was the e.h.t. tripler. Nice to have a straightforward, old-fashioned fault for a change. **N.B.**

Baird 8233 (Ferguson TX10 Chassis)

This set has search tuning of the single press-button type. The set locks to each station it comes to automatically, until the button is pressed again. In this case however if the set was left switched off for several hours the memory would die on channel one only. My thanks to Roger of SEME for his advice to change D345. Apparently it's a common problem. **M.D.**

GEC C4001

This 14in. colour portable was definitely of ITT origin but we didn't recognise the chassis. The problem was that the line hold was slightly off. We found that the line oscillator is at the top corner of the end panel, were we normally expect to find the power supply. Much time was spent checking components here before we discovered that the line discriminator circuit is on the main board. The cause of the trouble was that R514 and R515, both 2·7MΩ, had gone open-circuit. **M.D.**

Sony KX20PSI

This set had come in from another dealer after he'd spent many hours trying to find the cause of a double intermittent fault. The symptoms were intermittent field roll and faulty chroma – similar to a delay line fault. After the set had run for several hours the symptoms appeared, as described. What the other dealer had failed to note was that this is a multistandard set and that it was going into the NTSC chroma mode, with no PAL switching, while the field timebase was trying to run at 60Hz. Switching between standards is carried out in the CX7916 chip IC503, which turned out to be the cause of the problem. **M.D.**

Philips CP90 Chassis

We've had several of these sets with no picture due to failure of the first anode supply. In every case the cause has been an internal defect in the line output transformer. **M.D.**

GEC C2295 (Tatung 160 Chassis)

This set wouldn't start. The power supply was o.k. but there was no line drive. We found that there was no 12V supply as R508 and R509 (both 12kΩ) had gone open-circuit, removing the base bias from the 12V regulator transistor. **M.D.**

National Panasonic TC361

This elderly colour portable suffered from intermittent field roll and touchy tuning. A common cause of this problem is C115 (15µF) drying out. Changing it didn't work on this occasion but when two other electrolytics in the same area were replaced, C118 (1µF) and C139 (0·47µF), the problem had been cured. **M.D.**

Skantic/Luxor 3781 (180 Chassis)

The problem with this colour portable was slightly reduced width and height with a bright line across the screen about 2·5cm down from the top. All voltage outputs from the chopper power supply were low. We checked back to the switch-mode section and found that RN28 was open-circuit. Replacing this 560kΩ resistor restored the set to normal working order. **R.C.**

Triumph CTV8209

This popular 14in. portable took quite a while to sort out – every now and then it failed to start. If any part of the chopper chip was touched electrically the set would immediately start up. After many days I found that R119, which is connected to pin 4 of the chip, had increased in value from 150kΩ to about 270kΩ. Fitting a replacement cured the problem. Incidentally this set is very difficult to tune with the existing tuning head and fitting a replacement makes very little difference. **H.MacM.**

National Panasonic TC430

This set had the no results symptom but the power supply produced the 113V h.t. The chopper transformer also produces a 16V supply for the AN5256 audio output chip, so to be thorough we checked this. No problems here. Our next check was at the collector of the line driver transistor, where the voltage reading was high at 110V. This suggested that there was no drive, which was soon confirmed. The drive comes directly from pin 6 of the AN5435 chip IC501 whose supply is derived from the 12V regulator IC802. Since the input to this regulator comes from the line output transformer a start-up supply is required. A study of the circuit diagram revealed a likely candidate in the form of R512, a 10kΩ resistor that feeds pin 7 of IC501, where we expected to find around 9V. The reading was only 1V and R512, which is connected to the 113V line, was very warm indeed. A resistance check from pin 7 of IC501 to chassis produced a short-circuit reading that disappeared when the pin was lifted. A new AN5435 jungle chip made the set happy again. **S.L.**

Teletopics

CABLE TV

The Cable Authority has awarded the final three franchises, for Macclesfield and Wilmslow, Newport and the Wirral, bringing the total up to 135. On April 1st however only 92,974 homes had been connected to a modern broadband cable system, though such systems were available to 599,737 households. The total number of homes covered by the 135 franchises is over 14·6m. If all the networks are built the total investment will be of the order of £4bn.

More than twenty cable franchise holders have been given till the end of the year to complete their licensing arrangements – licences have to be obtained from the DTI and the Cable Authority once a franchise has been awarded. Action is being taken by the Director General of Telecommunications against four cable companies, in Coventry, Glasgow, Guildford and Westminster, that have failed to complete their networks though they were amongst the first to receive franchises, in November 1983. Notices setting our completion timetables are being published under the Telecommunications Act. The Cable Authority is to be wound up at the end of the year, when the Independent Television Commission will take over responsibility for all commercial TV.

New TV audience figures published by the Cable Authority, based on a study carried out by Continental Research, show that cable and satellite channels now account for over a third of all viewing in broadband cable homes. Children's viewing of the new channels scores highly: their share of viewing in the early morning and the popularity of channels such as Sky One and Children's Channel take the new media's total at that time to 77 per cent. After BBC-1 and ITV, Sky Movies was the third most watched cable channel amongst adults.

SATELLITE TV

According to viewer research carried out by the Broadcasters' Audience Research Board, Sky Television has a 30·8 per cent share of viewers in homes able to receive the satellite services. The figures given for BBC-1 and ITV are 20·7 and 26·9 per cent respectively. It's rather early to come to firm conclusions about new viewing habits since many figures, based on relatively small samples, are at present being put about. There seems to be no doubt however that Sky Television is doing well.

BSB has got off to a slow start due to shortage of equipment. According to Kleinwort Benson Securities, BSB could make a loss of some £370m in its first year. Rupert Murdoch expects Sky Television to have made a £300m loss during its first three years. KBS says that Sky's running costs are half those of BSB. There have been one or two teething troubles with early BSB equipment. In particular a faulty batch of access control modules was supplied to all four manufacturers. There have also been interference problems – an example is quoted in Roger Bunney's column on a later page. Sky Movies is to transmit for 24 hours a day from September 1st.

The Department of the Environment has issued a consultation document outlining proposals for changes in planning regulations covering satellite TV equipment. Interested parties have until September 7th to comment or put forward suggestions. New guidelines are expected to be issued to local authorities by the end of the year.

The IEEIE, Savoy Hill House, Savoy Hill, London WC2R 0BS (071-836 3357) will hold its third annual conference in a series on DBS at the IBA Conference Hall, Brompton Road, London SW3 on October 18th and 19th. The two-day non-residential conference is intended for those engaged in the design, manufacture, installation and maintenance of satellite TV receiving equipment. Contributions to the programme will include papers on receiver design, aerials, encryption, broadcasting standards and the installation of BSB and Sky receiving equipment. The cost is £210 for the two days or £105 for one day only, plus VAT.

DISH PAINT

HRS and SEME have both introduced paint specifically for satellite TV dishes. HRS's version is described as a unique spray paint specially for satellite dishes. At present it's available in brick red or stone, but other shades are to be added. SEME's coating system, called Vellox, is described as a unique coating system that provides improved reception in poor weather conditions. It's a water-repellent coating that was originally developed for the US Air Force's radar equipment in Alaska in order to keep snow and ice away. In doing so it will maintain reception free from sparklies under adverse weather conditions. Surfaces treated with Vellox refuse water to the extent that a visible air layer can be seen between the water and the treated surface. It's a two-component system consisting of a primer and an aerosol topcoat. Other uses include the protection of PCBs – and even cardboard packaging.

SATELLITE TV HARDWARE

The interesting range of BSB support products available from Syntronix Systems, St. Matthews House, Brick Row, Darley Abbey, Derby DE3 1DQ (0332 553 024) includes a BSB monitor/VCR adaptor which enables MAC signals to be viewed in RGB form while at the same time providing an AV feed to a VCR, AV amplifier or video sender. There are various models with different features, e.g. a colour saturation control or a sharpness control. The retail price is £49·95 plus VAT.

Longreach Marketing Ltd., Riverside Business Park, Lower Bristol Road, Bath, Avon BA2 3DW (0225 444 894) has been appointed distributor for Finlux and NEC satellite TV equipment. The Finlux range includes the new SR3000 receiver whose features include stereo sound, 60 fully-programmable "favourite status" channels, a built-in aerial positioner, two dish inputs, MAC capability and decoder compatibility. There are six different dish packages from 45 to 120cm, both fixed and motorised. The agreement with NEC allows supplies to go only to Longreach customers who do not infringe on existing NEC dealers' territories. The range includes the up-market 3022 system, with 65 or 80cm dish packs. Also available is a motorised up-grade kit.

NEC is to introduce an integrated VCR and satellite receiver – it will combine a Nicam stereo VCR and an

Astra-capable receiver. The Model number is NS7000K.

Siemens has developed a SAWF, type Y6901, for use as a bandpass filter in satellite TV receivers. It's intended to define the bandwidth at the second i.f. of 480MHz, the bandwidth being 27MHz at the −3dB points. The insertion loss is typically 17dB.

T. POWELL

Our regular advertiser T. Powell has had to go into hospital for a major throat operation and as a result his business will be closed for a few months. We wish him every success.

NEW FROM AMSTRAD

Amstrad has announced a couple of particularly intersting products. The latest addition to the 8000 series of VCRs, Model VCR8800, features a Nicam stereo decoder and Hi-Fi recording and playback at a retail price of £369·99. Due later this year is the Double Decker VCR, which as the name suggests includes two decks. The suggested retail price will be £399·99. It offers various options not available before, the most important being that recordings can be made on one deck while watching a tape on the other, two different TV programmes can be recorded on different tapes simultaneously, etc.

STEREO SOUND

The Durris IBA transmitter and its relays are now providing a Nicam sound service. On the radio side the IBA has started medium-wave stereo test transmissions from its Foxhall Heath transmitter at Ipswich. They are the first in the UK to use a.m. for stereo. The C-QUAM system being used was developed by Motorola.

A & R Cambridge and Eldon Technology of Leeds have produced a Nicam tuner, Model Delta 150, that can store up to eight TV channels. There are r.f. and composite video BNC output sockets and scart sockets. The tuner can be controlled by an IR remote control handset. A & R claims that the tuner offers improved performance through the use of dual SAWFs to separate the sound and vision signals, parallel i.f. circuitry and separate synchronous PLL detectors. The price is £349·90.

MPEG MEETING

The Moving Picture Experts Group which was set up to develop an international standard for digital video coding recently met in Portugal. Organisations that attended include IBM, Philips, Matsushita, Sony, Thomson, the IBA and British Telecom. The group was formed in May 1988 and began testing fifteen proposed coding systems in October 1989. The front-runner is the discrete cosine transform algorithm used by the CD-I format. A draft proposal is due this month and the findings are expected to be published in the first half of 1991.

MORE VIDEO-8 COMPANIES

Thompson is to market Video-8 camcorders in addition to its VHS and VHS-C models. The Video-8 machines will be launched in the USA this autumn and will be marketed in Europe in the Saba range by the end of the year. Hitachi is also to introduce 8mm camcorders. The first models will be launched in Japan and the USA this year, with a European launch in 1991. These announcements follow survey results suggesting that Video-8 is now the leading camcorder format in Europe.

Grundig CTV Service Notebook

David Botto

Plenty of Grundig TV sets come into our workshop, including many older models. They are well-made, solid sets and it looks as if they will continue to give good service for many years to come. The following notes summarise some of our experience with these sets. I hope that the information will be of help to other readers of *Television* – it's the result of a lot of suffering, frustration and expensive phone calls! To make things easier for you I've included the names of some of the panels in both English and German – this is because they may not be marked in English.

GSC200 Chassis

Symptom: The receiver works well and is faulty only when the remote control handset is used.
Cure: Suspect Telepilot preamplifier 290304-015-01 and tuning module 29502-003-21. You may have to replace both.

Symptom: The e.h.t. voltage is present but no light shows at the front of the TV set and the L, F and H voltages are absent.
Cure: The 47kΩ, 4W wire-wound resistor R633 is open-circuit.

CUC220 Chassis

Symptom: It's impossible to obtain correct horizontal centring.
Cure: There's an official modification – reverse diode D521 (BA157). If this fails, remove D521 from the circuit.

CUC720 Chassis

Symptom: Set trips and you can hear a relay shuddering.
Cure: Replace diode D2772 on baustein (module) 29504-007-01.

Model 8232

Symptom: Set dead with B+ voltage absent.
Cure: The B+ feed resistor R652 (12Ω) is suspect. Change it – it's the little, hard to get at one near the tuner.

Symptom: Set dead. The numbers light but there's no e.h.t.
Cure: Remove diode Di505 – with the mains supply unplugged! If the set now comes to life, suspect in the following order R504, R510 and L508. Then check C505 for leakage.

Note that with this model the point labelled C on the line output transformer should record a voltage of 56V d.c. with respect to chassis. This voltage is critical – the set won't work if it's incorrect. To adjust, use the potentiometer on the Regel Baustein (regulator panel).

Symptom: Set works o.k. then cuts out.
Cure: Change thyristor Ty503. If the fault persists, carry out the following official modification. Connect in parallel an 0·1µF capacitor and a 1kΩ resistor between the anodes of D504/5 and chassis.

Model 7150

Symptom: Field collapse and reduced horizontal scan. The field scan transistor and field timebase module are both o.k.
Cure: Replace diode D1627 in the EW (Ost/West) module.

Symptom: Intermittent start-up.
Cure: this can be due to the diode encapsulated with the 17153 thyristor going open-circuit. Replace the thyristor. This fault will show up on your component tester!

Symptom: East/west fault.
Cure: Replace both SKE4F diodes on the EW (O/W) panel. Only one diode will usually be found open-circuit but both must be replaced.

Model 6232

Symptom: Numbers alight but no picture.
Cure: Suspect the 18Ω resistor connected to the bridge rectifier diodes.

Model 6011

Problem: The red/black wander lead tends to fall off and it's difficult to find out where it should be connected.
Answer: It fits on to connection Z9.

Models 6210/6610

Symptom: Small picture and the width control doesn't work.
Cure: Replace the SKE2E diode Di514 in the Regel Baustein (regulator panel). Unofficial replacement is a Sony SID30: it works well and is very reliable.

Model 6010

Symptom: Cause of wriggling line jitter on verticals and other lines is hard to track down.
Cure: Replace R504 (39Ω9 which is open-circuit. It's in parallel with diode Di504 (1N4004). Check this diode too.

Model 4415 (GSC100 chassis)

Symptom: The set goes dead after about half an hour and the wire of fusible resistor R607 is found to be unsoldered.
Cure: Replace thyristors 17052, 17053 and 17127. It's important to renew the insulating washers at the same time.

With this model the voltage at connection C on the line output transformer should be 49V d.c. with respect to chassis. The adjustment potentiometer is on the Regel Baustein (regulator panel).

Model 2230

Symptom: The line oscillator is o.k. but there's no line drive to the output thyristors.
Cure: Replace the corroded screened cable that goes from the oscillator to the output stage.

Model 1645

Symptom: Set cannot be switched on with the remote control unit but is o.k.
Cure: Suspect R607.

Symptom: Remote control apparently faulty.

Cure: Suspect the Telepilot receiver and the Abstim Baustein (tuning module). One or both may need to be replaced.

Component Equivalents

Some of the devices used in Grundig sets can be difficult to obtain. To save you time when this occurs here are a few equivalents.

The GD241 transistor used in the field output stage can be replaced with a BDY81 or a 2N5296.

The 17053 thyristor can be replaced with a Toshiba SG087AR. Both devices contain an internal diode.

The BSTC1233 can be replaced with a 17127.

The 17089 thyristor can be replaced with type 8309-507-0631, but it must be remounted.

Four separate BY127 diodes can be used to replace a mains bridge rectifier.

Test Report: The Cirkit TM175 DMM

Nick Beer

Cirkit Distribution has avilable a comprehensive range of competitively priced digital multimeters. I decided to take a look at an example and was sent the top-of-of-range Model TM175 for review. After a period of use any reservations I might have had have been dispelled.

The range consists of six models, starting with the basic specification Model TM5315B at about £17·38. The TM175 is priced at £49·99. VAT has to be added to these prices, but there are generous bulk quantity discounts. With all models the specification is impressive considering the price.

On Test

The TM175 comes well packed in a box that could be used for resale purposes if you sell meters. Its plastic case is bright yellow in colour, and whilst it appears to be very tough it will probably start to look a bit grubby with average workshop use – this has happened to a yellow Pantec meter I've used for some years. Whether this matters or not is largely a matter of personal taste.

Naturally every possibility cannot be assessed during a short bench test. The meter has 39 ranges, i.e. it's not auto-ranging. I'm used to auto-ranging meters, but once you remember that it's not of this type flicking up or down a range becomes automatic. The ranges cover 200mV to 1kV d.c. and 750V a.c., 200μA to 10A d.c. and 200mA to 10A a.c., 200Ω to 2,000MΩ on the resistance ranges, 2nF to 20μF with the capacitance ranges and there's a frequency counter that goes up to 10MHz. The lower values quoted represent the lowest range f.s.d.s. There are also a continuity beeper (under 200Ω), an hfe measurement, LED and diode testers and a logic indicator. The latter produces an arrow head either upwards or downwards to indicate logic state: if low it also beeps, allowing "eyes-off" testing. The meter has sockets for connection of capacitors being tested – these must first be discharged of course – also for diodes and transistors as well as the common, low and high current and general test lead connections. The next model down in the range lacks the frequency counter but has two temperature ranges.

Mechanical switches are provided for a.c./d.c. switching, power switching and high/low trigger level switching for the frequency counter. These switches are small and it's possible that with very heavy use they could be damaged. The probes are well made and have welcome sharp points for digging into solder and corroded component legs.

A great deal of thought was obviously given to the design of the meter. The set of ranges is extremely useful for field servicing. Some jobs that couldn't be done previously in the field can be undertaken – by using the frequency counter for example. In this mode it may not be suitable for all applications because of meter loading with the normal test prods, so a frequency counter with scope-type probe will still be needed.

There are several nice touches. For example the bench stand is held securely against the back when not in use to prevent it flopping about aimlessly: it can be unclipped and fitted farther up the back to provide a hanger to suspend the meter. The battery cover not only clips but is also bolted, which will prevent some slip-ups. I hope that the battery contracts last longer than in my Pantec meter – these lasted for about six months before I had to modify them to make them work!

The range indicators are well protected to prevent the information being lost. The range selector knob is plain yellow with the indicator bar running across its diameter. A slot at one end indicates the range. It's difficult to define – a strip of red paint in the slot would help. The display is rather smaller than I've been used to but is perfectly adequate. As is only to be expected with such a reasonably priced unit, there's no bar graph.

The meter performed beautifully on test. It was very easy to use considering the number of ranges. To start with we were rather dubious about the frequency counter, but when it was checked against our Racal unit we found that it had a faster response and a perfectly acceptable accuracy. Having a capacitor tester is a real boon. Previously the best we could do was to carry out a resistance check to see a capacitor charge. This doesn't tell you much with a small-value capacitor of course.

I feel that Cirkit has come up with a range of real winners with these meters. For the price the TM175 offers exceptional quality and features. You can't expect the build quality of more expensive machines such as those produced by Fluke, but the test unit gave no cause for concern on this score. I wouldn't hesitate to recommend the unit to anyone in the service industry. My thanks to Cirkit Distribution, Park Lane, Broxbourne, Herts EN10 7NQ for providing the test unit.

NICAM Digital Stereo Sound

Part 1

Eugene Trundle

For many years sound was the "poor relation" in television. Most TV sets had a tiny, often side-mounted loudspeaker which was driven by a barely adequate amplifier. The situation remains much the same with many TV designs. But the advent of hi-fi VCRs and the integration of audio and video equipment has in recent years led to a great deal more attention being paid to "with-picture sound". The f.m. TV sound system that came into use with 625-line transmissions has served us well, providing quality sound to which receiving equipment seldom does justice. But it's incapable of carrying stereo, and various other shortcomings become noticeable when it's processed by high-quality receivers, recorders, amplifiers and loudspeakers.

Stereo TV sound has been available in W. Germany and Japan for some years. The systems used in these countries employ analogue modulation of an audio subcarrier or a second carrier by a stereo-difference signal – the systems are in many ways similar to the technique used for v.h.f.-f.m. radio broadcasting. Encoding and modulation systems of this type don't fit easily alongside a video signal in the tightly packed broadcast bands however, and many compromises are necessary.

Research and development by the BBC led to the publication in 1986 of a specification for a radically different TV sound system for broadcasting. It takes full advantage of modern digital technology and exploits the ability of chip manufacturers to mass-produce very complex digital i.c.s at low unit costs. In short, it represents the current "state of the art". Setmaker Ferguson Ltd. did a great deal of decoder design work, which culminated in the Texas Instruments' single-chip demultiplexer that's currently used in many TV and VCR Nicam designs. The system is officially known as NICAM 728 – Near Instantaneously Companded Audio Multiplex, the 728 referring to the data rate.

Digital Sound

Modern sound systems are based on the use of digital technology. The first example that came along in the domestic electronics field was the compact disc (CD) which was introduced by Philips and Sony in 1982. Pulse-code modulated (PCM) sound was first introduced in the video field with the Video-8 format. We will soon have more record and playback digital audio technology in the forms of VHS-PCM and R-DAT.

Audio signals must start and end in analogue form, i.e. what goes into the microphone and comes out of the loudspeaker is a sound pressure wave. Conversion to digital form, by quantisation (sampling the audio signal at regular intervals and assigning to each sample a digital value), is done to overcome deficiencies in the intervening systems and equipment. When reproduced, the quality of digital sound, and particularly its signal-to-noise ratio, largely depends on the number of quantisation levels used. The ultimate, as used in the CD and R-DAT systems, is 16 bits, giving over 65,000 values each representing a signal amplitude level. A 16-bit signal would require a wideband channel for transmission however. As there is not room to accommodate such a signal in the broadcast TV bands the Nicam system uses 10-bit words. Ordinarily, these would provide a signal-to-nose ratio of about 60dB. An improvement is achieved by continuously "moving the baseline" as it were. This gets close to the 84dB signal-to-noise ratio provided by a 14-bit system. Just how this is done will be explained later.

The 32kHz sampling rate used by the Nicam system provides a frequency response of 0-15kHz in two channels for stereo. Separation between the two channels is total, so that dual-language sound tracks can be broadcast without crosstalk. The Nicam system can carry data in one or both channels and is completely separate from and independent of the existing f.m. sound channel at 6MHz (system I). Before it was adopted the Nicam system had to be tested under many different sets of conditions. It proved to be extremely rugged, providing high-fidelity stereo sound even when the signal is so weak that the picture can hardly be locked.

System Overview

Many of the processes and techniques that the Nicam system uses are common to those employed by the compact disc system. Thus readers who are familiar with the CD system – primed, perhaps, by Joe Cieszynski's excellent series of articles in this magazine (March 1989 – July 1990) – will have little trouble in understanding and servicing Nicam equipment. Fig. 1 provides an overall view of the system, which we'll describe in outline before going into detail.

The studio sound feeds for the left and right channels are first pre-emphasised and passed to an analogue-to-digital converter which produces 14-bit audio samples ("words") at a sampling rate of 32kHz. These samples are then fed to a compressor which reduces the bit rate to 10 per word, effectively extracting the ten most useful bits and discard-

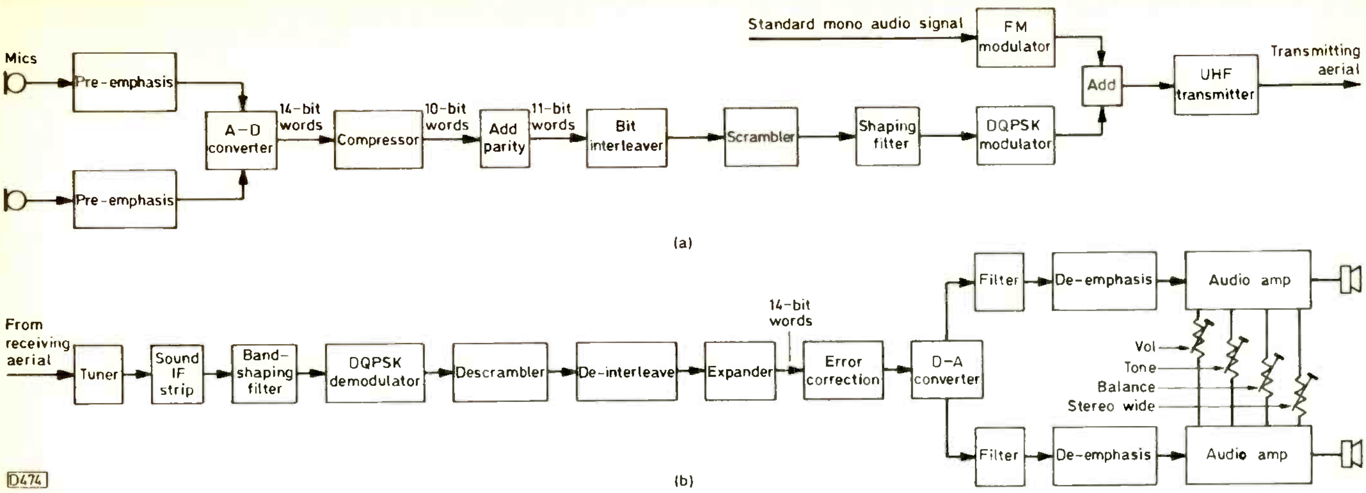


Fig. 1: Block diagram of the Nicam system, (a) at the studio/transmitter end, (b) at the receiver end.

ing the rest. At this stage an error bit is added for error checking and correction in the receiver. In the following interleaver stage the bits are shuffled like a pack of cards. This is done to distribute the effects of propagation errors or interference when the original order is restored at the receiving end. Scrambling is then done by adding to the interleaved data an effectively random data stream, so that the sidebands of the transmitted Nicam signal have no strong, fixed-frequency components that could cause interference.

Modulation comes next. For system I the Nicam subcarrier is at 6·552MHz. It's phase modulated by the data pulses, using the DQPSK system that we'll describe later. With digital signals phase modulation is economical of bandwidth, a factor that's a key to being able to squeeze yet another signal into the tightly-packed 8MHz slot available for a system I TV channel. The Nicam carrier is added to the 6MHz f.m. sound carrier fed to the transmitter, where it joins the vision carrier (at a level of −20dB relative to the peak vision carrier level) on its way to the transmitting aerial.

At the receiver the tuner converts the Nicam carrier to an i.f. of 32·95MHz. This is demodulated and selected by a filter for application to the first section of the Nicam decoder, the DQPSK demodulator. The Nicam signal emerges from this as a data stream. It then undergoes a series of processes that reverse those carried out at the broadcasting end. First comes a descrambler which subtracts from the data stream the random data added at the transmitter to smooth out the sidebands. De-interleaving, in accordance with a simple codebook held in memory, then takes place. As a result the order of the original 10 + 1 bit words is restored. The words are next expanded to 14-bit form in accordance with a scale factor transmitted with the data. Error correction on the basis of the parity bits is then undertaken. At the end of this decoding process we have a real-time data stream of 14-bit words, containing information for both the left and right sound channels.

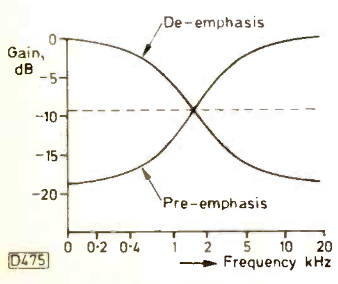


Fig. 2: The CCITT J17 emphasis characteristic.

It remains to convert the data back to analogue form, using a DA convertor, then to filter the result to obtain the original sound signals. User controls are incorporated into the audio amplifiers, whose design is critical if the low distortion and high signal-to-noise ratio of the transmitted signal are to be maintained. The performance, rating and positioning of the loudspeakers are also crucial to the realisation of the full potential of Nicam sound.

An Incongruity

The incongruity with many types of programme of having this wide, high and full-bodied sound alongside the necessarily limited picture area is something we won't dwell upon here. The system comes into its own with concerts of any type, and with any Nicam programme the larger the screen the better. In one jump the TV sound system has got itself several strides ahead of the picture transmission and display capabilities.

System in Detail

Although it's not essential from the servicing point of view to understand what goes on in the studio and the encoding and even the decoding processes, a reasonable knowledge of how the system works does help with fault diagnosis and Nicam decoder setting up. Nicam decoders are now becoming a common feature in top-of-the-range TV sets and VCRs.

Pre-emphasis

First, pre-emphasis. No sound or vision transmission or recording system is complete without a pre-emphasis system, which gives a boost to the high-frequency components of the signal. During reproduction the balance is restored by reducing the amplitude of the higher frequencies: noise is reduced in proportion. The pre-emphasis/de-emphasis characteristic follows the CCITT J17 recommendation, with a boost of 6·5dB at 800Hz. Fig. 2 shows the characteristic curves.

Sampling and Quantisation

The sampling rate for DA conversion is 32kHz, which means that digitised samples of the original analogue sound waveform occur at 31·25μsec intervals. To prevent aliasing (this occurs when the lower sidebands of the

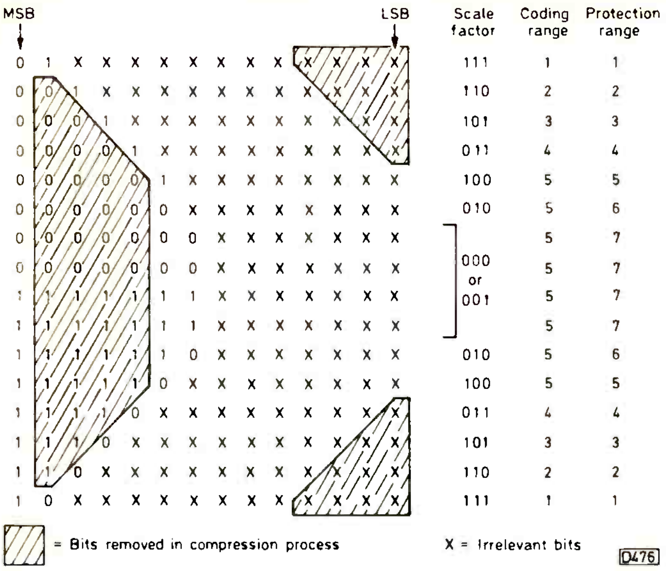


Fig. 3: The digital compression system – 14 to 10 bits. The bits in the shaded areas are deleted during transmmission: those in the wedge on the left can be reconstituted at the receiving end.

sampling frequency overlap with the upper end of the audio frequency spectrum), and the distortion to which this gives rise, the upper frequency limit of the audio signal must be held at or below half the sampling frequency, i.e. at or below 16kHz. For this purpose a filter with a very sharp cut-off at 15kHz is inserted in the L and R channel feeds prior to the sampling gates.

The 14 bits per sample used give a total of 16,238 possible sound signal levels. L and R signal sampling is carried out simultaneously. A samples carry L signals and the B samples carry R signals.

Digital Compression

The 14-bit rate is reduced to 10 bits to conserve bandwidth. The significance of each bit in a word depends very much on the sound level represented by that particular word. The least significant bit in a word can influence the final signal by only one part in 16,000 odd. While this may be important in a delicate, quiet passage, it matters not one jot when the sample represents a very loud sound or a rapid transition between two widely-different levels.

So we come to Fig. 3, where the possible combinations that could go to make up a 14-bit word are laid out. The shaded areas show the coding scheme. The most significant bit (MSB), the 14th (on the left), passes through the compression system unchanged. The 13th bit is discarded if it's the same as the 14th; the 12th bit is likewise discarded if it's the same as the 13th and 14th, and so on with the 12th, 11th and 10th bits. When this has been done we are left with words that have between 10 and 14 bits. If a particular word has more than 10 bits a sufficient number of bits is removed at the least significant bit (LSB) end to reduce the word to 10 bits. The digital signal has thus been compressed, and as long as the decoder knows what the compressor is up to it can expand the signal back to 14-bit length at the receiver.

Protection and Scale Factor

It's necessary to add to each digital word some protection against the possibility of transmission/reception errors. For this purpose a parity bit is added to the end of

Table 1: Scale-factor signalling.

Coding range	Protection range	Scale-factor code
1	1	111
2	2	110
3	3	101
4	4	011
5	5	100
5	6	010
5	7	001
5	7	000

each word. It's used in the decoder as a truth check on the word's six most significant bits. The system used is referred to as even parity.

We now have a protected 11-bit word. We must next send the decoder a scale factor to indicate which bits have been deleted during the compression process. If the missing bits are on the left-hand side in Fig. 3 the scale factor will enable them to be recreated: if they are on the right-hand side they are lost forever, but this is of no great moment since the words of which they form a part are not crucial ones from the noise point of view.

A careful look at Fig. 3 shows that 10-bit resolution is given to large signals (coding range 1), 11-bit resolution applies in range 2, 12-bit in range 3 and so through to the 14-bit range 5 which represents the quietest and most vulnerable sounds. This "progressive coding" system is very effective, giving bandwidth economy while losing little in comparison to a linear coding system.

For scale-factor signalling purposes the 11-bit (10 + 1 parity bit) words are grouped together in blocks of 32, each block lasting for 1msec. With each block a 3-bit code word is sent to indicate the scale factor. You will at once see that there's a degree of inaccuracy in this. Since only one scale-factor massage is sent for 32 consecutive words, some words will not receive optimum expansion. In fact what the scale factor tells the decoder is the magnitude of the largest sample in each block. This approximation increases the quantisation noise in the final audio signal, but this noise always occurs where the busyness of the signal disguises or masks it. The scale-factor data occurs sufficiently frequently for the fastest perceptible loudness transitions to be tracked – this is the key to subjective noise reduction. It's this "running approximation" characteristic of the scale-factor signalling that gives the system the first two words of its name, near-instantaneous. The average error is in practice very small and is imperceptible to the listener.

So far we've discussed two of the fiddle-factors involved in Nicam coding, bit reduction for compression and the 1-in-32 scale-factor signalling. Now we come to the biggest fiddle-factor, the way in which the scale-factor data is sent. In effect it's included for nothing, using the parity bits in the data words. The scaling factor is sent by modifying the polarity bits in accordance with a complex table that's held in memory in the transmitter and receiver. The receiver's decoder extracts the 3-bit scale-factor words by using what's called majority-decision logic – this process also restores the original parity pattern.

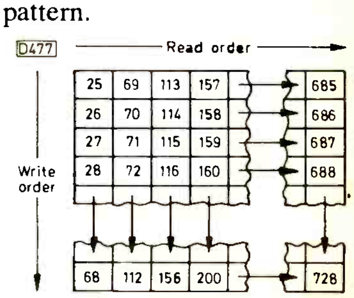


Fig. 4: The Nicam interleaving system. For protection, bits that are initially adjacent are scattered.

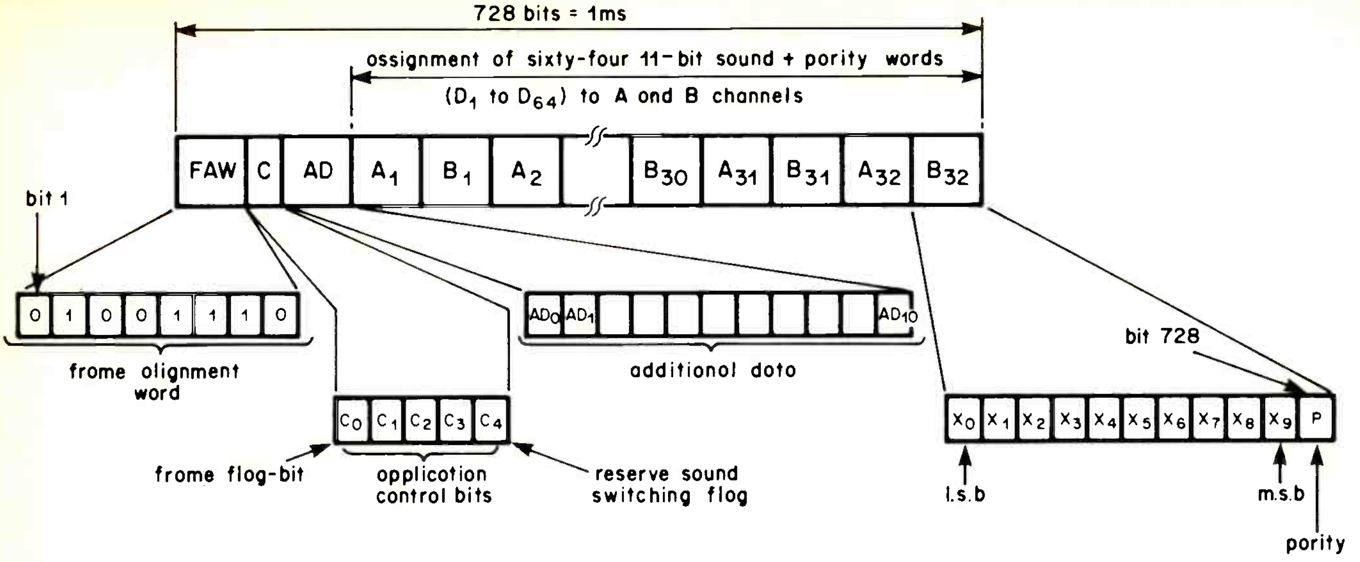


Fig. 5: The Nicam frame format, showing the arrangement of digital data for a stereo sound signal before interleaving. Diagram reproduced by courtesy of the BBC.

The scale-factor code words are shown to the right in Fig. 3. There are five different compression patterns, each being assigned a range figure from 1 to 5. Table 1 shows how the three-bit code words convey scale factor and protection data. The three scale-factor bits can give eight combinations. As shown, some of the "spares" are used to signal to the decoder the amount of error-protection required by each sample. This can be used in the receiver to give extra protection to the most significant bits of the samples.

Interleaving

The parity system gives significant protection to the data words. But impulsive interference and similar corruptive influences could blow large holes in the data stream. So further protective measures are required. The degree of protection called for depends on the likelihood of and probable pattern of data corruption. Nicam data, coming off-air, doesn't require the massive error protection used with the CD, V8-PCM and DAT systems. So far from the intricacies of CIRC, the interleaving system used with the Nicam system is simple.

It's achieved by writing the data into memory and then reading it out non-sequentially, as shown in Fig. 4. The readout order, which is held in a ROM address-sequencer, ensures that bits which were originally adjacent are separated by at least fifteen other bits. An error burst in the transmission path can corrupt several consecutive bits in the broadcast data stream. But as the error is distributed amongst several words the damage to each is minor. It can be repaired by parity correction and/or error concealment as necessary, techniques that are universally used with PCM sound systems.

Table 2: Control bit functions.

C1	*C2*	*C3*	*Contents of 704-bit sound/data block*
0	0	0	Stereo signal with alternate L and R samples
0	1	0	Two independent mono signals in alternate frames, e.g. dual-language sound
1	0	0	One mono sound signal and one data channel sent in alternate frames
1	1	0	One data channel

Housekeeping

The digital signal now has enough protection to enable it to withstand the rigours of transmission. "Housekeeping" data has to be added next so that the sections of data can be identified and synchronised and the decoding process can be controlled.

Fig. 5 shows the composition of a broadcast data frame – the transmitted data is arranged in 728-bit frames. The "housekeeping" data comes first, rather like the field sync pulse in the video waveform. As the duration of a frame is 1msec, the data rate is 728Kbits/sec. There are of course no gaps between frames.

The frame alignment word (FAW) synchronises and sets up the decoding process in the receiver. It consists of eight bits and is always 01001110. Next come the five bits C0 to C4, which are used for decoder control and switching. Their functions are as follows. The frame flag bit C0 is set at 1 for eight successive frames and to 0 for the next eight frames. This unchanging pattern defines a 16-frame sequence and is used to synchronise changes in the type of information being carried. Bits C1, C2 and C3 provide application control information – see Table 2. Note that C3 remains unchanged throughout these options. It's at present spare but is assigned to future sound and data coding options. The reserve sound switching flag C4 caused decoder design problems at one stage. It's set to 1 when the Nicam channel carries the same sound as the main (f.m.) sound carrier and to 0 otherwise. This permits fall-back switching should the Nicam carrier fail or shutdown when a data transmission is in use.

The next data block, AD0 to AD10, is at present unused – it's reserved for "additional data" and it will be interesting to see what this will be.

The Sound/data Block

This initial section of the frame accounts for 24 bits. The remaining 704 convey stereo/dual-channel sound data. There are sixty four 11-bit words, the A channel (stereo left) and B channel (stereo right) samples being sent alternately throughout the period – 32 of each. Since two sound channels, plus the initial data, are being transmitted as a single serial data stream the bit rate of each channel is approximately doubled. This form of time-compression is a common technique known as time division multiplex (TDM). It's easy to put into effect by writing the data into a RAM in real time and reading it out at approximately twice the rate at suitable intervals. TDM is used in many data storage and transmission systems to match signal density to channel bandwidth.

The order of A and B samples shown in Fig. 5 represents the sequence before bit interleaving (see above). Only the 704 bits of sound data are interleaved, which is why Fig. 4 starts with bit 25 and ends at bit 728. With monaural sound the data block is arranged slightly differently, see Fig. 6. In this case two 32-word blocks (n and n + 1) are placed end-to-end in a single frame, carrying the complete mono signal. Since the data rate is unchanged, the next frame is available for other forms of data if required. Odd numbered frames carry the mono sound data and even numbered ones the "information" data. To indicate this condition control bits C1-3 change to 100, switching the decoder to the mono mode.

If two independent mono signals M1 and M2 (e.g. dual-language sound) are being transmitted, M1 is carried in the odd-numbered frames as just described while the M2 signal is carried in the same manner in even-numbered frames. The control bits C1-3 change to 010 to switch the decoder sound routing.

Data information can take many forms. Computer programs or software are perhaps the most likely. If conditional or restricted access is required by the broadcaster or his agent, perhaps the spare bits C3 and AD0-10 will be used to provide this feature. No data information format for this purpose has to date been published.

Scrambling

Now that we've considered the composition of the Nicam data stream in detail it should be obvious that there are certain fixed patterns. Since the data stream modulates a carrier whose sideband structure depends on the characteristics of the modulation, the energy in the sidebands can be evened out by scrambling the data at random. This is a form of energy dispersal. Total random scattering of the bits is not possible because there's no way of descrambling such information at the receiver. A simple circuit that generates binary digits in what appears to be a random way but whose output is predictable and repeatable is available however. It's called a pseudo-random sequence generator (PRSG) and consists of a clocked shift-register with one or more taps that feed back to its input. Fig.7 shows the one used with the Nicam system. It consists of nine stages, with a tap between the fifth and sixth feeding one input of an exclusive-or gate whose other input comes from the final stage. If you work it out, the sequence starts 0000 0111 1011 etc. Once it gets going the output sequence lasts for 511 ($2^9 - 1$) bits and thus runs through almost one and a half times during the frame period.

One of these PRSGs is used at each end of the system, i.e. at the transmitter and the receiver. Each is reset to 111111111 at the end of the last bit of the frame alignment word, which is not scrambled, so that the PRSGs run in synchronism throughout the rest of the frame. The PRSG sequence is added "modulo-two" to the data bit stream on its way to the modulator – modulo-two addition is the action of an exclusive-or gate, whose behaviour is shown in Fig. 8. Fig 9(a) shows the action of the scrambler at the transmitter end, working on a data stream that consists of 010101010 for the purposes of illustration. Fig.9(b) shows the reciprocal process at the receiver end, after which the original data sequence is restored.

Modulation and Transmission

There are various ways of modulating a carrier wave with information. The best known are amplitude modulation, as used for terrestrial vision broadcasting, m.f. radio, etc., and frequency modulation as used for satellite vision, TV sound and f.m. radio. A digital signal has only two states, 1 and 0. In terms of bandwidth the most economical method of modulation for use with such a signal is phase modulation: the carrier frequency remains constant but its phase is altered by the modulating data. The simplest phase modulation system is a two-phase one, with for example ones setting the carrier phase at 0° and zeros setting it at 180°. This is easy to detect at the receiver. Bandwidth saving is possible by using four-phase modulation, in which the carrier has four possible states – 0°, 90°, 180° and 270°. Even more complex phase-shift systems have been devised, with eight phases, but the smaller the phase shift the more difficult reliable detection becomes.

The quadrature phase-shift keying system used for Nicam has four carrier phase states. At the transmitter a serial to two-bit parallel converter changes the serial data into a series of two-bit pairs. These pairs can take one of four forms – 00, 01, 10 or 11. Each of these moves the carrier phase by a different amount, as shown in Table 3. Thus the carrier phase has four possible states and is moved from one to another depending on the composition of each two-bit pair. Note that with a 00 bit pair the carrier remains at its 0° shift, i.e. its rest, state. Fig. 10 represents these conditions.

Since each phase change occurs at two-bit intervals instead of once per bit and the maximum shift is half a cycle of carrier (either way, in effect), the use of DQPSK greatly reduces the sideband spread. The sudden phase jumps depicted in Fig. 10 can be smoothed out to reduce the sidebands further. With a 2-bit data rate of 346Kbits/sec and a carrier frequency of 6·552MHz, there's a minimum of eighteen carrier cycles between each phase change. By feeding the data to the DQPSK modulator via a low-pass filter we can change it from a square wave to a triangular one. This has the effect of "smearing our" the carrier phase changes in time so that they are more evenly distributed along the eighteen cycle periods available.

With the broadcast system I as used in the UK the normal f.m. sound carrier is at 6MHz above the vision carrier at a relative level of −7dB. For use with Nicam transmissions it's reduced to −10dB. The Nicam carrier is at 6·552MHz (exactly nine times the bit rate) and is transmitted at a level of −20dB with respect to the vision carrier. It's important to appreciate that these levels are quoted as voltages, so that the power ratio of the peak

Table 3: Nicam carrier phase changes for each possible combination of 2-bit data pairs.

Input data	*Phase of Nicam carrier*
0 0	0°
0 1	−90°
1 0	−270°
1 1	−180°

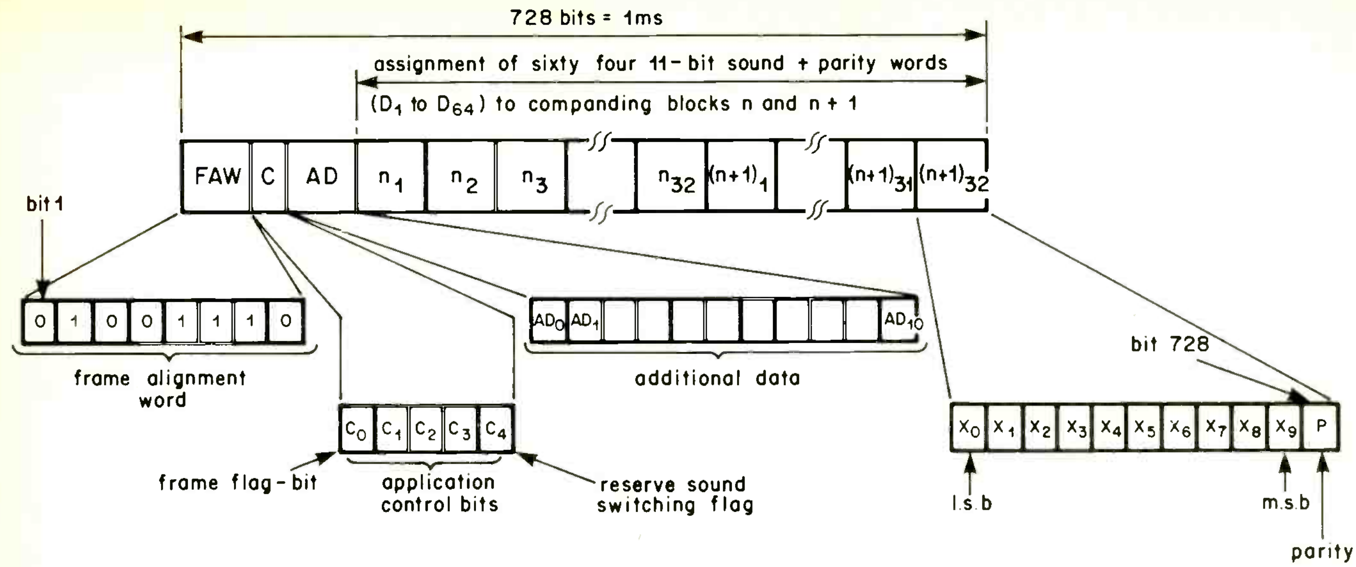


Fig. 6: Nicam frame format for two monaural signal transmissions. Compare with Fig. 5. The n and n + 1 channels may carry different language sound tracks. Diagram reproduced by courtesy of the BBC.

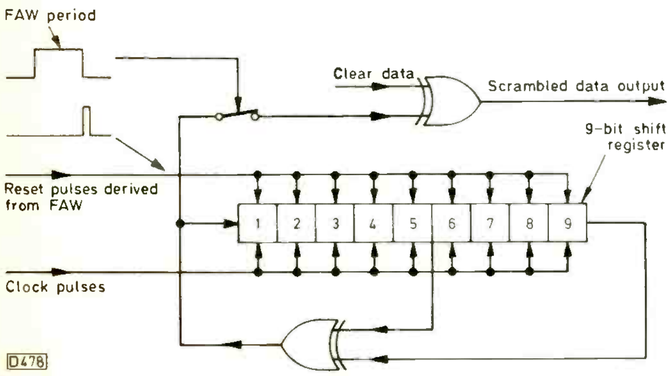


Fig. 7: A PRBS generator using a shift register and two exclusive-or gates, with a tap between the fifth and sixth stages of the shift register.

A	B	F
0	0	0
0	1	1
1	0	1
1	1	0

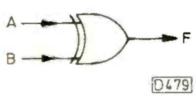


Fig. 8: Modulo-two addition binary data.

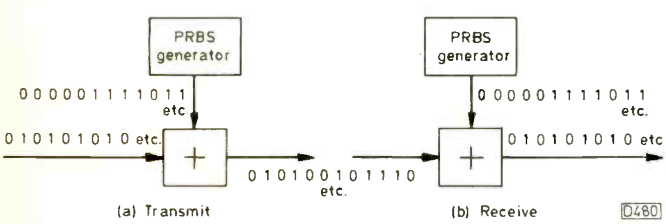


Fig. 9: Action of the scrambler, (a) at the transmitter end, (b) the reciprocal process in the receiver.

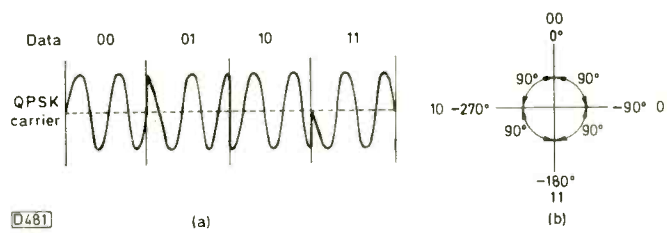


Fig. 10: Changing the phase of a carrier to convey data. In this case there's a phase change with different bit-pairs in the transmitted data. A graphical presentation is shown at (a) while (b) shows the phase shift conditions.

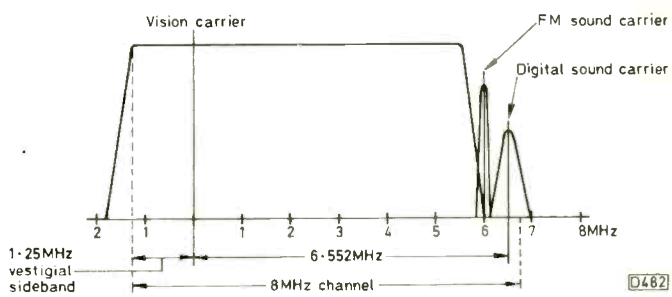


Fig. 11: Frequency spectrum of a system I TV channel with Nicam carrier. The total spread of the Nicam signal is about 700kHz.

vision carrier to the Nicam carrier is 100:1. Fig. 11 shows the spectrum of a system I TV channel with Nicam sound.

At a main transmitter the Nicam carrier is fed to the klystron power amplifier used for the f.m. sound signal. For optimum efficiency this normally operates in a very non-linear mode and is very sharply tuned to the relevant channel frequency. For correct operation with Nicam signals its conditions have to be re-tweaked for more linear operation and for greater bandwidth to allow for the extra phase-modulated carrier. A great deal of trouble is taken, as we've seen, to keep the Nicam carrier's sidebands low and quiet. There's no interference to the other carriers in the channel or to the adjacent sound and vision channels – or, with co-channel reception conditions, to French system L transmissions which have an amplitude-modulated sound carrier at 6·5MHz.

The Nicam system has been adopted by some European countries and many others have expressed interest. For the Continental system B/G, with the f.m. sound carrier at 5·5MHz, the Nicam carrier frequency is set at 5·85MHz. This is rather close to the f.m. sound carrier, but can be accommodated with critical modification of the data-shaping sideband filter. The Nicam signal bandwidth is reduced from 700 to 500kHz with system B/G.

The Nicam format is compatible with the sound and data transmission arrangements used with the MAC/packet system that's been adopted for the BSB satellite TV transmissions. Thus the chip sets developed for one can be used for the other, which is useful for both set designers and chip manufacturers. These chip sets have to sort out the rather complex Nicam transmissions at minimal cost, which is no mean task. Next month we'll be considering the receiver and decoder.

VCR Clinic

Reports from Philip Blundell, AMIEIE, B. Ross, Chris Avis, Stephen Leatherbarrow, S. Da Costa and Ian Bowden

Philips VR6290/6291/6390

If you encounter one of these machines that intermittently doesn't play or record check the error memory. You'll need the remote control handset for this. I know the manual says otherwise, but where's the set clock button gone? If the last two digits are E6 (head blocked) the following modification is probably needed. Find C2040 on the family board. If its value is $0{\cdot}1\mu$F, replace it with an $0{\cdot}01\mu$F capacitor (part no. 4822 121 51304). The circuit shows it as being $0{\cdot}01\mu$F. **P.B.**

Philips VR6720

This machine produced no sound from the speakers, though the headphones worked all right – it's the one with the 2 × 15W stereo amplifier. The supplies and input signals were present, but the signals got lost at the driver chips IC101/2. The delay muting transistor TS120 was leaky. **P.B.**

Grundig VS200/220

This machine would intermittently stop playing. When this happened it would unthread and show F2 in the display. It would also sometimes stop during wind or rewind, but the display would then show F6. Both of these fault codes indicate that the microcomputer chip thinks one of the spools has stopped. As there was no tape spillage scope checks were made on the spool optocouplers. With the machine playing or winding the optocouplers' output should consist of a signal of about 9V peak-to-peak. The output from one of them was only 2V pk-pk. A new supply optocoupler was required. **P.B.**

Grundig VS310

We've had two of these machines in recently. The problem with the first one was wow on sound. On inspection we found that the capstan belt was hard and covered with cracks. Fit a Grundig replacement if you have the same problem.

The second one was dead – no clock, no booster, nothing at all from the power supply. The chopper transistor was o.k., with 30V across it, but there was no drive. D425 was short-circuit. **P.B.**

Ferguson 3V36/JVC HRD225

In the play mode the sound was o.k. but the screen showed nothing but dark grey with occasional flashes of picture content in the background. On tracing the video signal through I discovered that it became a little distorted in the luminance amplifiers (Q106/7) that follow the f.m. demodulator filters. It disappeared completely at the output of amplifier transistor Q103. Meter checks showed that the pre-playback 9V supply was low at only 2·5V. Switching transistor Q501 was the cause of the problem. **J.C.**

Grundig 2 × 4 Super

This machine would play back, search and wind/rewind but wouldn't record. It wouldn't initiate record or thread in. The problem was that the left-hand keyboard didn't respond as button 1 was permanently "on". In fact the push-buttons jammed in when pressed – buttons 4 and 7 exhibited this to a lesser extent. The keyboard is part of a large board that's secured to the front panel by plastic blobs and contains all the other front panel push-buttons. Grundig Service told us that a repair kit is available but that relieving the front panel cutouts around the buttons is usually adequate. This provided a perfectly acceptable cure. **B.R.**

Panasonic NV688

Here's an example of confusion caused by an incorrect symbol on the circuit diagram. The problem was no playback, recording or signals – just a buzz and noise bar in the E-E mode. We soon found that the regulated 5V rail was low at only 2V. No excessive load was apparent and transistors Q1003/4 and zener diode D1006 in the regulator circuit all checked out correctly when cold resistance tests were carried out. We decided to check the 2SD1275 series regulator transistor by replacement. It's listed as a Darlington device, though the circuit shows it as a straight npn transistor – which it seemed to be from our meter check. In fact the Darlington bit had shorted out. A replacement solved the mystery, with no thanks to Panasonic's circuit diagram. **C.A.**

Hitachi VT8000

This machine would load up and play. It then refused to unload and eject the tape, though the left-hand reel was driven normally to retract it. If the tape was unloaded manually and a fast wind command was given the machine would respond initially but the loading arms would also move forwards slightly. This disturbed the loading switch, thus preventing acceptance of further commands until the loading arms were wound back again manually. The microcomputer's voltages were all correct and the right instructions reached the loading motor control chip IC905. Replacing this TA4194A device did the trick. **C.A.**

Saisho VR1200HQ

When we find "HQ" appended to this breed of VCRs we're inclined to take it as meaning highly questionable. "It won't stay on" said the owner, the reason being that fuse F502 had blown. When our adapted Thorn 3500 cutout was connected temporarily the machine wouldn't accept a tape and the BA6239A loading motor chip quickly reached fried egg temperature. After using an external supply to check the loading motor we replaced the chip, fitted the correct fuse, and another Saisho limped off into the sunset. **C.A.**

Panasonic NV730

I owe this one to regular reading of *Television* articles! The problem was intermittent stopping in the play mode. The machine had come to us as another local firm had unsuccessfully tried to sort it out. It was obvious that previous work had been done on the deck – the guides had been cleaned and the take-up idler roughened up. After a long soak test the fault showed up as no take up, with tape spillage into the machine before the system control came to the rescue. Q1504 at the rear right of the machine (from the front) was found to have dry-joints. **S.L.**

Saisho VR1200HQ

This machine would very intermittently go to stop while in use. It didn't matter which particular function was asked of it, i.e. rewind, FF, play etc. Although we didn't really suspect the deck sensors they were replaced as strange things do happen. The supply lines were all checked, the mode switch was cleaned and aligned, and a thorough search for dry-joints was carried out. On test however the fault was still present. Eventually we found that the BU2716S (IC01) was the cause. Other Saisho models such as the VR1600 etc. could equally be affected by this problem as similar circuitry is used. **S.L.**

Sharp VC651HM

This was another intermittent nasty – tape chewing. After a very long on/off cycling test the fault showed up as intermittent no take-up. The machine had been serviced recently and the reel drum unit had been replaced, so this was assumed to be all right. With the carriage out and the machine on its side it was possible to observe the operation. The fault showed up on about one in every ten or fifteen tries. We noticed that the brake on the take-up reel lagged now and then: the brake driver lever didn't move far enough to disengage this brake and didn't latch on to the little electromagnet. We deduced that the cam switch (mode switch to you and me) must be faulty. The problem was cured by stripping this switch out and cleaning it. As a precaution we also replaced the loading belt. **S.L.**

Ferguson 3V44/JVC HRD140

There were several problems with this machine. The clock couldn't be set, there was no tuning and the timer couldn't be set being amongst the most obvious ones. A case of a very large brain failure. After perusal of the circuit diagram we suspected the microcomputer chip IC601. As its 5V supply and clock were o.k. we tried a replacement. This cured all the symptoms. It's type M50730-607. **S.L.**

Samsung V510T

The basic problem with this machine was failure to switch on. The take-up reel rotated backwards and the capstan motor intermittently ran slowly. This was all without a tape in. The power supply at the rear of the machine, with an i.c. of the STK variety, produces several rails. There's an always 13V supply from the chip and switched 12V, 50V and −24V supplies from a transformer-fed series regulator. The basic problem was that the switched 12V supply was missing. A check was made on the power-on command from pin 15 of IC1 and this was found to be present, but instead of a nice positive d.c. charge when the operate button was used there were several pulses – see Fig. 1.

We then found that the machine operated normally when the error detector transistors were temporarily shorted across, to simulate full conduction. As soon as power was removed however the machine would of course fail to respond. If nothing else this removed the possibility of a d.c. fault in the 12V series regulator. The power-on command was then checked with the line disconnected from the power supply. Since the pulses disappeared the fault appeared to be generated in the few components in the first transistor's base circuit. So it was, with C6 being open-circuit. We found that an 0·22μF capacitor gave reliable operation. Since then we've had another of these machines with the same problem. **S.L.**

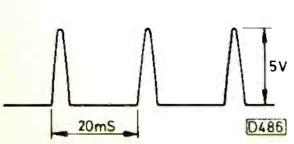


Fig. 1: Incorrect power-on signal discovered in a Samsung V510T.

Sentra VX8400/Questar V300R

This one caused us some problems due to the random nature of the fault. Basically the machine would occasionally fail to store ch. 2 only, after correctly searching for the channel. Alternatively ch. 2 would search and store but on selecting channels sequentially, both up and down, ch. 2 would be missed in the down direction. Unusual I think you'll agree, and we stored each channel several times before we actually believed what the machine was doing. The culprit turned out to be the M58659P EPROM IC702 on the front panel. **S.L.**

JVC HR7700/Ferguson 3V23

Rewind and fast forward were o.k. but when play was selected the machine loaded the tape half way then stopped – the drum also stopped. To unlace the tape you had to use the on/off button. All the sensors and switches were tried, then all the panels, but still no success. We finally tried a new drum assembly, after which the machine worked perfectly. The rotor base unit in this assembly has two magnets opposite each other at the bottom. One of them was missing, so there was no pick-up pulse. **S.DaC.**

Panasonic NV-L20

The fault report was that the on/off button didn't work. When the machine was connected to the mains supply the clock display flashed as usual. Key scanning is carried out by IC7501 which is also the timer/display driver chip. It appeared to be working all right since pressing the timer button produced a warning that the clock wasn't set and that there was no tape, i.e. there were beeps and the timer and tape symbols in the display flashed. On a couple of occasions we found that the machine seemed to be on when connected to the mains supply since a channel number appeared in the display – it could be changed up and down with the front keys. A check was made on the serial clock and data lines between IC7501 and the system control chip IC2001 (pins 44 and 45). Both were high (5V) with no pulses. Since IC2001 produces the serial clock signal its reset and clock inputs were checked. There was no clock input from the osc pack CBA, a small PCB beneath the main panel. The single transistor on this PCB was at fault. It's Q6101, type 2SC2206. **I.B.**

Panasonic NV-G45

The reason for no play or record with this machine was that the drum didn't start up. It just kicked backwards and forwards. Experience has shown that with the type of motor used here the cause of this condition is usually something to do with the rotor position sensing, since this controls the current that's switched to the three pairs of drive coils. A single Hall-effect device is used with these drums. The connections are to pins 2 and 6 of plug/socket P2001. With this particular unit we got a reading of 2·7kΩ between these pins. When we checked a G40 drum the reading was 400Ω.

Unfortunately the Hall device is not available as a separate item. You have to order a complete motor assembly which costs around £60. We had a scrapped rental NV430 in the workshop however – it had been written off due to liquid spillage. It's drum motor has two Hall-effect devices, one of which was removed. Before removing the cup-shaped rotor of the G45's motor we marked on it the positions of the centres of the two securing screws in the two adjusting slots. The Hall-effect device was then removed and the replacement from the NV430 was carefully fitted in exactly the same place. The rotor was then refitted, with the two securing screws just tight enough to allow adjustment of the rotor's phase, and the drum was secured back in the machine. A standard tape was played and the head switching point was adjusted visually before tightening the rotor screws fully and carrying out fine electronic adjustment of the head switching point. **I.B.**

Panasonic NV-G45

The customer complained of a whine from the machine when it was switched on, and that it wouldn't play back correctly. The reason for these symptoms was that the drum motor ran flat out. When tests were made we found that the voltage at the torque control input pin of the drum driver chip IC2901 (pin 7) was incorrect. In the stop mode (machine on) the voltage at this pin should be 3·8V. It was low at 1·4V. With the pin disconnected from the PCB the motor didn't start and the voltage rose to around 3·6V, indicating that there was some loading on the line. It was due to a leaky capacitor, C2117 (0·47μF electrolytic), which filters the speed and phase control voltage from the operational amplifier IC2103. **I.B.**

The Commodore CD-TV System

George Cole

Computer company Commodore plans to launch its CD-TV (Commodore Dynamic Total Vision) system in the UK by this coming Christmas. It's a multimedia format that combines computer, compact disc and video technologies. CD-TV puts a mix of sound, video, text and graphics on to a compact disc which is controlled by the user – Commodore calls CD-TV "television you can control". The format is clearly aimed at the market targetted by the Philips compact disc interactive (CD-I) system – and you won't be surprised to learn that the two formats are incompatible!

Features

I recently had an opportunity to see prototype CD-TV players and discs in operation at Next Technology, a computer company based in Cambridge. The CD-TV player looks like a small VCR and is designed to be linked up with existing domestic TV sets and hi-fi systems. It consists of a CD-ROM (compact disc read-only memory) drive and an Amiga computer housed in the same case. On the player's front panel there are a disc drawer, a display panel which shows the time, track number, volume level and clock, and controls for power on, headphone level, play/pause, stop, forward/reverse and scan/skip. Most users will operate it via an IR remote control system however.

Various computer peripherals, such as a keyboard, mouse, modem, floppy-disc drive and joystick, can be connected to the player. Video output sockets include provision for analogue and digital RGB, Y/C and r.f,. There's also a pair of phono audio sockets.

At the heart of the player there's a Motorola MC68000 microprocessor chip whose clock speed, in PAL machines, is 7·09329MHz. The player has a 1Mbyte RAM, 2Kbytes of non-volatile RAM for the clock and other functions, and 512Kbytes of ROM. In addition there's a facility for storing up to 64Kbytes on a smart card.

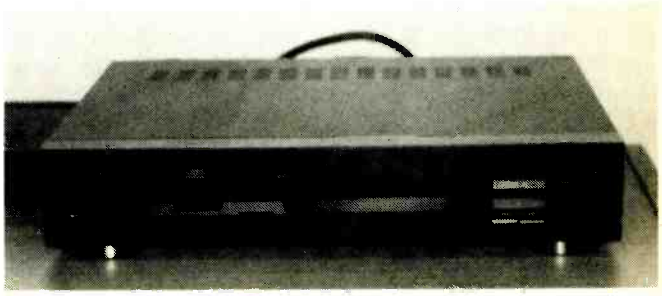
CD-TV players can handle CD-TV and ordinary CD audio discs, including those encoded with CD graphics. They cannot play Laserdiscs, CD-ROM or CD-I discs.

CD-TV offers full-motion video, though at present this is restricted to a quarter of the screen. Commodore says that full-screen, full-motion video will be incorporated at a later stage. The system has a number of graphics modes, with both sequential and interlaced scanning. The text mode offers 80 or 60 characters per line, and there's a choice of font types, sizes and colours. The audio circuitry operates with times eight oversampling, using dual 16-bit DA converters. There's an optional sound system that provides up to 14 hours of a.m.-quality sound.

Performance

So much for the basic specifications. How does CD-TV look and sound? CD audio discs sound as good as I've heard with any normal CD deck. I was shown the Next Technology sampler disc which will be supplied with every new CD-TV deck. It offers users six topics to explore, including the life of Bach, sport, and exhibits at the Victoria and Albert Museum.

Operation of the player is simple. You use the IR handset to guide a cursor over the screen, and click on at the appropriate place. With the Bach section I listened to his music, looked at his scores and read a biography to find



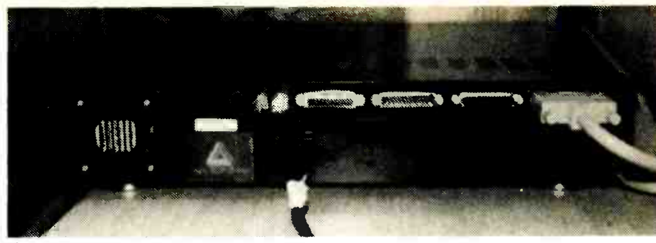
Front view of a prototype CD-TV player.

out details of his life. It's fun to use, and quite addictive!

The picture quality is roughly that of pre-HQ processing VHS, but to be fair the system I saw was a prototype one and Next Technology says that the performance of full production players will be much better.

Marketing

CD-TV should be on sale in the UK by Christmas, with the players costing around £699 and disc prices starting at £25. According to Commodore there will be around a hundred titles available by the launch date, though some industry watchers suggest that the figure is much more likely to be in the region of 30-50. CD-TV will be aimed at educated 24-49 year olds with families: disc titles will include games, encyclopaedias, atlases and cook books. There are plans to put Shakespeare and the King James bible on the CD-TV!



Rear view of the player showing the plugs and sockets.

The effect CD-TV will have on CD-I is hard to guess. Some suggest that Philips will regret not having put CD-I on the market sooner, while others reckon that CD-TV will stimulate a market that will come to be dominated by CD-I. As ever the Japanese are hedging their bets: Matsushita, a major CD-I supporter, is also making the CD-TV players for Commodore.

An RGB Interface for BSB Reception

Brian Webb

My ITT-Nokia D-MAC receiver for the BSB transmissions provides RGB outputs, a feature that appears to be available with all BSB receivers. Like many TV sets, the Philips receiver I use employs a TDA3560 colour decoder chip which is designed to switch between off-air video and RGB teletext inputs. These RGB inputs are digital of course, but enquiries revealed that analogue RGB inputs could be fed to the chip with a.c. coupling. I decided to convert my Philips K30 chassis set – the Edition II version with the TDA3560 decoder – so that it would accept the RGB outputs from the ITT-Nokia BSB receiver. The conversion proved to be a success and the results are very pleasing.

Many recent TV sets have a mains isolated chassis. This is not the case with the K30, so a suitably rated double-wound 1:1 ratio mains isolating transformer must be used when this modification is adopted. I fitted a toroidal type transformer rated at 400VA inside the K30's cabinet – there's plenty of room. A chunky wire runs from the set's chassis to the earth pin of the mains plug.

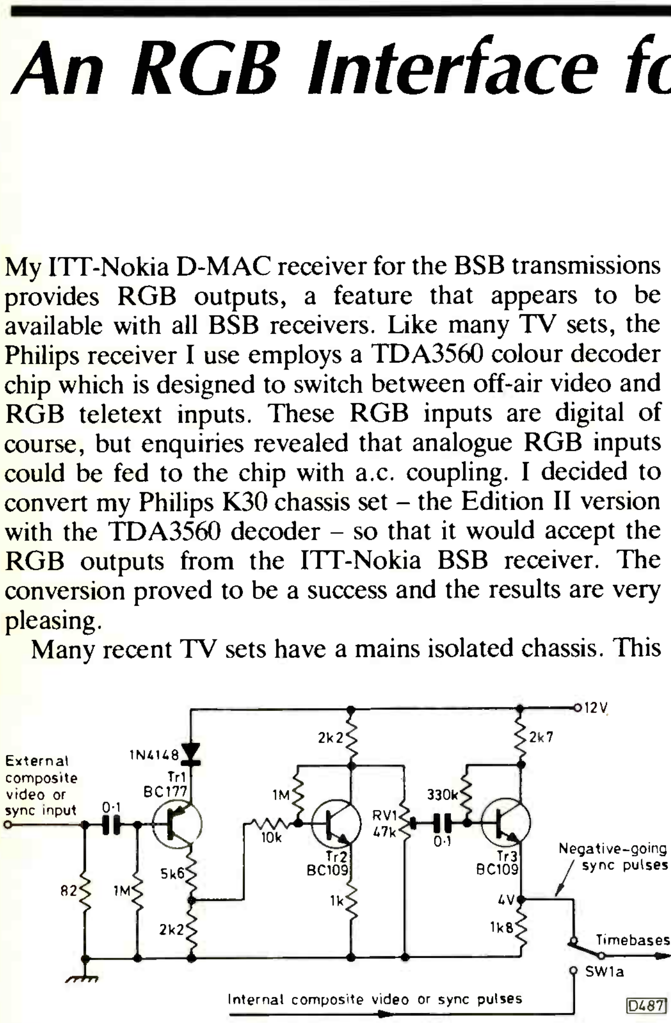


Fig. 1: Circuit used to interface the composite video output from the BSB receiver and the TV set's sync circuit.

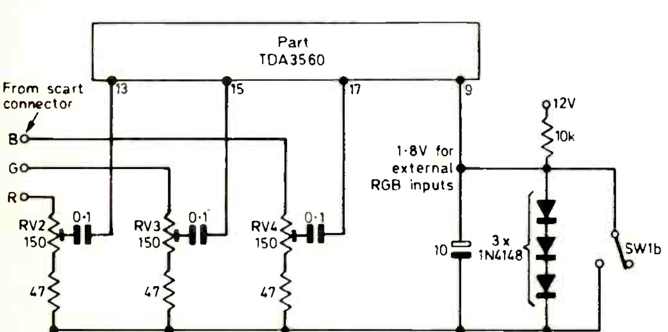


Fig. 2: RGB interface for the TDA3560 colour decoder chip.

I kept the conversion as simple as possible. A double-pole, double-throw toggle switch is used for manual switching between off-air and external signals. Figs. 1 and 2 show the sync and RGB interfacing circuitry. You'll find that the TDA3560 and the other members of this family of colour decoder chips were very widely used, making conversion of many older TV sets a simple matter.

The ITT-Nokia receiver's RGB outputs are available at a scart connector. My first problem was that I couldn't find at the connector a sync pulse output to complement the RGB outputs. A phone call to ITT-Nokia confirmed that there isn't one and that the composite PAL signal output would have to do.

The video input to the TDA2571AQ sync/timebase generator chip in the Philips K30 chassis calls for a composite signal of about 3V peak-to-peak. The composite video output at the ITT-Nokia receiver's scart socket is 1V pk-pk into 75Ω. So amplification is required. Fig. 1 shows the ciruit I used. Since amplification is necessary, I thought why not bias the first transistor Trl as a sync separator? Thus Trl acts as an amplifier/sync separator. Tr2 inverts and squares the signal. The emitter-follower Tr3 provides a relatively low-impedance drive to the K30's timebase circuitry, which also requires a 4V d.c. offset. The sync pulse amplitude can be adjusted by RV1.

Fig. 2 shows the RGB signal interfacing. RV2/3/4 are included for contrast adjustment. For selection of off-air video or RGB inputs the voltage at pin 9 of the TDA3560 chip has to be altered. SW1b sets the voltage at 0V for off-air operation and 1·8V for operation with the external RGB inputs.

Carrying out these simple modifications and viewing clean D-MAC pictures accompanied by digital stereo sound, as provided by BSB, through a hi-fi system gives another dimension to TV entertainment. It's really worth the effort.

Vectorscope Use

Steve Beeching, T.Eng.

In the July issue Nick Beer drew attention in a brief review to the Electronic Visuals Model EV4061 vectorscope/ waveform monitor. The purpose of this follow-up article is to provide details of vectorscope use and outline the circumstances in which such an instrument is helpful.

I first used an Electronic Visuals vectorscope when I worked for a video company in Nottingham back in 1977/8. Electronic Visuals vectorscopes have been used at some time by most broadcast TV companies as an engineering waveform monitor, mounted in a console or an equipment rack. When I wanted a combined oscilloscope and vectorscope two years ago I purchased an EV4061. It's to broadcast standard and is from Electronic Visuals, so it's good enough for me!

As Nick mentioned, the basic vectorscope is a monitoring instrument. So it's not used with wandering probes like an oscilloscope – mainly due to the difficulties of locking to a source of reference.

The set-up shown in Fig. 1 is typical. The camera or camcorder camera head is connected via a suitable interfacing test jig to a video monitor where it's looped through to the vectorscope and then terminated. A T connection is used to link the video waveform to an oscilloscope's external trigger input, which has a high impedance and bridges the line. The whole rig is thus synchronised to the camera's video output. This leaves the oscilloscope's two probes free for measurement at various test points without the hassle of having to keep twiddling with the trigger controls.

My set-up, as shown, was tested with a Grundig VG1000 pattern generator, which is also to broadcast standard, to check for and eliminate phase errors between the source camera and the vectorscope due to odd cable lengths or mismatching. Hence the 75Ω termination at the vectorscope. External sync inputs to the oscilloscope, which is a Philips PM3217, make stable switching between line and field rates possible without loss of lock. The rig allows full monitoring of the camera/camcorder which is to be set up, as the oscilloscope's channels can be connected to the R − Y and B − Y test points in the camera's signal processing circuitry.

The waveforms shown in Fig. 2 illustrate the effects produced by a camera head whose output gives magenta shading at the right-hand side of the screen or picture area when the camera is pointed at a white reference lit at 3500°K and is white balanced. The R − Y and B − Y test points are at the output of the camera colour tube's decoder matrix or processing, prior to being sent to the PAL encoder for encoding into a composite colour signal on a 4·33MHz carrier.

So what do the signals tell us? As can be seen on the monitor, the colour error is magenta. But is it due to too much red and blue or too little green? In the camera one Y signal feed is passed through a low-pass filter to give it the same bandwidth as the red and blue signals. This filtered Y signal is generally referred to as YL. For practical purposes it's equivalent to the green signal. As a result the colour-difference signals are effectively R − YL and B − YL.

A vector display on the vectorscope shows the vector angles and amplitudes of a colour signal. In the example we're considering the magneta error will be shown in the upper right-hand quadrant, see Fig. 2(d). If the vectorscope is switched to its scope mode at line rate you'll now see a single line that thickens at the right-hand side, as shown in Fig. 2(c). This thickening is caused by the chroma signal. The vectorscope tells us what this colour is and how much there is of it.

Trace (a) produced by the oscilloscope probe shows that the R − Y signal level has increased during the line period, forming a slight ramp. Trace (b) also shows a ramp, but this time inverted since B − Y is inverted – it's −(B − Y). The conclusion follows that the error is caused by slight increased in the amplitude of the R − Y and B − Y signals during a line period.

To correct such an error use is first made of the red horizontal sawtooth and red horizontal parabola shading controls to flatten the tilt of the R − Y signal (trace a). As this is being done you'll see the colour error on the monitor change from magenta to a bluish tint. On the EV4061 the

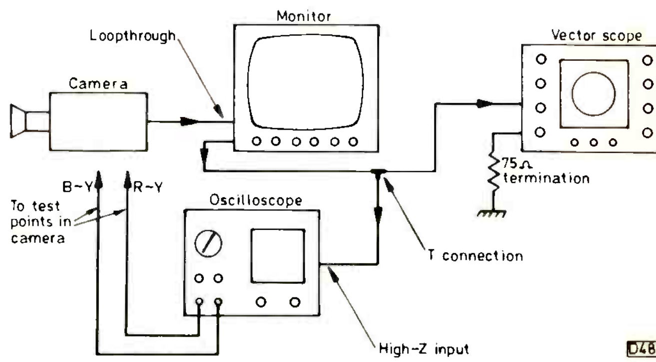


Fig. 1: Typical camera/camcorder test set-up using a monitor, an oscilloscope and a vectorscope.

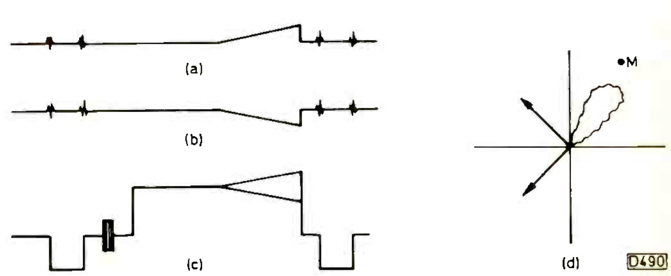


Fig. 2: Waveforms produced by a camera whose output gives magenta shading on the right-hand side when pointed at a white card. (a) Scope R −Y waveform; (b) scope − (B −Y) waveform; (c) vectorscope display in its scope mode; (d) vectorscope display in its vector mode.

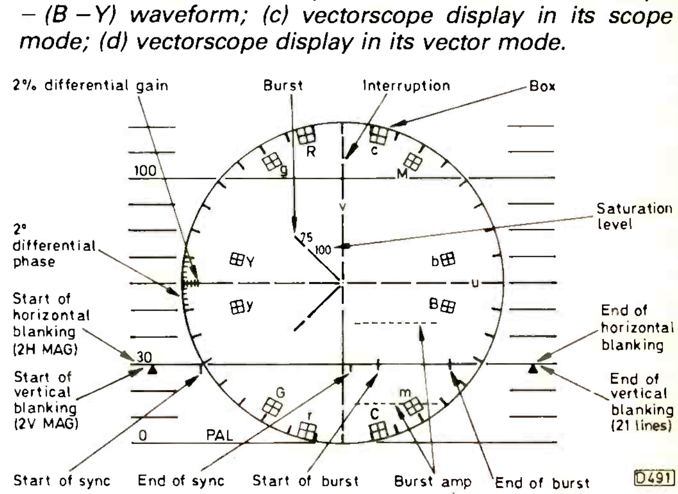


Fig 3: The EV4061's PAL graticule markings. The interruptions to the U and V axes represent the magnitude of the colour vectors in these axes.

vector display rotates clockwise slightly towards blue. In the oscilloscope mode it shows a slight reduction in the thickness at the right-hand side of the line. Further correction by means of the blue horizontal sawtooth and blue horizontal parabola controls to flatten the tilt of the B – Y trace (trace b) will finally remove the colour error in the monitor's display, giving two flat traces on the oscilloscope. The colour vector displayed by the vectorscope is reduced to a fuzzy circular patch around the centre of the display, with a single, clean straight line in the oscilloscope mode.

What we have just outlined is an ideal example, assuming that the camera tube is new. It never seems to turn out quite that way in real life, though it's close enough to what actually happens. Four-way monitoring of the signal reduces the setting up time by eliminating doubt and the time that would otherwise be spent disconnecting and reconnecting probes and trying to get the trace to lock.

Another useful feature of the EV4061 is the tight pull-in range of its colour phase-locked loop to a colour signal carrier. If the subcarrier burst is not 4·43361875MHz ± 50Hz the chances are that the EV4061 won't lock up and the burst vectors will spin round like a catherine wheel. When a camera is connected this provides a useful check as to whether its master oscillator is at the correct frequency or is way off. It has helped many times with JVC GXN70, GXN5 and GXN7 cameras, when the problem has been a colour shift towards salmon red on playback of recordings that have seemed to be all right when the owner has monitored them in the E-E mode. In some cases it has proved that the subcarrier frequency is off, even before checking with a counter, when the problem has been intermittent colour dropout with recordings made using a camera and a portable VCR.

The burst level and phases can of course be checked and adjusted, something that's not easy to do with just an oscilloscope. Useful when the phantom twiddler has been at work.

The vectorscope is essential for camcorder repair work, not just when setting up the camera section for correct colour matrixing but also for the range of white balances – auto, fluo, indoor and outdoor. This assumes that the correct colour filters have been purchased from the manufacturer (at a cost of about £30 each for some twenty or more filters).

The ability to watch the replayed burst vectors once helped to solve a perplexing problem with a JVC GRC1 camcorder. It recorded and played back fine in colour, but when its recordings were copied on to a main VCR subsequent playbacks were plagued by dropout to monochrome. As usual the owner had a mate whose similar camcorder didn't exhibit the problem under the same conditions. So he was under some social pressure to have his camcorder brought "up to standard".

We used the vectorscope to monitor the camcorder while it recorded and played back colour bars. This revealed that the burst span round for a short period after playback was selected. When pause was used during playback the time delay before the vectors locked on returning to normal playback was very apparent, showing that there was an a.f.c. problem. I enjoyed charging for that one – the colour processing chip is about £68 plus VAT!

In conclusion, although my EV4061 cost me about £1,600 plus VAT when I bought it from Electronic Visuals some two years ago I can state that it has more than paid its way in terms of time saved. Fig. 3 shows the EV4061's vectorscope graticule markings.

next month in

TELEVISION

FREE SCREWDRIVER!

Next month's issue comes with another cover-mounted gift, this time a handy screwdriver with hardened blade and an integral wire-stripper. It's a neat design – and you can't have too many screwdrivers!

● PRACTICAL DIGITAL LOGIC

With so much logic circuitry nowadays used on consumer electronics equipment it's essential to have a thorough grasp of logic circuitry. That doesn't mean being able to design a computer or logic system: it does mean being able to find your way around logic circuitry. The essential steps are to master the old and new circuit symbols, have a reasonable understanding of circuit operation and a basic knowledge of Boolean algebra, which is the basis of digital systems. Once this vital background information is programmed into your mind you'll have no problems when confronted with involved logic circuit faults. In a new series David Botto provides a guide, with the emphasis on practical understanding.

● SCRAPBOX LOGIC PROBE

While you're getting acquainted with all this logic stuff, why not build this low-cost logic probe?! Though making use of items from the scrapbox it doesn't give a logic one indication when a chip's output is tri-state, a common failing with home-made probes. Designed by Derek Boyt.

● NICAM DECODING

The bit that's really essential, the operation of the decoder in a Nicam receiver. Also of course the i.f. strip arrangements.

● TATUNG'S BSB RECEIVER

Rounding off our series on BSB receivers, Eugene Trundle describes his Tatung installation.

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The ITT Nokia BSB DMAC Receiver

Nick Beer

Salora has been a leader in satellite TV reception from the start. It's now part of the ITT Nokia group, which is one of the four TV manufacturers that have been contracted by BSB to produce receiving equipment for its satellite TV services. The ITT Nokia BSB receiver is Model SAT3300: it's also available as the Salora SVR5903.

The ITT Nokia system is available with a Marconi 35cm dish or the famed Squarial – Nokia source the latter from STC. D or S added to the end of the model number indicates the type or aerial supplied. The system I had for test came with a dish, but was also tested with a BSB-supplied Squarial. As the receiver was a pre-production unit, certain minor features may differ in comparison with production units that have new software.

Description

The receiver is reminiscent of the fabulous Salora 5902 which is sold for Astra reception and was reviewed by Ian Bowden last October. Its cabinet is slightly darker in colour but retains the bright orange button at the front right-hand corner – in both cases this is the only front panel control. With this BSB receiver however the button is a non-latching standby TAC switch instead of a power-off switch. There's a mains switch at the rear right-hand side. The standby display is the standard single green bar, but it's preceded by a pretty performance from the seven-segment LEDs – three pairs of horizontal bars light up in sequence from top to bottom!

On test the standby switch was a bit disappointing. If pressed inwards the action was not positive and you could feel the PCB behind it flexing – not sufficiently for the knob to foul the escutcheon, but disconcerting nonetheless and not to the usual Salora standard. A better result was obtained by pressing the switch downwards. Presumably the reason for the different arrangement is to discourage users from powering off and encourage the use of the standby mode – to prevent problems because of the code refresh commands from the satellite being missed. For this reason BSB receivers are still powered in the standby mode, little other than the r.f. converter being switched off.

The i.f. input from the LNB is to a coaxial socket. AV connection to a TV set and/or VCR is via a 21-pin scart connector, with an option switch for RGB or composite video signals – there's no mention of Y/C outputs and there are at present no plans to make this a retrofit option. There's provision for terrestrial r.f. loopthrough. The r.f. output is set at channel 37. The access control module connectors are mentioned below.

The rear panel has provision for fitting a mains socket, though the test unit had a fixed lead. The power supply seems to be of the switch-mode type as there's no mains transformer and the transformer in the power supply is tiny.

The D-MAC decoder appears to be the same as that in the Ferguson SRB1 receiver that was reviewed by Ian Bowden last month. It seems that the ITT chip set and indeed the PCB construction has been standardised, at least as far as the first generation of BSB receivers is concerned. Much the same can be said of the access control module (ACM), whose unique number is printed on the main chip and on the rear of the unit – this is the number required when contacting BSB by telephone to get the receiver enabled. Two sockets are provided for future use, such as PPV (pay per view) broadcasting. These consist of a phono ACM and a DIN data socket.

The unit's construction is reasonable, so the unit should be as reliable as its Astra counterpart, though the cabinet doesn't sppear to be as robust.

The handset is the same as that used with the 5902, so anyone familiar with this receiver or indeed the Salora 15L portable TV series will recognise it. One feature with this unit is the Next button that enables the user to see which programme comes on next and how long there is to go before it starts. With production units that have the new software this function will remain on for about ten seconds as opposed to the five or so with the pre-production unit. There is of course the standard BSB feature of an on-screen display at channel change or when the View button is pressed, giving programme title, remaining time and rating where applicable. This latter is used with the parental lock-out system described last month.

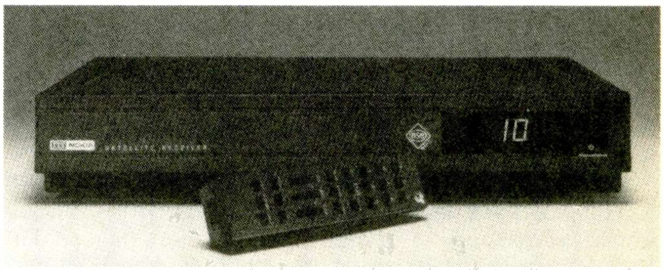
To assist with installation the receiver incorporates an r.f. test signal generator, which is switched on at the rear of the unit. The ten channel presets are pretuned to the present five UK and future Irish DBS allocations. They can of couse be retuned if a different order is wanted. I understand that the ITT Nokia unit is the only BSB receiver with frequency-synthesis tuning.

User access to the various features is via menus, again a common design arrangement. The Menu button gives you the main menu, and from here submenus and individual functions are selected numerically. Other features include an on-screen display of the ACM code, and an installation screen that shows the signal received with a signal-strength DAC bar and the BSB top line header. This is particularly useful as it's easy to align the aerial to the wrong satellite – Olympus is very close – though with a little experience you'll soon appreciate that BSB requires slightly less elevation and gives a very different meter indication. The header is the thing to watch for. Operation is easy to follow and carry out but as an aid the Help button on the handset brings up on the screen the various options available at the time.

Outside installation with either a dish or a Squarial is quick and easy. Here in North Devon the results obtained with either type of aerial are absolutely stunning.

The dish is an offset type that sits bolt upright and sometimes even appears to decline slightly. We've installed these dishes in some very discrete places, very low to the ground, with no problems. The Squarial mounts more like a prime-focus dish, with a greater elevation.

As with the 5902 there's an a.g.c. test point accessible through the rear of the unit. Measure the voltage here with



The ITT Nokia SAT3300 BSB receiver.

respect to any chassis point in the unit.

The mount design with both types of aerial makes alignment very easy, unlike some Astra designs where the dish has to be very loose for it to be moved and can well shift quite considerably when tightened up.

Conclusions

Because of the features that BSB receivers have in common there's little to choose between them with regard to the features offered and their performance. So choice is likely to be made on the basis of appearance and reputation. The Nokia unit looks good from a viewing distance and its finish is better than that of the Ferguson unit. The dish is cheaper than the Squarial. I'd buy the dish but suspect that the Squarial will prove to be more popular, especially if smaller types come along. The manufacturer's policy now is to use the ITT Nokia brand name for sales through independent dealers and the Salora name for sales via the multiples. Suggested retail prices are £380 for the dish version and £393 for the Squarial version. After testing this receiving system I'm perfectly happy to recommend it.

My thanks to John Breeds of Nokia Consumer Electronics for making the system available for review and answering my questions.

TEST CASE

333

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 almost the first time in memory those in the Test Case workshop have had a deadly quiet time this summer. So far from a five-day wait the startled customers now get a phone call within hours of bringing their sets in for repair.

So it was that a Tatung TV set went straight on to the bench of TechnoCrat (TC) from the customer's car. It was fitted with the 170 chassis and, in the words of the owner, stood accused of " 'orrible colour". 'Orrible it was too. With a test pattern selected the picture had a sickly green overlay. Switching to a monochrome step-wedge display showed that the grey scale was way out. TC removed the rear cover and fetched a service manual. From this he discovered that there are no drive controls and that the set is innocent of any form of automatic grey-scale correction associated with the colour decoder chip. In fact the only provision for gun tracking in this design is a black-level preset in each of the RGB output stages.

TC reset these controls in accordance with the manual's instructions. He found that he could tie the tube's three guns together at the cut-off points to obtain true grey in the low-light parts of the display, but the highlights then had a strong green tint. A compromise setting of the G background potentiometer R216 was tried. This produced a better picture, with the mid-tones reasonably grey, but dark picture areas were purplish while the bright areas were still a bit green. Could the picture tube be faulty? TC was thwarted in his quest to check it because no matching base connector could be found amongst those with the tube-testing machine.

It seemed unlikely that the tube was reponsible. Unless something very peculiar had happened inside, the emission of both the red and blue guns would have had to have deteriorated simultaneously and equally to produce this symptom. If only he could be sure of the tube! It was a Philips type which is normally reliable and well behaved. TC sorely missed the drive controls that are often present with circuits of this type. They normally take the form of preset resistors in series with the bases of the RGB drive transistors. As an experiment, the G-feed resistor R221 (270Ω) was replaced with a 470Ω skeleton preset. It didn't provide a miracle cure. There was some effect on the G drive, but at no setting was a correct grey scale restored. TC refitted the original resistor and scratched his head.

A helpful colleague then came along and cast his eye over the display. He suggested interchanging the green and red video drives as a check that would narrow the field of search. This was done at the point where the drive signals arrive at the c.r.t.'s base panel. There was little effect on the black-and-white display, but on a normal picture the colours were bizarre. This proved that the circuitry on the main panel, including the colour decoder chip, was o.k. TC restored the correct connections.

Maybe the tube was the culprit after all? Another check was made by interchanging the drives at the tube's red and green cathodes. This had a marked effect on the display, which took on a very warm look. Twiddling the G background preset R216 now affected the red part of the display of course: with things at the dark end of the brightness range correct the highlights were now pink rather than green. Within a very few minutes a definite diagnosis was made. What was it? See next month.

ANSWER TO TEST CASE 332
– page 789 last month –

We left our new man Dylan gazing dolefully through borrowed binoculars at Mr. Burnham's chimney and at the two aerials mounted there. Since the 35cm BSB dish had been installed ITV reception had gone downhill, with grainy and intermittent colour, though reception of the other terrestrial transmissions was fine and the BSB pictures were reproduced perfectly. In fact the trouble was put right by Stick-Em-Up Ltd., though it sprang from the action of the Wild West company in its choice of a mounting position for the space-age hardware. The satellite dish was adequately mounted and perfectly aligned, but it was near enough to the elements of the u.h.f. array to create some sort of standing-wave pattern. As a result there was near cancellation of the Band V signal at one particular wavelength. This corresponded with the colour subcarrier frequency in the ITV channel used by the local transmitter. It was a case of the dreaded suck-out, which one of our engineers used to blame for just about every reception problem he came across.

Neither Stick-Em-Up nor Wild West had a spectrum analyser. If they had, they would have seen that the ITV channel's vision and sound carriers were of much reduced amplitude in comparison with the others. The cure consisted of repositioning the crank arm to increase the spacing between the two aerials. Stick-Em-Up insisted on being paid for the job, but Dylan never got any money for his call-out. The set was under guarantee, wasn't it?

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BBC Tuning Signals 1934-1963

Keith Hamer and Garry Smith

The world's first regular public high-definition TV service started at 3 p.m. on Monday November 2nd 1936 from the BBC's 17kW transmitter at Alexandra Palace, on channel B1 with the vision and sound carriers at 45MHz and 41·5MHz respectively. The first fifteen minutes were taken up by the opening ceremony, which included Adele Dixon singing "Magic Rays of Light" – it had the alternative title of "Television is Here". At 4 p.m. the transmission ended, to be resumed five hours later with a programme summary followed by a BBC film called "Television Comes to London". This traced in detail the work that had been done in building and equipping the studios and transmitter at Alexandra Palace. It was subsequently used many times during trade test transmissions to demonstrate TV to prospective viewers. In the early days programmes ended promptly at 10 p.m., which meant that only two hours of programmes were broadcast each day.

Although TV as we know it began in 1936, the first demonstration of true television took place on January 27th 1926 when John Logie Baird showed his apparatus to a less than enthusiastic audience. Baird didn't invent television – a number of experimenters were actively engaged in this field – but he was the first to put all the theories into practice.

Several firsts were notched up during the following three years. An image was transmitted via telephone cable between London and Glasgow in May 1927, and in August 1928 a simple coloured picture was demonstrated. Experimental transmissions of still pictures, using the Fultograph process, were started on October 30th 1928, from the Daventry transmitter.

In September 1929 an experimental broadcast service was jointly inaugurated by the BBC and The Baird Company. A dual-transmission system was started in March 1930, using a vision wavelength of 261m with sound at 356m. These transmissions were radiated for half an hour daily. Although very few people at the top of the BBC took much interest in TV at the time, on August 22nd 1932 the Baird process was taken over by the BBC, using a mirror-drum scanner that was installed at Broadcasting House, London.

The Baird system used only 30 scanning lines which were repeated 12·5 times a second. This restricted the possibilities to close-up shots and bold, contrasty scenes. Experiments were carried out to see whether the picture quality could be improved, but it was realised from the start that Baird's 30-line system would not be suitable for broadcasting general entertainment programmes.

The First Tuning Signals

The BBC began to radiate simple test transmissions to check on receiver performance towards the end of 1934. Some of the very early tuning signals are shown in this article. We refer to them as tuning signals because they were far too simple to be called test cards, but all the parameter checks included in these 1934 tuning signals were later incorporated into the BBC test cards A to G.

Fig. 1 shows a low-frequency chart which was transmitted to check for low-frequency amplitude attenuation, in the 12·5-100V range, that would result in the pattern being reproduced with an intensity fall-off of black to white. Phase distortion would produce a brilliant white quarter above the black quarter, with an obvious greying of the right-hand quarter compared with the quarter below it. Well, that's roughly what was said and we can only hope

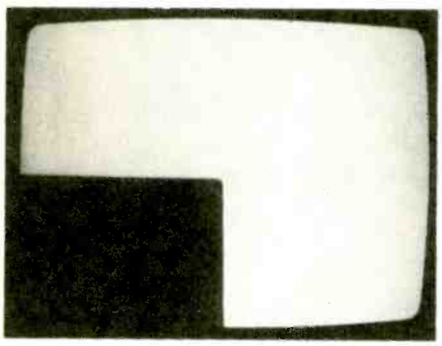

Fig. 1.

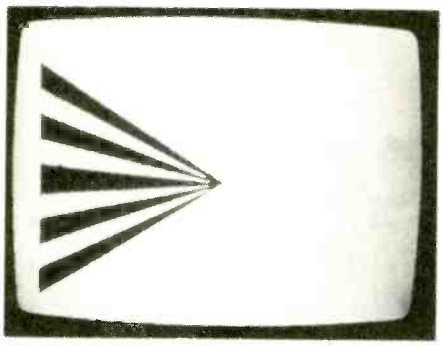

Fig. 2.

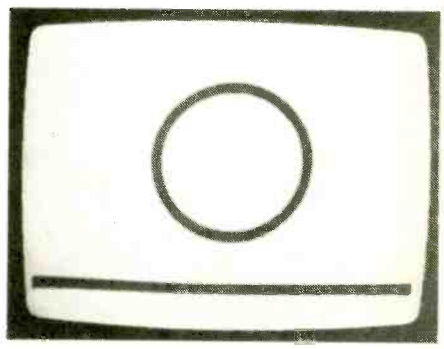

Fig. 3.

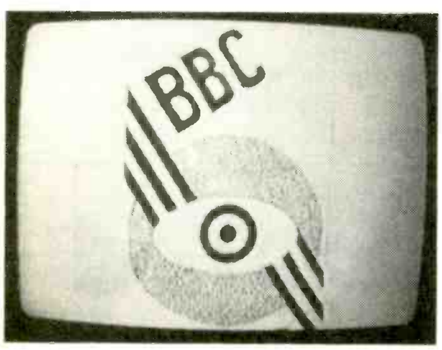

Fig. 4.

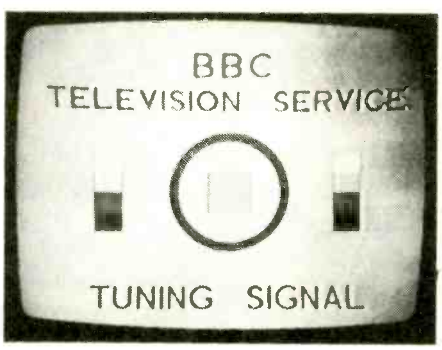

Fig. 5.

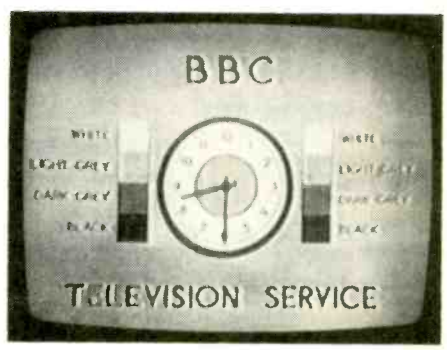

Fig. 6.

that Mrs. Average could follow all this as she tuned in. This particular check subsequently appeared as the famous "letter box" in the BBC test card C, which first appeared in January 1948. Note the date – some official BBC documents state that it first appeared in 1949!

Fig. 2 shows the 1934 version of the familiar corner focusing bars and frequency gratings that appeared in BBC test cards C to F. This chart was radiated as an h.f. response check and should, to quote the original, have "appeared on viewers' televisors with a greyish black point as far as the third or fourth line from the point or, conversely, on the fourth or fifth line from the point where the black and white converging line should always have been clearly resolved." Oh dear, why didn't they simply tell Mrs. Average that if her receiver wasn't performing correctly the chart would be out of focus? Although this check was a feature of all subsequent BBC test cards, the pattern shown here was not used as the BBC test card designers preferred a fixed set of frequency bars that gave an exact h.f. response check rather than a step-wedge that could easily mean different things to different people. In Europe however the story was different. Test cards with wedges abounded. The Spanish monoscope test card introduced in the early 70s for example used two central wedges that were very similar to the 1934 pattern.

The BBC also radiated the pattern shown in Fig. 3 during 1934. Its circle and straight line were used to assess the accuracy of the picture ratio and any angular displacement. If the circle appeared as an ellipse, the 7:3 (yes!) picture ratio was out. So far so good for Mrs. Average, but there was more. "If the greatest axis of the ellipse is vertical, the height is too great compared with the width. If the straight line has a slope it shows progressive angular displacement. If the line appears jagged, this indicates irregular angular displacement." Since 1934 every professional test card has included a circle – always in the centre and also occasionally in the four corners – and a set of straight lines.

It's difficult to decide whether the three designs so far shown should be classified as test charts or tuning signals – as mentioned earlier, they can hardly be called test cards. The next photograph however, see Fig. 4, can with confidence be called a tuning signal, if only of a very simple type. The "BBC Television Eye" as it was called was frequently transmitted during 1934/5. A photograph we recently unearthed shows this caption mounted on a small carousel which held a total of twelve captions, including two that read "Good Night" and "Finis" (not "Finish"). The caption drum, now housed in the television control room at 16 Portland Place, was the forerunner of the BBC's "noddy" caption scanning system, except that in the 30s the caption moved into position instead of a vidicon camera nodding up and down to find the required symbol or test card.

The Move to Electronic TV

While these 30-line, low-definition transmissions were taking place a number of companies in the UK, the USA and elsewhere were carrying out experimental work with a view to eliminating the mechanical scanning system. The aim was to produce an all-electronic system capable of transmitting pictures that would compare favourably with cine film. Such a system had been proposed, in theory, by Alan A. Campbell Swinton back in 1908. His idea was to use a photoelectric mosaic screen on to which the image of the scene could be focused, the screen being scanned by cathode rays deflected by a varying magnetic field. Vladimir K. Zworykin in the USA and the team at Marconi-EMI in the UK turned this theory into reality. Worried by this electronic competition, Baird managed to increase his scanning system from 30 to 240 lines, with 25 frames per second, scanned sequentially.

When high-definition transmissions began in November 1936 Baird just managed to scrape into the "high-definition" category, as defined by the government, with his new improved system. Unfortunately for him, EMI came up with the famous but now discontinued 405-line, 50 frames interlaced (giving 25 complete picture frames per second) scanning system. The first public demonstrations of these systems began with the Radiolympia Exhibition in August 1936.There were two one-hour transmissions each day for the duration of the Exhibition, which closed on September 5th. The Baird and Marconi-EMI transmission systems were used on alternate days. When the Exhibition ended, the station closed down and the final preparations were made for the start of the full service. The Baird and Marconi-EMI systems continued to be used alternately when the BBC London Television Station opened in November, to enable the two systems to be fairly assessed. Baird's system was soon dropped, and from February 8th 1937 to January 3rd 1985, with the exception of the war years, the 405-line system was used.

Baird's Studios

Before we leave Baird, it's worth mentioning how his studios operated. He was provided with two at Alexandra Palace, where Marconi-EMI had just one. Separate methods of producing TV programmes, the intermediate-film process and the Baird Electron camera system, were available in Baird's main studio, which measured 70ft long, 30ft wide and 23ft high. The intermediate-film process used 17·5mm film which was exposed in the studio and continuously passed in turn through a developing tank, a washing tank, a fixing tank and a second washing tank. The complete process took 65 seconds. While still wet the negative film was scanned by a disc that rotated at 6,000 r.p.m., illumination being obtained from a 30A arc lamp. The light from the scanning disc fell on a photocell that incorporated an electron multiplier. From this device the vision current was fed to an amplifier chain after which it went to the Baird control room. The recorded sound was passed to the control room after being taken off the film by a pick-up head. Baird's intermediate-film equipment was housed in a room adjacent to his main studio: it had a glass window through which the camera filmed the action.

Baird's Electron camera system was located in a special sub-control room and was used for programmes such as lectures, cartoon films, etc. It made use of the spot-light system, in which the studio was kept mainly in darkness except for a scanning light beam which was projected on to the artist or subject matter. The reflected light was detected by photocells. In the adjoining projection room a large disc rotating at 6,000 r.p.m. was illuminated by a 150A arc lamp to generate the scanning beam, which entered the small studio via a window. In the studio four photocells with multipliers generated signals that, after amplification, were fed to the control room. A single microphone picked up the sound.

Engineers in the control room could fade between the signals produced by the intermediate-film process and the Electron camera system. Apparently artists hated the prospect of appearing in front of Baird's scanning system, and found all sorts of excuses to put off turning up at the studio until the following week when the Marconi-EMI

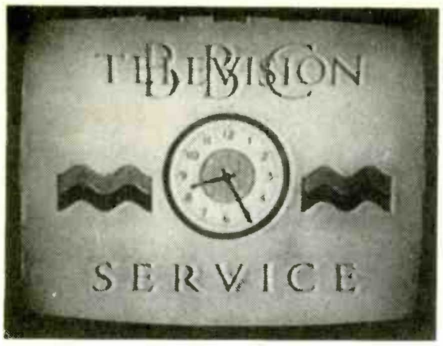

Fig. 7.

Fig. 8.

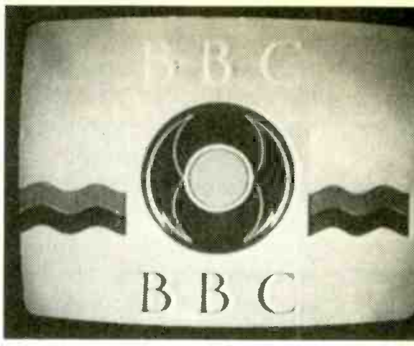

Fig. 9.

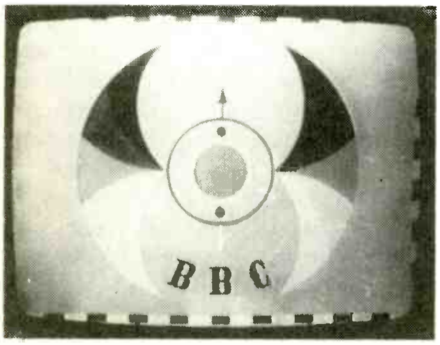

Fig. 10.

Fig. 11.

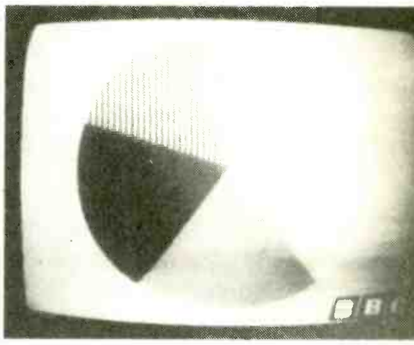

Fig. 12.

system would be in use. From all accounts Baird's systems worked very well. But in addition to the reduced number of scanning lines there was lack of flexibility in the studios and conventional filming would have to be used for outside broadcasts.

Post-war Tuning Signals

Work on radar during the war years led to a great deal of knowledge being acquired about television and cathode-ray tubes. Some of this expertise was put into practice when the television service was resumed on June 7th 1946, thus improving the overall quality. A new tuning signal/identification symbol was designed to cater for the improved picture clarity. It's shown in Fig. 5 and consisted of a very large card, approximately 2ft by 3ft, which was placed in front of an Emitron camera. It was transmitted for five minutes before the start of programmes to enable viewers to adjust their receivers. This tuning signal was also used for camera alignment in the studio. Unfortunately our picture cannot resolve the lines in the centre of the circle: they represented a frequency of 2·5MHz. By the end of October 1946 the number of television receivers in use had rocketed to the dizzy heights of 3,350 while the licence fee had risen to the astronomical figure of ten shillings.

Three years later, on July 24th 1949, the tuning signal was modified to include a clock in the central area, see Fig. 6. At the same time the four different grey-scale steps were labelled – just in case viewers weren't sure what they were supposed to be. With the introduction of this tuning signal/clock caption the monotone, which had previously accompanied the tuning signals, was replaced with some specially composed music. Incidentally TV weather forecasts started on July 29th 1949, with specially prepared charts that seemed quite adequate for the job – no computer-generated graphics in those days.

We're not sure whether the clock in the first-ever TV clock caption actually worked! All the photographs we have dating from this period show the clock, which didn't have a seconds hand, at exactly 3, 8·25 or 8·30 p.m. We suspect that this clock caption was a forerunner of the one used on "Play School". This theory is supported by the fact that the clock caption/tuning signal showing 3 p.m. was introduced in July 1949 while an identical one showing 8·30 p.m. wasn't officially unveiled until the following month. If the clock actually worked, why use different captions/tuning signals? Answers on a postcard please.

On December 18th 1949 the tuning signal underwent some slight alterations: the two sets of stepped grey scales were replaced by wavy ones and the style of the identification was changed. The result is shown in Fig. 7, with the clock at 8·25 p.m.

A new BBC Television symbol was introduced in December 1953. Now in case you thought that the tuning signals and identification symbols produced by the BBC graphics department were devoid of deeper significance, think again! Quoting from the official description of the symbol shown in Fig. 8 we learn that "the abstract pattern consists of two intersecting eyes that scan the globe from north to south and east to west, symbolising vision and the power of vision. Flashes of lightning at either side represent electrical forces, and the whole form takes the shape of wings that suggest the creative possibilities of television broadcasting." Incidentally this design, created by Abram Games, seems to have been the first to incorporate the idea of a globe, which was to become a BBC tradition.

As far as we can tell the next tuning signal, shown in Fig. 9, first took to the air on August 19th 1955. It retained the wavy grey-scale used with the 1949/50 clock caption, but the identification was again changed and the clock face was replaced with the familiar wings design. It was followed on June 16th 1956 with the tuning signal shown in Fig. 10, in which the grey-scale and the wing patterns were combined. This photograph is not quite accurate – the grey-scale peak white and black BBC lettering should be at the top. Some specially composed music, called the "Television March", accompanied this tuning signal at the start of each day's opening sequence.

Fig. 11 shows the penultimate tuning signal, which was used to introduce experimental colour broadcasts. Colour test transmissions originally began from the Alexandra Palace transmitter on October 10th, 1955, after normal programmes had closed down. The first series of experimental colour TV transmissions to include live pictures from the studios at Alexandra Palace, using 405 lines and the NTSC colour system, commenced on November 5th 1956, via the new transmitter at Crystal Palace which went into service on a temporary basis on March 28th that year. This transmitter replaced the one at Alexandra Palace and was completed on December 18th 1957. The colour photograph used in this tuning signal featured television announcer Sylvia Peters. It was included mainly as a test for the all-important flesh tones.

BBC Schools' transmissions began on September 24th 1957. Our last example of a BBC tuning signal, shown in Fig. 12, was transmitted for two minutes before each Schools' programme. It first appeared in 1963, together with some flute and cello music. Although the music changed in 1969, the tuning signal continued in service until 1973. It must have been transmitted well over 8,000 times but despite this vast amount of air time very few people seem to have photographs or video recordings of it. This is a great pity since it was the last tuning signal to be used by the BBC.

In this article we've tried to feature as many BBC tuning signals as possible. No doubt there were others which we don't have in our files. Unfortunately the BBC has kept no records in its archives. So if anyone has photographs or video recordings, please write to us at 7 Epping Close, Derby DE3 4HR (telephone 0332 513 399). Similarly we'd be very pleased to hear from any readers who have recordings of BBC Test Card C music.

Letters

COST OF REPLACEMENT TUBES

I would like to draw attention to the current price of replacement c.r.t.s. One of our regular customers recently brought in a nine-month old Philips Model 21CE1251, a 21in. remote-control set with an FS tube. He'd tripped over a rug, knocked the back off the set and, in refitting it, had knocked the neck off the tube. He was not too bothered however since his insurance company was going to pay for the repair. Could we do an estimate?

I was aware that other things could have been damaged if he'd switched the set on, but he assured be that he hadn't. So I contacted a wholesaler with whom we deal. Several days later I received a card saying that the trade price for a new tube was a little over £240 including VAT. If one assumes a mark-up on spares of say 25 per cent the cost of the tube, before fitting, works out at £300 give or take a few bob. We contacted our customer to ask how much he'd paid for the set nine months previously. His reply was £299·99.

In other words the price for the new tube alone is the same as that of the whole set a few months ago. While appreciating that the tube has always been the dearest component in a TV set, this really is absurd. Are setmakers going to stop supplying any spare parts for their sets soon, so that we can all go out of business and the customer can simply dump a set in the bin if it's damaged or goes wrong? If so, are they going to advertise their sets as being impossible to repair? What would that do for sales? Those who adopt such a stupid pricing policy will find that they have few dealers who will stick with them.

L.J. Pitts, South Brent Electronics,
Buckfastleigh, Devon.

SWITCH-MODE POWER SUPPLIES IN VCRs

Having just finished reading J. LeJeune's excellent article on the power supply used in the Ferguson FV30 I'd like to make a few comments – prompted by J. LeJeune's suggestion that switch-mode power supplies are about to become the norm in domestic VCRs.

What I'd like to know is the manufacturers' thinking behind this move? Whilst it's true to say that a switch-mode power suppy is more efficient than a linear one, this is purely relative. A 20 per cent saving at 40W is only 8W – less than the rating of a car's interior lamp. At 500W, as is the case with many computer power supplies, the saving is a much more respectable 100W. In view of the kilowatts being force pumped into a fairly closed-in rack by the rest of the machine, stopping another 100W from contributing to the temperature is a sensible and valid reason for using a switch-mode power supply.

I cannot therefore believe that power saving/heat is the reason for using this type of supply in a VCR. Weight is the next possibility. From the end user's point of view however this is of no significance at all. After all, we don't keep carting our VCRs around the house, do we? There might be some advantage to the manufacturer in shipping VCRs around the world, but as most of this is done by surface transport I can't see it being a significant factor.

Cost seems to be the other major possibility. But looking at the FV30's power supply circuit I can't believe that it would be cheaper to build than a comparable linear one on a PCB. Any PCB can be machine assembled, and the fewer components that have to be placed the lower the cost.

No. I'm inclined to believe that the reason for using this technology is closer to the "why climb Mount Everest" one – because it's there! This also applies to a lot of the other technology used in today's consumer electronics. It seems that ever more complicated ways of doing jobs are being found to make use of the latest whizz-bang i.c.s.

To return to switch-mode power supplies in VCRs, there's no performance advantage to be gained from using them. I defy anyone to tell the difference in the reproduced picture quality with a VCR that has a linear power supply. This is not the case with equipment such as high-performance monitors and computers that function markedly better for being fitted with switch-mode power supplies and have a distinct advantage in terms of transformer size. The majority of modern VCRs don't employ a large transformer and this is not an expensive item to replace on the rare occasions when it fails. In contrast chopper transformers, which do fail regularly, can be very expensive. Further the main switching device is more often than not critical and cannot be substituted. Again some of these devices are very expensive.

To move to the servicing angle, I feel that the use of switch-mode power supplies in VCRs is another nail in the coffin of the independents. I've been repairing switch-mode power supplies for many years and consider myself to be experienced in the field, but I still feel daunted by the prospect of changing every semiconductor device only to find that the thing still won't go. It's very easy for the hours spent on a repair to go up and up without the engineer being fully aware of this, and it's in many cases impossible to pass on to the customer the true cost, as has been mentioned many times in your columns. Joe Public just doesn't understand.

As a point of historical interest, I had a smile when I saw that the machine was a Ferguson model. I recall that some twenty years ago Bush brought out the A823 chassis. It employed a "switching" power supply that used one thyristor, three resistors, a couple of lengths of damp string and a piece of chewing gum! Based on a Mullard applications report, it worked fine, being very respectably stable and easy to fix when it went wrong. At the same time Ferguson, then known in the trade as BRC or was it Thorn, brought out the 3000/3500 chassis. It employed a switch-mode power supply that used half a day's output from the Texas Instruments semiconductor factory. . . Those who remember it will probably smile with me whilst looking at that circuit in the FV30.

Finally, on a somewhat more serious note, having seen the catastrophic way in which this type of power supply can fail I personally wouldn't feel inclined to leave one of these things unattended in my house.

I'd be interested in other readers' comments on the points raised above. I must point out that I'm no Luddite, just an honest engineer trying to earn an honest living. One who believes in horses for courses.
G.R. Darby, Proprietor, Monitech,
Earls Barton, Northampton.

SATELLITE TV RECEPTION AT VHF

Here's a possible explanation for D.H. Davies' reception of Sky TV at v.h.f. (Letters, July). I think we can safely say that his reception is not direct from the Astra satellite and would suggest that the clue lies in his address. Would I be right in thinking that Ebbw Vale is wired for cable TV? If so, and if the cable is on or near his property, he's receiving an unscrambled channel at v.h.f. by leakage radiation.
E.J. Cooke,
Stonehaven, Kincardineshire.

With reference to D.H. Davies' letter regarding satellite TV reception in the v.h.f. band, I think his reception is from one of the illegal video senders that are widely advertised in the satellite TV press. Although these small, low-power transmitters claim to operate at u.h.f. they frequently operate in Band III, relying on their third harmonic for the u.h.f. output. I'm afraid that he's certainly not picking up the satellite direct.
Gareth Foster,
Whitton, Middlesex.

I read with interest D.H. Davies' letter and would like to relate a similar experience of my own regarding satellite TV reception without either a dish or a decoder. After moving to a house that required substantial redecoration one of the first tasks I decided to undertake was to install a TV aerial amplifier and distribution system. When this had been done it was time to tune in the various TV sets throughout the house. The first one to receive my attention was the Philips Matchline TV and tuner in the main bedroom. While tuning this I found that it managed to lock in on a somewhat snowy but watchable picture from an MTV programme. This came in on ch. 21. I decided to store this in the set's memory for investigation later on. When I next tried the set ch. 21 was receiving Sky Movies!

On looking at the houses nearby I noted that about a third of them have Astra dishes. The conclusion I came to was that one or more of these systems is pushing out copious amounts of r.f. that my TV set is able to receive. I wonder whether Mr. Davies is experiencing a similar phenomenon?
T. Holland,
Camberley, Surrey.

Mr. D.H. Davies writes about his puzzling reception of Sky Sport in one of the v.h.f. bands with his Pye Model 99. Obviously this isn't a microwave signal being decoded but a v.h.f. transmission, probably from one of the Irish TV transmitters as Bands I and III are still in use there for domestic TV and particularly as Rupert Murdoch's Sky TV has been given a transmitter to help him sell his receivers in Ireland. So, Mr. Davies, don't be surprised if in a month or so you switch that set on to find MTV, Super Channel or one of the other Sky channels on that particular frequency.

Readers may wonder why Mr. Davies can't receive RTE-1 and -2. The answer to this is that in the mid-Seventies the British military complained to the Irish government that Irish TV transmissions were interfering with military communications on the mainland. As a result, RTE-1 and -2 now operate under reduced power along Ireland's eastern coast and cannot be received in the UK. A very dubious request indeed.

In the same issue Mr. J.M. Williams asks for a cure for teletext interference with the Thorn 2000 chassis. Maybe a solution could be found from the 3000 series field timebase. In this a capacitor was changed to cure the problem by pushing the start of the field scan farther "up" the screen.
Garry Robinson,
Chorley, Lancs.

BRIGHT VALVES AND OTHER MATTERS

In the August issue Brian Renforth asks about valves that light up brightly at switch-on then fade down to normal brightness. I've noticed that cheap East European valves do this more often than Mullard etc. ones. The effect seems to be caused, with parallel heater arrangements anyway, by the heater coil not being pushed fully into the cathode cylinder during manufacture. The coiled section of the heater has two thick tails attached to its ends, to prevent the heater glowing where it's welded to the pins inside the valve. If the coiled section projects from the end of the cathode the exposed ends will heat up first, while the rest of the heater remains cold because it dissipates most of its heat to the relatively massive cathode. As the heater has a positive temperature coefficient of resistance, the exposed ends of the heater initially have greater resistance per unit length than the part inside the cathode. The result is that the exposed ends of the heater are subjected to a brief surge of power, until equilibrium

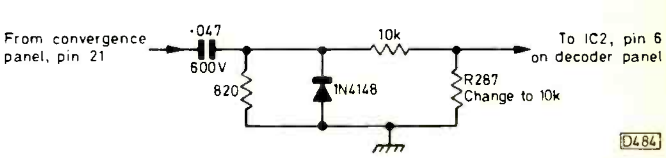

Fig. 1: Extra field blanking circuit for use with the Decca 30 series chassis.

is restored when the cathode reaches its emission temperature.

An additional factor comes into play with series heater chains. The cathodes of the small-signal valves reach emission temperature more quickly than those of the larger line output type valves and initially receive more than their fair share of heater voltage. Some manufacturers included a thermistor in the heater chain to get round this "problem".

Various of your contributors mention teletext interference with older sets. My Decca 30 series set recently suffered from this problem, on ITV only – presumably due to the inclusion of extra teletext lines on this channel. Fig. 1 shows the field blanking circuit I devised to resolve the problem. R287 was changed to 10kΩ and the circuit shown was connected between pin 21 on the convergence panel and pin 6 of the IC2 on the decoder panel. The capacitor must be rated at 600V minimum to block the h.t. that's present on the covergence panel. Most of the components can be tacked on to the back of the decoder panel, with the capacitor fastened to the convergence harness. Sleeve the capacitor's leads to prevent shorting.

Finally, ET's letter about his colleague getting a shock from a TV set's mains plug. Surely there must have been a mains rectifier fault that allowed the reservoir capacitor's charge to lead back to the mains lead? It's possible that a shock, admittedly not so powerful, could have been received from the mains filter capacitor if the plug had been pulled out when the mains input waveform was at its peak.

S. Pearson,
Chipping Norton, Oxen.

THE ELECTRIC SHOCK PROBLEM

I was interested to read E.Trundle's electric shock warning last month. Having received many shocks myself when moving TV sets I carried out various experiments and have come to the conclusion that a capacitor is formed by the tube's shadowmask as one plate and the unsuspecting engineer's chest the other plate. Any residual e.h.t. is just waiting to charge this capacitance when the circuit is completed via the pins of the mains plug.

W.R. Hill,
Clifton, Bristol.

With reference to the engineer who received a nasty shock from the pins of the mains plug when he lifted a set fitted with the Luxor SX9 chassis after disconnecting it from the mains supply, readers may be interested to know that there's a simple modification. Adding a 1MΩ resistor (0·5W) across CN50 reduces the discharge time to 100msec.

Alan C. Davies,
Crewkerne, Somerset.

BADLY DESIGNED SETS

I agree totally with those who've written previous letters about the shoddy design of current sets. They are not only irritating to us engineers but confusing to customers. For example plastic, single-board sets with no service position and no markings on the panel (Fidelity) make field servicing impossible and bench servicing a pain in the backside. Customers can't understand many modern tuning and control systems. We get lots of calls to Hinari VCRs because the users can't tune them in as the design is too complicated for a non-technical person to follow.

I sadly miss such TV sets as the Philips G8, the ITT hybrids, the Rank/Bush models etc. They were solid and easy to work on, and the owner had no problems in understanding them. The main beauty however was the power supply. Modern ones are a nightmare. The first company to bring back a wooden cabinet with a decent tube and a well thought out chassis, with push-buttons and traditional controls, will have a winner. Finally, who says that the present "monitor" style is modern? Sets were styled like this in the Fifties.

J.R. Hepworth,
Peterlee, Co. Durham.

HELP WANTED

Does anyone know of a firm in the UK that can supply the TBA240 i.c.?

A.I. McLean, Tele-Phil (Pvt) Ltd.,
PO Box 338, Mutual House, Herbert Chitepo St.,
Mutare, Zimbabwe.

Does anyone know of a source for the 2SD1887 transistor? It's from a Sony monitor whose model number we don't know. All we know is that the board order number is 1-621-776-11 and the transistor is Q508. SES can't help.

Martin Burke, 22 Clark Street,
Bell Green, Coventry CV6 7HF.
0203 687 615.

Can any reader provide a power supply and a timer circuit diagram for the Mitsubishi HS700 portable VCR? Photostats would do and all expenses would be paid.

Darren Egerton, 42 Beech Avenue,
Greenacres, Oldham, Lancs OL4 2EE.

Has anyone got say five video cassettes for the Technicolor CVC Microvideo VCR type 212E. It was introduced into the UK by Sulkin (UK) Ltd. and was also taken up by Grundig. Let me know the cost which will be sent immediately.

B.J. Lawler (Electronics), 215 Liverpool Road,
Birkdale, Southport, Lancs.
0704 65 935.

Can anyone supply an e.h.t. transformer for the Lloytron CTV Model T142C, new or secondhand? All expenses paid.

Mr. Burston, Prism TV, Focus Warehouse,
Teignmouth Road, Clevedon, Avon BS21 7DF.
0272 873 806.

I'm trying to find the manufacturer or agent for Safgan Ltd. I have one of their 20MHz dual-beam scopes, Model DT50, with a 4in. Telefunken tube and need to get it repaired.

T.H. Hughes, 51 Standard View,
Ynyshir, Rhondda, Glam CF39 0HR.

Could any reader supply information and/or spares for the Murphy VCR1 video recorder? I've been unable to trace the original manufacturer.

Roger W. Scales, 17 High Street,
Bridlington, East Yorks YO16 4PR.
0262 673 374.

Could any reader sell me any of the following items? (1) A valve tester capable of testing ECF80 type valves, complete with instruction manual. (2) 0-2,000V and 0-

4,000V multipliers for the Avo Model 7 and 0-10,000V for the Avo Electronic Testmeter, including all leads, test prods, etc. (3) Pin connection details for the ETGL-3AZ-P31 tube used in the Telequipment D31 and D31R scopes, also a service manual. (4) Any radio books by John Scott Taggart exept for "The Book of Practical Radio".
J. Chatterton, 230 Brownley Road,
Wythenshawe, Manchester, M22 5EB.
061 437 5085.

SERVICE COMMENTARY

In the June VCR Clinic Jeff Herbert mentioned fast flutter with the Panasonic NV-G40. Our experience is that this fault with a VCR that uses a direct-drive, brushless capstan motor will be due to the electrical rather than the mechanical side, particularly when the fault is discernible and constant. Eugene Trundle mentions this problem in his book *Servicing TV and VCR Equipment* and provides the very good advice to monitor across the current sampling resistor. The trace will reveal a problem in one stator coil pair or triplet, showing up as a ripple. We've noticed that all models which use this type of motor suffer from stator failure occasionally, though it's not a common fault. It strikes me as an advantage that Panasonic doesn't supply these motors complete, since this enables you to replace only the faulty part, reusing the bearing and rotor. An advantage of such motors is their accessibility for repair and lubrication. With the G mechanism, routine servicing would be extremely expensive if you had to replace the entire motor every time the rotor bearing became noisy.

In the August TV Fault Finding column Roger Burchett mentioned dry-joints on the various wire-wounds used in the Sony KV2096. This problem also occurs with the 2090 and 2092 models in the same series. Sony stress that resoldering should be done with high melting-point solder – the procedure is part of the famous switch modification. Because Sony arrange for all such modifications to be done through their own authorised dealers, others who come across such sets are not always aware of what's needed. It would be best for Sony to publish the details now that most dealer modifications have been done, so that sets which fall through their net can be dealt with. It seems that in a very few cases the end results of unmodified sets developing possible faults are not too nice.

In the same issue Hugh MacMullen refers to equipment renovation. Cabinet cleaning can be done effectively, with somewhat less disruption than the use of soap and water, by using Servisol Foam Cleaner which is available from Willow Vale. This also looks like tea when cleaned off! We find the RS foam cleaner much less effective (unless it has been improved in the past year or so). The RS aerosol demoisturing lubricant (code no. 555-307) however is far less messy than silicone grease. It's also by far the best control track cleaner – try it! I see that Hugh uses the same dry-joint test procedure as myself! It's always advisable to ensure that the fuse in the mains plug is correctly rated. Hugh's comments on cheap head drums shouldn't be taken to mean the cheapest. This is very false economy, especially considering the advice to give a 12-month guarantee. I recommend MCES heads and would point out that they supply new ones as well as rebuilds. The same rules apply to belts, particularly belt kits. Many inferior ones are available: use only originals.

One job that can make the world of difference to a VCR's appearance is to replace a low-emission digitron. When you've overhauled a machine's mechanics you know it'll go for a long time, but prospective customers can be deterred by a dull clock display. Finally I'd advise commonsense and caution with respect to uprating regulators. While it was common practice years ago to modify circuits, great care and consideration need to be given to any such actions today. I'd never suggest a modification without reference to the manufacturer – and they invariably dissociate themselves from such changes.

In the August VCR Clinic S. Da Costa mentions the relays in the Panasonic NV366/777. In my experience dirty contacts usually result in severe noise following or whilst in the still mode. The relay invariably still clicks. I would expect a coil or switching fault rather than dirty contacts to cause the relay not to click, though I've never had such a fault – only dirty contacts.

In the June CD Player Casebook Mike Leach mentions the diffraction grating adjustment with the Pioneer PDZ-72T. With Pioneer units this adjustment is one of the earliest stages in the alignment process. The adjustment can be fiddly, and yes I'm sure we've all sworn at a few three-beam units when the adjuster slips from one end to the other in one movement. But it becomes easy with experience, especially if you regularly replace the optical unit when of course the complete alignment must be carried out. It's fair to say that unless the player has been dropped or subjected to shock, and has not been got at, grating adjustment is required only when changing the optical unit – it can't drift easily. With Pioneer machines you need to adjust it to check it.

In his series Joe Cieszynski mentioned Ken Clements' advice on this adjustment. It's 100 per cent successful. Monitor the tracking error with the player in the test mode and the focus and disc servos on. Set the adjuster to one end, then gradually move it through to the other end, counting the amplitude peaks in the error waveform. Finally return the setting to the centre peak. If an even number of peaks is encountered (expect ten or eleven normally) try both the middle ones. The test will be that when the tracking servo is closed, in the test mode using the pause key, there will be sound. Thus if only slight misadjustment is suspected, for example where the tracking is poor, check the amplitude of the focus error in the test mode with the servo not closed and ensure that it's peaked with the grating adjuster, as it's more than likely to be on the correct peak. As long as you are careful a smallish jeweller's driver can be used, in a pivot action, for the adjustment – I seem to recall that the proper tool is very expensive. We've found these methods to be very successful, and have also found that with the average Pioneer replacement optical unit the grating is accurately

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set. The thing you usually have to do immediately is the tangential adjustment, which is often right at one end.

Finally on CD players I'd like to thank Joe Cieszynski for performing a mammoth task with the recently concluded CD player servicing series and doing it so well. I think we all learnt a lot from it.

One more point. In the July TV Fault Finding column Chris Avis mentioned the Hitachi CPT2050 which if I recall correctly uses the Salora J chassis. The fault – erratic height variations with simultaneous colour changes – was very common but was usually due to the hold potentiometer rather than the chip. The height control also suffers from noisy tracks.

Nick Beer,
Bideford, N. Devon.

SIMPLE PLACEMENT MMV

Because the MMV part of a large i.c. was faulty an elderly JVC VCR wouldn't record. There was a sync pulse input but no divided-by-two squarewave output from the faulty section, i.e. no CTL pulses. The i.c. concerned has 40 pins and, worse, costs over £30. So I decided to make up a separate MMV on a small piece of board, using the ubiquitous NE555 (20p from Grandata). Its input and output were connected to the respective pins of the faulty chip, 26 and 27. Fig. 2 shows the circuit.

Careful scope adjustment of the mark-space ratio resulted in a thin line across the picture. So the time-honoured trial-and-error approach was adopted. With the potentiometer R fully anticlockwise and a counter at zero, a recording was made. At each 5 on the counter (from 10 to allow for loading) R was turned one sixth of its revolution. On playback a position was noted where there was no line. This position has given stable results for many weeks. The time-constant of *RC* is o.k. for ÷1 or ÷2: it might have to be changed for say ÷15, depending on the frequency involved with other applications.

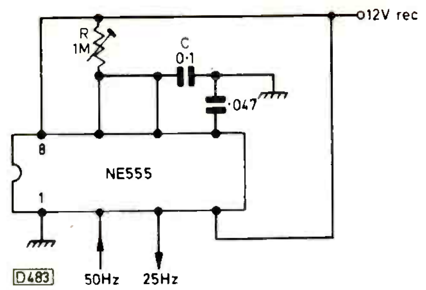

Fig. 2: Separate NE555 MMV circuit used to avoid having to replace a larger, expensive chip.

I'd like to thank D.R. Bracknell for his G8 blanking modification. Teletext interference has been a problem with these sets from the start, especially with Channel 4. I've fitted the modification to two chroma panels and find that it provides a complete answer.

With reference to Geoff Davies' letter, my 1962/3 Mullard Data Book describes the UL46 as a video output pentode.The characteristics are the same as the UL41, which is referred to simply as an output pentode. They are probably the same valve. In my experience, failure of the volume to reduce to zero with a double-diode-triode valve has always been due to the cathode resistor's bypass capacitor drying up.

G. Cox,
Bexhill-on-Sea, East Sussex.

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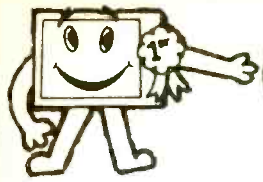

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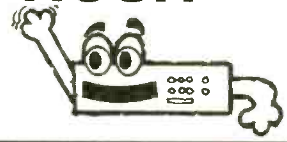

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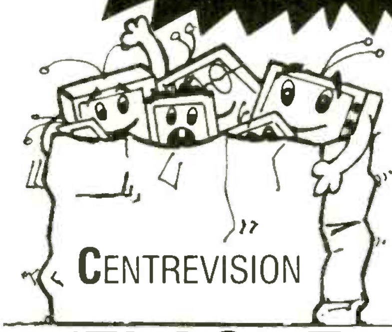

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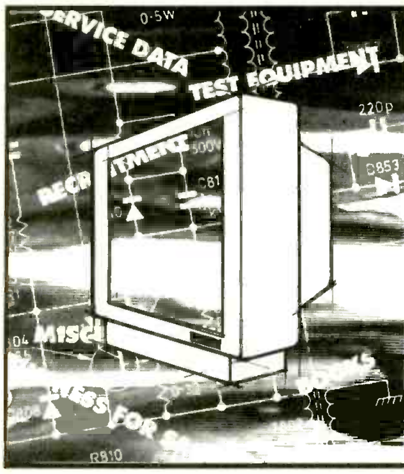

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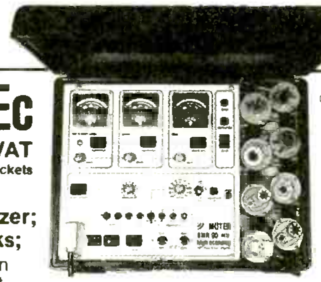

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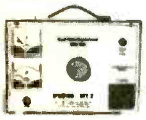

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G8 Tripler £5.00
CVC20-32 £5.00
Decca 80 100 £4.50
Grundig TVK 52 £2.50
11TBO Pye 731 £3.00
11THY £4.00
D22 for Pye 18" colour portable £4.00
LP 1193/63 £4.00
BG 100/41 £3.25
ERO Tripler print type with focus PO7
BG2087 £5
T/text ultrasonic rec'r panel £14.00
12-14V. 20 for £5.00 200 for £25.00
GEC 8 touch unit assy complete with all I.C.'s + pots £4.00
G11 E.W. Transformer 50p
G11 E.W. coils £1.00
G11 Transient Suppressors 245V 20p
G11 Scan Coils £5.00
G11 100K tuner pots 12 for £1
KT3 IF panel £6.00
KT3 line OSC transformer £1
KT3/K30 infra-red receiver head £1
K30 drawer unit with IC's (home) £10
K30 drawer unit with IC's (export) £10
KT3 AE Sockets 50p
KT3 receiver panel £8
KT3 line driver transformer 50p
Pye. K30. GEC. etc. Pre-mains stand-by switch £1
Decca 80/100 IF panel £5
NPN PNP 80V 6 Amp TO66 O.P Trans. pair 25p
5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 560T/570T £7.00
Control panel 5 sliders + mains lead £1.50
G11 8 touch button unit replaces old 6 P.B.U. £24
Tube base + base unit for 820 Euro chassis £4.00
GEC Line O/P Trans. & Rec Stick for Portable £3.00
CVC 20/25/30/35/40 decoder panel £10
CVC 20/25/30/35/40 decoder panel (untested) £5
CVC 40/45 IF panel £5
40K Transducer 50p
PHILIPS NE511N £1.20
LM337M Reg. 30p
20 GEC Black Spark Gaps £1.00
KT3 Front Panel Control Assy. £2.50
BTW 30/50 50p
BTW 92/800R £3
25A473 PNP C/P 10p

Voltage Regulators
+5V/UA78P05SC 30p
−8V/79M08c 30p
+6V/78M06c 30p
+10v/78LA10 20p
LM 317T 30p
LM 337 30p
LM 342/18 30p
LM 340T 5.0 50p
+12V/LM 340T12 50p
+18V/MC78M18 20p
+24V/78M24 30p
MC 7724cp 40p
MC 7824 40p

TIS 90 10p
TIS 92 20p
TIS 93 20p

U 19885 40p
U 3832 15p
U 3845 15p
MR 508 10p
MR 501 10p
MR 502 10p
BYW 71R 10p
BYF 1202 30p
BYF 1204 10p
BYF 3126 40p
BYF 3214 40p
BYX 10 10p
BYX 36/600 35p
BYX 38/300 25p
BYX 49/600R 75p
BYX 55/350 10p
BYX 55/600 (Bead) 10p
BYX 71/350 20p
BYX 71/600 50p
BYX 72/300 20p
BYX 36/600 50p
BYV 95B 10p
BYV 95C 12p
BYV 96D 10p
BYZ 106 10p
BPW 41 15p
BYW 56 2A/1000v GD 8p
BYW 29/50 15p
BYW 95C 10p
BZU 15/24 54p
BZY 93c75 50p
BZW 15/18 30p
BZW 15/30 30p
BZW 70c6v2 10p
BZX 79.3v 10p

Bush thyristor RCA 76122 £1
Transformer 240v/20v-500Ma 75p
Chassis type Transformer 240v/12 Volts 500m/a 75p
CVC 20 tube base £2
Tube Base Rank & G11 £1.20

BRIDGES
KBL 005 30p
KBL 02 30p
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

Self adjusting cutter stripper £5.00

10 mixed tube bars £4.00

5000 Diodes-Resistors £3 pack

* D/P push mains switch 20p each

Mains lead & two pin socket for radio cassette 35p

T/V loop aerial 75p

Radio Telescopic Aerial £1.00

Philips Silicon Grease £1.50

Freeze Philips £1.15

Foam Cleaner Philips £1.15

Contact Cleaner Philips £1.15

100 Coax Plugs £12.00

De-solder pump + 2 nozzles Philips £4.00

Flat Red LED and Green 5p

500gm 60/40 solder reel £6

Dual v/u meter -20 — +10db £1

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
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
R 2737 40p
R 2738=TIP41 30p
R 2775=TIP41c 40p
R 3129=TIP47 40p
R 4050 £1
S 2008b 80p
2SD898B £1
2SC1942 £1

Hitachi sets etc.
STR454 £2
STR6020 Kit £6
S 2000AF line o.p. £1
2SC940 £1
BU 105/04 80p
BU 108 £1
BU 124 50p
BU 126 80p
BU 180a 65p
BU 204 60p
BU 205 75p
BU 206 £1
BU 207 £1
BU 208 80p
BU 208A 75p
BU 208D 90p
BU 222 £1
BU 326 £1
BU 407 60p
BU 426A 45p
BU 500 £1.10
BU 500D £1
BU 508A 90p
BU 508D 80p
BU 508V £1
BU 705 £1
BU 806A £1
BU 807 £1
BU 824 50p
BUT 11 50p
BUT13 600V-28A £1
BUW 11 50p
BUW 84 60p
BYW 20-08-9 £1
BYW 95 10p
BUX39 25A-150V £1
BUX84 50p
BUX85 50p
BUY49 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 (T092 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 L761A-1000V/4Amp 75p
T 6032 30p
T 6036 40p
T 6040 40p
T 6047 40p
T 6049 40p
T 6051 40p

Philips Handset IC £3.00
SAA3010P £3
MAB8461/W063 £3

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

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
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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
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RC4001 Full Remote KT3 K30 Teletext Handsets exchanged £15.00

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GEC Full Remote Infra-red, 1983 models £15.00

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CT9133 £4.00

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TOSHIBA
HAND SETS
24 Button CT938 Fullremote £5.00
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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.
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RC4001 KT3 and Teletex £14.00
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CVC 32 Hand Set £15.00
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TX10 Hand Set Text £12.50
TX9 with Text £12.50
TX9 & TX10 button print £2.00
TX10 Focus Pots £5.50

ITT
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PHILIPS
UNIVERSAL HAND SET £12.00 RC5
KT3 – K45

We have all parts for Philips Handsets

RC5353 £15.00
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TEXT-TYPE
Replace Hand Set for
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THORN HAND SETS
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PHILIPS
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Repaired for £5.00

p-826 £8+75p+VAT
835 £8.70+£1+VAT
this page 7.00+VAT+£1