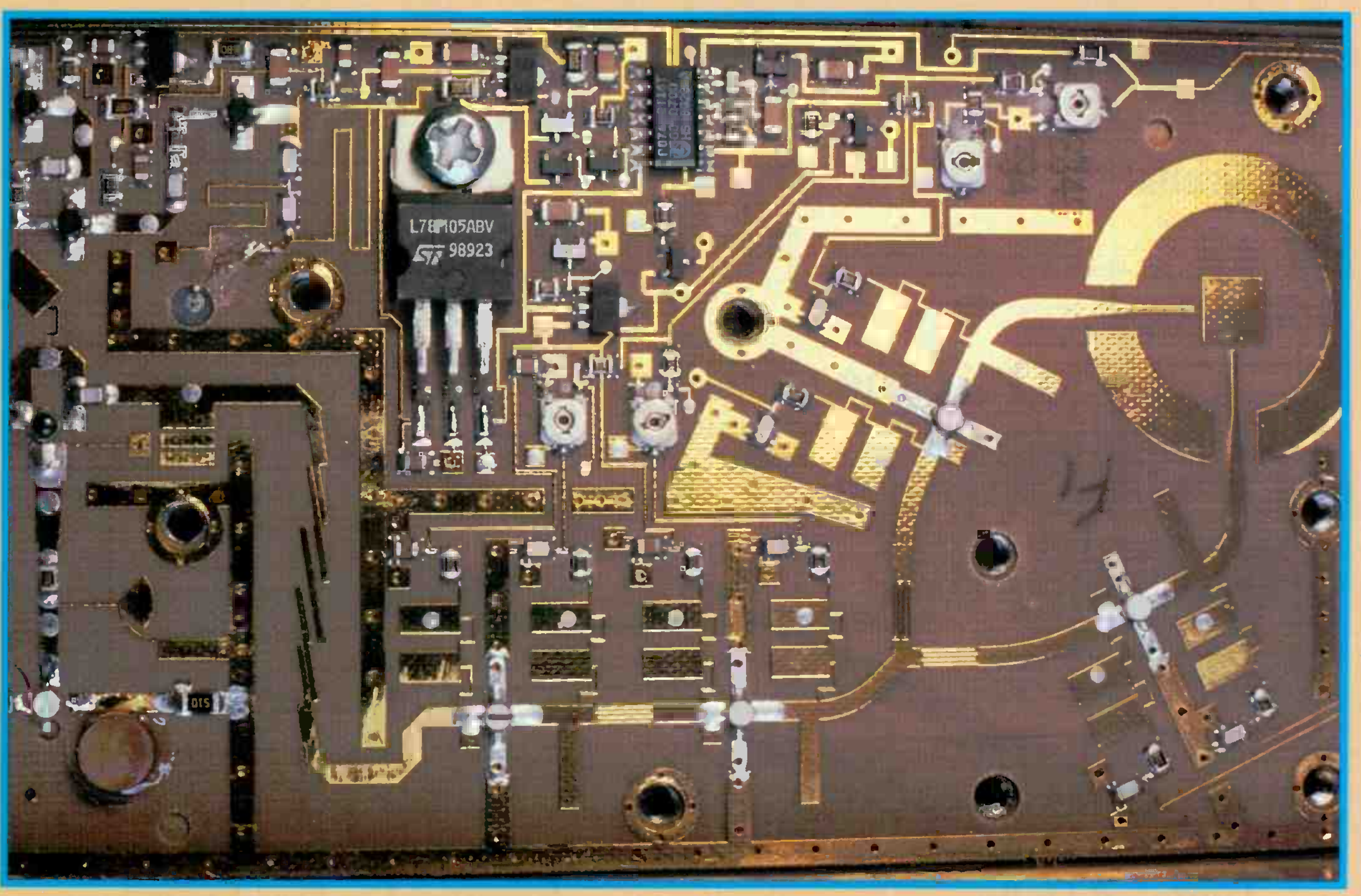
APRIL 1991 £1·80

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

FREE TV/VCR SPARES GUIDE PLUS 32-PAGE CATALOGUE (East Cornwall Components)



Satellite TV Aerial Systems
Adding NICAM Stereo Sound
Service Briefs – Philips•DX-TV
Test Report•Camcorder Notebook
TV Fault Finding•VCR Clinic

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TELEVISION

April 1991

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On sale March 20th

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

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

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

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

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

this month

OUR NEXT ISSUE DATED MAY WILL BE PUBLISHED ON APRIL 17

AA119	9p
AAY32	9p
AC107	40p
AC125	25p
AC126	25p
AC127	21p
AC128	21p
AC128K	26p
AC141K	30p
AC142K	30p
AC176	22p
AC176K	28p
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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
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AF379	45p
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BA145	10p
BA148	10p
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BA526	188p
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1.3W	
BZX61 RANGE	
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PL519	480p
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LED 5MM YEL	10p
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YELLOW	15p
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TDA-5800	600p
TDA-5820	480p
TDA-7000	200p
TDA-7040	250p
TDA-7050	200p
TDA-7211	150p
TDA-7220	150p
TDA-7240	300p
TDA-7250	600p
TDA-7255	600p
TDA-7270	150p
TDA-7274	100p
TDA-8115	300p
TDA-8140	300p
TDA-8170	300p
TDA-8190	280p
TDA-8440	380p
TDA-9403	250p
TDA-9503	200p
TDA-9513	350p

LINEAR IC'S — Cont.

TEA-1002	650p
TLO-61	40p
TLO-64	80p
TLO-71	38p
TLO-72	55p
TLO-74	92p
TLO-81	40p
TLO-82	46p
TLO-83	67p
TLO-84	80p
ULN-2002	70p
ULN-2003	69p
ULN-2004	69p
ULN-2068	270p
ULN-2803	130p
ULN-2804	170p
UPC-16C	160p
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
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UPC-1197	140p
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UPC-1373	85p
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UPC-1420CA	500p
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UPC-1505C	400p
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UPC-1525C	400p
UPC-1536C	550p
UPC-1571C	300p
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ZN-459	190p
ZN-1034	170p
ZN-1040	640p
ZNA-134H	2150p
ZNA-234E	920p

JAPANESE TRANSISTORS

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2SA-608	15p
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2SD-973A	70p
2SD-985	120p
2SD-986	120p
2SD-1012	120p
2SD-1021	120p
2SD-1022	400p
2SD-1024	130p
2SD-1031	130p
2SD-1046	200p
2SD-1051	130p
2SD-1060	130p
2SD-1064	250p
2SD-1071	450p
2SD-1073	350p
2SD-1094	520p
2SD-1111	60p
2SD-1128	200p
2SD-1135	150p
2SD-1138	80p
2SD-1159	90p
2SD-1160	150p
2SD-1163A	220p
2SD-1164	120p
2SD-1168	425p
2SD-1169	280p
2SD-1185	400p
2SD-1186	400p
2SD-1189	125p
2SD-1190	150p
2SD-1196	150p
2SD-1207	50p
2SD-1210	280p
2SD-1211	120p
2SD-1225	120p
2SD-1229	250p
2SD-1237	300p
2SD-1248	270p
2SD-1251	180p
2SD-1266	180p
2SD-1272	200p
2SD-1273	100p
2SD-1275	160p
2SD-1276	200p
2SD-1277	190p
2SD-1279	600p
2SD-1289	300p
2SD-1291	400p
2SD-1292	60p
2SD-1297	425p
2SD-1308	140p
2SD-1309	140p
2SD-1310	140p
2SD-1326	200p
2SD-1328	60p
2SD-1347	70p
2SD-1348	85p
2SD-1350	150p
2SD-1376	125p
2SD-1379	100p
2SD-1380	100p
2SD-1383	100p
2SD-1390	350p
2SD-1391	450p
2SD-1392	150p
2SD-1395	150p
2SD-1396	240p
2SD-1397	220p
2SD-1398	130p
2SD-1399	300p
2SD-1400	280p
2SD-1402	280p
2SD-1406	120p
2SD-1407	160p
2SD-1409	190p
2SD-1415	190p
2SD-1425	430p
2SD-1426	350p
2SD-1427	380p
2SD-1428	360p
2SD-1429	410p
2SD-1430	280p
2SD-1431	400p
2SD-1432	600p
2SD-1433	750p
2SD-1438	140p
2SD-1439	320p
2SD-1441	380p
2SD-1448	140p
2SD-1450	60p
2SD-1451	260p
2SD-1453	140p
2SD-1455	320p
2SD-1457	220p
2SD-1459	120p
2SD-1468	60p
2SD-1496	450p
2SD-1497	450p
2SD-1505	180p
2SD-1554	500p
2SD-1555	450p
2SD-1576	450p
2SD-1577	480p
2SD-1579	120p
2SD-1591	310p
2SD-1595	160p
2SD-1604	200p
2SD-1608	210p
2SD-1609	100p
2SD-1632	500p
2SD-1649	260p
2SD-1651	270p
2SD-1663	450p
2SD-1666	120p
2SD-1667	120p
2SD-1668	120p
2SD-1677	300p
2SD-1739	450p
2SD-1783	100p
2SD-1815	100p
2SD-1825	120p
2SD-1843	100p
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			1000p

UHF TUNERS

U322LO	600p
U341	500p
U342	500p

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SLC9, SLC20, SLC24, SLC30, SLC33, SLC44, SLHF100, SLF1, SLF11, SLF25, SLF30, SLF60, SLF100 £3.20

VCR BELT KITS

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

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

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

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

GEC
4005 £1.50

HITACHI
VT11, VT33 £1.00
VT5000 £1.20
VT5500 £1.30
VT8000 £0.60
VT8500 £0.60
VT9300 £0.50
VT9500 £0.50
VT9700 £0.60
VT14, VT17, VT19, VT35, VT38, VT88, VT52, VT62, VT64, VT65, VT86 £1.50

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

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

MITSUBISHI
HS200 £2.00

NATIONAL
NV300 £1.60
NV333 £1.35
NV777 £1.00
NV2000 £1.50
NV3000 £1.60
NV7000 £0.95
NV7200 £0.90

NATIONAL
NV8600 £1.60
NV7500, NV7800 £1.10
NV340, NV366 £1.40
NV600, NV788 £1.20
NV230, 250, 280, 370, NV380, 430, 450, 460, NV465, 600, 630, 730, NV810, 830, 850, 870, NV890 £1.35

PHILIPS
VR6460 £1.70

SANYO
VTC500 £0.75

VTC5300 £1.00
VTC5500 £0.95
VTC9300 £2.20
VTC1100, 1300, 1500 £1.00

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

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

TOSHIBA
V55, V57 £0.85
V5250, V5280 £2.30
V5480 £2.10
V5475 £1.60
V7540 £1.60
V8600 £1.50
V9600 £0.85

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STK 3152 II	1150p	STK 8280 II	1950P
STK 4019	600p	STM 1240	600p
STK 4032 II	650p	STR 1195	450p
STK 4042 II	900p	STR 1229	550p
STK 4132 II	750p	STR 3113	330p
STK 4172 II	1050p	STR 3135	330p
STK 4182 II	1100p	STR 3132	330p
STK 4231 II	1650p	STR 3214	330p
STK 4432	900p	STR 3215	330p
STK 5331	500p	STR 3315	330p
STK 5333	750p	STR 4142	650p
STK 5335	500p	STR 4512	500p
STK 5337	850p	STR 5214	650p
STK 5338	500p	STR 5314	650p
STK 5339	700p	STR 20005	550p
STK 5461	850p	STR 20013	550p
STK 5462	550p	STR 30110	330p
STK 5466	850p	STR 30112	330p
STK 5467	500p	STR 30118	330p
STK 5478	650p	STR 30120	330p
STK 5479	400p	STR 30125	550p
STK 5725	600p	STR 30134	330p
STK 5730	600p	STR 50020	650p
STK 6732	1500p	STR 50213	650p
STK 7226	800p	STR 56041	650p
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FREEZE IT 140p
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If you purchase more than one Servisol product postage will be £2.00

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SONY THYRISTOR SG264A 800p

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

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4.7UF at 250V	25
10UF at 250V	35
22UF at 250V	40
33UF at 250V	55
47UF at 250V	65
100UF at 250V	1.25

DIODES

TYPE	PRICE
R2M	95
BY127	10
BY179	65
BY223	1.25
BY227	20
BY229/800	95
BYX55/600	30
1N4007	10
1N5408	20
BZX61C (1.3 Watt) 4v7, 5v6, 6v8, 7v5, 8v2, 9v1, 11v, 12v, 15v, 18v, 24v, 27v, 33v, 47v, 68v, 75v, 120v, 130v Pkts of 5 per value	1.00

E.H.T. TRAYS

Continental 30AX Focus	8.95
DECCA 120/130	7.95
ITT CVC20/30	6.95
PHILIPS KT3	7.95
RBM T20/22A	7.35
THORN 9000	8.00
UNIVERSAL	5.70

FUSES

20mm A/S; (Pkts of 10) 250MA, 315MA, 500MA, 630MA, 800MA, 1A, 1.25A 1.6A, 2A, 2.5A, 3.15A 4A, 5A ... 1.20
20mm Q/B; (Pkts of 10) 500MA, 630MA, 800MA, 1A, 1.6A, 2A, 2.5A, 3.15A ... 60

I C SOCKETS

16 Pin Dil-Dil	15
18 Pin Dil-Dil	20
24 Pin Dil-Dil	25
28 Pin Dil-Dil	30

INTEGRATED CIRCUITS

TYPE	PRICE (£)
HA1377	2.95
HA13001	3.95
LA4440	2.75
LA4445	2.45
LA4460	2.45
LA4461	2.45
LA7800	2.95
LA7801	2.95
M293B1	7.95
MC13002	4.95
MC14497P	4.50
SAA1250	4.95
SAA1251	4.95
SAA1293	6.95
SAA5000A	3.95
SAA5010	4.95
SAA5012	4.95
SL1430	1.95
SL1431	1.95
SL1432	1.75
STK5332	6.95
STK5333	12.50
STK5421	4.95
STK5481	8.95
STK5482	8.95
STK7308	7.95
STK7348	7.95
STR441	6.75
STR4090	8.95
STR4211	4.50
STR40090	7.95
STR5412	4.95
STR50103A	6.50
STR55041	6.95
STR58041	6.95
STR6020 (KIT)	5.75
TA7193P	4.50
TA7205AP	1.40
TA7227P	2.95
TBA120U	1.00
TBA820M	1.25
TBA950/2X	2.25
TDA440	2.95
TDA1035T	2.40
TDA1037	2.50
TDA1044	2.95
TDA1170S	1.80
TDA1180P	2.65
TDA1506	4.35
TDA1510	3.80
TDA1512	3.50
TDA1515	4.50
TDA1670A	4.20

TYPE	PRICE (£)
TDA1770A	3.70
TDA1908A	1.95
TDA2003	1.50
TDA2004	2.50
TDA2005	2.50
TDA2030	1.80
TDA2170	2.95
TDA2270	2.95
TDA2530	5.95
TDA2532	2.95
TDA2540	1.95
TDA2541	2.95
TDA2560	1.95
TDA2576A	3.25
TDA2577	3.75
TDA2577A	3.95
TDA2578A	2.95
TDA2579	3.75
TDA2581	2.95
TDA2582	2.50
TDA2591/3	2.00
TDA2594	2.95
TDA2595	4.95
TDA2600	6.35
TDA2611A	1.50
TDA2653A	3.95
TDA3190	1.95
TDA3330	3.95
TDA3560	4.95
TDA3561A	4.95
TDA3562A	5.50
TDA3562A (TFK)	6.75
TDA3565	4.95
TDA3571 B/Q	7.75
TDA3576	7.50
TDA3651	2.75
TDA3651A	4.95
TDA3652	9.95
TDA3653	3.95
TDA3653A	4.75
TDA3654A	3.95
TDA4500	3.95
TDA4501H	6.50
TDA4503	4.50
TDA4505	5.75
TDA4600/2	2.85
TDA4600/2D	3.30
TDA4601	3.50
TDA8180 (Genuine)	7.50
TDA9503	2.95
TEA1014	3.95
TEA2018A	2.75
UPC1365C	3.95
UPC1378H	3.70
UPC1394C	2.95
UPC1420CA	8.50

LINE O/P TRANS

Decca 100	8.95
Ferguson 1790/1	17.95
Ferguson TX90 (14")	19.75
Ferguson TX90 (20")	21.50
Ferguson TX100 90D	19.95
Ferguson TX100 110D	19.95
Ferguson TX100 100D FST	27.50
Fidelity ZX2000 14"/20" (Inc. Mod)	12.50
Fidelity ZX3000 14"/20"	11.50
Hinari CT4/5	19.95
ITT Compact 80 11D	19.95
ITT CVC25/30/32	8.95
ITT CVC800/1/2/3	23.95
ITT CVC1100	19.95
ITT CVC1150	23.95
ITT CVC1200/1	19.95
ITT CVC1204	12.95
ITT CVC1215	19.95
Matsui C1410/1420	26.95
Philips CF1	23.50
Philips CP90	22.95
Philips CTX 14"/20"	21.50
Philips KT3	14.95
Philips K30	22.95
Philips K40	23.75
Philips 2A	23.50
Sharp C1410	23.95

ON/OFF SWITCHES

TX9/10 Standard	1.00
TX9/10 Remote	1.75
TX90/100 Standard	1.50
TX90/100 Remote	1.75
Fidelity AVS	1.50
Fidelity CTV140	1.50
Fidelity CTV14R	2.95
Fidelity CTV14S	2.95
Grundig CUC731	3.50
Philips G11	1.35
Philips G11 Remote	1.75
Philips KT3 Standard	1.75
Philips CTX Remote	1.75
RBM T20A Vol. 3K3	3.95
Sony KV1612 Genuine	3.95
Sony KV2022 Genuine	3.95
Sony Universal	3.75
Tatung 140 Standard	1.50
Tatung 160 Remote	1.75
Thorn Universal	1.00

REMOTE CONTROLS

Ferguson T725	14.95
Ferguson T785	12.50
Ferguson T789	12.50
Ferguson TX9/10 N/Text	12.95
Ferguson TX9/10 Text	12.95
Ferguson TX Stereo Text	12.95
Ferguson TX90 Basic	14.95
Ferguson TX100 Text	14.95
Ferguson TX100 Stereo	14.95
Ferguson 3V23	14.95
Ferguson 3V31	14.95
Ferguson 3V35	14.95
Ferguson 3V43	16.95
Fidelity CTV14S	13.95
Fidelity Text	17.95
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Grundig TP200	13.95
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Hitachi CPT2038	15.95
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Hitachi 9300	14.95
Hitachi VT64E	15.95
ITT FS9/10	14.95
ITT RG305	14.50
ITT RG306	14.50
ITT VS4 N/Text	14.95
ITT VS5 Text	15.95
Panasonic TNQ1411/2	14.95
Panasonic TNQ1419	16.95
Panasonic TNQ1621	19.95
Panasonic TNQ2607	22.95
Panasonic TNQ2611	22.50
Philips G11 I/R N/Text	12.95
Philips G11 I/R Text	12.95
Philips KT3/30 N/Text	12.95
Philips KT3/30 Text	12.95
Philips KT4/CTX Text	12.95
Philips RC5991	12.50
Philips VR6362/7	15.95
Philips VR6660/6680	16.75
Rediffusion MKIV Text	13.95
Rediffusion MKIVA Text	14.95
Saisho RC33	14.95
Saisho RC40/44	15.75
Saisho RC51	16.95
Sony RM604/606	14.95
Sony RM615/632/636	14.95
Tashiko 14D962	15.75
Tatung RC31	16.95
Tatung RC40/43/45	15.95
Tatung RC42	14.95
Tatung RC60	15.95
Toshiba CT9117	16.50

TRANSISTORS

TYPE	PRICE
BC307	10
BC327	10
BC337	10
BC547/8	10
BC557/8	10
BC639	20
BC640	20
BD238	40
BD677	65
BF337	30
BF422	35
BF423	35
BF458	35
BF460	95
BF757	70
BF871	95
BR103	75
BT151/800	1.35
BU126	1.50
BU208A	1.45
BU208D	1.95
BU426A	1.35
BU500	1.95
BU508A	1.50
BU508AF	1.95
BU508D	1.95
BU508DF	2.35
BU508V	2.50
BU705	3.95
BU807	1.30
BU826A	2.50
BU907	2.95
BU908	1.95
BUT11AF	2.75
BUT12A	2.95
BUT56A	2.95
BUX84	80
R4050	2.95
T9053V	3.50
T9054V	3.50
T9064V	1.95
TIP29E (TO168V)	75
TIP41C	45
TIP42C	45
TIP112H (TO167V)	75
TIPL791A	1.95
15/80H	2.95
15/85R	2.95
2SC1942	2.95
2SC3156	3.50
2SD725	4.95
2SD1398	2.35
2SD1453	2.95
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7805	50
7812	50

VIDEO HEADS

Akai VS1/5	23.95
Alba 4000	22.95
Amstrad 4500	19.95
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Amstrad 6000	28.50
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Amstrad 9000	19.95
Ferguson 3V00/39	11.50
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Ferguson 3V43	39.95
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Mitsubishi 303	29.95
Mitsubishi 306	32.95
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Panasonic NV366	27.50
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Panasonic NV777	27.50
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Panasonic NVG7/9	22.75
Panasonic NVG10	27.50
Panasonic NVG18	44.95
Panasonic NVG21	35.95
Panasonic NVG30/40	32.50
Philips VCR6460/6520	15.00
Philips VCR6462/6560	42.95
Philips 6467	37.50
Samsung VX510	23.50
Sanyo VHR1100/1300	23.75
Sanyo VHR1500	34.95
Sanyo VHR3200	24.95
Sentra 8000	22.95
Sharp 9300/381	19.95
Sharp 581/681	19.95
Solavox 1000	22.95
Sony C5/6/7	18.50
Sony C9	32.95
Toshiba V73/83B	23.95
Toshiba V93B	24.50

FERGUSON TV SPARES

Focus Unit TX10	8.50
Push Button TX9	16.95
Push Button TX10	16.95
Push Button TX90	12.95
Tuner TX90	14.95

FERGUSON VIDEO SPARES

3V00/16/22

Belt Kit	2.50
Pinch Roller	3.95
Take-Up Clutch (Small)	5.95
Take-Up Clutch (Large)	5.95
Video Head	11.50

3V29/30

Belt Kit	1.80
Capstan Motor	33.50
Pinch Roller	3.95
Pilot Lamp	80
Reel Idler	2.85
Take-Up Clutch	2.45
Take-Up Idler	1.40
Tension Band	1.95
Video Head	11.50

3V35/39

Belt Kit	1.95
Capstan Motor	22.95
Cassette Housing	25.95
Mains Transformer	21.95
Pinch Roller	3.95
Reel Idler	2.85
Take-Up Clutch	2.45
Take-Up Idler	1.40
Tension Band	1.95
Video Head	11.50

3V44/45

Belt Kit	1.95
Cassette Housing	25.95
Pinch Roller	3.95
Take-Up Clutch	2.95
Video Head	22.95

3V64/65

Cassette Housing	29.95
Clutch Assembly	11.95
Pinch Roller	3.95
Reel Idler	1.95
Video Head	29.95

HITACHI SPARES

HM6232	5.95
HM6251	5.50

VIDEO SPARES

VT8000

Belt Kit	1.95
FF/Rew Idler	2.65
FF/Rew Pulley	85
Pinch Roller	3.95
Play Idler	4.50
Video Head	19.95

VT9300/9500

Belt Kit	1.95
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

VT11/VT33/63E

Belt Kit	1.95
Capstan Motor (VT11)	28.95
Capstan Motor (VT33)	29.95
Capstan Motor (VT63)	27.50
Clutch Assy (VT11/33)	7.95
FF/Rew Idler	2.50
Pinch Roller	3.95
Video Head (VT11/33)	19.95

PANASONIC VIDEO SPARES

NV230

Belt Kit	1.95
Complete Maintenance Kit (Genuine)	12.95
Pinch Roller	3.95
Reel Idler (Genuine)	2.95
Tension Band	1.95
Video Head	27.50

NV333/366

Belt Kit	1.95
Complete Maintenance Kit (Genuine)	13.75
Pinch Roller	3.95
Play Idler (Genuine)	4.95
Reed Idler (Genuine)	1.25
Reel Motor (Genuine)	17.95
Tension Band	1.95
Video Head (NV333)	11.50
Video Head (NV366)	27.50

NV370

Complete Maintenance Kit (Genuine)	12.95
Belt Kit	1.95
Pinch Roller	3.95
Reel Idler (Genuine)	2.95
Tension Band	1.95
Video Head	15.00

NV730

Complete Maintenance Kit (Genuine)	12.95
Belt Kit	1.95
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Tension Band	1.95
Video Head	27.50

NV777

Complete Maintenance Kit (Genuine)	12.95
Belt Kit	1.95
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Tension Band	1.95
Video Head	27.50

NV2000/2010

Complete Maintenance Kit (Genuine)	21.50
Belt Kit	1.95
Pinch Roller	3.95
Play Idler (Genuine)	1.25
Reel Idler (Genuine)	1.25
Video Head	11.50

NV7000/7200

Complete Maintenance Kit (Genuine)	17.50
Belt Kit	1.95
Pinch Roller	3.95
Play Clutch (Genuine)	4.95
Reel Idler (Genuine)	1.25
Video Head	11.50

NVG7/9/10/12

Complete Maintenance Kit (Genuine)	12.95
Video Head (NVG7/9)	22.75
Video Head (NVG10/12)	27.50

PHILIPS VIDEO SPARES

VR6460/6520

Belt Kit	1.95
Loading Motor	9.95
Pinch Roller	3.95
Reel Idler	2.95
Tension Band	1.95
Video Head	15.00

VR6462/6560

Belt Kit	1.95
Cassette Housing	17.50
Pinch Roller	4.50
Reel Idler	3.95
Reel Motor	39.50
Tension Band	1.95
Video Head	42.95

VR6467

Belt Kit	2.45
Cassette Housing	19.95
Pinch Roller Assy	17.50
Reel Idler Assy	11.95
Remote Control	22.95
Video Head	37.50

VR6760

Belt Kit	1.95
Clutch Assembly	7.95
Pinch Roller Assy	17.50
Remote Control	19.95
Video Head	49.95

SANYO/FISHER VIDEO SPARES

VTC5000

Belt Kit	1.00
Reel Idler (Genuine)	5.70
Reel Motor (Genuine)	7.95

FVH-P615

Belt Kit	1.95
Clutch Assembly	5.95
Pinch Roller	4.50
Reel Idler	5.95
Video Head	19.95

FVH-P905

Belt Kit	1.95
Reel Idler	5.95
Clutch Assembly	5.95

SERVICE MANUALS GENUINE

Ferguson TX85	9.95
Ferguson TX90	14.95
Ferguson TX100	18.95
Fidelity AVS1600	5.95
Fidelity AVS2000	5.95
Fidelity CTV14R	5.95
Fidelity CTV20T	5.95
Philips CTX-E	3.50
Philips CTX-S	3.50
Philips KT4/40	9.95
Philips 2A	6.95

VIDEO

Ferguson 3V54/55	11.95
Ferguson 3V64/65	11.95
Ferguson FV11	9.95
Ferguson FV12	9.95
Ferguson FV14	9.95
Philips VR6467	7.95
Philips VR6542	9.95
Philips VR6560	7.95
Philips VR6760	9.95

SHARP SPARES

VC9300/381

Belt Kit	2.45
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
Reel Motor (Genuine)	16.95

VC481

Belt Kit	2.50
Pinch Roller	3.95
Reel Idler (Genuine)	3.95
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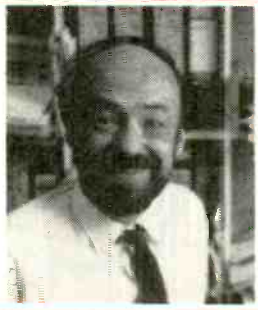

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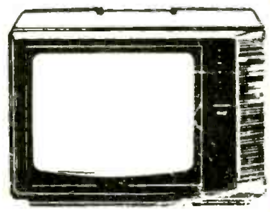

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BA6208	250p	STK3042	600p
BA6209	250p	STK4121	800p
BA6219	300p	STK4131	650p
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BA6239	250p	STK4142	800p
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HA1366	160p	STK4152	900p
HA1367	300p	STK4161	800p
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HA1377	200p	STK4171	1000p
HA1384	400p	STK4172	1100p
HA1389	210p	STK4191	1100p
HA1392	230p	STK5315	650p
HA1394	280p	STK5325	650p
HA1396	395p	STK5338	700p
HA1397	255p	STK5421	625p
HA1398	240p	STK5481	799p
HA11717	600p	STK5482	520p
HA11225	170p	STK7308	580p
HA11226	410p	STK7348	600p
HA11227	225p	STR451	480p
HA11235	170p	STR4090	650p
HA11423	210p	STR40090	600p
HA11724	600p	STR50103	500p
HA12413	275p	STR50020	700p
HA13001	195p	STR58041	650p
LA4261	300p	STR6020	490p
LA4270	300p	TA7205	100p
LA4430	130p	TA7193	400p
LA4440	230p	TA7203	180p
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LA4461	170p	TA7230	170p
LA4465	425p	TA7240	260p
LA4466	425p	TA7241	260p
LA4500	230p	TA7245	400p
LA4505	260p	TA7269	550p
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LA4700	425p		
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TA7270	250p
TA7271	275p
TA7272	260p
TA7273	350p
TA7274	260p
TA7279	400p
TA7280	330p
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TBA800	40p
TBA820M	50p
TBA950	120p
TDA1515	250p
TDA1670	300p
TDA1908A	100p
TDA2003	100p
TDA2005	130p
TDA2575	200p
TDA2577	250p
TDA2581	200p
TDA2593	150p
TDA2653A	350p
TDA3560	320p
TDA3561	300p
TDA3562	260p
TDA3565	300p
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TDA3652	900p
TDA4500	360p
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UPC1181	110p
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UPC1185	230p
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2SA-489	55p
2SA-490	40p
2SA-495	25p
2SA-496	40p
2SA-564	15p
2SA-608	15p
2SA-628	70p
2SA-672	30p
2SA-673	20p
2SA-677	60p
2SA-683	25p
2SA-684	40p
2SA-697	45p
2SA-715	35p
2SA-720	20p
2SA-722	40p

2SA-726	25p	2SB-548	40p
2SA-733	20p	2SB-554	170p
2SA-748	90p	2SB-557	150p
2SA-765	300p	2SB-558	150p
2SA-769	130p	2SB-560	35p
2SA-771	130p	2SB-561	20p
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2SA-794	60p	2SB-564	70p
2SA-798	55p	2SB-566	110p
2SA 817	25p	2SB-568	40p
2SA-841	40p	2SB-595	80p
2SA-844	15p	2SB-596	75p
2SA-861	50p	2SB-618	325p
2SA-872	20p	2SB-631	40p
2SA-893	15p	2SB-632	40p
2SA-896	35p	2SB-633	50p
2SA-899	60p	2SB-641	20p
2SA-900	35p	2SB-643	20p
2SA-905	20p	2SB-644	15p
2SA-915	30p	2SB-647	30p
2SA-916	30p	2SB-648	55p
2SA 917	35p	2SB 649	40p
2SA-921	10p	2SB 673	80p
2SA-940	50p	2SB 681	250p
2SA-950	25p	2SB-686	120p
2SA-958	70p	2SB-688	130p
2SA-962	60p	2SB-695	325p
2SA 964	65p	2SB-705	200p
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2SA-968	70p	2SB-718	70p
2SA-970	15p	2SB 738	25p
2SA-984	30p	2SB-744	25p
2SA-985	65p	2SB-755	310p
2SA-992	30p	2SB-757	350p
2SA-999	20p	2SB-764	25p
2SA-1015	20p	2SB-772	45p
2SA-1016	20p	2SB-792	45p
2SA-1020	30p	2SB-793	35p
2SA-1048	20p	2SB-817	200p
2SA-1060	90p	2SB-837	60p
2SA-1062	125p	2SB-856	60p
2SA-1094	190p	2SB-857	60p
2SA-1095	275p	2SB-861	60p
2SA 1102	180p	2SB-886	65p
2SA-1104	200p	2SC-789	50p
2SA-1106	200p	2SC-790	80p
2SA 1110	60p	2SC-815	15p
2SA-1123	40p	2SC 828	25p
2SA-1141	200p	2SC-829	20p
2SA-1142	65p	2SC 839	25p
2SA-1145	60p	2SC-929	20p
2SA-1146	190p	2SC-941	25p
2SA-1147	190p	2SC-945	20p
2SA-1156	60p	2SC-959	65p
2SA 1180	200p	2SC-984	40p
2SA 1220	50p	2SC-998	300p
2SA-1232	175p	2SC-1162	35p
2SA-1262	65p	2SC-1172	150p
2SA-1265	150p	2SC-1173	45p
2SA-1282	35p	2SC-1195	200p
2SA 1386	275p	2SC-1212	60p
2SB-507	100p	2SC-1213	60p
2SB-509	100p	2SC-1214	40p
2SB-511	100p	2SC-1222	20p
2SB-511	100p	2SC-1226	75p
2SB-512	100p	2SC-1306	75p
2SB-514	100p	2SC-1317	25p
2SB-527	40p	2SC 1318	25p
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2SB-531	200p	2SC-1328	25p
2SB-534	200p	2SC-1344	30p
2SB-536	60p		
2SB-537	60p		
2SB 544	60p		
2SB 545	150p		
2SB-546	70p		

2SC-1417					
2SC-1445					
2SC-1446					
2SC-1447					
2SC-1454					
2SC-1473					
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-2581			
2SC-1577	800p	2SC-2582			
2SC-1584	600p	2SC-2603			
2SC-1627	30p	2SC-2611			
2SC-1667	150p	2SC-2631			
2SC-1669	85p	2SC-2634			
2SC-1670	85p	2SC-2660			
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2SC-1722	60p	2SC-2785	50p		
2SC-1756	40p	2SC-2791	325p		
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2SC-1775	20p	2SC-3078	40p	2SD-8	
2SC-1815	15p	2SC-3156	325p	2SD-87	
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2SC-1845	20p	2SC-3182	250p	2SD-880	
2SC-1846	45p	2SC-3284	175p	2SD-882	
2SC-1848	45p	2SC-3298	120p	2SD-898B	
2SC-1875	260p	2SC-3506	250p	2SD-917	
2SC-1890	20p	2SC-3519	150p	2SD-951	
2SC-1906	30p	2SD-198	180p	2SD-982	
2SC-1909	250p	2SD-200	210p	2SD-985	8[illegible]
2SC-1913	100p	2SD-234	40p	2SD-1128	80p
2SC-1914	30p	2SD-235	40p	2SD-1134	80p
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2SC-1980	25p	2SD-400	20p	2SD-1273	100p
2SC-1986	60p	2SD-401	50p	2SD-1275	125p
2SC-2003	25p	2SD-414	40p	2SD-1276	125p
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2SC-2057	25p	2SD-427	150p	2SD-1427	275p
2SC-2068	50p	2SD-428	150p	2SD-1432	400p
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2SC-2153	40p	2SD-468	25p	2SD-1453	170p
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2SC-2230	30p	2SD-476	60p	2SD-1497-06	520p
2SC-2236	30p	2SD-478	100p	2SJ-50	425p

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2SC-2238
2SC-2240
2SC-2274
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2SC-2320
2SC-2335
2SC-2371
2SC-2427
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2SD-525
2SD-526
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2SD-570
2SD-571
2SD-592
2SD-600
2SD-612
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2SD-621L
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VIDEO BELT KITS FOR AKAI, AMSTRAD, FERGUSON, FISHER, HITACHI, ITT, JVC, PANASONIC, SANYO, SHARP, SONY, TOSHIBA FROM 1.45

IDLERS

VIDEO IDLERS FOR AKAI, FERGUSON, FISHER, HITACHI, ITT, JVC, PANASONIC, PHILIPS, SANYO, SHARP, SONY, TOSHIBA MOSTLY ORIGINAL MANUFACTURERS. FROM 1.76

MISCELLANEOUS

HUNDREDS OF WEIRD AND WONDERFUL PARTS IN STOCK E.G. FAULT FINDING GUIDES JVC, SONY, PANASONIC	FROM 7.30
MOTORISED VHC 'C' TO VHS ADAPTOR	20.65
PANASONIC TEST CD	30.62
VIDEO MOTORS	FROM 9.42
SENSOR LAMPS	FROM 0.53
SONY NICAM ADAPTOR (ONLY IF TV IS ADAPTABLE)	107.50
SCREW KIT APPROX. 2500 WALKMAN SCREWS 72 SIZES. UNIT COST APPROX. 4P	99.17
FERGUSON/JVC CASSETTE CARRIAGE	24.95
CARRIAGE ROLLER 3V23/31/32/hr7600	4.57
ECCENTRICITY GAUGE BETA UMATIC	72.99
SONY 5 SERIES UMATIC SERVICE KIT	76.40
REMOTE CONTROL RUBBER PADS	FROM 4.80
DE-SOLDER BRAID	FROM 0.80
AUDIO CASSETTE MOTORS 6/9/12V	4.50
SONY CD BATTERY PACKS	FROM 11.76
CAMCORDER BATTERIES For Most Models	FROM 20.00
SONY CAMCORDER CHARGERS & RF UNITS. CABINET ITEMS E.G. FLAPS ETC. FOR SONY AND PANASONIC TV AND VIDEO	FROM 2.50

SWITCHES

SONY TV POWER SWITCHES	FROM 4.18
SONY TV MICRO SWITCHES	FROM 1.03
SONY SLC7 TIMER SWITCHES	1.08

PANASONIC VCR MODE SWITCHES FROM £2.26

ACCOUNTS WELCOME

PLEASE SUPPLY THE FOLLOWING INFORMATION FOR AN INSTANT CREDIT ACCOUNT.

1. COMPANY NAME
2. COMPANY TYPE (EG. LTD, PARTNERSHIP, SOLE TRADER)
3. FULL ADDRESS INC. POSTCODE
4. TELEPHONE INC. STD CODE
5. DATE COMPANY STARTED TRADING
6. YOUR FULL NAME AND POSITION
7. FULL NAMES OF ANY OTHER DIRECTORS OR PARTNERS
8. NAME AND ADDRESS OF COMPANY'S BANKERS, BRANCH SORT CODE & ACCOUNT NUMBER
9. TWO TRADE REFERENCES
10. SPECIMEN OF LETTERHEAD OR ORDER FORM.

MINIMUM TRADE £40.00 PER MONTH

ORDERS BEFORE 4.00 PM — SAME DAY DESPATCH
ALL LIST PRICES ARE EX-VAT

Orders Under £10.00 (Ex VAT) Please Add £2.50 Handling then VAT
Orders Under £25.00 (Ex VAT) Please Add £1.50 Handling then VAT
Orders Over £25.00 Free Despatch

EAST CORNWALL COMPONENTS

Access

BARCLAYCARD VISA

EAST CORNWALL COMPONENTS
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WEM
SHROPSHIRE SY4 5TT TEL: 0939 32689
TELEX: 35565
FAX: 0939 33800

APRIL SPECIAL OFFERS

FARNELL 'G' SERIES HURRY, LIMITED QUANTITY DON'T MISS OUT . . .

The Farnell 'G' Series power supplies use a switching technique to provide stabilised dc from ac inputs. This permits the production of compact, lightweight and high efficiency units which will operate from all nominal international mains supplies. A front panel switch provides a choice of 220 to 240 volts or 115 to 120 volts with tolerances of −20% to +10% of nominal. Once the required input is set, a cover over the switch prevents accidental selection of the wrong input.

A useful range of output voltage is provided and may be varied by screwdriver adjustment of a front potentiometer. Full output current is available at any setting of the potentiometer. Output presence is indicated by a front panel LED. With the exception of the 30 watt range the output voltage may be programmed by an external connected resistor or remotely inhibited. Provision is made for remote sensing of the voltage at the load to compensate for voltage drop across the load connecting leads.

Mostly still in Farnell boxes and unused. Two types available. Info from current Farnell catalogues as follows:

G125S 60 WATTS
(Nominal Output 12V at 5A)
INPUT: 115-120V
220-240V

VARIABLE OUTPUT:
8-12.6V at 5 Amps
DIMS: 88 × 60 × 165mm

Current Price: £189.75!
ORDER CODE: S0/431

OUR PRICE: £75.00

G12-20A 240 Watts
Nominal Output 12V at 20A
INPUT: 115-120V
220-240V

VARIABLE OUTPUT:
8-12.6V at 20 Amps
DIMS: 88 × 160 × 194mm

Current Price: £368.00!
ORDER CODE: S0/432

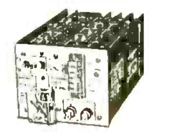
OUR PRICE: £150.00

SWITCH MODE POWER SUPPLY
Made By Farnell UK
350 Watts Model N350/F4184

A fully enclosed unit made to the highest standard.
320 × 190 × 75mm
+ 5V at 11A
− 5V at 3A
+24V at 7A

240V Input. Outputs are clearly marked.
Original price over £200 each
BARGAIN PRICE!
ORDER CODE: S0/430

PRICE: £15.00 1+
PRICE: £12.50 10+



FULL RANGE OF TRANSISTORS & ICS

FULL RANGE BABINI BOOKS IN STOCK

VIDEO HEADS

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VP77	£13.65
VP88	£13.65
VP 7100	£13.65
VS 1	£13.65
VS 2	£13.65
VS 3	£13.65
VS 5	£13.65
VS 10	£13.65
VS 77	£13.65
VS 9300	£13.65
VS 9500	£13.65
VS 9700	£13.65
VS 9800	£13.65
FERGUSON	
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3V01	£13.65
3V16	£13.65
3V22	£13.65
3V23	£13.65
3V24	£13.65
3V29	£13.65
3V30	£13.65
3V31	£13.65
3V35	£13.65
3V36	£13.65
3V38	£13.65
3V39	£13.65
8903	£13.65
FISHER	
FVE P615	£40.50
FVE P920	£40.50
GRUNDIG	
Full range now available PHONE FOR PRICE	
HITACHI	
VT1125.00	
VT14	£25.00
VT33	£25.00
VT34	£29.99
VT3000	£13.65
VT4000	£27.00
VT4200	£27.00
VT5000	£27.00
VT6500	£25.00
VT7000	£25.00
VT8000	£25.00
VT8500	£25.00
VT9000	£25.00
VT9300	£25.00
VT9500	£25.00
VT9700	£25.00
VT9900	£25.00
JVC	
HRD110E	£13.65
HRD110E G	£13.65
HRD111	£13.65
HRD120	£13.65
HRD121	£13.65
HRD225	£13.65
HR2200	£13.65
HR3300	£13.65
HR3660	£13.65
HR4100	£13.65
HR7200	£13.65
HR7600	£13.65
HR7610	£13.65
HR7650	£13.65
HR7700	£13.65
NEC	
N830	£13.65
N831	£13.65
N832	£13.65
N833	£13.65
PVC 2300	£27.70
PVC 2400	27.70
NATIONAL PANASONIC	
NV100	£18.10
NV230	£42.50
NV300	3.65
NV322	£13.65
NV330	£42.50
NV333	£13.65
NV340	£13.65
NV366	£13.65
NV370	£18.10
NV380	£18.10
NV430	£27.99
NV450	£42.50
NV470	£42.50
NV480	£42.50
NV730	£42.45
NV2000	£13.65
NV3000	£13.65
NV7000	£13.65
NV7200	£13.65
NV7500	£13.65
NV7800	£13.65

NATIONAL (Cont)	
NV7850	£13.65
NV8170	£13.65
NV8200	£13.65
NV8200	£13.65
NV8400	£13.65
NV8600	£13.65
NV8610	£13.65
ORION	
VH 1	£13.65
VH 2	£13.65
PHILIPS	
VR 6460	£18.10
VR 6520	£18.10
SANYO	
VTC 3000	£25.00
VTC 5000	£45.00
VTC 5500	£45.00
SHARP	
VC200/300/482/3300/9100/9300/9400/9500	
9600/9700	£30.99
VC381/384/385/386/387/388/481	£28.50
SONY	
SL C5	£25.00
SL C6	£25.00
SL C7	£25.00
SL C9	£48.60
SL C20	£24.85
SL C24	£24.85
SL C30	£24.85
SL C33	£24.85
SL C44	£24.85
SL F1	£24.85
SL F30	£24.85
SL 3000	£24.85
SL 8000	£24.85
SL 8080	£24.85
TELEFUNKEN	POA
THOMSON	POA
TOSHIBA	
V31	£31.70
V33	£31.70
V55	£13.45
V57	£13.45
V5470	£13.45
V9600	£31.70

REMOTE HANDSETS

AMSTRAD	
CTV1409	£17.50
CTV2200	£17.50
CTV2210	£17.50
TV/VIO-TVR1	£17.50
VCR5200	£20.00
VCR7000	£12.00
VCR9000	£12.00
DECCA	
80/10 NON TEXT (RC1)	£24.50
101 NON TEXT	£27.50
FERGUSON	
TX9/10 NON TEXT	£15.95
TX9/10 TEXT	£15.95
TX9/10 TEXT/STEREO	£15.95
FIDELITY	
FD09193 TEXT	£15.95
FD09141 CTV14S	£15.95
GRUNDIG	
TP400 TELETEXT	£15.95
TP400 NON TEXT	£15.95
ITT	
RG305	£15.95
RG306	£15.95
JVC	
3V23	£15.95
3V31	£15.95
3V35	£15.95
PHILIPS	
G11 TEXT	£15.95
KT3/K30 TEXT	£15.95
KT3/K30 NON TEXT	£15.95
RC5 STD	£15.95

UNIVERSAL
High quality 12 Volt Universal Video Cassette Recorder Lamp and Head. Lead length Approx 30cm
ORDER CODE: VID/LAMP
F19Price — 60p

SERVICE MANUALS

SONY SL-C5/6/7
FERGUSON VHSTJ1/3V00/HR3330EK
FERGUSON VHSTJ1/3V22/HR3320EK
ALL £8.00 EACH

PINCH ROLLERS

AKAI	1EG/2EG/4EG/5EG/6EG/9EG/SC15EG	£3.99
	VS9700	£4.35
FERGUSON	3V00/3V24	£3.99
	3V29/3V32	£5.25
HITACHI	ALL	£3.99
JVC	HR2000/3000/3300/3660/4100/7700	£3.99
NEC	N830/N833	£3.99
ORION	VH-1/2	£3.99
PANASONIC	NV100/180/332/333/366/600E/777/778	£4.95
	2000/230/3000/370/430/460/465/7000/7200/730/780/810/8200/830/8400/850/8600/8610/870/890	£3.99
PHILIPS	VR 6460	£3.99
	VR 6560	£3.99
SANYO	VTC3000	£4.20
	VTC5000/5150/5300/5350/5400/5500/6000/6500/9100/9300/m10/11/20/21/30/31/M50	£4.25
SHARP	200/382/384/385/386/388/390/3300/2300/6000/6200/6300/7300/7700/7750/8000/8300/9300/9500/9700	£3.99
SONY	SL C5/6/7	£4.20
TOSHIBA	V5	£3.99

VIDEO BELT KITS

AKAI	VS 9300/9500	2.10
FISHER	MOST	2.50
HITACHI	VT5000E/5500/3000	2.75
	VT/7000/8000/8500/9300	
	VT/9500/9700	1.50
	VT11/VD88	3.75
JVC/FERG	3V00/3V22	2.10
	3V29/3V30	1.50
JVC/THORN	3V35/3V39	1.50
JVC	3300/3300/3360	2.10
	7200	2.00
	7600/7610/7650/7655	2.25
NAT. PAN	NV7000/7200/777/7800	1.75
	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
TOSHIBA	V32 & 33	6.30
	V55 & 57	1.50
	V66/67/9600	1.20

FULL RANGE OF CASSETTE PLAYER DRIVE BELTS: 19mm to 57mm 25p; 60/94mm 29p; 100/110MM 35p each
TURNTABLE DRIVE BELTS: 121/210mm £1.99 each
CASSETTE DRIVE BELTS: 68/78mm 45p each; 81/95mm 50p each
CASSETTE DRIVE BELTS: (WALKMAN TYPE) 30p each

IDLERS

FISHER	143-0-4204-00400	3.85
FISHER	GEAR IDLER 143-0-4904-00900	6.00
FERG/JVC	TAKE UP IDLER PU51402A	1.90
HITACHI	6886971	1.99
PANASONIC	VXP 0344	1.00
PANASONIC	VXP 0251	2.30
SANYO	REEL DRIVE PULLEY VTC 5150 143-0-6621-01201	6.50
SHARP	NIDL 0005 GE22	1.90
SHARP	NIDL 0006 GE22	2.10
THORN/JVC	PU48967B	2.99

MAINS SWITCHES

PB3008 Decca/GEC	0.99
SONY (Universal)	4.05
PB5030 Rank Remote	1.50
PB3003 Philips G8 Plastic	0.95
PHILIPS KT3 (Remote)	1.99
5031 PHILIPS G11 Remote	1.40
285/1 ITT CVC5/CV20	1.40
PB3005 PHILIPS G11	0.95
THORN TX90 00E2 158-001	0.95

MOTORS

Reel Motor SANYO VTC 5150 4-529V-10800	9.20
Reel Motor SHARP VCS3000/9800DRM0TV 1008 GE22	18.95
Capstan Motor FERG/JVC 3V35 PU56371V/M	27.50
Audio Motor Recorder 12V CW 34mm	4.10
Audio Motor 9V CW 34mm	4.20

20m FUSES

QUICK BLOW — 80mA, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1A, 1.25, 1.5, 1.6, 2, 2.25, 3.15, 4.5, 6.3 — 50p/10
TIME DELAY — 50mA, 60, 80, 100, 125, 160, 200, 250 315, 400, 500, 630, 800, 1A, 1.25, 1.6, 2, 2.25, 3.15, 4, 5, 6.3, 10 — 1.50/10

14 QUICK BLOW FUSES

500Ma, 1A, 1.25A, 2A, 12A — 50p/10

SOLDER 18 & 22 SWG -500gm REEL

	1+	10+
18swg	£4.95	£4.70
22	£34.99	£4.75

Remember: Our prices INC. VAT!

HEATSHRINK PACK

Approx 10 lengths of assorted sizes from 1.6mm to 12.7mm. Lengths 12". Price: £1.00 ea.

RAYCHEM MINIATURE CO-AX

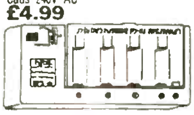
75 Ohm Type: 7528A 1317-9 (100). Very high quality.
28 awg, stranded 7/0, 127mm.
Dia: 2.6mm. Colour White
Reel length 100 mtrs.
Current price £92 per reel.
ORDER CODE: SO/446

PRICE: £45 (per reel)

All prices include 15% VAT and our p&p is now £1.75

NI-CAD CHARGER

Charges AAA, AA, C, D & PP3 Ni-Cads 240V AC
£4.99



NI-CAD RECHARGEABLE BATTERIES

	PRICE 1+	EACH 10+
AAA	£1.50	£1.30
AA	£0.95	£0.85
C	£1.95	£1.80
D	£2.00	£1.85
PP3	£3.90	£3.75

SPARE HALOGEN BULBS

Standard length bulbs in 3 Wattages.

200W SEC/200W	PRICE: £3.50
300W SEC/300W	PRICE: £3.75
500W SEC/500W	PRICE: £4.00

TUNGSTEN HALOGEN LAMP

8 WAY SPLIITER

8 way splitter ampifier to supply 8 TV's from one antenna. White plastic box with aluminium panel. On/off switch with neon

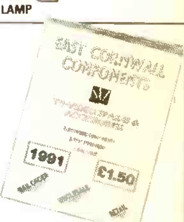
Band width	40MHz-860MHz
Gain	3dB per channel. Total 21dB
Impedance	75Ω
Max output	80mV (38dBnV)
(signal/cross modulation	= 6dB
Noise	6dB
Isolation between outputs	40dB min
Power	240Vac 50Hz
Dims	250 × 100 × 60mm

£29.99

LATEST 1991 CATALOGUE

★ Velleman Kit catalogue
★ Free pre-paid envelope
★ Many new lines
★ Pages of special offers

£1.50



RESISTOR KITS — each value individually packed

1/4W pack 10 each value E12 — 10R to 1M 610 pieces	5.10
1/4W pack 5 each value E12 — 10R to 1M 305 pieces	3.75
1/4W pack Popular — 10R to 10M 1000 pieces	6.99
1/2W pack 10 each value E12 — 2R2 to 2M2 730 pieces	8.75
1/2W pack 5 each value E12 — 2R2 to 2M2 365 pieces	5.40
1/2W pack Popular — 2R2 to 10M 1000 pieces	10.75
1W pack 5 each value E12 — 2R2 to 1M 365 pieces	15.25
2W pack 5 each value E12 — 10R to 2M2 317 pieces	25.00

ADDITIONAL KITS

DISC CERAMIC 50V	125 pieces	£3.99
ZENER DIODES 5ea	55 pieces	£3.99
ELECTROLYTICS CAPS. RADIAL	100 pieces	£8.50
FUSES Q/BLOW 20mm	80 pieces	£4.75
FUSES T/DELAY 20mm	80 pieces	£8.50
PRE-SET POTS. Hor	120 pieces	£7.75
PRE-SET POTS. Vert.	120 pieces	£7.75
POLYESTER 100V	110 pieces	£5.00
NUT & BOLT	800 pieces	£5.99
SELF-TAPPING SCREWS 3 Sizes		P.O.A.

VALVES

DAF	0.70	EF95	0.90	PCL84	1.30
DF96	0.80	EF183	1.35	PCL86	1.50
DK96	3.10	EF184	0.90	PCL88	2.95
DY86/87	0.90	EH90	0.45	PCL805	1.55
DY802	0.98	EL34	4.15	PD500	4.35
E88CC	4.65	EL36	1.60	PFL200	1.95
EABC80	2.75	EL81	8.05	PL33	1.45
EAF42	1.78	EL84	1.50	PL84	1.20
EB91	0.80	EL86	1.45	PL504	1.98
EBC41	2.45	EL509	8.50	PL508	1.80
EBC81	1.65	EL519	8.50	PL519/509	8.85
EBF80	1.38	EM80	6.25	PL802	11.25
EBF83	1.35	EM84	0.92	PY81/800	2.00
EBF89	1.15	EM87	6.30	PY88	0.95
EC92	2.10	EY51	2.40	PY500A	3.30
ECC81	1.58	EY86/87	0.85	PY801	1.35
ECC82	2.35	EY88	1.15	UABC80	1.05
ECC83	2.55	EY500A	2.55	UAF42	1.30
ECC84	0.65	EZ41	3.45	UBC41	4.15
ECC85	1.30	GY501	1.65	UBC81	2.05
ECC86	3.25	GZ32	2.85	UCH42	2.85
ECC88	1.50	GZ34	6.25	UF41	3.45
ECC189	1.50	KT88	POA	UL84	1.50
ECF80	1.55	PC86	0.75	UY41	6.65
ECF82	1.60	PCC84	0.50	UY85	2.05
ECF83	2.25	PCC85	0.95	2D21	3.05
ECH35	4.35	PCC88	1.30	6AU6	1.50
ECH42	1.68	PCC89	0.85	6BA6	1.45
ECH81	1.30	PCC189	0.85	6BE6	2.18
ECL80	0.80	PCF80	1.35	6C4	2.40
ECL82	1.85	PCF82	0.75	6K7G	3.05
ECL83	3.80	PCF86	1.35	6X4	1.80
ECL84	1.25	PCF87	1.35	12AU6	3.20
ECL85	1.15	PCF200	3.10	12AV6	2.85
ECL86	1.45	PCF800	1.05	30FL2	2.65
EF37A	5.45	PCF801	1.50	30PL1	1.95
EF80	0.80	PCF802	1.25		
EF85	0.55	PCF805	1.65		
EF86	2.65	PCL82	1.55		
		PCL83	2.95		

FULL RANGE IN CATALOGUE

HOME ALARM PACKAGE

Includes
★ Optima Alarm Control Panel
★ External Feed Bell Box
★ 2 × 1 Internal Passive I/R
★ 2 × Door Contacts
★ Siren for Bell Box
★ 100 mtrs cable and clips
★ Full fitting instructions

ONLY £127.50
★ BACK UP LEAD ACID BATTERY 12v 1.9 £14.00

BACK UP LEAD ACID BATTERY CHARGER £19.99

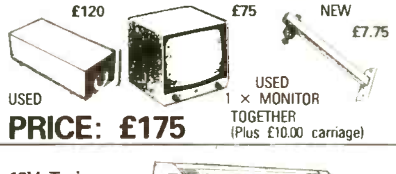
FM TRANSMITTER

Very High Quality MINIBUG — Ideal for baby alarms etc!! reception on any FM radio. Frequency: 105-109MHz FM. Power: PP3 9V battery (not included). Dimensions: 4.25" × 2.25" × 0.76". Code: S0.004

£9.99

"CLOSED CIRCUIT TELEVISION SYSTEM

1 × CAMERA £120 USED
1 × CAMERA BRACKET NEW £7.75
£75 USED 1 × MONITOR



PRICE: £175 TOGETHER (Plus £10.00 carriage)

12V Twin Fluorescent Lamp 12" Double Tubes £5.99

Attractive white fitting, ribbed perspex diffuser. On/off switch. 3ft cable. Transistorised circuitry. Keyhole fixing. 12V D.C. 8W Tubes. Dimensions: 368 × 67 × 43 mm

BT APPROVED

Master Socket (Flush)	£3.30
Master Socket (Surface)	£3.25
Secondary Socket (Flush)	£2.05
Secondary Socket (Surface)	£2.50
B.T. Cable (per metre)	15p
15 199M 4 CORE	£12.00
15 199M 6 CORE	£17.00
Line Jack Cord with Plug	£1.75
Extn. Lead 5 metres	£4.30

VISIT — VISIT

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EPROM SPECIAL
27C256-25 (Brand New)
£3 ea.
10+ £2.50 ea

p&p NOW £1.75

ORDERING: All components are brand new and to full specification. Please add £1.75 postage/packing (unless otherwise specified) to all orders. Minimum order £5.00. Either send cheque/postal order or send telephone your Access or Visa number. Official orders from schools, universities, colleges etc most welcome. (Do not forget to send for our catalogue - only £1.50 pere copy). Delivery by return on ex-stock items. All prices subject to change without notice. RETAIL shop open Mon-Sat 9.00-12. REMEMBER ALL PRICES NOW INCLUDE VAT.

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EDITOR
John A. Reddihough

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COVER PHOTO
This month's cover photograph shows the electronics inside a well-known LNB. A new series on satellite TV aerial systems starts on page 422.

Is Servicing Recession-proof?

The present recession in the UK has some unusual features. It seems for example to be affecting all regions in much the same way. In the past it has been a case of areas with industries that are already in decline suffering worst. And it seems to be affecting every type of economic activity in the UK, from manufacturing to services of all sorts. There was of course excessive growth in many service industries such as banking and property dealing during the Eighties, but that's no comfort for those who are suffering the consequences. Just what has gone on? Mainly we are suffering from the effects of a credit explosion. People in the UK have been all too ready to borrow and when the banks, building societies and stores go overboard lending more and more, with monetary deregulation adding to the excesses, there has sooner or later to come a crunch. People can't take on ever more debt servicing, while shortages begin to stoke up inflation and lead to balance of payments deficits. Asset inflation has been a major contributor to the problem. If house prices go on rising for example there's ever more collateral for loans. Lack of experience begins to play a part when booms continue for an excessive time: lenders and borrowers both tend to forget that conditions can become adverse. It would be nice if all this bother and hassle could be avoided. But it's the price one pays for credit-based economic activity. A planned economy might seem to be a neater way of going about things. But the complex nature of economic activity doesn't lend itself to neat planning, which goes haywire when the unforeseen occurs and can never move fast enough to be able to take advantage of opportunities when they arise. We just have to put up with the boom and bust cycles, though it should be possible to moderate them – there have been some awful miscalculations by the authorities.

Another feature of the present recession is that servicing has been affected to a greater extent than on previous occasions, a factor highlighted by the difficulties at Serviscope (see page 418) which is now being administered by the receivers. Traditionally servicing has tended to be recession-proof. Whatever else has happened people have had to get their cars, TVs and appliances repaired. Why are things so different this time? One can only guess at the root causes of this sort of thing, but there do seem to be a few pointers that one can identify. One factor in the consumer electronics field could be the sheer quantity of goods in people's homes. If, as is common enough, there are two, three or four TV sets in a house there's no great urgency about getting one of them repaired when it goes wrong. When it does become necessary to get something done you then come to the repair or replace question. Consumer electronic products have been sold at such competitive, i.e. low, prices in the UK that replacement is often a more sensible course of action. Right now however it's difficult enough trying to sell sets even at knock-down prices. Perhaps some organisations have been a bit too clever. Amstrad for example carried out a major push to clear surplus stocks last year, at little or no profit. Turning inventory into cash is the way it was put. You can't blame Alan Sugar for doing this. It wouldn't be sensible to sit around with warehouses full of equipment that costs a lot simply to store. To try to keep things moving is a part of economic survival. But the consequence has to be faced. How do you once more establish a sound, profitable market after such a give-away period? Well, we know part of Alan's answer, to introduce new, innovative products. But that doesn't help with trying to get a decent return on bread-and-butter lines.

People may also have been put off having repairs done by some of the silly quotations given them. We've received a number of letters on the high repair quotes given by high street outlets. Could some firms have a policy of deliberately inflating repair quotations in order to generate sales instead? It seems quite likely. There's probably nothing that many retailers would like more than a rapid move to a throw-away era. Much easier to make a profit out of a new sale than arrange to have someone's set taken to a service department where fault finding could be quite a time-consuming business ending up with a replaced transistor and a couple of dry-joints made good. What can you charge for that?

It's said that any situation, however bad, offers opportunities for some. The smaller firm able to offer a more personal service with a better technical understanding and appreciation of what can be done should be able to gain business when the larger firms are interested only in sales. But how do you manage to get your services appreciated when the larger organisations have given servicing such a bad name? You can't, as Peter Nutkins pointed out last month, rely on regular customers since the need for servicing is today so infrequent. Meanwhile ever greater costs, driven by high interest rates and business rates, hit firms of all types and sizes.

When one feels despondent about the prospects it's worth recalling that there are a lot of people out there and that they do a lot of viewing. There will always therefore be a need for TV/video repair work. Since even the newest equipment can go wrong, though this is not a common occurrence, service backup has to be maintained. The present recession has hit the servicing industry like all others, but sets will continue to require attention. Another thing that's always worth remembering is that an economic upturn inevitably occurs sooner or later. Just as excessive credit leads to a recession, the savings that are generated during the recession and the debts that are unwound eventually lead to an upswing. In the meantime it's a matter of being able to handle recessionary conditions. Let's hope that most of us manage this trick.

Letters

FORMATS AND STANDARDS

I get the impression from reading *Television* that the servicing industry simply takes whatever comes along. It's rare to see opinions expressed on the format and standards battles that are so much a part of consumer electronics.

The Beta VCR format wained in the UK because, in part, of the indifference of those involved in sales and service, certainly not for technical reasons – Sony has now ceased manufacture of the SuperBeta machine for the UK market. But I think we would all agree that a Sanyo VTC5150 is a much easier machine to work on than a Panasonic NV333 for example, while giving superior results. Then BSB collapsed and along with it virtually all hopes of a European high-definition TV system in the near future. Relevant to this is the fact that there is now only a very small market for S-VHS video recorders, as there are no high-quality broadcast signals for them to use.

We find a similar indifference to the current camcorder format battle. An article recently described copying VHS-C on VHS cassettes using a modulator! I've heard and read so much poor advice given to prospective camcorder buyers from people who should know better that I feel it's time to look at the pros and cons of the formats. It should be remembered that most users will want to edit their camcorder tapes in order to remove the shots of their feet and the sky that are inevitable with home videos.

The Video 8 format gives ninety minutes recording time at full speed (three hours at half speed) on metal tapes that last well. Technically the results compare with Beta in relation to clarity and noise, i.e. the low-band performance is good, and all machines have very good sound quality. Most video manufacturers now market Video 8 equipment, including Ferguson whose latest machine is sourced from Hitachi. All camera manufacturers back this format.

These days VHS is not such a popular camcorder format – the tapes, and hence the machines, are just too bulky. The recording time is good, but after editing the result is relatively poor VHS-VHS copies. Unless hi-fi sound is incorporated the audio quality is very poor, especially after editing. The VHS format is useful for people who know that they will not want to edit the recorded material.

The main competition to Video 8 comes from VHS-C. This does mean a small cassette, but the recording time is short. If this is increased by using half speed, the edited tape will be a half-speed VHS-VHS copy, which is not really acceptable for any but the most uncritical viewer. It suffers from the same poor-quality sound as VHS of course, but has the advantage that the tapes can be played on a normal machine by using an adaptor (or directly with a few machines). If the tape is to be edited however this is in practice of little use.

The same general comments apply with the high-band formats, except that S-VHS is not significantly inferior to Hi 8. The advantage of S-VHS-C being playable on a full-size machine is lost however since there are almost no S-VHS machines in the UK – in part due to the failure of BSB. For this reason it seems that S-VHS-C is going to have a tough battle with Hi 8, as the latter provides a longer playing time and superior sound.

So I suggest that to the extent we can influence people's purchases we should on the whole be advising selection of the 8mm formats, except where it's unlikely that editing will be done. To be brutally honest I feel that the VHS-C format could well be obsolete within a couple of years. With the present boom in camcorder sales, despite the recession, large numbers of Video 8 camcorders are finding their way into people's homes. Sales of domestic Video 8 machines will probably follow. Thus the format could replace VHS, particularly if the running time can be extended. Sony's film interests should help ensure that there will be good Video 8 software availability, and such tapes could always be played on a camcorder.

Colin McCormick,
Plymouth, Devon.

THE HITACHI G8Q CHASSIS

In his article on the Hitachi G8Q chassis (February) John Coombes described the power supply and the faults he has encountered but only touched upon the problems that arise when the posistor TH902 in the start-up circuit goes faulty. We've had many of these sets, especially the CPT2196/2198, with faults of cataclysmic proportions due to the failure, often intermittent, of TH902. If the set comes in with a blasted mains input fuse you have one of two options (I talk from experience!) – either pray or quit.

First, TH902 must be replaced with the new blue type even if it checks o.k. It's then necessary to check most of the silicon in the power supply. I recommend that the following items are checked/replaced: Q901 (BUZ71A or SGSP222), Q902 (SGSIF344), ZD901 (27V zener diode), D902 (BYD33D), D903 (BYD33J), D905 (BYD33D), D907 (BYV10-40) and D908 (BYD33D). The following must be replaced, in addition to TH902: IC901 (UC3844), C908 (470μF, 25V) and R910 (0·5Ω, 7W). Next check the print, especially around the chopper transformer: if repairs to the print are required, Hitachi recommend the use of hot-melt (part no. B975476).

If you're sure that everything is now o.k., put in a new fuse, stick your finger in your ear and (this is where the prayer may help) switch on. If the fuse goes again it's definitely time to quit, but the power supply should now work normally.

Hitachi recommend that TH902 is replaced with the new type whenever one of these sets comes in for repair. Now for the good news. The new blue type posistor can also fail with the same disastrous results. Yep, I think it's time to get into double glazing!

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

WARNING – AND A REQUEST

By now many of your readers may have had to service, or bought, Memorex, Hitachi or Panasonic portable CD players. Here's a warning to them. When the batteries begin to run down, replace them! A friend of mine has had experience of what can happen: his player literally burnt holes into the aluminium layer of three discs. What appears to happen is that the disc stops rotating but the laser doesn't switch off. This can happen at any position on the disc, and one or more tracks could be lost. For some reason it happens a lot more often with the makes mentioned. So if you do have a portable CD player make sure that you check and replace the batteries on a regular basis, or serious damage could occur to your favourite disc.

Now for a request. I recently acquired an early Pioneer laser disc player, Model PR8210, of US origin. The remote control unit is missing but I'm assured that it works all right. What I want to do is to convert the machine from

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NTSC to PAL, also to 240V operation. An isolation transformer works but is impractical for normal use. A display was obtained on a Commodore 1081 monitor, but only in monochrome. Attempts to obtain service data have so far been unsuccessful. The discs tried gave poor or no sound, so a fault may be present. Is there anyone out there who can help?
M. Wright, 7 Dundas Street,
Spennymore, Co. Durham DL16 6AS.

DEAD ALBA/SOLAVOX VCRs

We too have has the trouble Donald Bullock mentions with a completely dead Alba VCR4000X. On carrying out the modification suggested for the Solavox NVCR5000 (same chassis) the machine sprang to life and has worked since. But we are concerned because adding the 4·7kΩ resistor in the position specified effectively places a leak across the memory capacitor C821, thereby rendering the memory ineffective. Does anyone have any other ideas for curing this problem, which appears to be quite common?
Roy Robinson, Goodspeed TVS,
Fallowfield, Manchester.

I was interested in Donald Bullock's comments about the Solavox NVCR5000, having had a similar problem with the Alba VCR5000. Replacing the 5·5V back-up battery brought the display back to life, the clock etc. But the machine, a front loader, wouldn't accept a cassette. I scratched my head for an hour but got no further, so I phoned Technical Information. I was told to load the cassette by hand, then press eject. I felt that they must think I'm stupid, but having had stranger things happen to me I decided to try it. To my surprise, the machine sprang to life! I can only assume that the micro chip must get muddled and is in a lock-up state. Anyway, well done Alba.
C. Bainbridge,
Washington, Tyne and Wear.

TIMER SETTING DIFFICULTY

On the subject of VCRs that are too complex, a couple of weeks ago we sold a new Akai machine to a customer. Since then we have been back four times simply because the customer cannot set the timer correctly. After several one-hour crash courses he still presses the wrong buttons, and on one occasion wiped out the tuning memory when trying to set the timer. Gone are the days when VCRs had two buttons to set the timer — start and stop!

A small point I'd like to make in connection with Sentra and Alba VCRs is that C821, which one of your contributors describes as a "battery", is actually an 0·1F, 5·5V electrolytic capacitor.
Michael Dranfield,
Buxton, Derbyshire.

ALAN BLUMLEIN

Being a child of the thermionic age myself, I must say how much I am enjoying Harold Peters' recollections. I must however take him to task over Alan Blumlein's death in 1942. Blumlein was indeed an outstanding designer for EMI, pioneering much of the well-known timebase and deflection circuitry of the valve TV era. He was seconded to the RAF but was still an EMI employee. His death was certainly not over enemy territory.

It's inconceivable that such a prominent engineer would have been allowed to operate in an aircraft over enemy territory with a prototype airborne radar. In fact he was killed in an aircrash at Ross on Wye whilst testing the H2S prototype. Blumlein, other engineers and the complete crew were killed when their Halifax II bomber, serial number V9977, crashed into a field at 1600 on June 7th, 1942. Apparently the aircraft had caught fire at 500ft then descended into a farmer's field eight miles south west of Ross on Wye. The aircraft was used by the Telecommunication Flight Unit.

At the time TRE had moved from Orford Ness and was operating from Malvern in Worcestershire. I'm reliably informed by a member of our local aircraft preservation group that the crash site still yields Perspex fragments from the original transparent prototype (the production domes were opaque). It seems to me to be only fitting that the correct facts should be made known about an engineer who contributed so much to the evolution of real television.
Colin L. Turner,
Maidstone, Kent.

DEVELOPMENT OF RADAR

When the war stopped the World's first TV service there were only a few hundred TV receivers in use. Production lines as we know them today did not exist. So there was no swing over to RDF "at the drop of a hat" as Harold Peters suggested in Part 2 of his interesting series. Radio Direction Finding, as it was first known, started way back in 1935, on February 26th to be exact, when Robert Watson-Watts and Arnold Wilkins "borrowed" the BBC's then most powerful transmitter, operating at 49m, and with the help of a Hereford bomber (wing span 23m) observed on an early oscilloscope the movement of the blip as the receiver's output, direct from the transmitter, was varied by reflections from the bomber, thus proving the feasibility of RDF. Harry Wimpresse at the Air Ministry then took action. Within five weeks an experimental RDF station was built near Orfordness, and before long an aircraft could be detected at a range of 140 miles and at up to 30,000ft.

By 1937 a chain of RDF stations, called the "Chain Home", was started at a cost of £10m. By 1940 they were to prove decisive in the Battle of Britain. The Chain Home aerials were mounted on 360ft towers. When German bombers found that they were largely undetected if they flew in low "under the beam" Chain Home Low was evolved, with aerials much nearer the ground. The transmitters, working at 1·5m, were housed in metal cabinets that looked like commercial fish and chip fryers and were thus dubbed by their operators. They used silver-plated Lecher Bars as tuned circuits, and on a dry day a maximum of 25kV could be used. In more humid conditions however they would often spark over at 15kV!

As might be expected, the Americans became involved. They called RDF radar (radio aids for direction and range) and we eventually followed suit. By the end of 1941 1·5m radar was being used in aircraft for the Battle of the Atlantic. It was rather crude and was really successful only in good weather. What was needed was a new radar at a much higher frequency. Scientists suggested that 3GHz, or 10cm, would be the best option. The only device capable of oscillation at this frequency was the klystron, but it provided far too little power. At Birmingham University Professor Oliphant and a brilliant team of boffins had been working on this problem. The result was that John Randal (later Sir John) and Harry Boot invented the resonant cavity magnetron. The significance of this brilliant invention is undenied, but their names have never been given the publicity they deserve.

On February 21st, 1940, using all sorts of bits and pieces including a large electromagnet, they finally switched on their "device" and cranked the e.h.t. up to 10-15kV. As there were no instruments to measure the frequency they resorted to an open pair of transmission lines across which they slid a car light bulb. By measuring when it lit and extinguished they found that the wavelength was 9·8cm: there was plenty of power, because the bulb eventually burnt out!

By the end of 1941 magnetrons were fitted to corvettes on escort duty in the Atlantic. The 10cm dipoles were turned by hand and were hidden in a lantern-like structure. This proved decisive, as submarines were detected with far greater accuracy. By 1942 magnetrons were being used in aircraft, with a rotating scanner angled towards the ground, feeding a plan position indicator (PPI). This provided a picture of the ground over which the aircraft was flying. It proved to be a marvellous navigational and bombing aid, especially in ten-tenths cloud. I'm surprised that you fell for the hoary old joke that H2S was so called because "them upstairs" said "it stinks": H2 was the mode in which it worked and S was the frequency band!

By this time the Germans had a 50cm radar (but no magnetrons). It was vulnerable to "window" – 25cm lengths of aluminium foil showered from an aircraft. Now called "chaff", this is still used today. The only way of countering its effect is to change frequency.

AR3D, our latest radar, called The Martello, has a planar aerial array with 40 elements, each element housing 64 aerials. This adds up to 2,500 aerials which can be combined in various ways to overcome interference. It's equivalent to having 40 separate radars, so that if one breaks down it falls soft, i.e. the other 39 carry on. AR3D can detect the nose cone of a missile travelling at 2,500 m.p.h., and can pass the information to an aircraft or missile battery – it can even fire the weapons on either if required. For the future, solar-powered radars with no moving parts and a range of 300 miles, linked to others around the country, are envisaged. Radar was first switched on in 1938: it's still going strong today.

John S. Yerbury.
Hathersage, Derbyshire.

EARLY ELECTRICAL SUPPLIES

I've been following Harold Peters' series on life in the radio and TV trade with great pleasure. Just one small comment however, on the use of two-pin plugs for radio and TV receivers. This wasn't because 13A plugs hadn't been invented (three-pin plugs with earthing conductors had been in use from the very early days of electricity in the home) but because at one time most of the numerous independent supply undertakings operated two tariffs, one for power circuits and another for lighting. Electricity supplied for power was much cheaper than that for lighting, so strict rules applied as to the minimum wattage that could be used with the former. The figure varied from place to place, but was commonly about 500W. Hence the widespread use of BC adaptors for small appliances such as smoothing irons, soldering irons, even bowl fires, as well as radio etc. equipment. In the Thirties and Forties it became common practice for electricians wiring new houses to install at least one two-pin socket rated at 5A and connected into the lighting circuit, usually in the living room, to comply with the regulations. My late father-in-

law's house still has one of these – it's connected to a 1940 Marconi radio bought when he moved into the house that year! When the electricity industry was nationalised the two-tariff scheme was gradually scrapped, but a corollary reappeared later when it was forbidden for some time to use anything but storage radiators and water-heaters on cheap off-peak electricity.
Chas E. Miller,
Woodseaves, Staffs.

TESTING INFRA-RED HANDSETS

Here's a simple method of testing infra-red handsets that operate at about 450kHz. A radio receiver placed nearby, tuned to the low-frequency end of the medium-wave band, enables the various pulse train tones to be heard, giving immediate indication of keypad contact or i.c./ceramic resonator faults without the need to take the back off.
G. Cox,
Bexhill-on-Sea, East Sussex.

The simple answer to checking remote-control handsets is to use a cheapo long-wave radio. Sus out where the ferrite-rod aerial is, get your handset, and press any button. This works best at around 170kHz, up to four inches from the aerial.
John S., Romers of Rishton,
Blackburn, Lancs.

LAMP EFFECT

Quite by accident I recently came across a problem I'd not encountered before. It may be of interest to other readers. Apart from other machines I have a Ferguson 3V32. It started to give slurred sound with music, mostly at the slow speed, so I naturally assumed that a new pinch roller and a clean up were required. I removed the cover, then the metal cover over the mechanism and the cover over the audio-control head and inserted a 180 tape. Apart from slurring, everything worked all right mechanically. For some reason I then inserted a 120 tape. The machine kept rolling in spurts and after a while rejected the tape.

"Blast" I thought, I've found another fault. The same thing happened when another 120 tape was tried. Put in a 180 and everything was o.k. I checked everything, getting nowhere until I accidentally moved the 40W bulb that hung over the machine. That was the cause of the trouble! There was no problem with a lower wattage bulb. With a higher wattage bulb the light seeped through the tape housing and activated the sensor, creating the "fault".

I wonder how many engineers have had a problem like this and didn't realise that the lamp over the bench was the cause of the trouble?
Monty Alter,
London N15.

STATIC SHOCKS FROM TV SETS

Sandy Hewat (Letters, February) asks for an explanation of the static shocks that can occur with TV sets. The c.r.t. is a large capacitor that can retain its charge for some hours after the set has been switched off, and all electronic people will know about the capacitor left on the bench for fun. Being in electronics rather than the TV trade I don't get this trouble because the monitors I work on have a large encapsulated resistor to earth connected to the e.h.t. lead so that the charge leaks away. I would suggest the use of a special socket with all the pins connected together via large-value resistors. On disconnecting the set from the mains the plug is inserted in the safety socket straight away. Thus no shock will occur because the circuit has been discharged.
Andrew Stuart,
Devizes, Wilts.

YAMAHA'S REVOLUTIONARY CONCEPT

Just recently while working on a Sansui PC-V100 CD player (Yamaha CDX2 in disguise) I noticed in the CDX2 service manual something that will revolutionise electronics as we know it. It seems that Yamaha can make i.c.s work without electricity! To see what I mean, get hold of a CDX2 service manual and turn to page 28. Look at the top left-hand corner of this page. There you will see a diagram showing the internal works of IC403. The pin connections are all given, but there's no VCC supply. So the chip works without any power?! The Sansui manual shows the same situation, near the back. Is this the future of electronics? No power supplies!
P.J. Roberts,
Fishponds, Bristol.

HELP WANTED

Can anyone supply a second-hand or new line output transformer for an Amstrad CTV1600, also a circuit diagram for the Waltham W130? All expenses would be met.
Robert Cox, 35 South Vennel,
Lanark, Strathclyde.
Telephone 0555 65744.

Can anyone supply a circuit diagram for the Advance OS15 oscilloscope?
Gordon Skelhorn, 386 Loughborough Road,
West Bridgford, Nottingham NG2 7FD.

Can anyone sell me a complete i.f./chroma panel for the Sony KV2000 Mk.II? The last owner twiddled the present one so much that it's beyond repair!
Bernard Hunt, 7 Little Hereford Street,
Bromyard, Herefordshire HR7 4DE.
Telephone 0885 482702.

Can anyone supply me with a service manual or any technical information on a Dynastar satellite receiver Model DS330EK – it was also marketed as the Orbital OS330EK and was manufactured by the EFA Corporation in Taiwan. If there's a UK distributor this might be a starting point.
Eamonn Galvin, Ballygroman Upper,
Ovens, Co. Cork, Ireland.
Telephone 021 331208.

Can anyone help with the circuit diagram for a Marantz SD152 cassette machine?
D. Long, 15 Wellholme,
Brighouse, Yorks HD6 4AF.

I am trying to obtain an on/off/volume/tone/balance control for a Galileo WE4500 car radio/cassette but have been unable to locate a source of spares. Can any reader help?
Paul Hardy, 43 Sheridan Avenue,
Cavenham, Reading, Berks RG4 7QB.
Telephone 0734 475869.

Adding NICAM Stereo Sound

Keith Cummins

Inspired by Eugene Trundle's series of articles on Nicam stereo sound, and tempted by Maplin's advertisement, I decided to take the plunge and add Nicam to my own TV receiver. My current set is a Sony KVX2521U, which has dual audio channels and spatial/pseudo-stereo facilities but no Nicam. Before the addition of Nicam I had already connected to the set a pair of separate forward-facing speakers which sound much better than its internal ones.

Planning

A considerable amount of thought and roughing out of ideas was undertaken before I even ordered the parts required. Since I've been out of the TV trade for many years my TV activities are now restricted to hobby interests and fixing the odd set for friends and relations. As a result I was not in the position to have the set out of service for a prolonged period and decided to install the Nicam decoder as a separate add-on unit which would be interfaced with the receiver during a "quick-hit" operation – it actually took one hour from taking the back off to having the pleasure of hearing Nicam sound. But I stress again that this was made possible only as a result of the lengthy initial deliberations in my workshop.

Once the decision to have the decoder as a separate unit is made several potentially difficult problems go away. First you don't have to find a location for the decoder within the set, where it might cause or be subject to interference from other circuits such as the timebases. Secondly there's no need to drill holes in the front of the set to accommodate LEDs. Thirdly if you dispose of the set you can keep the decoder. Fourthly the decoder can have an independent power supply (more on this later). And fifthly the modifications to the receiver can be kept to an absolute minimum and are quick and easy.

Warnings

A warning is necessary at the start. The type of modification outlined in this article is suitable only when the TV set involved has an isolated and earthed chassis. In its literature on the decoder Maplin expresses particular concern about the possibility of people making direct connections, and recommends that qualified TV personnel are consulted before doing so. Maplin also makes the point that certain SAW filters may remove the Nicam carrier. I think one would have to be particularly unlucky for this to happen however, especially as the decoder has an input sensitivity of 100μV r.m.s. At the output of a typical video demodulator chip the signal amplitude can be 2V peak-to-peak, so the -20dB Nicam signal can be a further -56dB down and still be sufficient to drive the decoder. If this problem does arise however a separate decoder can still be used with another set, so you won't have wasted hours building one into an unsuitable receiver. This is another good reason for adopting the "add-on" approach.

Description

The decoder unit is shown in the accompanying photographs. There are three LEDs on its front face: f.m. (i.e. non-Nicam), Nicam and stereo. The stereo one is green, the others being red. Apart from labelling there's nothing else – there are no controls. The rear of the unit has a mains input lead, a five-pin DIN interfacing socket for the audio and control functions, a BNC connector for the Nicam carrier input and two phono plugs that provide left and right outputs for a separate hi-fi system. The Maplin decoder – I chose to buy mine assembled and tested – is inside the unit along with a small power supply to provide the 12V/200mA required by the decoder. A control line from the TV set switches the power supply on and off. The lot is assembled in an instrument case measuring 200mm wide, 75mm high and 150mm deep. It can sit inconspicuously next to the TV set.

Now for a bit about the decoder. Maplin provide comprehensive information with it – you'll get a good photocopy when you buy the decoder. When presented with a Nicam signal the decoder produces left and right audio outputs. With no Nicam signal present the unit reverts to the normal f.m. sound condition: the audio signal from the TV set's f.m. discriminator is routed through the decoder, emerging as a dual mono signal. The LEDs are provided with drive signals so that the unit's status can be readily observed.

Power Arrangements

You might wonder why I bothered to build a separate power supply when it might by possible to obtain the decoder's power from within the TV set. My reason for doing so was to ensure that the extra 200mA required by the decoder didn't overload a 12V supply within the receiver or perhaps damage a switch-mode power supply within the set by imposing an extra load that it wasn't designed to accept. I did however feel that the risk when draining an extra 50 to 60mA to operate a control relay was minimal. So a 12V feed within the TV set energises a relay which then turns on the separate power supply.

Interconnections

Fig.1 shows the interconnecting circuitry within the add-on unit. There are two connectors for coupling to the TV set. These are SK1, the Nicam carrier input, and SK2 which provides the control and audio interface. We'll consider SK2 first. Pin 2 is the system earth (chassis connection). When the TV set is switched on 12V is

The Nicam stereo decoder unit sits inconspicuously beside the main receiver.

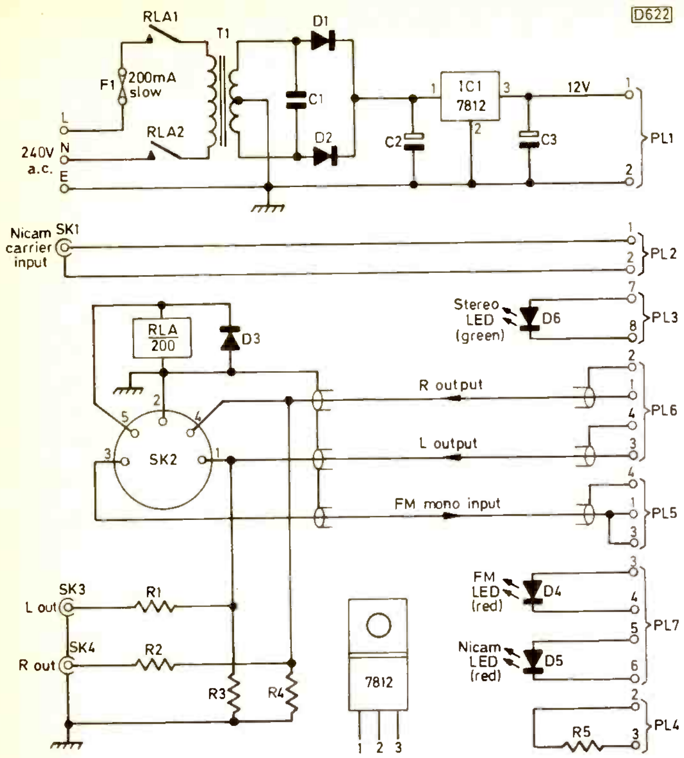


Fig. 1: Nicam decoder unit, wiring of instrument case peripherals. Maplin decoder connections on the right: pins not shown aren't connected.

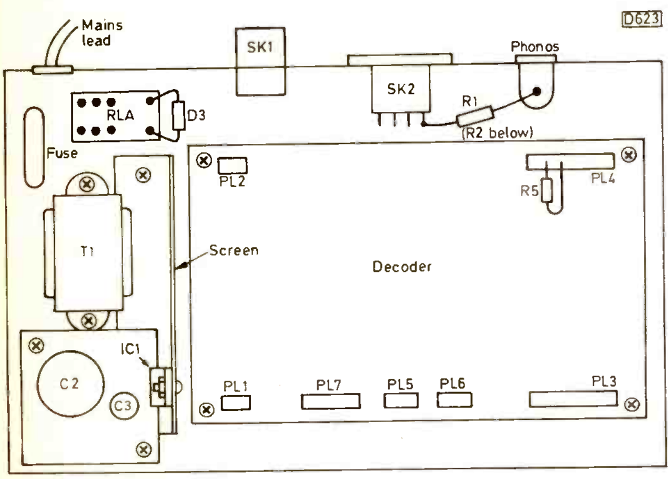


Fig. 2: Basic layout in the instrument case, wiring detail not shown. LEDs are fitted to the front where appropriate.

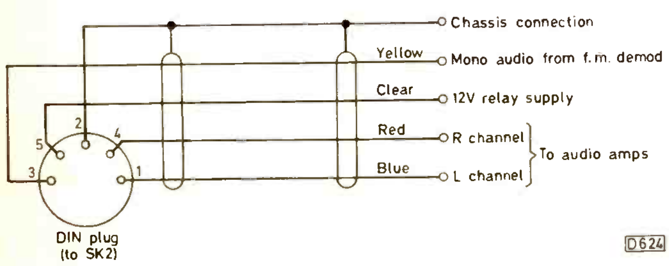


Fig. 3: Details of the 5-pin interfacing DIN plug and lead.

present at pin 5. Thus current flows through the relay's winding and its contacts close, switching on the separate power supply. Mono audio from the TV set's f.m. discriminator is fed to the decoder via pin 3. Outputs from the decoder to drive left and right audio channels within the TV set are fed via pins 1 and 4. These outputs are also fed to sockets SK3 and SK4 which provide left and right signals for a hi-fi system, tape recorder etc. R1 and R2 are included to prevent accidental shorts from other equipment loading the decoder's outputs. Note that the decoder's outputs are at a low impedance, terminated by R3 and R4 – this, along with the 1V r.m.s. output, helps to keep the level of hum and other extraneous noise low. The decoder's output operational amplifiers are used whether the unit is decoding Nicam or has reverted to the f.m. mono mode, so the unit must be powered whether or not Nicam is being received.

The indicators operate on the basis of a simple logic. If it's not Nicam, it must be f.m., i.e./Nicam = f.m. Thus with the power relay energised but no other input the f.m. LED lights.

The Nicam carrier is fed directly to the decoder PCB via the BNC connector SK1.

Power Supply Circuit

The 240V a.c. mains input is connected via a conventional mains lead. The live side of the supply is taken to fuse F1 which is live whether or not the unit is switched on. When relay RLA is energised the mains input is connected to the primary winding of transformer T1. Its secondary winding supplies 15-0-15V at 250mA to the full-wave rectifier diodes D1/2 which charge the reservoir capacitor C2. The output from this simple rectifier circuit is fed to pin 1 of the 7812 12V regulator chip. C1 is included to provide protection against transients and r.f. noise.

Construction

Construction of the unit is straightforward. Fig. 2 shows the layout adopted. All I did was to position the major components on the chassis of the instrument case and mark out the hole positions using the transformer, decoder PCB etc. as their own templates. The relay is mounted on its head, secured to the chassis by double-sided tape. A hole is drilled at either side to enable a cable tie to be passed through the chassis and around the relay. A right-angled screen is mounted between the power supply and the decoder PCB, serving also as a heatsink for IC1. The power supply components on the secondary side of T1 are mounted on a piece of Veroboard which is bolted to, but spaced away from, the chassis plate.

The layout shown gives, I believe, the best arrangement of the connectors on the decoder PCB relative to the peripheral connections, LEDs etc. so that the wiring is neat and straightforward – follow Fig.1. As I consider that this project is one for experienced people only it's not necessary to provide details of every last nut and bolt. It should however be pointed out that to comply with IEC regulations a clearance of 3mm must be provided between mains connections and other metal parts.

Before starting work on the TV set it's a good idea to make up the leads that connect to SK1 and SK2. Coaxial cable is used for the former and, as shown in Fig.3, screened four-core lead for the latter. Colour coding is a matter of choice – that shown is in accordance with the cable I happened to have.

Receiver Modifications

The following points should be borne in mind when considering the modifications to be made to the TV receiver.

The original mono feed to the left and right channels (assuming that the set has left and right channels with a mono input – if not you'll have to use the left and right phono outputs) has to be disconnected and the two

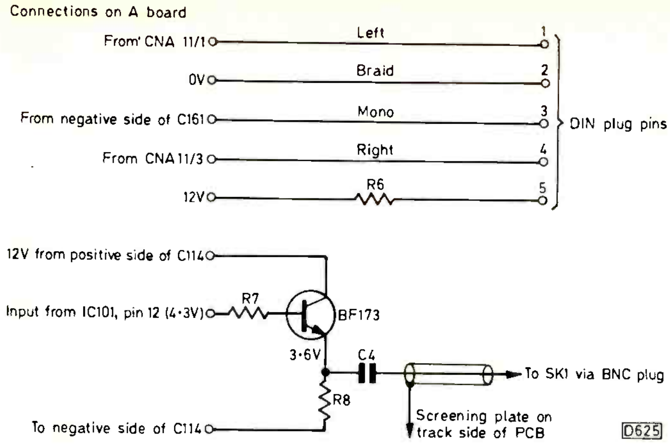


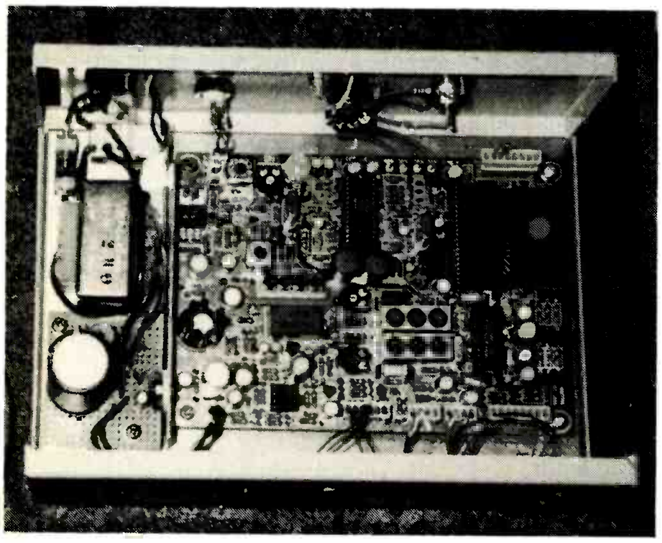
Fig. 4: Interfacing at board A in the Sony Model KVX2521U, including the Nicam take-off buffer stage.

channel inputs split. Where these were previously connected together they have to be connected individually to the interface lead. The braid has to be connected to chassis nearby and a source of 12V for the mains switching relay has to be found. It's probably a good idea to connect a resistor (I used 33Ω) in series with the 12V feed to provide a degree of current limiting in the event of a short-circuit occurring on this line. This is illustrated in Fig. 4. Because of the increased length of the connection, it's useful to take the output from the set's f.m. demodulator via a buffer stage – the Sony KVX2521U already has one (Q112). With this particular set all the modifications are done on the A board. Remove it from the receiver, locate connector CNA11 and remove the wire link connecting the tracks that go to pins 1 and 3 (1 is left and 3 the right channel). Connect the left and right feeds from the interfacing cable to the two vacated holes in CNA11. Disconnect the negative end of C161 from board A and connect it to the interfacing cable's mono feed. Attach a 33Ω, 0.3W resistor to the relay line and connect its other end to 12V (the feed in this case comes from L101 via JW108). Tie the braid to chassis by attaching a stiff wire and soldering it into an unused earth track hole.

Extracting the Nicam carrier requires caution. Demodulated luminance and chrominance plus the f.m. and Nicam carriers appear at pin 12 of the TDA3541 chip IC101 in the Sony KVX2521U. From here the video signals and the intercarrier f.m. signal are routed to their separate circuits. Because filters are incorporated in these feeds it's not possible to tap the Nicam signal from a later point in the circuitry, but direct connection of a coaxial cable for the Nicam signal take-off to this point would upset things due to the cable's capacitance. So an emitter-follower buffer stage is required.

I used a BF173 transistor for this purpose. The circuit, shown in Fig. 4, is wired on the back of board A, immediately adjacent to IC101. PVC tape is laid on the PCB between the transistor and the tracks, and also on the inside of the screening plate which has to be removed to fit these components. The screening plate has holes, which enable the lead from the 1nF coupling capacitor to be fed through and soldered to the inner coaxial cable conductor – the outer is connected to the screening plate.

When the above work has been carried out, judicious use of cable ties will provide mechanical stability. By enlarging the aerial connector hole in the cabinet the cables can be brought out to the decoder unit.



Interior view of the unit, showing the Maplin decoder board and the peripheral components and wiring.

Adjustments

Some simple decoder setting up has to be done before the job is complete. Monitor TP1 and check the amplitude of the 6.552MHz carrier. Peak T1 and T2, then adjust RV1 for approximately 200mV peak-to-peak on a calibrated scope. While receiving a Nicam signal set the volume to a sensible level then unplug the carrier feed at SK1. The decoder will then revert to f.m. Set RV2 (right) and RV3 (left) to obtain the same subjective volume level. You may find that there is a tendency for the Nicam sound to crackle on certain captions. This can be cured by stagger-tuning T1 and T2 – one turn clockwise with T1 and one turn anti-clockwise with T2. This ensures that there is adequate bandwidth prior to the Nicam bandpass filter.

In Conclusion

While this article has dealt with modifying a specific receiver, I've no doubt that those with adequate experience would have little difficulty in tailoring the interfacing arrangements to suit other sets. Static precautions should be carefully followed, especially when handling the decoder.

Component details

Nicam stereo decoder, Maplin part no. AM00
Mains relay, Maplin part no. YX98
Mains transformer, 15-0-15V, 250mA, Maplin part no. YN17
7812 12V regulator

R1 2·2kΩ	C1 0·1μF, 100V
R2 2·2kΩ	C2 2,200μF, 25V, radial leads
R3 1kΩ	C3 10μF, 25V, radial leads
R4 1kΩ	C4 1nF, 100V, polystyrene
R5 1kΩ	D1 1N4002
R6 33Ω	D2 1N4002
R7 47Ω	D3 1N4002
R8 470Ω	F1 200mA, 20mm, slow

All 0·3W
LEDs are included as part of the decoder kit, along with a mating plug kit for the connectors
Instrument case 200 × 75 × 150mm
5-pin 180° DIN plug and socket
BNC plug and socket
Aluminium for heatsink
20mm fuse carrier
Grommet for mains lead
Nuts, bolts and washers, M3 size
Screened cable, coaxial cable, mains lead, equipment wire etc. Cable ties, PVC tape, labelling tape etc.

What a Life

Donald Bullock

When I first settled here years ago it was a quiet village. Then houses went up on odd scraps of land we'd scarcely noticed, and a field of grazing cattle gave way to a whole estate. Others followed, and finally the old dog track became a jungle of chimney pots. These extra people have brought trade of course, but it's of a different kind. There's a world of difference between the original villagers and those who now outnumber them.

Recently, as I was settling to my evening meal, there was a knock on the door. A Mr. Trubbel had brought an Hitachi CPT2218 (NP81CQ chassis) along for repair. He said that it had expired with a bang, that he wasn't on the phone and that he'd call next evening for a progress report.

Next day I found that the mains fuse had blown. Also that pin 6 of the chopper transformer was surrounded by a small, carbonised crater. I scraped it clean and reconnected pin 6, which feeds the h.t. rectifier, using a wire bridge. After replacing the fuse I switched on. It went again and I now found that the STK441 chopper chip, which I'd not encountered before, read oddly. It looks like a BU208, with three legs. An order for one was placed by telephone and credit card and the set was then put to one side.

I next picked up a Sony KV2204. It's a model that frightens me rather less than other Sonys. The set was dead with a blown mains fuse. Checks showed that the bridge rectifier diodes were all right. So were the transistors until I got to the BU500 chopper Q605 which was short-circuit all round. I replaced it and, after checking around a bit, switched on. The transistor and fuse both went. As I couldn't find anything else amiss in the power supply I rang Jim Woods. He works for a firm with the unusual name of Duck, Son and Pinker. They're Sony dealers, and Jim is their technical wizard.

"Try R627 (0.68Ω, 1W) in the protection circuit" he said. "It sometimes fails and causes the trouble you're having."

So I did. It was open-circuit. I replaced it and the other blown components and switched on. Up they all went again.

I counted my BU500s and thought about it all. Was I being intimidated because it was a Sony – I find these sets inscrutable. What would I be doing if it was any other make of set? I'd check the line output transistor, wouldn't I? It was dead short of course. What a silly goose I'd been!

That evening, just as I'd picked up my knife and fork, Mr. Trubbel presented himself at the door. I told him I'd ordered a replacement STK441 chip and expected it to arrive tomorrow.

"It's taking longer than I'd hoped" he said.

It arrived the next day and I fitted it. Before switching on I checked the nearby transistor Q901 in the overload protection circuit. It had gone short-circuit. As I had one (a 2SD787) I fitted it. I also discovered that R904 (82kΩ) in the bias network had gone high in value. So this was also replaced. I then muttered a short prayer and switched on, to be greeted by a bang and a wisp of pretty blue smoke. I pondered on whether to invest in a manual but instead decided to order another chip and some more transistors. Before doing so I had a further look at the circuitry and saw a couple of zener diodes, D901/2. They were both short-circuit. I could see that D901 was a 2·7V device but couldn't make out the value of the other one.

When Mr. Trubbel called at the expected time I gave him a progress report. He drew himself up like a Prussian drillmaster and told me that the last people who'd mended it had taken only an hour. I was to understand that he wanted the set the following evening.

Next day the spares arrived and I fitted them. I also discovered that the other zener diode was a 33V device. I didn't have this value in stock, nor could I make it up precisely. So another order was required. Remembering the Sony set I also checked the line output transistor, which was dead short. After replacing it I put the set aside to await the other spares.

I then put a Tatung VCR on the bench. It had ceased to work when its owner's son had put money in its mouth. It's similar to the Akai VS205EK. A manual would be required. Meanwhile I took a look at the power supply circuit, armed only with prejudice and suspicion. Some fusible resistors, FR309, FR310 and FR323, were all open-circuit. The 33V zener diode D304 was short-circuit and transistor Tr301 had failed. After replacing these items I switched on and the machine came to life. While it plays back perfectly however it doesn't record or erase – though its display says that it does. I put it aside to await the manual.

That evening Mr. Trubbel called again and I told him that the set was (I thought) ready but for one diode.

"Can you guarantee that once it's been fitted the repair will be finished?"

"No technician can be 100 per cent sure until the spares are fitted and the set actually works" I explained, "but I can't see why not."

"Let me see the set" he demanded, thinking perhaps that I hadn't even started on it. So I walked him to the workshop and showed him his set, which was still on the workbench. He looked it over carefully, taking his time, then left saying he'd call next evening.

Twenty minutes later his wife arrived. She said the set was hers, not her husband's, and that he'd seen a scratch on it. I took her to the workshop where she peered around an area near its top aside. She pointed to a tiny blemish on the cabinet.

The next day the bits arrived and after fitting them the set at last came to life. But there was no sound. I concluded that the TDA1035S sound chip had suffered during the initial arcing and ordered another one.

Mr. Trubbel turned up that evening, heard the news and told me that unlike his former repairman I was both incapable and slow. He asked me how long I'd been mending sets and whether it would definitely be finished next day. I told him for thirty five years and that I hoped so.

Next day the new TDA1035S restored the sound. I reassembled the set, gave it a polish, left it working on the bench and awaited his call.

When he came he looked the set over and said he could still make out the scratch.

"Perhaps you did it whilst bringing the set in your car" I suggested.

"Not me" he replied, "I'm a very careful person. What are you going to do about it?"

I sighed. I'd have done almost anything to see the back of Mr. Trubbel. So I offered to reduce his bill.

"No" he said. "I'll pay the full bill, but I want the cabinet restored. Can't you fit a new one?"

"This set is ten years old" I pointed out. "I'll get a polisher to attend to it."

I did. That was weeks ago. Mr. Trubbel still hasn't returned.

VCR Clinic

Reports from Philip Blundell, AMIEIE, Ian Bowden, Richard Flowerday, Jeff Herbert, Stephen Leatherbarrow, Eugene Trundle, Ed Rowland and Alfred Damp

Philips VR6180

There was no cassette lift operation. When a cassette was inserted the system controller sensed the switch but the motor wasn't energised. The supply to the control motor was missing as R3002 and R3003 were open-circuit. **P.B.**

Grundig VS440

The display showed A0 but the customer hadn't set the child lock. Now this is often caused by a flat memory battery with the VS500 range, but the VS440 doesn't have one. I cleared the child lock and gave the machine a test. It would tune in but wouldn't memorise. There was a faulty RAM in the tuner, so a new tuner was required. **P.B.**

Philips VR6180

This machine kept ejecting the cassette when play was selected. The cause of this was that the head drum didn't spin fast enough. When it was rotated by hand it seemed to be slightly stiff and a faint scraping noise could be heard. Someone had disturbed the drum and hadn't used the mylar spacers to set the gap between its upper and lower sections. Normal operation was restored when this was done.

New Philips video heads come with a fitting kit that consists of the following items. (1) A plastic holder so that the head can be fitted without getting finger marks on it. This holder has a plastic rod that locates in the lower drum to align the head position. (2) A plastic spring-loaded rivet that fits through a hole to set the drum motor position with respect to the lower drum. (3) Two transparent mylar shims to set the gap between the upper and lower drums. The fitting kit can be removed when the head fixing screw is secure. Keep it in the workshop so that you can swap heads between machines if necessary. **P.B.**

Panasonic NV370

The complaint was that this machine wouldn't do anything except load and eject a tape. The digital tape counter showed a flashing d, indicating the dew condition. There was a high on the dew input pin (23) of the microcomputer chip IC6001, and voltages that would give this result were present around the operational amplifier chip IC6004 that acts as a comparator. The reference signal at the inverting input (pin 6) was 0·375V while 0·83V was present at the non-inverting input (pin 5). The dew sensor is connected from pin 5 to chassis and is the lower half of a potential divider. We found that there was 0·83V at both sensor connections as the earthing screw on the small connection PCB, to which the sensor is connected, was loose. When the screw was tightened the voltage at pin 5 of IC6004 dropped to 0·007V and the machine worked normally. **I.B.**

Ferguson 3V59/JVC HRD180

The customer reported that the "time remaining" function didn't work. We found that there were just dashes in the display when the machine was put into play and the function was selected. So we waited for it to calculate from the two reel speeds and display the results, but nothing happened. We knew that the take-up sensor was o.k. otherwise the machine would have cut out. So we checked the supply sensor input to the syscon chip IC601 (pin 35). There was no high/low cyclic change, just a steady high level. A check was then made, with the bottom cover removed, at the sensor's output connection. There was a high/low switching output here, and within a few seconds a time remaining display. The cause of the fault was a loose earthing screw – the one that earths the optocoupler's LED and opto-transistor emitter connections. The pressure we'd applied when connecting a meter to its output was enough to re-establish the earth connection. **I.B.**

Panasonic NV-MC20

This machine came in with a tape stuck inside it. When it was powered the tape wound for a few seconds then the machine switched off. With the right-hand cover removed we saw that the tape was nearly fully threaded. The outlet guide assembly was slightly back from its end stop while the inlet roller guide was up against its stop. We removed the tape and powered the unit. The loading rings tried to move, but something was jamming them. The cause of this was the inlet guide itself. When the guide assembly moves forward to thread the tape, the slant guide follows the roller guide along the guide runners. As the roller guide reaches its end stop the assembly pivots around and the slant guide moves anticlockwise from behind the roller to alongside it. The problem was that during unloading the slant guide end of the assembly was catching on a rough spot on the aluminium stopper base as it pivoted clockwise, jamming the loading rings. Normal operation was restored when the V-stopper base and the shaft-holder S1 unit (inlet guide base) had been replaced and lubricated with a suitable grease. **I.B.**

Pioneer VR727/Philips VR6870

This machine's power supply was tripping. It's apparently a clone of the Philips VR6870. On investigation we found that all the power supply outputs were low but went back to normal when connector M8, the power supply output plug, was removed. Fitting another power supply from a working machine proved that the fault was in the power supply. The cause was eventually traced to C2011 which was open-circuit. It's on the vertically-mounted switch-mode power supply control board, within the power supply can. The manual lists the value as 10μF, but 33μF was fitted in the machine. We've had this fault on several machines now, so beware! **R.F.**

Hitachi VT120

The drum motor would start when play or record was selected but as soon as the tape was laced up it would slow down and eventually stop. The machine then unlaced and switched itself to standby. On many VCRs with digital servos the 4·43MHz chroma subcarrier oscillator signal is used as a servo reference/clock signal. On this machine it was missing. Replacing the HT4539B hybrid chip solved the problem, restoring the 4·43MHz signal at pin 27. **R.F.**

Samsung VI710/711/730

No sound erase or record is a common problem with these machines. The cause of course is failure of the bias oscillator, which is contained in a can on the top board to the right of the deck. The transistor within the "osc. block" (part no. 62429-014-122) appears to be underrated. Samsung now supply a different transistor, type 2SC1008. The 6·8kΩ resistor alongside it is changed to 12kΩ with this type of transistor. **S.L.**

Samsung VI710

This machine was dead with no d.c. at pin 4 of the STK5333 regulator chip. The cause was that R102 was open-circuit. We've also had failure of the chip. **S.L.**

Ferguson 3V30/JVC HR7300

These machines just go on and on. This particular example came in with F4 (2·5AT) blown and no rewind or fast forward. Q16 turned out to be short-circuit. **S.L.**

Sharp VC381

The E-E signal continued to be displayed in the playback mode and the video light didn't come on as it should. The reason for this was that the PLBK 12V line was not present, the cause being Q806 (2SA950). It's on the bottom syscon/servo board, at front centre. **S.L.**

Saisho VR3700

The E-E picture drifted in and out of tune because the varicap tuning voltage continually varied. Sometimes the tuning line to the tuner would disappear completely for a few seconds. R6115, a 33kΩ resistor feeding the digital-to-analogue converter transistor, was going open-circuit intermittently. **J.H.**

JVC HRD830

The reported fault was no Nicam sound. To our horror this proved to be the case. The f.m. sound was normal, but when the machine switched to Nicam the result was no sound at all. Circuit protector CP1 N10 had failed due to an internal short in the M65109BSP microcomputer chip. Replacing both items restored the Nicam sound. **J.H.**

JVC HRS5000

The fault with this machine was muted E-E and playback video. When we attempted to tune it the channel display would revert to number one after a few seconds. In all modes pin 13 of IC3 was high at 5V due to a dry-joint. Putting this right restored the playback video but there were still no E-E signals. After tracing the picture mute line back to the tuner control PCB we found that pin 23 of the M50445-398SP tuning and channel change microcomputer chip IC1 remained high at all times. Replacing this chip restored everything to normal. **J.H.**

JVC HRD755

Although the symptom with this machine was a common one its cause was very unusual – in our experience anyway. In play or record the machine would run for a few seconds then revert to stop. During the short running period the head drum, capstan and take-up reel all turned. The supply spool didn't! It had a lot of slack tape on it, and before this had been taken up the lack of rotation sensor pulses put the syscon into the shutdown mode.

Why was there this slack tape on the supply spool? During the lace-up phase the left-hand guide hit a tight spot in its curved slot and momentarily stopped. The guide-pulling spring on the loading ring stretched to its limit, then the guide jerked forward into its locating slot, snatching at the supply spool so that it span clockwise. As a result of this several centimetres of tape lay slack on the reel. The cause of the loading-slot fault was distortion of the plastic loading guide (groove liner) where its fixing screw had been tightened down excessively.

This can happen with any model that uses the same sort of deck. But unless the machine has a supply-spool rotation sensor it will work all right in the record and playback modes, the only symptom being a clunk and a twang during lace-up. **E.T.**

Panasonic NV-MS1

This camcorder's auto-focus didn't work, though the lens rotated freely and the motor-driven zoom function was o.k. The AF5V switch transistor Q602 had an open-circuit collector, as a result of which the 12V supply to the AF5V regulator IC603 was cut off. I got of lightly this time – have you seen the auto-focus circuit used in this model?! It occupies the best part of a square foot of the tightly packed circuit diagram in the manual. **E.T.**

Logic VR950

A hum bar on E-E, record and playback was the result of C6 (2,200μF) having fallen in value. It's in the power supply. **E.R.**

Saisho VR3600Z/Matsui VR755A

The display lit but when the function button was pressed the operate light failed to come on and there were no functions. Voltage checks around the STK5332 regulator chip IC501 showed that the 5V that should have been present at pin 1 was missing. A replacement i.c. restored normal operation. **E.R.**

Ferguson 3V35/JVC HRD120

This machine came in with a tape threaded up and the loading arms in the V blocks. We unlaced the tape manually then inserted another cassette. On pressing play we could see that the loading cycle was not being completed. A new loading belt failed to improve matters however. After a check on the after-load switch we ensured that the gears ran freely then suspected the loading motor. Replacing this cured the fault. Incidentally the motor used in the earlier 3V29 is identical to the one used in this model. **E.R.**

Ferguson 3V54

This machine's head drum rotated clockwise. As we had a loan machine of the same type to hand the drum and motor drive amplifier were swapped over. This proved that the fault was on the main board, where we found that D408 was short-circuit. **A.D.**

Hitachi VT220

This machine wouldn't switch on. The syscon didn't receive data from the timer, though the operate button produced the correct results at the timer chip. Further checks around this chip showed that it wasn't receiving data from the search-tuning board. Replacement of the search-tuning chip brought the machine back from the dead. **A.D.**

Teletopics

THOMSON'S SPACE AGE SET

Although there are no high-definition TV transmissions in Europe at present Thomson Consumer Electronics (TCE) has unveiled a set capable of HD-TV operation. It has a 34in., 16:9 aspect ratio tube and produces a 1,250-line picture. The current 625-line transmissions are converted to 1,250 lines. Converted 4:3 pictures can be expanded horizontally and vertically to fill the screen, with no noticeable distortion and surprisingly little clipping of the picture, or the 4:3 aspect ratio can be retained with the picture to one side of the screen and the remaining section filled with three picture-in-picture displays. Film broadcast in Cinemascope style (with black areas at the top and bottom) can be expanded to fill the screen with only slight loss of picture at the sides.

Thomson calls the set the Space System. It's considered by TCE and its owners, the French government, as being an important ploy in ensuring that the preferred European course towards HD-TV, via the MAC system and compatible transmissions, is followed. The idea is that the set will be upgradable when HD-TV transmissions start in Europe. TCE is understood to have spent some £100m on bringing the set into production. It's now on sale in France at the equivalent of about £3,500, with free installation and a three-year parts and labour guarantee. A D2-MAC decoder costs some £500 extra – at present only three French stations, Canal Plus, a pop music and a culture channel, use D-MAC. A production capacity of 1,000 sets a week is claimed. The set will be launched in Germany under the Telefunken brand name in late spring and will go on sale in the UK as a Ferguson set in the autumn, at a price of around £3,500 which will include a built-in Astra receiver and dish.

TCE plans to spend some £900m over the next five years on the development of HD-MAC equipment. A third of this will be provided by the French government.

A similar set, using a Thomson tube, is to be shown at the Philips trade shows this spring. It has already been shown to the trade in Holland. The UK launch is expected to be in October, at a price of around £3,000.

BROADCASTING NEWS

Leading advertising agency Saatchi and Saatchi has been taking a look in its crystal ball. The results are summarised in a publication entitled *UK Television Forecasts to 2003*. It suggests that the share of TV advertising revenue taken by Channel 3, as ITV will be known when the new franchises come into operation, will fall from 79 per cent in 1990 to 50 per cent in 2003 while its share of the commercial TV audience will fall from 74 per cent to 40 per cent. Fifty per cent of UK homes are expected to be able to receive satellite TV channels by 1996, rising to 70 per cent in 2003. The satellite TV channels are expected to have 40 per cent of commercial advertising revenue and 28 per cent of the audience. Channel 5, due to start in 1994, is expected to account for nine per cent of the commercial television audience with eight per cent of the advertising revenue. Channel 4 and TV-a.m. are expected to lose audience and advertising share. Because of the proliferation of channels, total TV advertising revenue is expected to rise from £2·29bn in 1990 to £7·95bn in 2003.

Launch of the BBC's Select night-time subscription TV service has been postponed from the autumn to "the first half of 1992". Reasons given for this include the recession and difficultly in getting high street retail and rental organisations to stock and supply the decoders that will be required.

Channel 4 is to introduce a programme delivery control (PDC) system for timed VCR recordings later this year. The addition of PDC codes in the teletext signal to identify particular programmes will enable a VCR to know exactly when a selected programme has started, thus avoiding the problems that arise when programmes are delayed or rescheduled. The VCR must of course be able to detect and act upon the PDC codes – Ferguson and Philips have already announced preliminary details of models. PDC differs from the system now in use in Germany. It's based on a recently agreed EBU specification. The BBC and the ITV companies do not at present have plans to adopt the system.

Statistics collected from its cable licensees by the Independent Television Commission show that in the last quarter of 1990 the number of cable subscribers increased by over 50,000, the largest quarterly increase ever recorded. Some 32,000 of the connections were to broadband systems. Almost 150,000 homes are now connected to broadband systems, a rise of 70 per cent over the previous year.

SERVISCOPE UNDER ADMINISTRATORS

Serviscope Electronics, one of the largest servicing organisations in Europe with 900 employees in 51 depots throughout the UK, has been placed in the hands of administrators Touche Ross who are trying to preserve the business. Until January 1990 Serviscope had been owned by the Electronic Rentals Group Plc, part of the Granada organisation. It had been making a loss for several years. In January 1990 it was bought for a nominal sum by Computec of Doncaster. Unfortunately trading losses during the last year, exacerbated by a continuing dispute between Computec and the previous owners about the value of the net assets at the takeover date and the present economic situation, made the situation unsustainable. Computec is now in receivership and at the time we go to press Touch Ross is seeking a new owner for Serviscope.

Serviscope undertook servicing work for a number of well known high street retail and rental organisations including Argos, Bennetts, Boots, Comet (in Northern Ireland), Granada and House of Fraser. Other clients included mail order firms GUS and Kays. Computec was set up in 1985 as a regional repair service for white goods.

BT'S NEW SERVICE

British Telecom has launched the ISDN2 telecommunications service that features videotelephony and faster fax and data communications. It will be available to businesses throughout the UK within the next eighteen months. ISDN2 uses digital lines: cost of a line is £400 to install with a quarterly charge of £84 for two telephone links. Adaptors enabling personal computers to be linked to ISDN are readily available but videotelephones are not yet available in the UK. They are likely to cost around £2,000 when introduced.

SERVICING AIDS

Soldering and desoldering specialist Ungar has introduced, under the EPA (Electronics Production Aids) banner, a new range of high-performance, high-quality hand tools with a unique shear-cutting action to minimise operator force and component shock. Less than half the operator force of crush cutting is required and the blade design

ensures a neat, square cut with a minimal acceleration. For details apply to Ungar, Eldon Industries UK Ltd., Unit 1, Clifton Road, Shefford, Beds SG17 5AB, telephone 0462 814 914.

Philips Consumer Electronics Service, PO Box 97, 420/430 London Road, Croydon CR9 4QS (sales order desk 081 686 5414) has introduced two new high-quality SMD component kits. Resistor kit SBC7092 comprises 86 snap-together plastic cases each containing ten values in E12 series (0-10MΩ, 0·25W) coded for ease of identification. The kit provides 860 resistors suitable for all consumer electronics products. Its price of £44·24 gives a unit cost of 5p compared with 22p/40p when the devices are purchased in smaller quantities. The companion SBC7091 semiconductor kit has 24 snap-together plastic cases containing a total of 240 components. There are five types of general-purpose diodes colour-coded orange and nineteen types of general-purpose transistors colour-coded red. The price of £35·90 represents a unit cost of around 15p compared with 44p/45p when purchased in smaller quantities. Both kits come with a set of tweezers.

Euras has a database of some 72,000 faults with their remedies, covering 5,000 models from 170 manufacturers. More faults are being added daily. You can obtain fault information at less than 30p a day including VAT via a viewdata terminal or a PC with modem and software. If you don't have either Euras can sell or lease you a viewdata terminal at a very competitive price, with full back-up maintenance. The system is available 24 hours a day seven days a week. Free use of the notice board and electronic mail box means that if Euras can't solve a particular problem another customer may be able to help. You can try the system for a month completely free of charge. For details phone 0272 724 475 or fax 0272 723 374.

During the recent bad weather there was a particularly large demand for Vellox kits from SEME Ltd. Vellox is a unique satellite dish coating system which provides improved reception in poor weather conditions. Snow and ice are kept away by the water-repellant coating. Vellox is available in kit form and is easy to apply in the workshop prior to on-site installation. For further details apply to SEME Ltd., Unit 2E, Saxby Road Industrial Estate, Melton Mowbray, Leicestershire LE13 1BS (telephone 0664 65392).

THE VIDEO CASSETTE RENTAL MARKET

Figures released by the British Videogram Association show that nearly a million video tapes a day were rented in the UK last year. But the 374m rentals were 5·5 per cent down on 1989. The Association attributes this decrease to an increase in the sale of prerecorded cassettes. The value of the rental market in 1990 fell by one per cent to £564m.

BUSINESS NEWS

Thomson Consumer Electronics' net losses last year quadrupled to FFr680m (approximately £70m), hit by the low value of the dollar, reduced demand in the USA and a price war in camcorders. TV accounts for 60 per cent of Thomson's sales. Philips announced a record net loss of Fl4·2bn (some £1·2bn) for 1990. Consumer electronics was the only sector with a rise in operating income. Amstrad's profit last year rose to £40·1 on turnover down from £373m to £327m. The company reports a collapse of sales during the early weeks of 1991.

VINTAGE COMPONENTS

The Vintage Wireless Company Ltd., Tudor House, Cossham Street, Mangotsfield, Bristol BS17 3EN (telephone 0272 565 472) has just published a new vintage audio and radio components catalogue that lists, in 67 A4 pages, details of an incredible store of components including grid leaks, coils and transformers, accumulators, Jones plugs for the R1155 and h.t. batteries. It costs £1·50 post paid in the UK and Ireland, £1·95 overseas by surface mail and £4·50 overseas by air mail. Also available, free of charge, are a valve catalogue, the 1991 audio catalogue and a books and data catalogue. The company can also supply *The Setmakers*, the book discussed in our leader last month.

VIDEO NEWS

Sharp has launched an LCD video projector, Model XV-100ZM, that displays images up to 250cm (100in.) in size. It can be linked to a VCR, video disc player, camcorder or personal computer (a special converter is required with the latter). The projector consists of three thin-film transistor LCD panels, each with 100,980 red, green or blue pixels. Three dichroic mirrors converge the RGB light to a single beam. The price is £3,995. Sharp has also launched two budget-priced VCRs, Models VCA30HM and VCA40HM, at £250 and £280 respectively. Both have digital programme tape search, remote control and trick-play features.

Some interesting products have been released by Canon. The EX1-Hi is the first camcorder to have an interchangeable lens system – the VL lens mount was designed by Canon, Sony, Hitachi and Matsushita. Canon is also marketing an adaptor to allow the EX1-Hi to use EF lenses designed for the company's EOS 35mm SLR film cameras. Other features include Hi-8 picture quality, digital picture effects and seven fast-shutter speeds (top speed is 1/10,000sec). The EX1-Hi is priced at £1,300 without lens.

Canon's second still video camera, Model RC260, includes an interval shooting facility for time-lapse shooting, interval playback, and a preview feature that enables users to see pictures on a TV set as they are being taken. Other features include individual or complete disc erasure, remote control, macro shooting, a back-light compensator, optional date/time recording and the ability to link to popular makes of personal computers. Price is £499·99. A YC/RGB converter, Model RGB-100E, costs £249·99.

Ferguson's second 8mm camcorder, Model F802, features five fast-shutter speeds, times six zoom and microphone mixing. It weights 980g and the price is £649·99.

Panasonic has launched two budget camcorders, Models NV-G1 and NV-G2, at £599·95 and £699·95 respectively. Both feature a times eight zoom lens and six fast-shutter speeds. In addition the NV-G2 has long-play operation, a detachable video light and a digital superimposer. Panasonic's 95cm screen TX-37A2G TV set has an integrated 88-channel Astra receiver, a Nicam decoder, Fastext, a 100Hz digital field frequency, digital noise reduction and comprehensive socketry. Panasonic claims that picture quality has been further enhanced by the use of new velocity modulation and black-level compensation circuits.

Sony's new Video Walkman, Model GV-300, has a 4in. LCD screen, stereo sound, a PAL B/G/I switchable tuner and trick-play facilities. Price is £699·99. This summer Sony will launch a component Video Walkman system comprising a compact 8mm VCR, a 4in. LCD display and a 60-channel PAL/SECAM tuner. The complete system will cost £899·99.

Nokia is offering to license its ASO (active sideband optimum) system to other VHS VCR manufacturers. The ASO circuit gives improved pictures even with poor quality tapes, replacing circuitry such as the HQ enhancement system.

IN BRIEF

The European Electromagnetic Compatibility Directive will come into force on January 1st 1992. Its aim is to ensure that electrical and electronic products made or sold within the EC do not cause excessive interference and are not unduly affected by such interference.

Eutelsat is to launch a DBS satellite at 19°W in mid-1993, with twelve transponders using 100-125W TWT amplifiers. It will provide interim capacity prior to the start of the Europsat service in 1996.

Finlux has reported a potential fire hazard with its 1000 and 2000 series colour TV receivers. The problem arises at the scan coil connector which can suffer from scorching after prolonged use. In some cases the overheating can result in fire unless the set is switched off immediately. Some 80,000 of these sets were sold in the UK. Finlux dealers are being supplied with kits containing two small metal bushes that fit on two pins of the line scan coil connector.

TEST CASE

340

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.

It was towards the end of a weary day in the workshop and Dylan was looking for a fast, easy repair to boost his throughput for the day. He thought he'd found it in an old Panasonic Model TC2205 (U2 chassis) whose job card bore the single word "dead". How wrong he was . . .

The set was soon on the operating table with its rear cover off. Cold resistance checks quickly revealed that the BU208A line output transistor was dead short-circuit between all its electrodes. Dylan noted that certain electrolytic capacitors had been ringed in pen on the circuit diagram in the workshop's copy of the service manual: he was relieved to see that they had been renewed in this particular set. So a new BU208A was fitted and the set was switched on. It burst into life. There was a slight lack of width, which fluctuated somewhat. After switching off Dylan resoldered some doubtful-looking joints under the PCB, squirted the h.t. preset R809 with switch cleaner and adjusted it for the correct picture width. The bill was soon made up and the set was taken off by its owner.

At ten to nine next morning the customer came on the phone. Apparently the set had failed again after about an hour's run. Dylan was sent to collect it as the owner flatly refused to make another twenty-mile round trip. When the set was put back on the bench it soon became clear that the new BU208A had suffered the same fate as its predecessor – it was dead short all ways.

Dylan wished he'd never seen the evil set. But he had to go on with it. After fitting another BU208A he confirmed that the set had once more been restored to life. He let it run for about five minutes, then felt the body of the new transistor with his finger. It was, to borrow a phrase from Colonel Sanders, finger-licking hot. It would obviously soon fail, but why was it running so hot? Some sort of overload perhaps? The transistor's load consists of the line output transformer, the scan coils and the many components associated with them. As a start Dylan replaced the EW modulator diodes D552 and D553, using suitable substitutes. The originals were soon restored when it was found that the line output transistor still ran hot.

The choices that now faced Dylan were vague and various. The presence of a picture, of approximately the correct width, indicated that everything in the line output stage was working. Perhaps the line output transformer had short-circuit turns? Workshop Sage said that if it did it would probably run warm. It remained cool to the touch after the five-minutes run however – in contrast with its baking, throbbing BU208A neighbour. Even so Dylan removed the e.h.t. connector from the tube and elaborately insulated it, hoping to prove that there was a fault in the diode-split overwinding section of the transformer. But still the transformer ran cool while the transistor was very hot. Not for the first time, Dylan wondered whether he should have taken that job as a test inspector at Aviation Electronics on the industrial estate . . .

Workshop Sage witnessed the struggle with a feeling of déjà vu. Some years before he'd had the same sort if trouble and had ordered a new line output transformer. It hadn't cured the fault but was still in the stores. He got it out and presented it to Dylan who promptly fitted it. The symptom remained totally unchanged. Were they barking up the wrong tree? See next month for the solution and another test case item

ANSWER TO TEST CASE 339
– page 352 last month –

Last month's test case probably sorted readers out into two categories, the old hands who remember first generation i.c. colour decoders and their discrete component predecessors and the newer race of technicians who've dealt mainly with single-chip decoders. Those in the latter category will be well aware of sandcastle pulses and, in the event of a blacked-out screen, would have gone straight to pin 8 of the TDA3561A chip (or pin 7 of the TDA3562) to look for trouble. This was the key to the problem. The sandcastle pulse is crucial to the signal processing in a single-chip decoder: its voltage levels must be spot-on for correct operation.

The sandcastle pulse normally has three levels, corresponding to field blanking at the lowest level, then line blanking and at the top a narrow-width pulse. If the amplitudes of the three levels are incorrect the result is likely to be a blanked out screen. The sandcastle pulse in the Philips CP90 chassis is assembled within the TDA2579 sync/timebase generator chip IC7038 on the sync module. One of its ingredients is a field flyback pulse which arrives at pin 1 of the module and enters the chip at pin 2. It comes from the field output stage. If it falls below 2V or rises above 6.5V, indicating a fault – possibly field collapse – in the field timebase, the scan-fail protection feature comes into play to prevent screen burn. Sure enough a field output stage fault had resulted in the conditions at pin 2 of IC7038 being out-of-spec. Thus the source of the fault was twice removed from the area of our technician's investigations! Always remember to check the sandcastle pulse.

Satellite TV Aerial Systems

Part 1

Derek J. Stephenson, B.A., I.Eng.

Many people seem to think that the theory of satellite TV is complicated and involves a lot of mathematics. This is not necessarily so: it's possible to achieve a reasonable understanding of the principles with a minimum of mathematics. To this end we shall in this short series of articles provide a basic introduction to the principles of satellite TV reception. The basic operation and function of a wide variety of aerial and head-end combinations that may be encountered will be described in a simple manner. This first article deals with aerials. There are several species, some of which are much more common than others.

Aerial Basics

The purpose of the aerial is to collect and concentrate the weak microwave signals from a distant satellite, guiding them to a point when they can start to be processed. It follows from this that the aerial has an inherent signal power gain. Various arrangements can be used to achieve this end. The parabolic reflector (dish) is the best known. Others are lenses or arrays of smaller aerial elements (flat aerials).

When describing items such as parabolic reflectors it's often convenient to use optical analogies, since they appear to behave in a similar manner to their optical counterparts. Although this helps to get the basic ideas over, we shall from time to time have to stress that, as with all analogies, the process must not be pushed too far. Microwave wavelengths are several orders of magnitude longer than light.

A factor that can be confusing in explanations of satellite TV reception is the use of terms such as feeds, illumination and radiation patterns. They appear to be more relevant to transmission than reception. Such terminology has its roots in the past – when radar was being developed during the second World War. Since reception is the reverse of transmission, albeit at lower power levels, we can say that what is true of transmission is equally true, in reverse, of reception. Because of this, descriptions of satellite TV reception often tend to switch at whim between the use of transmission and reception terminology. This approach benefits some explanations in that it helps to reduce unnecessary wordiness.

The Parabolic Reflector

Parabolic dishes of various sorts are by far the most common type of satellite TV aerial. Fig. 1(a) shows a two-dimensional representation of a parabolic reflector of the basic prime-focus type. It has the unique property of reflecting incident radiation that's parallel to its main axis (or boresight) to a common focal point in such a way that the total path length to the focal point is the same, i.e. in phase, from all parts of the dish. Ideally, any radiation that strikes the dish from axes not parallel to the boresight should miss the focal point altogether, as shown in Fig. 1(b). In reality however this is not wholly possible – see Fig. 2. Radiation or noise can be picked up from many directions, even from behind the dish, due to a pheonomenon known as diffraction, which is equally troublesome with optical apertures.

Some sort of device known as a feed is positioned at the focal point to collect the reflected radiation. A common device is a horn-shaped item known, for obvious reasons, as a feedhorn. Looking at it from the transmission angle, the feed is said to "illuminate" the dish. In practice this illumination (reflection from the reception point of view) is never uniform. It's reduced towards the rim of the dish to decrease pick-up of ground noise from beyond the rim. More about this in a later article.

A perfectly illuminated, or 100 per cent efficient, dish has a gain G given by

$$G = 10\log_{10}(\pi D/W)^2\,\mathrm{dBi},$$

where π is 3·14159, D is the diameter of the reflector and W is the wavelength. From this formula you can see that gain increases with dish area and decreases with the square of the wavelength.

Fig. 3. shows the basic prime-focus dish arrangement. The feed (head unit) is mounted centrally at the focal point of the dish. Fig. 4(a) shows the offset focus version generally used for Astra reception. It has the advantage that the head unit doesn't obscure the incoming signal. Fig. 4(b) shows the relationship between the offset design and the basic paraboloid.

Polar Response

Ideally the reflector should produce a parallel "pencil" beam with a circular cross-section. At microwave frequencies however the wavelength is comparatively large compared to the reflector's aperture and diffraction effects, surface imperfections and a number of other effects mean that a point source or focal point cannot in practice be precisely positioned. The result is a divergent beam whose polar response, see Fig. 5(a), has a narrow main lobe in the boresight direction accompanied by a number of side lobes. The aim of good aerial and feed design is to minimise the effect of the side lobes in relation to the main lobe, thus reducing off-axis signal pick up and ground noise from beyond the edge of the dish.

The polar response diagram in Fig. 5(a) is, being so narrow, difficult to interpret. So polar response/beamwidth diagrams for particular aerials are more often drawn in the manner shown in Fig. 5(b), using Cartesian co-ordinates and experimental data. The shape of the main lobe is largely a function of wavelength and dish diameter. From it the beamwidth for a range of received signal power levels below maximum can be estimated. I've found that obtaining such diagrams is nearly as difficult as acquiring a breeding pair of dodos. Fortunately a good estimate of the half-power −3dB) beamwidth in degrees can be calculated from the simple formula 70W/D, where W is the wavelength and D the dish diameter.

Beamwidth

Fig. 6 shows how the half-power beamwidth varies with dish diameter at a fixed frequency, in this case 11GHz. The important point to note is that the smaller the dish the wider the beamwidth (conical view of the sky). Offset-focus aerials normally have a major diameter vertically and

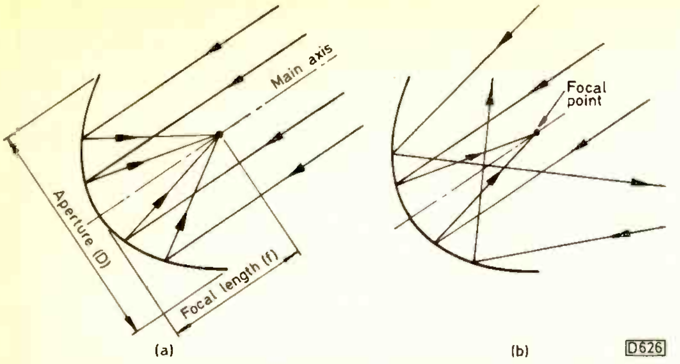


Fig. 1: The parabolic reflector. (a) Reflection of incoming on-axis signals. (b) Reflection of signals arriving from different angles.

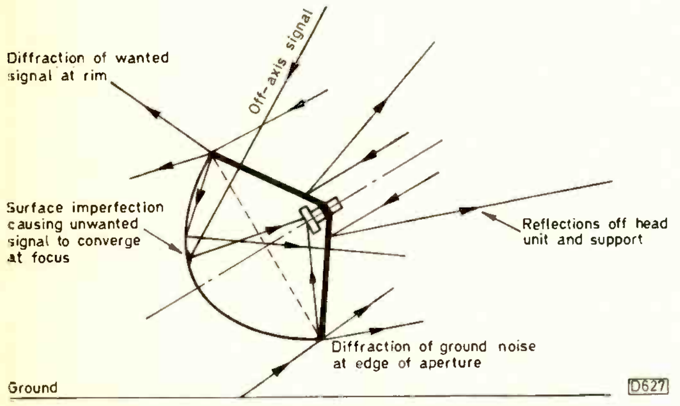


Fig. 2: Some unwanted effects with a parabolic reflector.

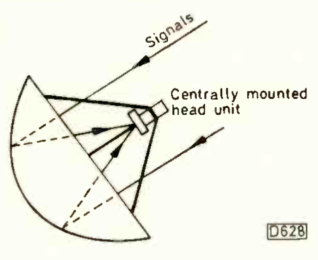


Fig. 3: Prime-focus dish arrangement.

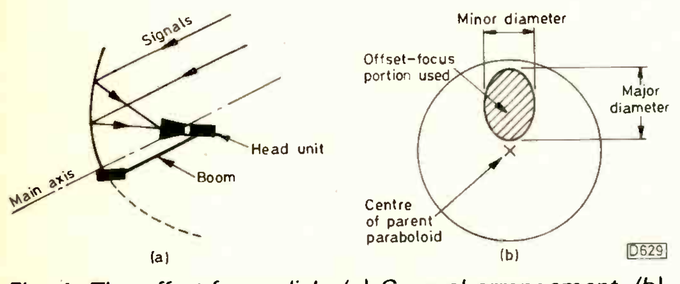


Fig. 4: The offset-focus dish. (a) General arrangement, (b) the relationship between the geometry of a prime-focus and an offset-focus dish.

a minor diameter horizontally. Thus the major diameter beamwidth will be narrower than the minor diameter one. The result is an elliptical view of the sky. So it would be reasonable to expect that the elevation adjustment would be slightly more critical than the azimuth adjustment when carrying out alignment for a particular satellite – see Fig. 7.

Dish Size and Satellite Spacing

One might expect that with recent improvements in receiver demodulator threshold figures and LNB noise figures smaller and smaller dishes will come into use. This doesn't necessarily follow however. The minimum

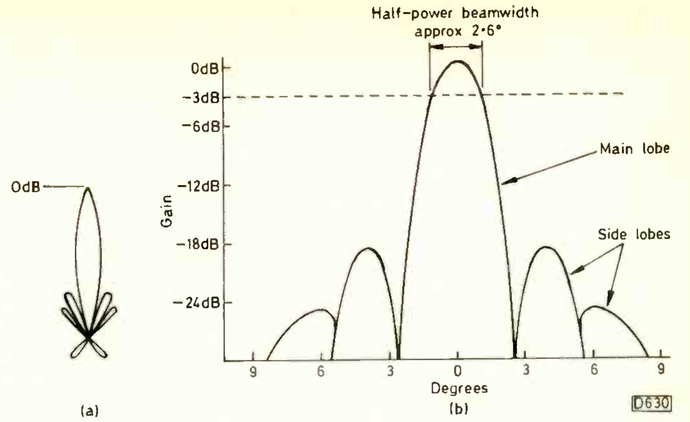


Fig. 5: Polar response. (a) Basic pattern, (b) version drawn using Cartesian co-ordinates.

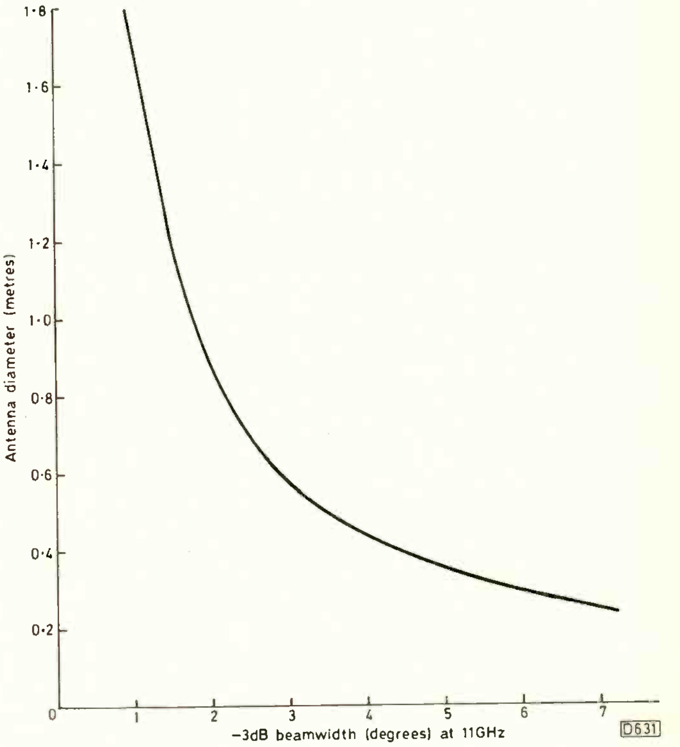


Fig. 6: Half-power beamwidth for various diameter dishes.

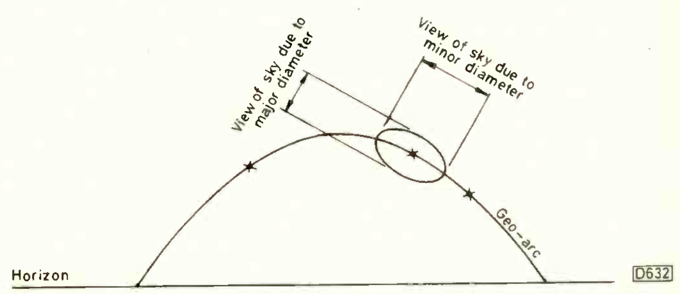


Fig. 7: An offset-focus dish's view of the sky.

acceptable dish diameter is largely dictated by the spacing of the satellites in the geostationary arc directly above the equator. Halving the −3dB beamwidth gives a rough indication of how likely it is that an accurately aligned dish will pick up signals from an adjacent satellite. If the dish is too small its beamwidth may well be wide enough to pick up signals from more than one satellite. If these satellites happen to be transmitting signals at the same frequency and with the same polarisation sense the result may be intolerable interference. Subjective tests have shown that interference is first detected at the −11dB level and is found to be intolerable at the −5dB level.

If you look at Fig. 5(b) you'll see that the main lobe is noticeably wider at these potential interference points than at the half-power (−3dB) level. But because satellite spacings are quoted in relation to the Earth's centre rather than its surface they appear to us to be slightly wider apart than the quoted figures. A full beamwidth diagram for a particular dish/feed system would be required for an accurate and detailed analysis of potential interference problems. There was, incidentally, a bit of flap only recently about the use of 45cm dishes for the Astra satellite in the south of England.

Causes of Side Lobes

Noise and unwanted signals can coverage at the head unit via the aerial system's side lobes. These are present for a variety of reasons, some of which are as follows:

(1) Microwaves, from whichever angle they enter the aerial's aperture, are diffracted at the edge of the dish, being scattered in all directions. Some of them will be unwanted signals that converge at the focal point, causing interference.

(2) Surface irregularities cause reflection errors, allowing unwanted signals to arrive at the focal point and wanted signals to miss it.

(3) Some wanted signals may be diffracted at the edge of the dish and thus miss the focal point.

(4) The head unit and its support both block and reflect wanted incoming signals.

(5) The head unit, occupying a larger space than the actual focal point, will pick up some off-axis signals.

(6) Ground noise, due to the Earth's temperature, gets diffracted round the edge of the dish and converges at the focal point.

(7) Sky noise, from the atmosphere and space, converges at the focal point (note that most of the sky noise enters via the main lobe).

(8) Wanted signals may be lost through absorption at the surface of the dish.

Many of these effects can be reduced by good design and manufacture. High standards of dish pressing can reduce the effect of item (2) in the list. Careful choice of materials will help to reduce the effect of item (8). An offset-focus design can eliminate signal blockage by the head unit and reduce the ground-noise contribution. The use of "illumination tapers", to be described in a later article, significantly reduces some of the other effects.

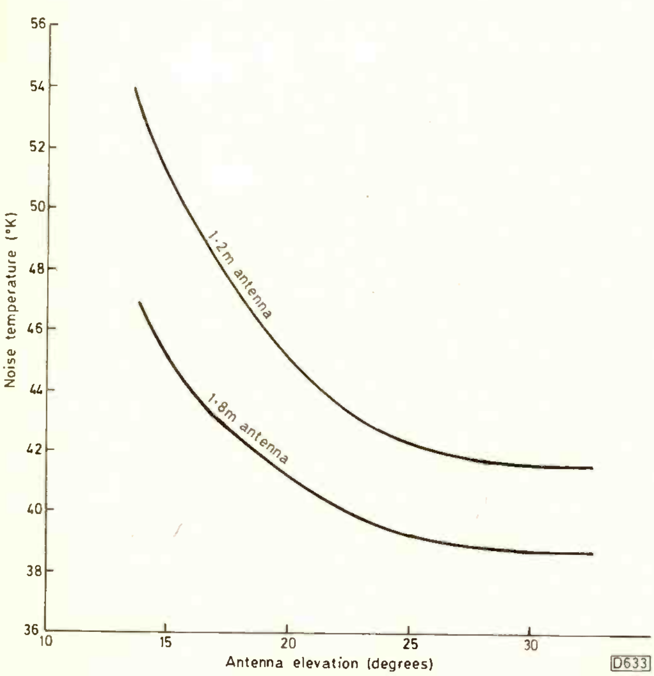


Fig. 8: Relationship between aerial noise temperature and dish elevation.

Aerial Efficiency

Aerial efficiency is a measure of how much of the wanted incoming signal arrives at the head unit. It's determined mainly by items (2), (3), (4) and (8) in the above list. Efficiency is expressed as a percentage, and is used to establish the practical gain of an aerial system in connection with the previously given theoretical gain formula. Aerial efficiency values are usually included in manufacturers' literature. The gain equation becomes as follows:

$$G = 10\log_{10}\left(\frac{(\pi D)^2 \times P}{W^2 \times 100}\right)\text{dBi},$$

where P is the aerial efficiency. Table 1 lists gain figures to be expected for a variety of dish sizes and efficiencies at a fixed frequency of 11GHz.

Aerial Noise

Any received signal contains some noise that reduces the overall system performance. Satellite TV is no exception to the rule. The following are the major contributors to the noise.

(1) Sky noise. This is wide bandwidth radiation caused by energy conversion in stars and by certain atmospheric activity. This type of noise enters mainly via the main lobe and is more independent of elevation.

(2) Ground noise. Excitation of molecules in the warm earth create wide bandwidth noise called ground noise. Its contribution to aerial noise is greatest with low elevation settings in high latitudes. This is because at lower elevations the aerial is tilted more towards the Earth, thus increasing the likelihood of ground noise being diffracted at the edge of the dish. At lower latitudes, where dish elevation is inclined more skywards, the contribution made by ground noise is much less. It enters mainly via the side lobes and is the major contributor to overall aerial noise.

(3) Man-made noise. Noise from machines and equipment also contributes to aerial noise. Examples are car ignition systems, lawn mowers, and flourescent lights being switched on and off. These all emit wide bandwidth noise due to high transient voltages. This type of noise also enters mainly via the side lobes.

At absolute zero temperature (0°K or −273°C) all molecular excitation would cease. Thus the higher the temperature the greater the amount of activity and hence noise. Because of this, noise is quoted as an equivalent noise temperature – in degrees Kelvin. The contributions made by sky noise and man-made noise are comparatively low compared with the major noise component, ground noise. Reduction of side lobes to a minimum is thus the main object of good aerial and feed design.

A narrow beamwidth means a narrow main lobe with closer spaced side lobes. It follows from all this that in addition to having a higher gain a larger diameter dish will have a greater immunity to aerial noise than a smaller one. Small dishes, less than 1m, are more susceptible to noise and are usually of the offset-focus type. With the offset-focus version the head doesn't block the incoming signal and in addition, as it's inclined away from the Earth and more skywards, the contribution of ground noise is reduced.

Fig. 8 shows the relationship between aerial noise temperature and dish elevation for 1·2m and 1·8m dishes. The shape of the graph is similar for other dish sizes, with aerial noise temperature increasing rapidly at elevations lower than about 30°.

Focus:diameter Ratios

The curvature of a parabolic dish can be shallow or deep. The feed will be specifically designed for a particular ratio of focal length to dish diameter (f/D ratio) or a limited f/D range. Using transmission terminology, the feed is said to "illuminate" the dish area. Looking at Fig. 9(a), where the f/D ratio is less than 0·25, you can see that the focal point lies well inside the plane of the aperture. This f/D ratio produces under illumination. In Fig. 9(b) the f/D ratio is 0·25 and the focal point lies exactly in the plane of the aperture. This f/D ratio usually provides maximum gain. Fig. 9(c) shows the effect of a high f/D ratio, greater than 0·25. The result is over illumination, with some of the signal from the source missing the dish.

A deep dish with a low f/D ratio has greater noise immunity than a shallower one since the feed/head unit is more shielded from ground noise. In other words the amplitudes of the side lobes are reduced, with less ground noise from beyond the edge of the dish getting into the system. Shallower dishes are more pleasing to the eye however. In practice f/D ratios commonly lie between 0·35 and 0·5 for prime-focus aerials and between 0·6 and 0·7 for offset-focus aerials. Fine trimming of the illumination pattern is made possible by the design of the feed, as we shall see in a later article.

Swinging the Main Lobe

Lateral movement of the feed in the focal plane of the reflector will to some extent swing the main lobe. If this is pushed too far however serious defocusing of the beam will occur. As Fig. 10 shows, a tilt of n° of the feed relative to the paraboloid axis will produce a beam displacement of about 0·8n°. This effect can be put to use experimentally when you want to use a fixed dish to receive signals from two closely-spaced satellites, or where dual band reception is required from the same satellite. Provided the spacing of the satellites is not excessive a single reflector with two feeds mounted side by side can be engineered.

Other Types of Aerial

In addition to the basic prime-focus and offset-focus dishes there are many mutant species that have various advantages and disadvantages. They are not at present very common and mainly consist of modifications or refinements to achieve greater efficiency than with the basic versions.

The Cassegrain Aerial

The essential difference between a Cassegrain aerial, see Fig. 11, and a standard prime-focus type is the introduction of a hyperbolic subreflector that intercepts the signals from the main reflector and re-reflects them to a rear-mounted head unit. The advantages of this arrangement are that the head unit has greater protection from the weather while

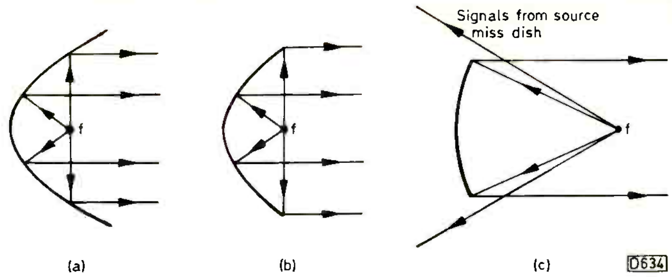


Fig. 9: Focus:diameter ratio. (a) Less than 0·25 gives under illumination. (b) At 0·25 maximum gain is obtained. (c) Greater than 0·25 gives over illumination.

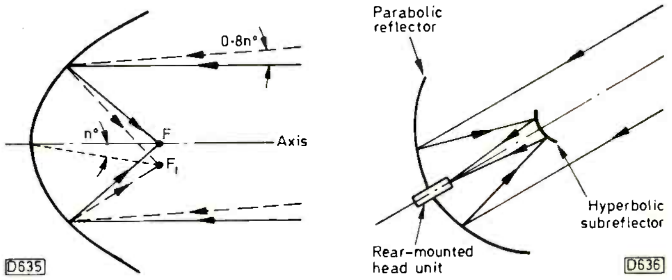


Fig. 10 (left): Beam displacement due to lateral movement of the feed/head from the focal point F to position F1.

Fig. 11 (right): The Cassegrain aerial.

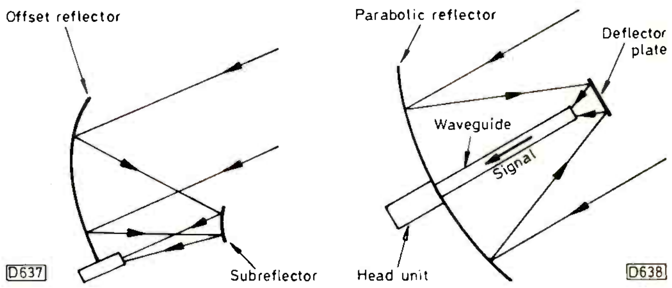


Fig. 12 (left): The Gregorian aerial, an offset arrangement.

Fig. 13 (right): The backfire aerial.

the subreflector can be made to illuminate the dish more efficiently. The result of over illumination is to increase the sky noise component rather than the ground noise, which is a help. A major disadvantage is that due to its position the subreflector blocks some of the incoming wanted signal.

Gregorian Aerial

The Gregorian aerial arrangement shown in Fig. 12 is similar but overcomes the disadvantage of the previous configuration by employing an offset-focus arrangement. The subreflector is carefully matched and shaped to illuminate the main reflector as efficiently as possible. This particular arrangement is capable of providing the highest aerial efficiency figures.

Backfire Aerial

The simple backfire arrangement shown in Fig. 13 has a subreflector (deflector plate) and a rear-mounted head unit. It has similar advantages and disadvantages to the Cassegrain aerial therefore. The major difference is the use of a length of waveguide ending just short of the subreflector. An advantage claimed for this arrangement is that the electronics of the head unit are shielded from the hot sun and its additional noise component. The subreflector is usually of the order of five wavelengths in diameter, or approximately ten per cent of dish size. The main disadvantage is signal blocking by the subreflector.

Environmentally-friendly Aerials

Now to the recent tendency towards environmentally friendly dishes. Two recent examples are the use of glass or black-mesh to reduce the visual impact of the dish. At the time of writing only the black-mesh type is available.

A type of glass known as metallised Armourplate glass, manufactured by Pilkington Glass Ltd., is known to be 99 per cent reflective at centimetric wavelengths. This material can be formed into tubes, plates and reflectors which can be assembled to form various aerial systems. One proposed system employs the backfire principle described above. The reflector, waveguide and subreflector plate are all made of Armourplate, which is reputed to be five times stronger than normal window glass, while the wall mount is made of a clear polycarbonate material. Various additional advantages of using Armourplate glass and the backfire principle are claimed. First, this type of glass holds its shape better than a solid metal dish in windy conditions. Secondly less solar radiation is reflected into the feed, thus reducing the risk of damage to the feed assembly at certain times of the day. Finally heating elements similar to those fitted to car rear windows can be fitted to keep the dish clear of ice and snow.

Black-mesh and Dual-view Aerials

Black-mesh dishes look considerably less obtrusive than their solid counterparts. Use of mesh or perforated metal provides considerable weight reduction and reduced wind loading with a minimal effect on the side-lobe pattern. Such perforated surfaces are insensitive to polarisation and can be regarded as short waveguides whose dominant frequency is well beyond cut-off. For example a wire-mesh reflector with square holes should have the sides of the squares less than the wavelength divided by 1·414. Mesh dishes are flimsier than solid metal ones and are consequently more easily damaged. Provided the deviation of the dish from a pure parabola causes changes of less than about one sixteenth of a wavelength in the path length of the incoming radiation any mild deformations won't matter too much. For minimum side lobes however a much lower figure is required.

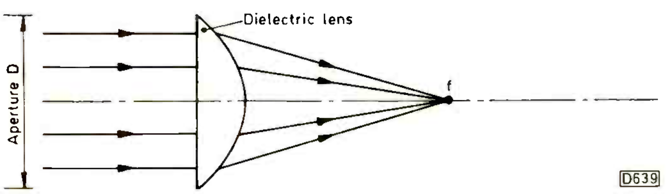


Fig. 14: Dielectric lens action.

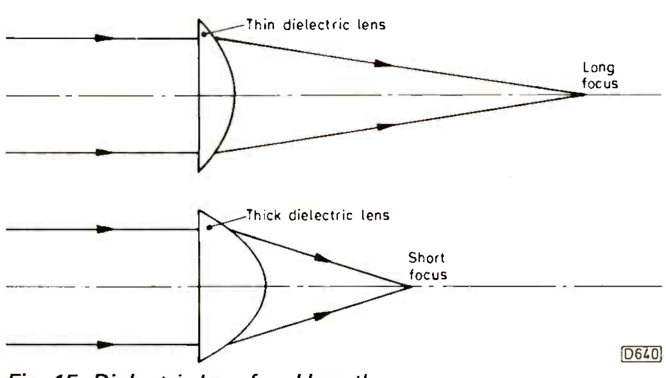


Fig. 15: Dielectric lens focal length.

Dual-view dishes have been proposed to capture the signals from any two popular satellites in different orbital slots and reflect them on to a single head assembly. These "two-faced" or "kipper" dishes may have provision for mounting two separate LNBs on a common boom. A portion of the available area is angled to receive signals from one satellite while the other portion is angled to receive signals from the second satellite. Twin coaxial cable is needed to feed the down-converted signals to either one receiver, via a combiner or a coaxial switch, or to two separate receivers.

Although these dishes are marginally cheaper than using two separate ones, many mounting positions may be unsuitable because one or the other satellite is blocked by a building or trees. The geometry of the situation should be checked out at the site survey stage before an installation is undertaken. This type of aerial was originally devised for Astra/Marco Polo reception. Recent events may have put an end to the idea.

Flat Aerials

Small, flat aerials (the Squarial) can be used with high-power DBS satellites. Instead of the incoming radiation being focused to a point it's possible to collect it using an array of small aerial elements arranged on a flat surface. The power received by these elements, which are in the form of slots, is added by a rear-mounted conductive transmission network and taken to a common point where the LNB is positioned. The advantages of this type of aerial are light weight with ease of installation and small physical size with no protrusions. Flat aerials are seldom used in sizes greater than about 40/50cm since their efficiency, compared with more conventional parabolic aerials, falls off as the size increases.

Lens Aerials

Although this is an uncommon arrangement at the present time, a lens which has similar properties in focusing the incoming radiation can be used instead of a parabolic reflector. There are two major classes of telescope for optical frequencies, the reflector and the refractor. The parabolic dish can be thought of as a parabolic mirror (reflector) that concentrates the incoming radiation to a focal point where the eyepiece is positioned. Likewise an optical refracting telescope using an objective lens instead of a mirror has its centimetric equivalent. Lenses used at centimetric wavelengths are often made of dielectric material which has the property of slowing down travelling waves, thus bringing them to a focus. Fig. 14 shows the general dielectric lens action.

Gains and radiation patterns for lenses are similar to those for parabolic reflectors, and an illumination taper is needed for the same reasons. It's not easy to achieve uniform illumination of a lens: those with long focus are more evenly illuminated than those with short focus. Another advantage of long-focus lenses is that they are lighter and thinner, as Fig. 15 shows. Lenses can however be stepped to reduce the weight and bulk without affecting their performance too much.

Feeds for lenses fulfil a similar function to those used with reflectors. In practice the focal length of the lens is chosen to be much the same as the lens aperture

Table 1: Aerial gain in dBi at 11GHz.

Dish diameter	Efficiency 55%	60%	65%	70%	75%	80%
0·30m	28·17	28·55	28·90	29·22	29·52	29·80
0·40m	30·67	31·05	31·40	31·72	32·02	32·30
0·50m	32·61	32·99	33·34	33·66	33·96	34·24
0·60m	34·20	34·57	34·92	35·24	35·54	35·82
0·65m	34·89	35·27	35·62	35·94	36·24	36·52
0·70m	35·53	35·91	36·26	36·58	36·88	37·16
0·80m	36·69	37·07	37·42	37·74	38·04	38·32
0·85m	37·22	37·60	37·95	38·27	38·57	38·85
0·90m	37·72	38·09	38·44	38·76	39·06	39·34
1·00m	38·63	39·01	39·36	39·68	39·98	40·26
1·20m	40·22	40·59	40·94	41·26	41·56	41·84
1·80m	43·74	44·12	44·46	44·78	45·08	45·36
2·20m	45·48	45·86	46·21	46·53	46·83	47·11

dimension. This is greater than that usually associated with a parabolic reflector, and consequently the feed needs to be more directional. Horns are commonly used, and to avoid stray radiation entering the horn its sides may be conveniently extended right up to the lens. For a given band the lens aperture is generally slightly smaller than its equivalent with a reflector. It often resembles a large cone in appearance.

CD Player Casebook

Reports from Mike Leach and Nick Beer

Pioneer PDZ72T

This popular twin-player came in with the complaint that it would work with only some discs. On test I found that when the fault was present the disc wouldn't reach full speed. A quick resistance check across the turntable motor confirmed my suspicions – the reading was 10Ω instead of the correct 20Ω. Obviously another case of a faulty motor – there have been reports previously in these pages.

If you are stripping down one of these machines for the first time you could fall into the same trap that I did, so here's a hint. When removing the twin carriage to gain access to the laser assembly you have to remove the four screws that hold the carriage in, after which you can simply lift it out. You then find that the carriage leads are routed underneath the laser assembly and that there is very little spare lead to keep the carriage well out of the way. When you put the carriage down on the bench it usually falls apart: the two trays come out of their runners and the metal plate mounted beneath the trays falls on to the bench. So make sure that you have a large rubber band handy to put around the carriage when you remove it. This can save a lot of time spent putting the carriage back together again. **M.L.**

Philips D8600 Portable

This portable machine came in with a bag of bits taped to the lid. The ticket said it had been dropped and didn't work. Wonderful, I thought.

The bag contained the plastic cap and copper spring that had come off the turntable. They were broken and needed replacement – fortunately a scrap deck provided the parts. Now to power up. The sled assembly made a funny noise and rattled away against its end stop towards the centre of the disc. My tolerance level hadn't been good all day and this made matters worse.

I removed the bottom cover to look for broken print. There wasn't any. Well, I'd got this far so I thought I would remove the board and take a peek at the deck and the laser. To take out the bottom board you have to remove the front escutcheon and unsolder the earth tag between the front panel and the copper earthing plate. I did this then carefully lifted the complete PCB assembly from the casing. Boing went the spring off the lid, almost landing on a Pioneer which had its top cover removed, exposing the mains transformer that was just waiting for something to land on it. Luckily it didn't.

On inspecting the deck I noticed two microswitches that had been bent, obviously when the machine had been dropped. Replacing these cured the problem and the machine again worked normally (after refitting that spring). It's amazing what customers find to do with their electrical equipment. We've had all sorts. A Ferguson camcorder that went for a swim in the sea; various thirsty VCRs full of Coca Cola (a common one); and a G11 TV set with a pint of Tequila poured inside it. **M.L.**

Pioneer PDM435

Having diagnosed a faulty laser unit in this new, stock machine I was somewhat alarmed when, after fitting the replacement and leaving the player on soak test, I found that it had developed a new symptom – it wouldn't play the first track of the disc, after which it was fine. Nasty things like a PLL fault come to mind with this sort of problem. But the fault hadn't been there with the previous laser unit and anyway it looked more like a mechanical fault.

The replacement laser unit had had its protective solder shorting link unsoldered and this had been resoldered very poorly. I reported an occurrence of this type some months ago in these pages, where a new laser unit was faulty and a second replacement had had to be obtained. The same thing had to be done this time.

Are these links unsoldered when the units are tested? If so they are not being resoldered properly and maybe they are being damaged during the process. Or possibly these are units that have been returned as faulty and have been found to be "o.k." on test. Whatever the reason, I don't like doing the same job twice! **N.B.**

TV Fault Finding

Reports from Steve Cannon, Ed Rowland, Steve Beeching, Colin Doman, Mick Dutton and S.A. Featherstone

Hitachi CPT1646R

The trouble with this set was that the colour could be seen to be pulsing. It was very faint, but the set belonged to a sports club and apparently the fault was quite noticeable with football. When a colour bar pattern was fed to the set a very faint shimmer was visible in the green and blue bars. It was more noticeable with the colour turned up and the contrast turned down. Several checks were made around the colour decoder chip but we were unable to arrive at a diagnosis. The chip was changed of course but the fault persisted. So more checks were made and various components were replaced, all to no avail. Then, by chance, we noticed that when fine tuning the station the colour seemed to pulsate in sympathy with the flashing LED display. The problem disappeared when the supply to the display was disconnected. But rather than replacing the display we decided to fit a new SAA1293 remote control decoder chip (IC1501). This provided a permanent cure. We've had a few faulty SAA1293 chips. **S.C.**

Finlux 1000/3000 Series Chassis

We, and no doubt many other dealers, have had trouble with the BY299 17V rectifier in the 1000 and 3000 series chassis (Du20 and Du18 respectively) going short-circuit. This gives the dead set symptom. We had a brand new 3600 chassis set with this symptom, so I got a new BY299 from stock and fitted it. I was then rather dismayed to find that the set was still dead. After making a few more checks I found that this time the cause of the problem was the main 138V h.t. rectifier Du16. **S.C.**

Sony KV211XMTU (AE1 Chassis)

An extremely common problem with these sets is failure of the rectifier and feed resistor in the tube's first anode supply, D803 and R807 respectively. The result of course is no picture. Evidence that the resistor has failed is clear to see, but the diode can check o.k. If it's taken out however you can see signs of arcing on the under side. It seems that the problem has now been recognised. Sony supply an uprated diode, type RGP02-17, instead of an ES1F. Part numbers for the diode and resistor are 8-919-300-65 and 1-218-025-51. **S.C.**

Salora 1H6

There was a real pearler of a fault on this set. The customer's complaint was of severe patterning on Channel 4, very nearly obliterating the picture at times. Our first thought was that something was beating with Channel 4, which in our neck of the woods is on ch. 42 and is definitely within the tuning range of a VCR. So we gave the video's channel adjustment potentiometer a quick tweak and of course this made no difference at all. Neither did unplugging and disconnecting the VCR. Trying to fine tune Channel 4 also made no difference, but I noticed that the set had another fault: the Band III and u.h.f. LEDs under the tuning flap were both lit. Probably a microcomputer fault I thought, they're always going wrong. Time to take the set back to the workshop, though I was still sure that something was interfering with it.

Back in the workshop the fault was still present. So it wasn't an interference problem. Several checks were made on the tuner: something was definitely wrong here as there was an extra 12V on one of its pins. Then I started to bang my head on the bench and remembered the obvious symptom I'd so hastily disregarded. What was happening was that the tuner was in the Band III and u.h.f. modes at the same time. Tracing the cause of the fault was now straightforward. After changing the UAA1008A tuning chip ICC1 the only patterning to be seen was on Pob's shirt. **S.C.**

Sony KV2217 with Teletext

We've had no teletext with several of these sets. In all cases the same component has been the cause. The exact symptoms are no teletext but if mix is selected text can be seen in black with the picture in the background. The culprit is RV3 on the text board. It's the text brightness control and we've found that it goes high in value. Adjusting it provides a temporary cure but a replacement (100Ω preset) will save a call-back. **S.C.**

Fidelity CTV140

About ten minutes after switch-on the sound and vision would suddenly disappear. A scope check around IC2 (TDA4503) revealed that in the fault condition the line drive frequency increased to over 1MHz. The culprit was C31 (2·7nF) in the line generator circuit – it's connected between pin 23 of IC2 and chassis. **E.R.**

Logik 4090 (Ferguson TX90 Chassis)

No colour with a faint blue cast was the result of C157 (22nF) having developed a leak – when measured it read about 25kΩ. It's connected to pin 18 of the μPC1365C colour decoder chip IC103, being part of the a.p.c. detector circuit.

In the past we've also had D103 (BAV20) cause loss of colour with these sets. It's connected to pins 19 and 23 of the colour decoder chip, in the line pulse feed. **E.R.**

Triumph 8209

This set would sometimes fail to come on, and when running would sometimes go into standby. There were periods when it would work for days at a time without trouble however. The cause of the problem was dry-joints on the pins of the line driver transformer. **E.R.**

Hitachi CPT1624

The snowy pictures and poor sound produced by this portable colour set suggested a faulty tuner. The cause of the fault however turned out to be C054 (22μF) in the a.g.c. circuit. It was leaky. **E.R.**

Sanyo CTP7132 (80P Chassis)

My colleague Mark was grappling with a Sanyo CTP7132 whose switch-mode power supply wouldn't start up. He disconnected the feed to the line timebase and checked the power supply with a bulb across its output. The bulb lit and the output voltage was correct. There was no apparent fault in the line output stage in terms of a short-circuit however – the transistor, transformer etc. were all checked. So I suggested reconnection and trying it out with the bulb still attached. Lo and behold, a fully operational TV set! Well, apart from the idea of fitting a table lamp on top of the set and wiring it to the power supply, what were we to do?

We checked around the switch-mode control circuit and found that the waveforms didn't match those shown in the manual, despite full regulation. We decided to change the two electrolytics C312 (10μF) and C314 (47μF) and after that there was no further trouble.

A similar fault with a Hitachi CBP260 (NP9A chassis) produced tripping at switch on, though the set would work normally after a few attempts. We decided to change C918 (220μF), C919 (22μF) and C909 (10μF), which put matters right. **S.B.**

Fidelity F14

The problem with this set was unreliable start up – sometimes it didn't come on at all. On inspection we found that there was a dry-joint at the centre (collector) leg of the BU508A chopper transistor TR2. This transistor is mounted at the edge of the main PCB. The printed tracks at this point don't totally enclose the holes for the transistor leads, due to the need to keep solder clear of the cabinet guides when the board is slid in. The other two legs had apparently been resoldered by hand during production.

There was still a variable start-up delay at each switch-on after we'd repaired the dry-joint. Eventually R84 (15kΩ, 5W) in the start-up circuit was found to have gone very high in value. Replacing it restored the set to normal operation. **C.D.**

Grundig CUC120 Chassis

I like these sets. Although they do go wrong the faults are generally common ones that can be put right quickly. This particular set was the exception. The problem was that the picture's luminance level would very intermittently drop. By substitution we proved that the cause of the problem was on the decoder panel. The luminance delay line and the TDA3561 colour decoder chip were replaced but the fault was still present. It was difficult to take any measurements or use the scope because any such action made the fault disappear. We eventually found that the cause was the luminance coupling capacitor C2527 (0·1μF). **M.D.**

Decca/Tatung 140 Series Chassis

The complaint with this set was no results. H.T. was present at the line output transistor (ouch!) but there was no other activity. It didn't take us long to find that there was no 18V supply. The connection to the rectifier (D811) from the chopper transformer appeared to be perfectly soldered but the diode's cathode lead had never been pushed through the board fully. **M.D.**

Rank T24 Chassis

We've recently had two of these sets in for repair. Except for the tubes they've proved to be very reliable over the years. Both sets had intermittent faults. The first one would shut down at random. It was tripping due to the protection circuit coming into operation. We suspected that the h.t. was rising but a check showed that it was steady at 111V. So checks were made in the trip circuit. Here we found that R476 (1MΩ) had gone open-circuit, upsetting the bias with the result that the trip operated at random.

The second set would work for days before the fault would put in an appearance. Then the picture would go, leaving a dark screen. The sound remained normal. We were able to see that the tube's heaters remained alight when the fault occurred, and the first anode voltage was correct. The bias to the video stages seemed to be incorrect however and we eventually found that the third video transistor TR203 (BC557) had an intermittently open-circuit base-emitter junction. **M.D.**

Ferguson TX9 Chassis

This was one of the early models with a thyristor power supply. The problem was no power supply output. There was h.t. at the anode of the thyristor but its gate drive pulses were missing. Many checks were made and we eventually found that the pulses were getting lost around D73. When this diode was replaced the set worked perfectly. The diode checked all right out of circuit. **M.D.**

Philips CTX-E Chassis

This set was brought to us in pieces from another dealer. We had to rebuild the power supply because the transistors were short-circuit, having been fitted back-to-front. We sorted all this out and got the 125V h.t. right with a bulb as the power supply load. When the line output stage was connected however the power supply wouldn't start. After replacing the line output transistor the h.t. pulsed up to 80V, with a discharge apparent in the line output transformer. We were about to order a new one when we decided to disconnect the focus and e.h.t. leads in case of shorts. When the e.h.t. lead was disconnected the h.t. rose to 125V and there was e.h.t. from the transformer. A check on the e.h.t. lead showed that it was dead short between the screen and inner conductor. A new lead wasn't all that was required however. We had to replace the field output chip and several safety resistors in the 12V supply. The set then worked well and we were relieved to see that the tube still had life in it. **M.D.**

Ferguson TX85 with Remote Control

The note on the job card said that this set took anywhere from two to ten minutes to come on, then the picture would go big and cut off. With these sets the usual reason for not coming on and cutting off is dry-joints on the remote control board. But this set was still reluctant to come on after the dry-joints, which are mostly at TR901, TR902 and the surrounding components, had been attended to. So the next thing to check was the supply lines. The h.t. and l.t. lines were a little high, but this was to be expected as the line output stage wasn't working. A scope check for line drive pulses was then made at pin 26 of the TDA4501H chip IC2. None to start with then up they came after two-three minutes. The supply to this chip was slightly low at 10V instead of 10·7V, so a new chip was tried and the components in the supply were checked. Then the penny dropped.

TR902 on the remote control board is used to switch the l.t. supply for standby operation. So the voltages around TR902 were checked. There was 17V at the emitter and 14V at the collector when cold. When the set started up the collector voltage rose to 16V. Changing TR902 cured the fault. When checked the transistor was found to be leaky base-to-emitter in the cold state. **S.A.F.**

ECONOMIC DEVICES PO BOX 15, WOLVERHAMPTON, WV2 4AZ

15-80H	3.72
15-85R	3.72
17052	4.50
17053	5.61
17074	9.30
17089	3.45
17127	2.50
17376	1.58
1N4001	0.04
1N4002	0.06
1N4003	0.06
1N4004	0.05
1N4005	0.05
1N4006	0.08
1N4007	0.06
1N4148	0.03
1N4448	0.05
1N5401	0.11
1N5402	0.13
1N5403	0.18
1N5404	0.10
1N5408	0.16
1N914	0.04
1S555	0.18
1S44	0.10
1S921	0.10
2N2219A	0.29
2N3053	0.35
2N3054	0.99
2N3055	0.66
2N3442	1.16
2N3702	0.10
2N3703	0.18
2N3705	0.15
2N3706	0.14
2N3707	0.16
2N3711	0.11
2N3771	1.55
2N3772	1.55
2N3773	1.61
2N3819	0.40
2N3823	1.17
2N3904	0.50
2N4101	1.33
2N4240	2.68
2N4444	1.66
2N4905	9.99
2N5293	0.50
2N5294	0.50
2N5296	0.55
2N5297	0.50
2N5298	0.61
2N6109	1.58
2N6130	0.85
2N6133	1.25
2N6292	0.60
2SA202A	0.65
2SA1208	0.26
2SA769	0.99
2SA771	0.75
2SA968	2.44
2SA1006	1.50
2SA1011	0.99
2SA1015	0.20
2SA1020Y	0.36
2SA1027R	0.45
2SA473	0.54
2SA766S	4.95
2SC1173Y	1.25
2SC1474	1.25
2SC1509	1.35
2SA1095	3.45
2SA1103	5.74
2SA329	0.40
2SA489	1.17
2SA490	1.32
2SA493	2.25
2SA562	0.57
2SA564	0.97
2SA614	4.88
2SA628	0.37
2SA639S	1.75
2SA659	0.49
2SA673	0.28
2SA684	0.97
2SA697	0.80
2SA699	1.25
2SA748	1.95
2SA835	2.50
2SA836	0.49
2SA844	0.65
2SA872	0.99
2SA884	2.15
2SA937R	0.97
2SA940	2.23
2SA950	0.50
2SA951	1.75
2SA966-Y	0.85
2SA999	0.75
2SB186	0.40
2SB688	2.10
2SB774	0.44
2SB185	1.13
2SB400	0.40
2SB405	1.03
2SB511	0.99
2SB54	1.39
2SB546	0.74
2SB56	2.80
2SB618A	5.82
2SB631	2.00
2SB643	0.58
2SB681	3.96
2SB695	3.43
2SB774	0.65
2SB819	0.60
2SC1089	1.45
2SC1101	3.22
2SC1128	0.66
2SC1307	5.06
2SC1449	0.50
2SC1941	0.56
2SC558	3.69
2SC1096	0.47
2SC1114	3.25
2SC1116	4.95
2SC1129	1.65
2SC1131	0.72
2SC1158	3.33
2SC1162	0.55
2SC1172	2.22
2SC1195	6.09
2SC1213	0.30
2SC1226	1.46
2SC1306	1.98
2SC1317	0.50
2SC1364	0.49
2SC1383	1.20
2SC1391	2.45
2SC1398	0.41
2SC1413A	2.27
2SC1447	2.07
2SC1475	0.60
2SC1505	1.00
2SC1514	1.76
2SC1573Q	1.10

2SC1583	0.34
2SC1617	3.89
2SC1678	1.98
2SC1741	0.21
2SC1810	1.75
2SC1815	0.20
2SC1826	0.69
2SC1829	3.35
2SC1875	4.50
2SC1893	3.85
2SC1921	1.37
2SC1923	0.30
2SC1929	2.35
2SC1942	2.59
2SC1959	0.20
2SC1957	0.95
2SC1953	1.93
2SC1962	1.93
2SC1969	1.79
2SC1983	1.32
2SC1985	0.60
2SC2009	0.34
2SC2029	1.95
2SC2028	2.11
2SC2063	0.99
2SC2078	1.10
2SC2073	2.73
2SC2085	1.65
2SC2091	1.30
2SC2141	1.30
2SC2166	0.87
2SC2216	0.69
2SC2233	1.20
2SC2236	1.69
2SC2278	1.14
2SC2314	0.87
2SC2335+Kit	7.00
2SC2551	0.35
2SC2565	4.65
2SC2570	0.46
2SC2577	1.34
2SC2578	6.75
2SC2671	0.91
2SC288A	1.85
2SC3153	3.20
2SC372	1.40
2SC373	1.16
2SC383	1.33
2SC388	0.29
2SC394V	0.81
2SC403C	0.60
2SC458	0.19
2SC495	0.92
2SC515A	1.85
2SC536	0.13
2SC537	0.54
2SC605L	1.16
2SC620	1.46
2SC643A	1.54
2SC668	0.67
2SC681	4.40
2SC682	1.88
2SC684	1.65
2SC693	0.63
2SC710	1.15
2SC711A	0.25
2SC717	1.28
2SC734	0.20
2SC783	3.98
2SC790Y	3.65
2SC828	0.28
2SC867A	4.54
2SC876	0.96
2SC930	0.54
2SC935	1.15
2SC940	4.68
2SD299	9.47
2SD355	0.64
2SD467	0.55
2SD869	3.75
2SD1128	0.94
2SD1138	0.62
2SD1273	1.48
2SD1453	1.50
2SD152K	2.64
2SD198	3.87
2SD234	0.47
2SD235	0.60
2SD24	2.29
2SD257	1.98
2SD313	0.55
2SD325D	2.26
2SD350	2.35
2SD401	1.40
2SD414	1.98
2SD471	2.13
2SD560	1.50
2SD600	2.98
2SD601R	0.65
2SD613	0.74
2SD636	0.20
2SD639-R	0.52
2SD655	0.98
2SD657	2.80
2SD661A	0.80
2SD731	1.95
2SD773	0.60
2SD811	6.84
2SD837	0.90
2SD841	1.37
2SD856	0.69
2SD8570	1.84
2SD882	0.35
2SD894	1.75
2SD898	2.37
2SK105H	2.15
7805-T022	0.63
7808	0.45
7812-T022	0.35
7815	0.64
7905	0.80
AD140	1.06
AD143	1.93
AD145	1.60
AD161	0.84
AD162	0.84
AF114	2.47
AF115	0.90
AF118	1.20
AF127	0.57
AF139	0.40
AF178	1.45
AF179	0.36
AF180	0.55
AF181	0.53
AF186	1.32
AF239	0.53
AF279	0.88
AN115	3.98
AN155	1.89
AN206	2.58
AN208	3.55
AN210	1.56
AN211	3.25

AN214Q	2.40
AN235	4.65
AN236	3.33
AN240P	0.99
AN241	1.71
AN245	5.48
AN253	1.80
AN260	3.85
AN272	7.92
AN295	7.63
AN301	2.45
AN302	3.99
AN305	8.88
AN315	2.46
AN316	4.95
AN318	7.16
AN320	5.47
AN321	2.25
AN322	7.62
AN337	5.37
AN340P	1.53
AN355	1.65
AN362	1.50
AN370	3.95
AN5111	3.43
AN5120N	4.50
AN5132	4.42
AN5250	5.04
AN5256	4.40
AN5612	2.20
AN5613	4.20
AN5630	3.95
AN5701N	1.66
AN6250	1.75
AN6300	4.40
AN6310	4.54
AN6340	5.62
AN6341	2.22
AN6363	16.00
AN6531	1.95
AN6551	0.69
AN6552	0.68
AN6610	1.78
AN7111	1.14
AN7115	2.52
AN7145	2.17
AN7146	9.90
AN7151	2.37
AN7156	3.87
AN7158	2.67
AN7218	0.80
AN7223	4.99
AU107	7.72
AU110	5.69
AU113	14.63
AY106	2.80
BA524	8.94
BA310	0.14
BA1310	1.50
BA1320	1.30
BA1322	3.95
BA1330	2.75
BA145	0.19
BA148	0.11
BA154	0.40
BA155	0.12
BA156	0.05
BA159	0.09
BA182	0.19
BA302	1.15
BA302	1.24
BA311	0.65
BA312	1.45
BA313	0.76
BA317	0.04
BA318	0.09
BA328	2.22
BA333	1.37
BA335	6.27
BA5102A	2.19
BA511	1.95
BA514	1.00
BA521	1.20
BA524	8.94
BA526	7.98
BA527	2.98
BA532	1.20
BA536	0.99
BA6209	1.27
BA656	1.51
BA7100	11.35
BA841A	9.27
BA843	3.96
BA854	5.76
BAV18	0.06
BAV19	0.24
BAV20	0.36
BAV21	0.10
BAW62	0.11
BAX12	0.49
BAX13	0.11
BAX18	0.94
BC107B	0.11
BC108B	0.15
BC109B	0.14
BC113	0.14
BC119	0.36
BC126	0.20
BC132	0.14
BC135	0.14
BC137	0.18
BC138	0.34
BC139	0.33
BC140	0.30
BC141	0.31
BC142	0.26
BC143	0.34
BC147	0.14
BC148B	0.13
BC148C	0.11
BC149B	0.13
BC153	0.14
BC154	0.14
BC159	0.16
BC160	0.40
BC161	0.28
BC168	0.36
BC169C	0.16
BC170	0.16
BC171	0.07
BC172B	0.27
BC173	0.17
BC174B	0.27
BC177	0.35
BC178	0.26
BC179	0.17
BC182	0.07
BC182LB	0.14
BC183LB	0.09
BC184	0.09
BC184LB	0.13
BC186	0.25
BC187	0.28
BC204	0.35

BC207	0.19
BC212B	0.26
BC213L	0.10
BC214	0.10
BC225	0.40
BC237	0.10
BC238	0.10
BC238B	0.08
BC239B	0.25
BC251A	0.31
BC294	0.50
BC300	0.38
BC301	0.34
BC302	0.53
BC303	0.48
BC307A	0.13
BC308A	0.11
BC309	0.17
BC317A	0.13
BC327	0.09
BC328	0.11
BC337	0.09
BC338	0.12
BC368	0.19
BC440	0.69
BC441	0.39
BC454	0.36
BC460	0.42
BC461	0.47
BC462	0.51
BC463	0.30
BC478	0.13
BC479	0.41
BC546	0.28
BC547	0.08
BC548	0.10
BC549	0.28
BC550	0.10
BC556	0.19
BC557	0.13
BC558	0.08
BC559	0.10
BC560C	0.10
BC635	0.20
BC637	0.22
BC638	0.20
BC639	0.24
BC640	0.20
BCX34	0.24
BD115	0.55
BD116	0.36
BD124	0.70
BD131	1.31
BD132	0.42
BD133	0.42
BD135	0.36
BD136	0.36
BD137	0.41
BD138	0.28
BD139	0.24
BD140	0.35
BD144	1.43
BD150	0.75
BD157	0.67
BD160	1.60
BD163	0.71
BD166	0.69
BD175	0.28
BD179	0.30
BD181	0.99
BD182	0.99
BD183	0.99
BD184	1.21
BD187	0.80
BD189	0.65
BD190	0.55
BD201	0.41
BD202	0.60
BD203	0.46
BD204	0.45
BD207	1.73
BD222	0.52
BD225	0.46
BD228	0.63
BD229	0.80
BD231	0.50
BD232	0.49
BD234	0.39
BD237	0.36
BD238	0.28
BD239	0.45
BD240	0.57
BD241	0.39
BD242	0.37
BD243A	0.62
BD243C	0.50
BD244	0.42
BD244C	0.58
BD245	0.83
BD246	0.95
BD253	1.05
BD278A	0.70
BD317	1.40
BD318	2.72
BD375	0.42
BD380	0.66
BD410	0.33
BD433	0.39
BD434	0.37
BD435	0.49
BD436	1.14
BD437	0.45
BD438	0.52
BD441	0.62
BD442	0.50
BD509	1.64
BD510	1.08
BD519	0.78
BD529	0.80
BD530	0.73
BD533	0.67
BD534	0.52
BD535	0.38
BD536	0.50
BD537	0.50
BD538	0.67
BD544B	0.75
BD677	0.33
BD679	0.43
BD680	0.49
BD681	1.48
BD696	2.47
BD699	0.80
BD700	3.70
BD707	0.60
BD709	0.80
BD710	0.80
BD809	0.45
BD810	0.57
BD879	0.74
BD895	2.18
BD901	0.55
BD902	0.56
BDW83C	1.20
BDW84C	0.99
BDX32	1.65
BDX53A	0.45
BDX538	3.35

BDX54B	0.33
BDX63A	2.09
BDX63A	1.16
BDY20	1.96
BDY81	1.18
BF115	0.29
BF117	0.66
BF118	0.67
BF121	0.25
BF123	0.13
BF127	0.13
BF137	0.29
BF153	0.58
BF154	0.26
BF157	0.33
BF158	0.18
BF159	0.18
BF160	0.31
BF167	0.38
BF173	0.34
BF177	0.55
BF178	0.40
BF179	0.36
BF180	0.36
BF181	0.32
BF182	0.24
BF183	0.39
BF184	0.43
BF185	0.39
BF194	0.17
BF195	0.14
BF196	0.17
BF197	0.24
BF198	0.17
BF199	0.17
BF200	0.37
BF218	0.36
BF224	0.17
BF237	0.65
BF240	0.19
BF241	0.17
BF245	0.50
BF245B	0.49
BF246A	2.67
BF255	0.20
BF256	0.17
BF257	0.34
BF258	0.33
BF259	0.30
BF262	0.57
BF263	0.57
BF271	0.34
BF273	0.20
BF274	0.34
BF324	0.32
BF336	0.33
BF337	0.31
BF338	0.34
BF355	0.45
BF362	0.99
BF363	0.50
BF371	0.50
BF391	0.25
BF419	0.65
BF422	0.15
BF423	0.33
BF435	2.61
BF450	0.35
BF451	0.11
BF457	0.41
BF458	0.49
BF459	1.27
BF460	1.63
BF469	0.33
BF470	0.26
BF471	0.25
BF472	0.33
BF479	0.61
BF480	0.89
BF491	0.50
BF506	0.43
BF532	0.45
BF596	0.18
BF597	0.27
BF694	0.22
BF757	0.34
BF759	0.28
BF761	0.43
BF762	0.34
BF869	0.49
BF870	0.30
BF960	0.47
BF966	0.51
BF970	0.39
BFR39	0.63
BFR61	0.92
BFR62	0.50
BFR79	0.29
BFR81	0.29
BFR89	1.63
BFR90A	0.63
BFX29	0.34
BFX84	0.37
BFX85	0.31
BFX86	0.36
BFX87	0.55
BFX88	0.34
BFY50	0.30
BFY51	0.33
BFY90	1.16
BLY49	2.20
BR100	0.23
BR101	0.78
BR103	0.79
BR303	1.20
BRC84	2.08
BRX44	0.60
BRX45	0.81
BRX46	0.30
BRX49	0.56
BRY39	0.85
BRY44	0.34
BSS38	1.18
BSTB0140G	4.93
BSTC0246	6.99
BSTC0233	6.12
BSTC1233	4.34
BST01043	2.85
BSV57B	3.69
BSW68	0.60
BSX19	0.34
BSX20	1.12
BSY52	0.50
BT106	1.18
BT108	1.45
BT119	1.76
BT120	2.17
BT121	2.48
BT123	1.98
BT151-800R	0.95
BT16018	1.36
BU106	2.48
BU110	1.35
BU111Y	4.16
BU124	1.48
BU125	2.48

BU126	1.10
BU204	1.58
BU205	1.15
BU206	1.27
BU207	1.65
BU208	1.12
BU208A	1.12
BU208D	1.43
BU209	1.75
BU226	2.55
BU326A	0.99
BU406	1.24
BU406D	1.24
BU407	0.54
BU412	5.29
BU426A	1.67
BU500	1.53
BU508A	1.50
BU536	1.53
BU608	2.17
BU705	2.67
BU806	0.98
BU807	1.95
BU826A	1.95
BUW84	0.66
BUX84	0.50
BUX85	0.69
BY126	0.13
BY127	0.09
BY133	0.15
BY164	0.64
BY176	0.93
BY179	0.85
BY182	1.05
BY187	0.79
BY189	1.76
BY198	1.62
BY207	0.17
BY208	1.86
BY210-400	0.18
BY210-600	0.31
BY210-800	0.19
BY223	1.45
BY224-600	4.95
BY226	0.15
BY227	0.20
BY228	0.60
BY229-600	1.28
BY229-800	0.90
BY255	0.13
BY295-600	1.23
BY298	0.20
BY299	0.20
BY407	0.90
BY409	1.49
BY448	1.40
BY713	1.12
BYW56	0.29
BYX55-600	0.23
BYX71-600	0.85
BYX71-350	0.88
BYY56	1.48
BZY93C30	1.65
C20	1.95
C106M	0.76
CA3046	1.55
CA3089	3.29
CA3090AO	3.25
CA3094	1.72
CA3131EM	3.12
CD4001	0.24
CD4002	0.27
CD4008	1.35
CD4011	0.20
CD4012	0.24
CD4013	0.33
CD4016	0.25
CD4017	0.30
CD4020	0.75
CD4021	0.39
CD4023	0.28
CD4025	0.64
CD4028	0.84
CD4040B	0.45
CD4047	1.06
CD4049	0.24
CD4052	0.35
CD4066	0.29
CD4069	0.29
CD4070	0.24
CD4081	0.14
CD4093	0.40
CD4511	0.44
CD4528	0.52
CD4556	1.47
CRO2AM-8	1.70
CV12E	4.19
CX095D	3.14
CX104	8.77
CX108	5.52
CX109	7.20
CX130	8.76
CX135	7.50
CX136	11.49
CX139	11.83
CX157	5.52
CX158	10.45
CX177	8.80
CX187	5.26
CX755	12.95
CX885A	6.85
E1222	0.40
E5024	0.28
E5386	0.25
GD243	1.95
GF758	1.07
HA11215	1.75
HA11211	2.53
HA11225	4.29
HA11229	2.15
HA11235	1.95
HA11244	2.95
HA1125	4.29
HA1137W	1.38
HA1138	3.75
HA11414	2.25
HA1156	1.16
HA1160	5.77
HA1166X	6.73
HA1167	6.60
HA11706	3.61
HA11705	8.00
HA11703	3.45
HA11701	3.37
HA11710	3.45
HA11713	2.90
HA11711	9.40
HA11715	10.19
HA11714	7.76
HA11716	13.10
HA11725	18.26
HA11725MP	16.00
HA11756	13.50
HA11781	21.15
HA1180	5.15

HA1196	7.43
HA13001	1.63
HA1306	2.26
HA13402	7.06
HA13403	11.86
HA1342A	6.08
HA1364	12.25
HA1366WR	2.88
HA1367	2.75
HA1368R	2.45
HA1368	1.95
HA1374	2.88
HA1377	1.59
HA1388	1.87
HA1389R	2.05
HA1389	2.26
HA1392	2.22
HA1394	3.19
HA1397	2.75
HA1398	2.55
HA1406	2.07
HA1452	0.85
HA1457W	2.23
HD38702-A2	2.99
HD38750A53	5.77
HD38750A-7	8.53
HD38800A50	14.12
HD44801A05	14.07
HISH1010	14.60
HISH1002	9.50
HM6211	14.55
HM6231	12.24
HM6232	7.20
HM6251	5.69
HM7103	2.97
HM9032	4.00
HM9012	3.22
HT4207	11.99
HT4208	2.75
ICH28I	1.20
KA2101	1.00
KC581C	7.75
KC582C	4.85
L200CV	1.27
LA1201	0.75
LA1210	1.56
LA1230	1.18
LA1231	3.04
LA1357N	3.06
LA1363	1.05
LA1364	3.02
LA1365J	1.45
LA1385	1.53
LA1387	3.18
LA3350	1.43
LA3361	1.00
LA3390	5.52
LA4032P	2.35
LA4100	1.25
LA4101	1.30
LA4102	0.75
LA4112	1.35
LA4125	2.25
LA4138	4.98
LA4140	0.70
LA4192	1.23
LA4220	1.25
LA4420	1.72
LA4422	1.28
LA4430	1.47
LA4440	1.99
LA4445	1.52
LA4460	1.50
LA4461	1.60
LA5112N	1.18
LA7020	13.86
LA7025	11.97
LA7027	10.92
LA7040	9.20
LA7042	4.05
LA7800	1.36
LA7801	3.21
LA7820	2.95
LB1274	1.90
LC7800	9.20
LD3120	1.13
LD3150	2.75
LM383	1.10
LM1017N	1.81
LM1877	1.88
LM2808	5.94
LM2877	7.45
LM324N	0.59
LM339N	0.43
LM340K	11.85
LM348N	2.15
LM380N	1.50
LM6402A093	10.15
LM6416	11.08
LM748	1.82
LM8360	3.87
LM8361	2.95
LR3419	9.37
LR3471	9.37
LU1141	7.27
LU52012	20.62
LU52011	14.95
LU03112	12.37
M21C	1.32
M23C	1.98
M192B1	2.32
M293	7.09
M51102L	1.75
M5115P	5.24
M51203L	3.15
M51231P	1.24
M51301P	4.53
M51353P	6.93
M51381P	5.98
M51393AP	4.50
M51394P	14.50
M5142P	6.85
M5144P	8.25
M51515BL	2.75
M51516L	1.95
M51521L	1.50
M5192	3.13
M5194AP	6.27
M5231L	1.55
M53274P	1.33
M54532P	1.45
M5454L	1.61
M58478P	6.75
M58485P	14.43
MA8001	0.82
MAA4004	11.46
MB3705	1.98
MB3712	1.85
MB3713	1.69
MB3730	2.31
MB3731	11.50
MC13002	2.99
MC1310P	1.95
MC1327P	1.33

MC1330P	1.98
MC1350P	1.56
MC1351P	1.25
MC1352P	1.40
MC1357P	2.15
MC1358P	1.48
MC14493P	3.75
MC14497	7.10
MC14511BCP	1.10
MC1458P	2.91
MC15428BCP	2.15
MC1712	3.88
MC3340	1.40
MC5192	19.50
MC7724CP	3.49
MCR106-5/6	1.56
MCR220-7	1.25
ME0411	0.75
ME6002	0.26
ME6102	0.28
ME9002	0.45
MEA2901	2.06
MEM4956	2.50
MJ2501	3.30
MJ3000	2.37
MJE2955	1.03
MJE3055	1.15
MJE340	0.49
MJE520	0.49
ML231	0.99
ML232B	3.01
ML237B	1.95
ML238	5.65
ML923	3.30
ML926	3.45
MM5314N	8.99
MM5316N	3.50
MM5318N	3.11
MM5369N	2.01
MM5387AA N	1.20
MM5841N	6.93
MN1400VL	13.65
MN1435VX	13.20
MN1455	14.04
MP1192	5.07
MP2794	4.00
MPC13355C	1.98
MPF256C	0.60
MPS6570	0.48
MPSA42	0.26
MPSA55	0.15
MPSA56	0.11
MPSA92	0.15
MPSU05	0.86
MPSU10	2.84
MPSU56	0.65
MPSU60	2.21
MR818	0.33
MR854	0.46
MR914	0.80
MRF477	24.77
MSM5840H	12.09
MV5460-02	0.61
NE542	2.75
NE555	0.35
NE556	0.65
NE565N	1.18
OA202	0.11
OA47	0.16
OA91	0.14
OA95	0.16
OC28	9.07
OC35	1.06
OC36	7.53
OC44	1.95
OC45	0.18
OC72	0.44
OC75	0.44
DN236	1.06
ON782	1.65
OT121	1.45
PT6042	3.25
PT8504	5.65
R1038	2.19
R1039	2.19
R2008B	1.33
R2009	1.98
R2010B	2.98
R2029	1.33
R2030	1.33
R2257	2.38
R2265	1.49
R2306	1.36
R2322	0.67
R2323	0.76
R2354A	0.60
R2354B	2.01
R2441	1.36
R2461	0.95
R2540	1.55
R2540X	3.30
R2615	0.67
RCA2060	1.20
RGP01-15	0.70
RGP10	0.23
RGP30M	0.36
RM11C	0.85
RT905A	3.28
S1299	5.34
S2055AF	3.75
S2800D	1.50
S2802	2.90
S2818	4.05
S3702S	5.21
S6080B	9.98
SA8063	15.55
SAA1006	1.85
SAA1020	5.77
SAA1025	4.40
SAA1024	2.50
SAA1075	4.25
SAA1121	7.44
SAA1124	2.60
SAA1130	6.69
SAA1174	7.77
SAA1250	3.95
SAA1251	3.20
SAA1351	8.11
SAA3027P	2.71
SAA5000	3.25
SAA5010	3.54
SAA5012	5.50
SAA5020	5.78
SAA5030	6.33
SAA5050	4.90
SAB1009B	5.98
SAB3011	7.34
SAB3013	4.69
SAB3021	3.95
SAB3024	6.36
SAB3209	5.82
SAB3210	3.21
SAF1032P	5.13
SAF1039	1.95
SAS5010	8.39
SAS560S	1.91

SAS560T	5.42
SAS570T	5.42
SAS570S	1.95
SAS580	2.85
SAS6600	1.33
SAS660	2.97
SAS6700	1.33
SAS670	3.96
SAS6710	2.21
SBA750	1.61
SC84283	19.35
SDA2006	17.10
SDA2010	20.50
SDA21122	11.77
SG264A	9.25
SG613	12.37
SG629	8.27
SG6533	9.00
SI1125H	7.50
SI163HD	27.87
SKE2F1/04	1.25
SKE2G3/04	0.73
SKE4F1/06	0.30
SKE4F2/08	1.07
SKE4F2/06	0.85
SKE4F2/10	1.36
SKE5F3/10	1.36
SKE4G104	0.54
SKS1/10	2.15
SL1310	3.14
SL1430T	2.31
SL414	3.69
SL432A	3.44
SL439	2.48
SL471	4.45
SL480	7.24
SL490	2.37
SL901B	8.32
SL918A	9.07
SN16861AND	0.82
SN16966N	10.25
SN29715N	6.04
SN29717N	7.19
SN29716N	3.66
SN29715N	6.04
SN29722	11.95
SN29723AN	14.46
SN29764AN	2.60
SN29767	4.55
SN29770BN	4.17
SN29772BN	5.75
SN29771BN	5.59
SN29773	2.58
SN29791	1.67
SN29798N	5.56
SN7400N	0.61
SN7401N	0.36
SN7402N	0.65
SN7404N	0.52
SN7410N	0.27
SN74121	1.60
SN74141N	2.65
SN74151AN	1.51
SN74154N	1.27
SN7417S	1.52
SN74190	1.35
SN7420N	0.34
SN7430	0.49
SN7440N	0.27
SN7442	0.74
SN7472	1.54
SN7474N	0.44
SN7490AN	0.75
SN74LS26N	1.45
SN76001N	1.65
SN76013ND	7.45
SN76023N	2.97
SN76023ND	3.91
SN76033N	2.68
SN76110N	0.90
SN76115AN	1.61
SN76131	1.71
SN76227N	2.45
SN76226DN	2.17
SN76228N	3.27
SN76242	5.23
SN76243	5.23
SN76396	2.90
SN76533N	1.75
SN76532N	3.03
SN76545	4.87
SN76549	2.45
SN76570	3.08
SN76611	2.59
SN76620	2.59
SN76630	2.55
SN76660N	2.48
SN76666N	1.20
SN76708	4.86
SN76709N	9.63
SN76707N	1.23
SN76705N	2.97
SN76730	5.54
SN76810N	0.60
SN76832N	1.35
SN94042	4.35
SP5422	1.83
STA401	2.75
STA441C	1.33
STA471C	8.70
STK0029	5.70
STK0039	5.25
STK0040	7.17
STK0050	11.96
STK011	5.08
STK014	12.25
STK031	12.95
STK040	13.34
STK054	9.35
STK058	27.50
STK077	9.28
STK1039	5.75
STK2110	11.95
STK2115	13.77
STK2240	16.65
STK2250	18.95
STK3042	6.08
STK3044	5.75
STK4019	13.87
STK433	6.18
STK4332	5.37
STK435	3.95
STK4352	7.95
STK436	7.26
STK437	9.50
STK1372	5.99
STK460	9.85
STK466	10.10
STK501	6.32
STK502	7.25
STK5314	9.48
STK5333	9.72
STK5730	3.67
STK7216	14.90
STK772	3.71

STR1096	4.78
STR4090	6.43
STR440	6.18
STR451	5.77
STR454	4.96
STR50103A	4.99
STR6020	6.16
T6016V	1.09
T6021V	0.40
T6036	0.67
T6037	2.11
T6044V	0.97
T6045	1.20
T6049	1.45
T6052V	0.87
T6058	4.95
T6059	4.22
T9003V	1.25
T9013V	4.95
T9014V	2.42
T9016	1.02
T9017V	1.25
T9019V	1.00
T9034V	1.34
T9035V	1.49
T9051	8.07
T9054V	5.98
T9057V	3.44
T9064	2.40
T9065V	3.44
TA7027	4.80
TA7050	1.74
TA7051	1.74
TA7054	2.55
TA7060AP	0.71
TA7061AP	1.27
TA7069	3.13
TA7070P	1.68
TA7072P	2.57
TA7074P	1.98
TA7076P	7.50
TA7089P	3.10
TA7092P	9.94
TA7093P	3.99
TA7108P	1.61
TA7109	3.71
TA7120P	0.64
TA7122B P	0.87
TA7124P	2.34
TA7129P	1.90
TA7130P	1.27
TA7136AP	1.89
TA7137P	1.21
TA7146P	5.18
TA7149P	3.26
TA7152P	3.16
TA7161P	16.54
TA7162P	3.61
TA7169	7.80
TA7172P	1.41
TA7176P	1.75
TA7193P	4.80
TA7204P	1.95
TA7205P	1.00
TA7207P	1.68
TA7208P	2.15
TA7210P	1.45
TA7214P	3.63
TA7215P	2.58
TA7217AP	1.45
TA7222	1.95
TA7226	4.22
TA7229P	4.66
TA7230P	1.35
TA7233P	4.63
TA7240AP	2.20
TA7245P	1.95
TA7310P	2.15
TA7313AP	0.60
TA7314	3.50
TA7323P	3.15
TA7325P	1.63
TA7339P	2.50
TA7340P	5.95
TA7607AP	1.95
TA7609	2.35
TA7611AP	2.32
TA7616P	5.25
TA7622AP	8.94
TA7628P	1.73
TA7629P	7.50
TA7630P	0.95
TA7640AP	1.95
TA7672P	2.75
TA7676P	2.81
TA7726P	10.25
TAA320A	1.27
TAA350A	6.59
TAA550	0.39
TAA570	1.85
TAA661B	0.95
TAA691	8.58
TAA700	2.37
TAA930	4.36
TAA970	2.83
TAG626-600	1.32
TBA120AS	1.45
TBA120SB	0.40
TBA120T	0.57
TBA120U	2.50
TBA120A	1.05
TBA1440	1.94
TBA1441	1.95
TBA395	0.66
TBA396	1.20
TBA400	2.39
TBA440C	2.34
TBA480Q	1.30
TBA510	1.37
TBA520	1.20
TBA530	1.30
TBA540	1.72
TBA560C	1.40
TBA570Q	1.60
TBA570A	1.71
TBA673	2.60
TBA700	1.85
TBA720	4.32
TBA730	3.55
TBA750Q	2.50
TBA800	1.08
TBA810P	0.98
TBA810S	1.61
TBA810T	1.75
TBA820	0.66
TBA820M	0.82
TBA890	3.50
TBA920	1.65
TBA940	1.87
TBA950	1.55

TBA970	3.60
TBA990	1.98
TCA270S	3.47
TCA270SQ	1.05
TCA290A	2.39
TCA420A	2.16
TCA440	1.89
TCA640	2.25
TCA650	3.05
TCA660B	2.60
TCA730	2.75
TCA750	2.25
TCA800Q	1.60
TCA830S	2.38
TCA890	5.44
TCA900	2.04
TCA910	1.65
TCA940	0.82
TCA940E	2.93
TCA4500	3.95
TD3F800R	6.51
TD3F900H	6.37
TDE361N-DS	5.25
TDA1001B	2.31
TDA1003A	1.47
TDA1005A	2.02
TDA1006A	7.00
TDA1010AE	4.25
TDA1011	1.14
TDA1010	1.10
TDA1011A	1.54
TDA1028	2.45
TDA1034B	2.42
TDA1035T	1.70
TDA1036	2.64
TDA1037	1.79
TDA1037D	2.05
TDA1044	2.10
TDA1047	3.25
TDA1059B	0.80
TDA1060	2.60
TDA1082	4.51
TDA1151	0.95
TDA1190	1.27
TDA1190Z	2.48
TDA1200	1.51
TDA1235	3.88
TDA1236	5.52
TDA1270	3.74
TDA1327A	6.93
TDA1412	1.08
TDA1420	1.52
TDA1470	2.90
TDA1470P	4.25
TDA1506	3.05
TDA1510	4.60
TDA1512	2.57
TDA1515	2.55
TDA1522	5.92
TDA1559	3.15
TDA1670	2.47
TDA1770	2.88
TDA1905	1.27
TDA1908	2.55
TDA1940	3.89
TDA1950	2.50
TDA2005	1.56
TDA2006	1.05
TDA2004	1.20
TDA2002	0.90
TDA2003	1.00
TDA2030	1.05
TDA2140	4.77
TDA2150	4.48
TDA2151	2.51
TDA2160	4.01
TDA2161	4.78
TDA2170	3.21
TDA2270	2.50
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TDA4431	2.27

TDA4440	3.18
TDA4442	5.14
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TDA4610	5.99
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TDA9503	1.56
TDA9513	3.15
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TEA1009	1.65
TEA1014	3.00
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TIC47	0.77
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TIP117	0.95
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TIP29	0.84
TIP2955	0.94
TIP29A	0.46
TIP29B	0.63
TIP29C	0.33
TIP29D	0.75
TIP3055	0.66
TIP30A	0.41
TIP30C	0.40
TIP31A	0.34
TIP31B	0.38
TIP31C	0.39
TIP32A	0.35
TIP32B	0.46
TIP32C	0.60
TIP33	1.30
TIP33A	1.02
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TIP41B	0.31
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UPC1351C	1.81
UPC1350C	0.75
UPC1353	1.65
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691 201 66	£61.93
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VID3	01X0-018-025	Rewind idler assembly T3V16/PU49282	6.20
VID4	01X0-018-729	Take up idler T3V00/PU49280	7.96
VID5	01X0-040-006	Loading belt T3V29/30/PU48941-2	0.26
VID6	01X0-033-454	Roller Assy. (cass. Housing) T3V23/PU49042	4.50
VID7	01X0-040-007	Take up idler 3V29/30/PU48967B	2.45
VID8	01X0-040-017	Reel motor assembly 3V29/30/PU51381V	27.95
VID9	01X0-065-009	Capston motor 3V35/36/38/39/PU55371V	20.92
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VID11	V5577355	GEC 4100/Hitachi VT11E capston motor	26.78
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NATIONAL PANASONIC

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VID23	VXP0401	Idler wheel NV333	0.85

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VID25	1430662T01201	Reel drive pulley VTC 5000	5.49
VID26	PR2758	Pinch roller VTC5000/5150	2.95
VID27	1430490400900	Gear idler Fisher FVH-P615	4.50
VID28	1430420400300	Heart idler Fisher FVH-P615	2.95

SHARP

VID29	RMOTP1029	Capston motor 73/9300	29.95
VID30	RMOTV1008	Reel motor VC9700	16.14
VID31	NIDL0006	Idler VC387H etc	1.60
VID32	NIDL0005	Reel idler VC9300 etc	1.80
VID33	NIDL0004	Idler wheel VC2300	3.50

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GEC

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VT 8500	DBK144	£0.68
VT 9300	DBK129	£1.10
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VTC 5400	DBK105	£1.15
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JVC

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HR 3600	DBK107	£5.25
HR 3660	DBK103	£1.42
HR 4100	DBK127	£2.50
HR 7200	DBK139	£1.22
HR 7600	DBK138	£0.86
HR 7650	DBK132	£0.86
HR 7700	DBK108	£0.85

NATIONAL PANASONIC

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NV 330	DBK110	£2.20
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NV 336	VID7521	£2.10
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NV 777	DBK131	£1.28
NV 2000	DBK109	£1.57
NV 3000	DBK113	£1.95
NV 7000	DBK111	£1.15
NV 7200	DBK140	£1.42
NV 8600	DBK112	£1.76

SHARP

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VC 385/386	DBK116	£2.15
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VC 6000/6300	DBK117	£1.40
VC 6500	DBK117	£1.40
VC 7300	DBK118	£1.50
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SONY

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SL 8600	DBK115	£2.00
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SLC 6	VID7519	£1.65
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Fifty Years in Radio and TV

Part 4: The coming of ITV

Harold Peters

Although the ITV transmitter network spread more quickly than the BBC network had done it followed the same pattern, starting in London and the Midlands and spreading outwards. The BBC and ITV transmitters were not co-sited, but in many cases they were close together for topographical reasons. Separate aerials were required, the standard for Band III being a five-element Yagi. The only concession to tidiness was that a common polarisation was used in each area. As with Band I, there was an initial myth that the signals would be strictly "line of sight". This was soon dispelled. The earliest Band I/III receivers had two aerial sockets, but a single socket soon became the rule rather than the exception. We were given two more bits of equipment likely to go wrong: the diplexer, which sat on the aerial cross-arm and combined the two signals for feeding to the TV receiver via a common downlead, and the turret tuner where silver-plated contacts oxidised faster than you could keep them clean.

Mechanics

Setmakers have, over the years, developed the reputation of being lousy mechanics. Any moving parts introduced into a TV set's works stike a chill in the hearts of service engineers. Perhaps the worst ever was a pre-war Philips radio called the Monoknob. Inside was 80 per cent drive cord and bowden cable and 20 per cent electronics. All this to make one knob work the lot. The memory of it could well explain the Philips concern in more recent times to rid its sets of even the smallest knob.

Apart from the turret and one or two other types of thirteen-channel tuner the coming of ITV was followed by almost a decade when there was little technical change in receivers. Many people regard it as television's Golden Age. Despite 405 lines and monochrome pictures, viewing habits that last to the present day were created.

Heaters

There was also a fair degree of stability in set design. Cabinets were approximately square and usually had a flat chassis beneath the c.r.t. Serviceability was generally good. Take off the back and the bottom, turn the set on its side and you had access to almost everything. This speeded up valve fault diagnosis. Remember that the heaters of the valves were connected in a chain, like Christmas tree lights. Also that the chain was not a simple progression but was carefully arranged so that the items most at risk of heater-cathode breakdown, the c.r.t. for example, were at the earthy end. Small silicon rectifiers to serve as droppers were still years away, so the heater chain was topped up at the live end with a tapped, wirewound mains dropping resistor. The whole chain dissipated some 72W of pure heat. Burnt fingers and scorched hankies were part of our everyday life.

There was another problem with the series heater chain. The resistive value of the heaters varied with their incandescent colour, but that of the mains dropper stayed the same. Thus at switch in the valves received more than their rated current and lit up like lamps for a second or two. To reduce the short life that this caused a thermistor (a resistor with a negative temperature coefficient) was included in the chain. Its resistance was high when cold, falling to a low value when hot. In fact when running the thermistor got so hot that the dip-soldered leadout wires oxidised and became open-circuit next time the set was switched on.

The Business Angle

So there was plenty to go wrong, and this gave an impetus to the tendency of viewers to rent their sets. Purchasers and dealers had to cope with the dreaded Purchase Tax, which the government used to use as an economic regulator (it was succeeded by VAT). Within reason you could tell whether it would go up or down at the next budget by studying the country's economic situation. If it looked like going up there was a mad panic, but if it looked like going down business would come to a halt. The effects were felt throughout the trade, right back to the manufacturers. It was to some extent responsible for the demise of the autumn radio and TV show at Earl's Court and the beginning of the spring launch of new models from hotel suites we've learnt to endure. The thinking behind this was that the launch of a new range would coincide with Budget tax changes and the public would therefore find it difficult to attribute any price change to either the tax or the setmaker.

Then there was the guinea. We still had pounds shillings and pence. A guinea was one pound and one shilling (£1.05 decimal). At the time a typical TV receiver would sell at around 79 guineas. That looked far more inviting on the price ticket than £82.19.0d!

Going Electric

ITV didn't come to East Anglia, where I was now living, until 1959. But we had plenty with which to keep ourselves occupied before that. BBC Tacolneston began by using the reserve London coronation transmitter, housed in a caravan with its feed to a temporary mast on the permanent site. There were ten progressive power increases as parts of the permanent installation were commissioned. Every increase extended the service area, and our business. More important was the supply of poles across fields to outlying communities. As isolated farmhouses "got the electric" these good people, who had saved for decades for the day when they doused the tilley lamp for good, invaded our showrooms and went mad.

It was a prodigious effort to deliver, install and explain the workings of a TV-radiogram, cooker, fridge and washing machine all in one go. When it came to presenting the bill, father would go upstairs and there would be the noise of floorboards being raised. Payment was usually by means of the large, white five pound notes, with the odd change being taken from the "hen on nest" on the mantlepiece.

Practical Television

It was as a result of the heroic struggle made by some of those who lived in farmhouses to watch TV before the poles arrived that I first became involved, in a very small way, with journalism. I had made notes, mostly for my own benefit, on what they got up to in order to receive TV without the mains. I wrote the notes up and sent them off to *Practical Television*, as this magazine was known until September 1970, and to my great surprise had them accepted. They appeared in issue 84, dated July 1957, almost 34 years ago. If you read that issue you'll find that Les Lawry-Johns was well into his famed "Servicing Television Receivers" series, dealing with the Etronic ECV1523 that month, and that F.J. Camm himself was continuing with his "Beginners' Guide to TV". On the front cover there was a vectorscope, and the centre-spread was devoted to more about colour TV – including the mathematical proof that the G – Y colour-difference signal can be derived from the other two.

Colour television had already started in the USA. The BBC, having moved its London transmitter to Crystal Palace, installed a working 405-line NTSC system at the Alexandra Palace site. If you count starting up after the war with 405 lines as one, and the Baird trials as another, this was the third wrong horse that the broadcasters backed: when colour eventually came, a decade later, it was the PAL system that was adopted, catching us relatively unprepared – but more about that another time, as we are jumping ahead a bit.

In that July 1959 issue of *Practical Television* somebody was advertising – transistors! Admittedly they were germanium types, suitable only for m.w. radio receivers. Henry's Radio was asking 15/- (75p) for each one. There was also a tobacco advertisement in the issue. Perhaps it was there because of the tin container in which the plug came – those containers featured regularly in articles describing small aerial preamplifiers and the like!

The old "Your Problems Solved" feature on the back page was already a favourite, and on the strength of my article I became one of the "agony aunts". As I soon found out, it was not as easy a task as it looked. The editor of the time tried to pass the queries to engineers who regularly handled the range concerned, so we were familiar enough with the sets. The great difficulty came with trying to assess from a short letter the skill, experience and equipment available to the enquirer. Dare you, for example, remind him that the chassis is live, tell him that the problem ought to be tackled with the aid of an oscilloscope, or both!

A Series of Changes

The continuing stability of receiver design kept us in steady work at the bench – and with the typewriter. If there was a fly in the ointment it came with the 110° tube. The c.r.t was not a problem in itself, but it brought with it the craze to make the cabinets as small as possible, and this led to overheating. It was commonplace to have a card back crumble away in your hand as you tried to take it off. On the political side we had a "credit squeeze". This made us all money conscious and the setmakers started to produce standard and fringe models, the former selling for about £12 less while being perfectly adequate for most service areas.

Printed circuits were introduced at about this time and took quite a bit of getting used to. We didn't like having the circuit on one side of the board and the components on the other side. Previously you could trace out a circuit or signal path just by looking at the underside of the chassis. F.M. radio had not caught on, so the setmakers decided to give it a push by putting it on extra turret tuner positions. This involved providing a long, wafer-type TV/f.m. switch linked to the tuner. A splendid source of trouble and income we thought. But it was only the beginning: worse was to come. In 1960 Mr. Pilkington put his glass-blowing tube down to chair a committee on the future of broadcasting. It came up with a proposal, which was accepted, that made our blood run cold.

The UK was to change over from 405 to 625 lines. This was to take twenty years, during which the two services would run in parallel. The 625-line programmes were to be transmitted from co-sited transmitters and would eventually be four in number. As an incentive to people to encourage them to use the 625-line u.h.f. transmissions a completely new service, now known as BBC-2, would be available on 625 lines only. As soon as practicable some of the new programmes would be in colour.

One sage commented at the time that "if you sat down and tried to devise the biggest mess you could get TV into, this is what you'd come up with". What the setmakers did come up with was the notorious dual-standard receiver. Although there are still some of them about, most engineers would now probably prefer neither to think about nor remember them. Freud would say we didn't want to, and he'd be right. But the dual-standard age needs, and will get, an article of its own.

The Single-valve Scope

One feature of *Practical Television* was that it always provided something for the home constructor. Of the various items I contributed at the time, my own favourite was a single-valve oscilloscope. It was based on the old VCR97, as there were still plenty of redundant ones lying around from the early days. The aim was to try to quell the fear of oscilloscopes amongst the older generation of engineers. So I was very pleased to be confronted by a familiar looking bit of gear on the Careers stand at the Radio Show. It was my single-valve oscilloscope, and it was being used as a standard constructional project for apprentices. The man on the stand told me that "some chap wrote it in one of the magazines, and we've adopted it".

Live Television

By 1962 the age of the permissive society was dawning. The BBC was desperately trying to shake off its "auntie" image. In this respect the most memorable programme was "That was the week that was", a live, late-night topical review. It gained such a large audience that the CEGB at first failed to predict the demand on the grid. Set in a bare-walled studio, with minimal "props" and the cameras and microphones constantly in view, David Frost introduced a youthful company with a wit and wisdom you could no longer afford to put together today. There were no holds barred. Politicians were mercilessly lampooned, Bernard Levin spoke as he wrote, Millicent Martin sang topical opening songs composed only minutes before and Lance Percival even made up calypsos as the news came in.

There were some memorable sketches. The *Which?* report on religion, which gave the C of E as its "best buy". The two Ronnies and John Cleese "I look down on him/I look up to him" skit on class differences. And a young Michael Crawford giving the teenager's view of life from the saddle of a Vespa. It was ahead of its time and died prematurely, killed off by a coming General Election.

If that hadn't done it, something else would. In the USA the Ampex Corporation had succeeded in producing a video recorder with broadcast quality reproduction on reels of tape of a manageable size. The days of live TV were numbered.

Camcorder Notebook

Nick Beer

We've had several Sony CCD-V90 camcorders in recently. They are early Pro-Handycam models, with an impressive specification.

Problems with Sony CCD-V90s

The problem with the first one was that it would load a cassette then shuffle to a ready state, laced up, but it wouldn't carry out any mechanical functions – it wouldn't even give the tape back. The mechanism would move when a mode was selected but it returned to the rest state almost immediately.

When we removed the mechanism and connected our mode selector jig to it we saw that the rest position wasn't stop/ready but fast forward/rewind.

We reconnected the mechanism to the machine and entered the service mode. Mode 5 enables the deck to run, overriding certain errors. You enter it by shorting the two test pins at the corner of the PCB that carries the large LCD to display the required information. This revealed that there was no capstan FG signal at the microcomputer chip IC001, and confirmed that otherwise the mechanism was fine. There was indeed no capstan FG signal from the FG head. We traced the cause to a high-resistance connection in edge connector CN002, which connects the mechanism to the syscon/servo circuits via a large flexi connector. The faulty connection read 1·5MΩ. A clean and retension cured the problem.

This fault highlighted the invaluable assistance that the Sony mode selector jig and the in-built error detection system provides.

The recorder section of the second CCD-V90 worked all right but the camera head picture was very weak both in the electronic viewfinder (EVF) and on a monitor, while the auto-focus system didn't work. On dismantling the unit and removing the camera head and recorder sections from the case the cause of the problem was immediately apparent – FP71, the flexi connector between the recorder and the camera sections, was torn across all but one of its lines. A replacement restored full working order.

The third machine would do everything but rewind a tape. When it was asked to do this it struggled for a second or so then gave up, asking for the tape to be ejected. The reason for this was that when the mechanism moved to the rewind position the back-tension arm didn't move out of the way sufficiently. Three repairs were needed to get things right. First the plastic arm that's driven by the main lever to move the back-tension post had to be replaced, secondly the loading/mode motor was worn and needed replacement, and finally the mode-selection mechanism was one tooth out and had to be retimed. Easier said than done, but it all works again now!

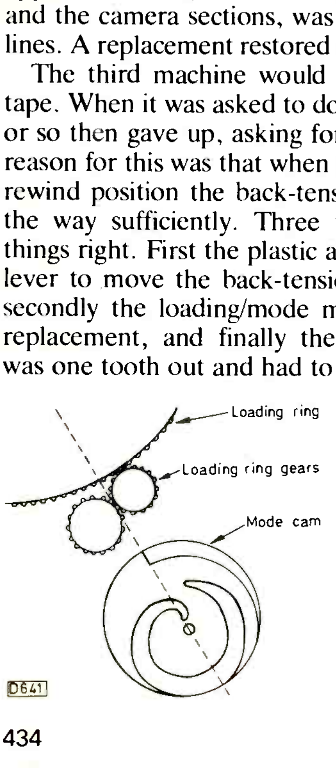


Fig. 1: Experience has shown that the best point at which to leave the mechanism is where the mode cam's projection edge just lines up tangentially, as shown here, with the middle of the two loading ring gears.

The fourth machine's recorder mechanism wouldn't perform any functions. It would move into position, then almost immediately cut out. Checks in the servo/syscon sections revealed that there was a lack of pulses from the supply reel. Dismantling the mechanism into its upper and lower halves enabled us to trace the cause of the problem. The flexi connector (FPC) that links the two reel sensors, the sensor LED and the tape switches on the top half of the PCB to the connectors on the bottom, main half of the mechanism had a broken connection. It's soldered to the board in two rows, and fairly large solder pads are used. As a result the connections are fairly strong, but the FPC had broken at its weakest point behind the joint. The only answer was a new FPC. It's easy to fit but requires the mechanism to be dismantled to a fair degree. The FPC comes with all the switches and sensors fitted and is backed in the appropriate places with self-adhesive tape.

It is important to dismantle the mechanism when it's in the correct state – in the blank area after loading is complete. This can really be achieved only by using the Sony mode selector jig, which needs an adaptor for this mechanism and uses only the mode switch half, not the loading side.

Unless I have a fault with my adaptor or jig this mechanism has a quirk when used with it, in that "loading/unloading" doesn't register, this condition illuminating the "FWD" LED. The blank area after loading, when the FWD LED goes out, is large and although it doesn't make a lot of difference I've found that the best point at which to leave the mechanism is where the mode cam's projection edge just lines up, tangentially, with the middle of the two loading ring gears, as shown in Fig. 1.

A Panasonic NV-MS50

The owner of a Panasonic NV-MS50 complained that the tape sometimes wouldn't load. This should happen only when the unit is switched on and the cursor is over the deck controls, i.e. in the camera mode. The tape should then lace to the record pause mode. This one seemed to work correctly every time, and I began to suspect that the user was getting confused about the cursor or something. Then the showroom chap who'd seen the customer came in to ask about the machine. When I told him that it appeared to be o.k. he was puzzled as it had failed many times for him. Asking to have a go he switched on, inserted a tape and, bingo, it didn't lace. Typical!

As you might expect, when the camcorder was dismantled it returned to the working state – then the battery went flat. When we got it going again it faulted. Checks showed that the cursor switch was working and I then discovered that slight pressure on the operations board would make the fault come and go. The cause of the problem was the record prevent switch.

Two Sony CCD-V100s

The problem with a Sony CCD-V100 was that the tape wouldn't eject and "caution" flashed in the viewfinder. I dismantled it and managed to remove the cassette by connecting the mode selector jig.

The tape had been laced, and the state of the loading switch indicated this correctly. Now before you unlace a tape with the loading switch buttons on the mode selector you should set the mode switch to the load/unload position, otherwise the tape won't be wound back into the cassette. In this case however the mode switch wouldn't move when the buttons on the mode selector jig were pressed. So the cassette had to be removed as things were. I unlaced the tape carefully, then removed the cassette carriage to gain access to the mode switching section. On dismantling and removing the mode select motor I found, after ascertaining that the mechanism wasn't jammed, that the motor was short-circuit. Replacing it and aligning the mechanism got things moving. Fortunately the motor drive wasn't affected. This was another example of the invaluable assistance provided by the mode selector jig.

The complaint with another Sony CCD-V100 was that "caution" flashed in the EVF and the eject symbol flashed in the VTR display. Apparently none of the deck functions worked but the camera was o.k. When I tried it out I found that this was so, but the camera went dead within minutes though the camera-on switch brought the VTR on.

I dismantled the unit and unloaded the cassette. The first thing I found was that the dew sensor was loose. After refixing this I discovered that there was a disconnected spring in the mode switch area. This was reconnected and the cassette unit was then run up with our mechanism control jig. The VTR section was now in order, so over to the camera section. Though the inputs were o.k., there were no outputs from its d.c.-d.c. converter. After fitting a new one then cleaning and resetting the unit it performed well.

The Lower End of the Market

E.G. Kempshall

There must be many readers of this magazine who realise, like myself, that they are never going to be a Steve Beeching but who have nevertheless had the necessary training and have the experience to be able to carry out quality repairs to a wide range of equipment. The following recent experiences should help them feel that they are not alone.

Recently a gentleman, cast in the same mould as Les's Beardy and Non-beardy, came into the shop with a radio-cassette player. Had I looked at it first I would probably have immediately declined to accept it. But my wife took it in.

The back was off, and my wife had been told that the power i.c. had been replaced but the set still didn't work. Apparently the original i.c. had been prised out with a screwdriver, but I've no idea how the original solder had been removed as there was no trace of it. There was not much left of the original print either. In fact I've never seen the like of it!

Anyway I'm not proud and have to eat. The thing was there in front of me and it was a JVC model. So, despite not having a circuit diagram, I foolishly decided to have a go. Armed with my trusty soldering iron, a large quantity of fuse wire and an illuminated magnifying glass, I set to. After a considerable period of time, during which there was much foul language mainly relating to my customer's ancestry, I reached the moment of truth and plugged the set into the mains.

Surprisingly enough it burst into life but, woe and despair, with an output from only one speaker. So it was back to the magnifying glass. Peering through this I eventually came to a straight section of print that in one place wasn't quite straight. The deviation was probably less than 1/32nd of an inch. Inspired, I thought do we need another connection here? So I gambled, put one in and switched on again. Joy oh joy! Sound from both speakers.

I wrapped it up by fitting new screws in the back cover and am now waiting to see whether the customer will pay the bill.

Restoring a Valve Radio

January and February are always a bit quiet, with everyone having had Christmas on credit. So to while away the time I dug out from the basement a vintage radio I intended to renovate. Many years ago I'd put the set into working order, but I'd not finished the job of realising its full potential. It was the usual story of a few out-of-tolerance resistors and a number of leaky capacitors. Some of the latter were not too bad but I decided to replace them for safety reasons, bearing in mind that someone in the future might reverse the polarity of the mains connections.

After a tune up the medium- and long-wave bands were loud and clear. But short-wave reception was appallingly insensitive and produced little volume. While probing around I eventually came across a wire that was disconnected from the wave-change switch. Reconnecting it restored the appropriate oomph. Puzzlement then set in as I tried to trim the short-wave band – the oscillator trimmer had no effect. For once the cause was immediately apparent. The wire between the trimmer and the coil wasn't there. It had been clipped out.

By this time we'd closed the shop. But this was something of a labour of love, so I continued while my better half flopped out in front of the telly, part of the joy she gets from helping me run a family business. I realised that I was getting no significant reception on the 16 and 19m bands. Time to put the set to one side until the following day.

Propagation was better in the morning and only a tweak on the trimmer was required. I was still left with a nasty hum at one setting of the volume control however. The cure was to use screened cable for the connection to the top cap of the EBC33, something the manufacturer had not seen fit to do.

After carrying out some cosmetic work on the cabinet I installed the set on our sideboard. It now needs only a knob to replace a missing original. A friendly customer who has a lathe and the necessary skill to duplicate the originals has promised to produce this.

You may ask why I troubled with such a restoration. Well, the set is a very rare one, labelled "Southdown". I understand that it was made in 1947 by a small radio firm in Newhaven, Sussex. The date of manufacture is definite at least – the final inspection is dated and recorded in pencil on the underside of the chassis. In addition I'm a sentimental old fool as far as these old valve radios are concerned. And as I indicated earlier, times are hard.

Long-distance Television

Roger Bunney

There were a number of surprises during January. Reception conditions at this time of the year are usually gloomy, matching the weather, but TV-DXers who have been vigilant will have experienced an exciting month.

MS pings and more sustained reflections were produced on a considerable scale by the Quadrantids meteor shower over the 3rd/4th. On the evening of the 3rd many Band I signals from the USSR, Denmark, West Germany and France were received. During the more intense activity on the 4th, Irish, Norwegian, Danish and Swedish transmissions in Band III were identified.

Tropospheric propagation was extremely active on certain days, with quite dramatic reception from Finland (Band III) and Austria. The first evidence of enhanced tropospheric conditions was a slow build up of TV signals in Band III and at u.h.f. on the 13th. The usual Benelux/French signals increased in strength then on the 14th we had a full-blown tropospheric opening. High-level signals from Germany, Denmark (both in Band III and at u.h.f.), Norway (ch. E4, all the Band III channels plus chs. 35, 36 and 52), Sweden (E4, most Band III and many u.h.f. channels), Ireland from the west, plus the usual Benelux, French and Luxembourg signals were received over much of the UK. Incidentally Luxembourg ch. E27 doesn't seem to carry vertical interval test signals, which can be a helpful point for identification purposes. The excellent conditions continued during the 15th when a mass of stations were logged with some spectacular reception: YLE (Finland) chs. E7 and 9 were received in North Wales, while other reports were of reception of Austria chs. E8 and 24, Czechoslovakia chs. R6, 10, 26 and 36, the USSR chs. R7 and 9 and Poland chs. R8, 10, 30 – many of these signals were monitored by Simon Hamer and David Glenday. Then on the 17th there was a decline, with just the closer German and Danish stations being seen. The high-pressure system that hovered over the UK for much of the mid-January period produced this excellent spell – though at the expense of dull, gloomy weather.

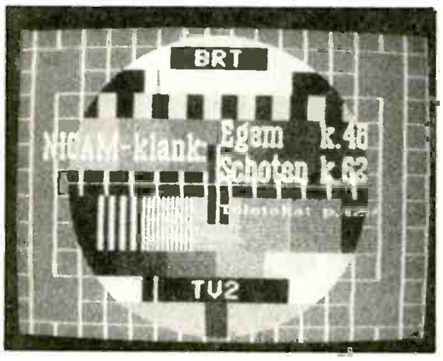
A second tropospheric opening started on the 22nd and died out on the 29th. Compared to mid-January, conditions were only fair, with signals from Denmark, France, Luxembourg, Germany and the Benelux countries being generally seen. The only exotic reception was on the 27th, when the Swiss channels E31 and 34 were noted.

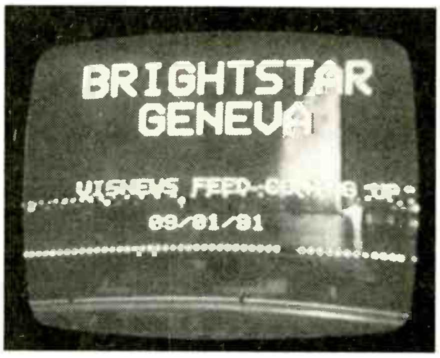
Sporadic E reception was very active too for the time of year. Here's the collated log of UK reception:

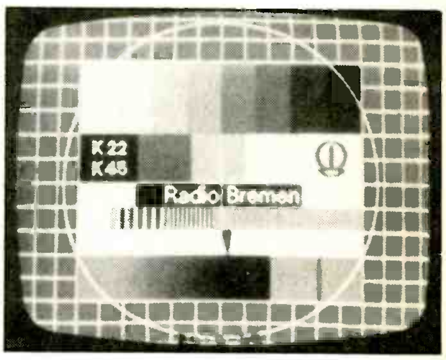
5/1/91	TVE (Spain) E2, 3; +PTT (Switzerland) E2; RAI (Italy) IA.
6/1/91	TVE E2, 4.
7/1/91	TVE E2, 3, 4.
8/1/91	TVE E2; +PTT E2, 3, 4.
9/1/91	HTV/JRT (Yugoslavia) E3, 4; TVE E2, 3; RAI IA, B; TSS (USSR) R1, 2.
13/1/91	TVE E2, 4; +PTT E4.
15/1/91	TVP (Poland) R1, 2; ARD (W. Germany) E3; CST (Czechoslovakia) R2.
16/1/91	RAI IA; TVE E2, 3; TVP R1, 2; ARD E2.
21/1/91	CST R1; DR (Denmark) E3.
22/1/91	NRK (Norway) E2.

Though now slowly falling off there was a welcome increase in sunspot activity, giving world-wide reception in Band I via F2 propagation. On January 3rd Simon Hamer in Powys received an unidentified ch. A2 signal, an Australian ch. A0 signal from station DDQ-0, and New Zealand ch. 1 video (45·25MHz) with no offset at 1000 hours. Characteristically smeary video was seen on chs. E2, R1 and the Chinese channels C1 and C2. Lunchtime F2 propagation produced ch. E2 and 3 signals likely to have been from Africa, also a further ch. A2 signal. On the 5th low-level F2 produced a ch. E2 signal from the Gulf, probably Dubai. A Russian R1 signal was received on the 9th at 0900. Conditions started to improve on the 11th, with a Russian ch. R1 and a Gulf ch. E2 signal being reported. By the 12th many DXers were logging signals in the lower Band I channels, which became jammed with high-level co-channel activity – chs. E2, E3 and R1 were affected most. At mid-day Tim Anderson logged a Malaysian ch. E2 signal and an African transmitter on ch. E3, most likely Sokoto, Nigeria. On this day Roger Fussell at Torpoint also logged several F2 signals, including some from Nigeria. Signals from Dubai and Iran were also evident, several with no VITS.

The most remarkable day for F2 reception was the 16th. This time Simon Hamer had access to a scanner and was able to measure the incoming vision carriers, decide on any offsets and thus confirm specific channels. Using this method he identified three New Zealand transmitters with carriers at 45·24, 45·26 and 45·25MHz, also two Australian stations, DDQ-0 (46·172MHz) and ABMN-0 (46·24MHz). These signals were received via the scanner during a window that lasted from 0900-0920GMT. Other signals received on the 16th were from Malaysia on ch. E2, from Thailand on ch. E2 with the "3" logo, and from the USSR







Left: Belgian TV is now testing NICAM sound via certain transmitters as this caption across a test pattern indicates. Centre: A Visnews feed via Brightstar, Geneva to an American TV network during the period just before the Gulf war. Right: The current Radio Bremen test pattern.

on ch. R1. Later in the morning, at 1100, a Dubai signal was noted in ch. E2 with zero offset and on the same channel an Iranian signal with an 8kHz plus offset. At 1300 an African signal, thought to be from Zimbabwe (ZTV), was logged with a +10kHz offset. There was weak F2 reception on the following day, then things died down until January 31st/February 1st when David Glenday in Arbroath noted TSS ch. R1, Dubai ch. E2 with Arabic captions and several other ch. R1 signals. He writes that "the 30-50MHz band was crammed with Russian and Middle Eastern communications".

Congratulations to all those mentioned. Reports were received from David Glenday (Arbroath), Ryn Muntjewerff (Holland), Brian Williams (Cardiff), Simon Hamer (Powys), Tim Anderson (St. Leonards) and Roger Fussell (Torpoint).

Ryn Muntjewerff mentions that the mystery "3" logo seen by many during F2 openings over the last two years originates from a Thailand ch. E2 source. He received this information from an Indian TV-DXer, Major Rana Roy. Garry Smith (Derby) had previously predicted the source.

The good conditions here have been mirrored in Australia. Robert Copeman (Melbourne) logged TSS Vladivostok ch. R1 via transequatorial skip on the 22nd and Todd Emslie (New South Wales) also reports evening TE reception from China and the USSR.

George Palmer (Queensland) has taken up satellite reception, using a 16ft C Band dish. This system enables him to see many UK news feeds, though the recent introduction of SAVE encryption on his BBC feed means that he has now lost this channel. George lives about fifty miles south of Brisbane.

On the subject of scanner reception, has anyone heard the following, "this is a test transmission from the East Tower", on a tape loop at 47·645MHz, narrowband f.m. The signal was present in the London area during the final week of January and was just audible here in South Hampshire.

It is with deep regret that I have to report the death of Bill Cotterill of Tipton, West Midlands, from a heart attack. He was a true enthusiast and sent in an extensive log each month. Though suffering from heart problems recently he had been planning new aerials and equipment modifications. TV enthusiasts who had contact with Bill will all miss him. On behalf of readers I have extended to Bill's wife and family our closest sympathy.

Satellite TV

Eutelsat II F2 is now in position at 10°E, replacing Eutelsat I F5. The high-gain beam has a 52dBW footprint centre, the wide beam a 49dBW footprint centre. Transponder details are as follows:

10·972GHz vert. RAI Uno, wide beam.
11·095GHz vert. RAI Due, wide beam.
11·158GHz vert. not allocated, wide beam.
11·150GHz horiz. TVE International, high-gain beam.
10·986GHz horiz. TVE video feed 1, high-gain beam.
11·080GHz horiz. TVE video feed 2, high-gain beam.
11·575GHz vert. France video, wide beam.
11·617GHz vert. Magic Box Star 1, wide beam.
11·617GHz horiz. Magic Box Star 2, wide beam.
11·658GHz vert. TRT (Turkey) TV1, wide beam.
12·584GHz vert. Canal Courses, high-gain beam.

Eutelsat I F5 is to move to 21·5°E. Eutelsat I F4 has moved to 4°E.

It seems that the new generation Aussat II series craft will have an Australasian rather than a pan-Pacific beam coverage. Some present Aussat operators are seeking lower-powered transponders in view of advances in receiver technology.

Twelve of the 24 transponders on Asiasat, which is operated by a Hong Kong consortium, have been booked for a Far Eastern package service.

Astra 1C is to have 18 instead of the originally planned 16 transponders.

The Premiere channel with Nagravision encryption is to be carried by the DFS-1 Kopernikus satellite at 23·5°E.

News Items

Rwanda: The colour standard is to change from SECAM to PAL. Apparently this is because the incoming material

is generally in PAL form.
Canary Isles: Antenna 3 is now available on ch. E34 in Tenerife and on ch. E36 in Las Palmas. Canal Plus Espagne and Tele 5 should be available soon.
Ghana: GBC is now transmitting CNN live news on a daily basis – the main broadcasting centre at Accra has installed a large dish system for the satellite pick-up.
Europe: More Belgian transmitters are being equipped for Nicam sound. Iceland has delayed the start of STOD-3 transmissions until 1992. The Czechoslovakian OK-3 Liberec transmitter operates on ch. R43, not 51. A new transmitter at Jihlava has opened on ch. R11, at 2kW e.r.p. Canal Plus encryption is being used for the French Children's Channel J during certain hours. It seems that CLT (Luxembourg) is investing heavily in the Irish TV3 network – the proposed start is this summer, with the Jefferson Smurfit company another investor.
Middle East: The Jordanian JTV-1 transmitters use the PM5534 test pattern. "TV Middle East – the action channel" is thought to be sited in the Lebanon: the test card has seven vertical colour bars covering the top two-thirds of the screen with seven black/white bars at the bottom. The top right hand has a three-pyramids logo. Both Arabic and English language programming is shown, the weather map covering an area from the Lebanon to the Red Sea.
Australia: Illegal use of low-power 49MHz equipment is causing increasing interference problems. Wenlock Burton (Victoria) mentions that the 88·1-107·95MHz f.m. broadcast band can be legally used by radio microphones operating with a maximum bandwidth of 180kHz and a range of about 100m. Other radio microphone frequencies are slotted between TV channels.
Amateur radio: Irish B licence holders can now use the 50MHz band outside TV hours – typically midnight to 0900.
Germany: ARD-1 is now being broadcast from the following DFF-1 transmitters: Helpterberg ch. 57, Berlin ch. 5, Brocken ch. 6, Leipzig ch. 9, Sonnenberg ch. 12, Marlow ch. 8, Cottbus ch. 53, Chemnitz ch. 8, Lobau ch. 27, Schwerin ch. 11, Dequede ch. 12, Dresden ch. 10, Inselberg ch. 5.

DFF, now called DFF Landerprogramm, is broadcasting from the following ex-DFF-2 transmitters: Helpterberg 22, Berlin 27, Brocken 34, Leipzig 22, Sonnenberg 33, Marlow 34, Cottbus 23, Chemnitz 32, Lobau 39, Schwerin 29, Dequede 31, Dresden 29, Inselberg 31.

ZDF is broadcast from Marlow 43, Cottbus 27, Dresden 46, Leipzig 42 (all at 100kW e.r.p.), Helpterberg 52 (200kW), Lobau 56 (50kW). The ZDF transmitter powers are to be increased to 500kW.

Service Briefs – Philips

The following items have been collated from various issues of the Philips Service publication *Link*.

TV Chassis and Monitors

K30 chassis: Reported problem was loss of raster after twenty minutes, the sound remaining o.k. Cause was a dry-joint at pin 1 of the U7 sound panel/mother board connector, as a result of which the 13V LT3 supply wasn't reaching the U10 RGB panel.

2A chassis: Problem was repeated field collapse every three or four days. Replacement of the TDA3654 field output chip, C2571 (100μF) in the flyback generator circuit and the 26V supply components D6646 (BYD33G) and C2646 (1,000μF) provided a cure.

Low brightness with severe Hanover blinds was cured by replacing the TDA3561A colour decoder chip.

3A chassis: F.M. sound o.k., no Nicam sound. Replace IC7201 on the Nicam panel.

CF1 chassis: Problem was low contrast and brightness. R3600 (18kΩ) in the beam limiter circuit was open-circuit.

CP90 chassis: Symptoms were low contrast after flashover with no voltage at pin 7 of the line output transformer and reduced voltage at pin 7 of the TDA3561A colour decoder chip. C2495 (33nF) in the beam limiting circuit was short-circuit.

For loud buzz in the standby mode replace the standby thyristor D6726.

CP110 chassis: Symptoms were lack of width and no EW correction with R3599 overheating. C2613 (390nF) in the scan coupling network was open-circuit.

For flickering text and apparent tuning drift try replacing the 9V supply rectifier D6673 (BYV95A).

GR1-AX chassis: There was no output from the chopper power supply, which uses a junction f.e.t. whose gate and source were at 12V while 300V was present at the drain. Replacing zener diode D6610 (BZX79C10) restored normal operation. The 5V supply was present.

For tuning drift replace the ZTK33B voltage stabiliser.

9CM0 and 90CM monitors: Picture flickering can be caused by discharge between the c.r.t. and the clamping ring. To cure, add PVC tape under the multipole unit clamping ring on the c.r.t. neck.

VCRs

VR6180: Distorted and reduced level E-E sound has been traced to the switching chip IC7550-3C on in/out board P90-4A.

VR6180, VR6290 and derivatives: To clear coloured stripes at the top of the picture with prerecorded tapes and camcorder recordings increase the value of R3130 from 680Ω to 1·5kΩ.

VR6290/6291/6293: Intermittent shutdown after a play or record function has been selected can be caused by excessive brake pressure and insufficient motor current for start-up. Reduce the value of C2040 from 100nF to 10nF.

VR6485: No E-E, playback or test signals was caused by the 5V supply to pin 6 of IC1301 being absent. F1501 was open-circuit.

VR6485 and VR6585: Failure of timed recordings to occur can be caused by corrupted microcomputer data as a result of mains-borne interference. To cure, fit 150pF tubular capacitors between pins 46 and 32 and between pins 47 and 32 of IC7101.

VR6548: Effects similar to a tracking error were caused by the drum pulse magnet on the lower drum assembly being missing. It must be replaced with correct polarity.

VR6291: For intermittent or missing sound check C2203 and C2213.

US HD-TV Update

Geoff Lewis, B.A., M.Sc.

My last report (October 1990) on progress in the search for a North American high-definition TV standard was made in the belief that the situation there had at last stabilised, with only six of the original twenty two proposals still being actively persued. These six were to be thoroughly tested under the same conditions so that the FCC could select what it considered to be the best system to place before the next Plenary Session of the CCIR in 1994. It looked, when I wrote about them, that the six proposals were set in concrete.

The announcement by Zenith Electronics and American Telephone and Telegraph just before Christmas, mentioned in February's Teletopics column, indicates that the goal posts have however moved somewhat. The five remaining systems in the contest, Faroudja Laboratories having withdrawn, now show a heavy bias towards all-digital signal processing.

Technical information on the new Zenith/ATT system is still rather sparse, but the following can be gleaned from various press releases. The basic picture format of 787·5 lines per field (1,575 lines per frame) and 60 fields per second of the Spectrum Compatible HD-TV System has been retained, with progressive or sequential scanning. The digital processing that allows the HD signal to be contained within a 6MHz bandwidth is the result of combining Zenith's work on system development and transmission technology with Bell Laboratories' work on a video compression algorithm, motion compensation and filtering, all of which take into consideration the attributes of human vision. The semiconductor technology and know-how of the high-speed digital signal processor (DSP) chips are being provided by ATT Microelectronics.

It's claimed that many of the new concepts employed have already been tested separately in videoconferencing and digital television research work. Although this has not been stated, it seems likely that the sampling quantisation filters will be of the recently developed Quadrature Mirror Filter type. They allow for frequency fold-over and aliasing to occur in the coding chain since these become self-cancelling as a result of the use of complimentary filters in the decoder. This technique allows perfect reconstruction of the original signal even under noisy conditions. Furthermore the three-dimensional filters required for TV image processing can be designed simply by cascading one-dimensional filters.

At about the time that Zenith/ATT made their latest announcement one industry observer commented that the Japanese NHK-Muse system, which is still one of the contestants and is the only HD-TV system currently in operation, was based on the technology of the Seventies. One must now wonder how MAC technology is being viewed outside Europe.

Obituary: John Bardeen

While last month's issue was going to press the death was announced of John Bardeen, the world-famous US physicist who in collaboration with others was responsible for the invention of the transistor and the development of the science of superconductivity.

It's true to say that Bardeen's influence in the phenomenal advancement of electronics during the second half of this century has been approached only by that of John Ambrose Fleming who in 1904 patented the thermionic diode – indeed there are those who maintain that had Fleming not done so the development of solid-state electronics would have occurred earlier.

The idea of mass communication "over the air" had become an exciting prospect following the theoretical recognition of electromagnetic waves by James Clerk Maxwell in 1864, their practical realisation in the laboratory by Heinrich Hertz in 1888, and their exploitation in the field by Guglielmo Marconi in 1895. Fleming's valve, used as a detector, made radio transmission and reception a practical and viable proposition, and broadcasting as we know it today was soon to follow. But it was the announcement of the transistor in 1948, by John Bardeen and Walter Brattain, that revolutionised electronics by removing the disadvantages and limitations associated with valves.

John Bardeen was born on May 23rd, 1908 at Madison, Wisconsin, the son of the dean of that University's medical school. He studied electrical engineering at Wisconsin University and afterwards studied at Harvard. In 1945 he joined William Shockley and Walter Brattain at the Bell Telephone Laboratory in New Jersey. Shockley was convinced that there had to be an alternative to the cumbersome valve, which he regarded as being clumsy, bulky, wasteful of energy and fragile. Other disadvantages that concerned him were its steadily declining emission and proneness to sudden failure. He experimented at length with various semiconductor materials, but never achieved successful control over the movement of electrons within them.

He shared his problems with Bardeen, who applied his mind to the theory of electron behaviour in a variety of substances. Whilst working with germanium, he decided to investigate the significance of skin effect on the subject. It was widely recognised that electron movement within a conductor is at its most efficient at the surface, a practical application of this being the use at the time of litze wire, especially for r.f. circuits where high Q was of paramount importance. He passed the results of his research to Walter Brattain who carried out the practical experiments.

Keeping to germanium as their basic material, they produced the first successful device in 1947. They called it a transistor, combining the words transfer (of electrons) and resistor (the semiconductor material). The invention brought Bardeen a Nobel Prize.

Bardeen subsequently addressed himself to the theory of superconductivity – the science of cooling conductive material towards absolute zero to reduce its resistance to the passage of electrons. Working in conjunction with Leon Cooper and John Schrieffer, he evolved the BCS theory (called after the initials of their surnames), which laid the foundations for all subsequent work in this field. It brought him a second Nobel Prize, an achievment previously matched by only Frederick Sanger and Marie Curie.

D.B.

Test Report: Sadelta TC90 SS Meter

Eugene Trundle

An accurate means of measuring signal strength is vital for those who install and maintain aerials of any sort, also for cable TV technicians and sometimes for field TV service engineers. Now that the network is nearly complete the proliferation of transmitters in the u.h.f. bands means that good signals are easier to find than they once were. On the other hand we find that there's an increasing demand for reception from the growing number of local radio transmitters in the now extended v.h.f. broadcast band. And of course satellite TV dishes, with their more exacting alignment requirements, remain the staple diet for most riggers at present.

Types of Meter Available

Instruments for measuring signal strength have evolved steadily to meet new requirements. Their design has taken advantage of new receiver technology, particularly with crystal-controlled synthesis tuning. At the top end of the price and facilities range there are spectrum-analyser type instruments like the Rover model I examined in the July 1989 issue. At the other extreme there are "dish peaker" boxes which are untuned and without a quantitative readout.

The Sadelta meter that's the subject of this review falls squarely in the middle of the available range. It could be described as a high-class "straight" signal-strength meter with wide coverage, accurate frequency control and quantitative indication of signal level. I would regard it as being the minimum requirement for a reference test set in a small to medium sized company that deals with aerials and r.f. distribution systems.

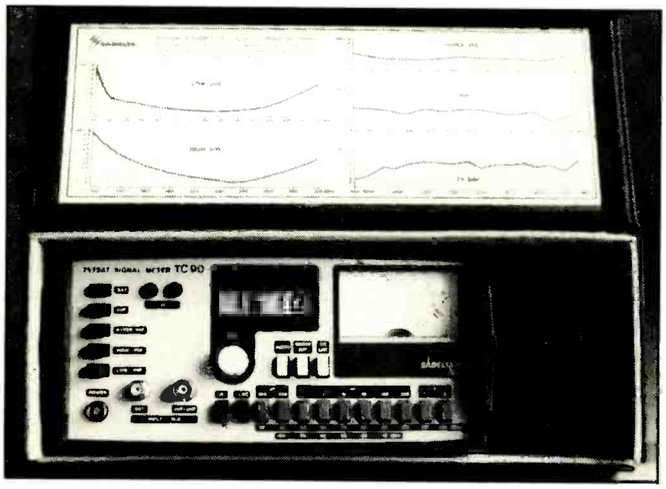
Description of the TC90

The instrument is made in Spain, its UK price at the time of writing this being £470 plus VAT. It's portable, battery-powered and able to read signal strengths from 20μV to 3V at v.h.f. and u.h.f. and from 39dB/μV (−70dBm) to 99dB/μV (−10dBm) in the satellite bands. Frequency coverage is continuous from 45-862MHz and from 950-1,750MHz, the latter being the standard range of the first i.f. signals from a satellite TV head end.

There's a facility for powering (at 15V) satellite LNBs, whose current consumption (0-600mA) can be read on the same calibrated moving-coil meter as the signal level. For the latter purpose the scale is ruled 0-3, 0-10, −2 to 10dB/μV and −10 to 1dBm. To assist with cable and connection checks an ohms range (centre scale 50Ω) is provided, with separate test prods.

An audio demodulator and amplifier are incorporated, driving a small internal loudspeaker. This gives station identification at v.h.f. and u.h.f. The same speaker gives an "eyes off" tone indication of relative signal strength on the satellite bands for spot-on dish alignment by ear.

The attenuation factor is selected by a bank of push-buttons. There are likewise five push-buttons to select the band. The frequency of interest within each band is tuned by means of a ten-turn potentiometer associated with a 4-digit LCD readout of the frequency. For further details see the accompanying specification table.



The Sadelta TC90 signal-strength meter in its carrying case, with the correction chart in the lid.

On Test

During extensive tests I was impressed with the accuracy of the digital frequency readout, which is absolutely spot-on from 45MHz to 1·7GHz. Frequency-synthesis tuning systems and very accurate crystals have done a lot for field-strength meters, as they have for radio and TV tuners. The exact correspondence between the actual signal frequency and that displayed rendered the sound f.m. demodulator and speaker system, whose output is not adjustable, almost redundant – it works excellently however.

Radio f.m. carriers have a constant amplitude and give a steady reading. The peak-level detector used for a.m. TV transmissions in the v.h.f. and u.h.f. bands works on the basis of detecting the sync pulses, which of course represent maximum signal amplitude. It gives a rock-steady reading regardless of picture content.

The satellite range coverage matches the output range of LNB converters, including those that work on the FSS (Astra etc.) and DBS bands. But to my disappointment I found that the meter was unable to distinguish between the separate Astra transponders, whose outputs all merged together to give a virtually constant reading from 1·2GHz to 1·45GHz. This robbed the instrument of the advantages it has in the lower-frequency bands. It's not possible to adjust polarising systems for maximum gain on alternate channels, because they cannot be distinguished. Neither is it possible to compare the signal strengths of the four different footprints which Astra presents to Europe on interleaved channels. On the satellite bands therefore the usefulness of the instrument is confined to a dish-peaker function, in which the audio tone varies in pitch with signal strength to facilitate exact dish alignment. This worked well enough for me, with a sufficiently wide range to permit alignment without need to leave the dish to switch ranges – but hardly justifies a price tag of over £500!

Even with the Marco Polo channels, which are spaced 77MHz apart (Astra's channel separation is 15MHz), I got only a small dip between the channels, whose first i.f.s ranged between 1GHz and 1·3GHz, though I was able to see that transponder one (The Movie Channel) was stronger than the other four.

The reason for this limitation is the wide bandwidth of the satellite TV i.f. amplifier within the instrument. Its specified bandwidth is 27MHz but in practice it may be much more. Without the benefit of the f.m. capture effect, which applies with real audio and video signals, the discrimination is poor, falling far short of what's required with a signal-strength meter. For meter use a relatively narrow passband is appropriate.

Neither was I happy with the arrangements for powering the LNB. At the press of a button 15V is provided at the SAT (F type) input socket. If required the LNB's current consumption can then be read, which is a useful feature. I found that the Matsushita Squarial, which is rated at 20V, worked happily with 15V, but I wonder how much its gain and noise were affected by the reduced voltage? A very large proportion of Astra installations use the Marconi LNB, which requires 13V for vertical polarisation and 17V for horizontal polarisation. Its switching threshold is about 15V, the very voltage provided by this unit! This is again a serious handicap for the practical user. I would like to have seen a variable or switchable LNB supply system plus a separate, variable polariser supply (for those systems that need it) of ±50mA to make possible full, certain and safe testing of all types of installation.

The v.h.f./u.h.f. input socket is a BNC type, which is ill matched to the Belling-Lee coaxial type that's almost always used in the UK. No adaptor comes with the instrument, so my first job was to make or buy one. Another useful adaptor that should be supplied but isn't is a 300Ω to 75Ω balun with a suitable input socket for correct matching to some types of f.m. aerials. The F type satellite input socket is more appropriate for its purpose but, curiously enough – and I can't blame Sadelta for this! – my Tatung BSB box has a Belling-Lee coaxial input socket.

I've no reason to disbelieve the accuracy of the readout in terms of μV, mV, dBm, and dB/μV. The custom-printed correction chart supplied, covering all bands, suggests that the makers have paid close attention to this. Even so the manual warns that because of the detection system used the reading obtained is that of peak carrier strength and may not correspond with readings obtained from other types of measuring instrument.

The built-in ohmmeter is a useful feature which helped with general fault-finding in aerial and distribution systems. The accuracy is better than 5 per cent at the centre-scale reading (50Ω), which is perfectly adequate for the purpose.

Conclusion

The instrument is better suited to outdoor work than some I've tried. Its internal battery weighs it down somewhat, but it comes in a tough case with a strong carrying strap which I found hung comfortably from my neck for hands-free rooftop and outside work as required.

Although this instrument seems to be of relatively recent design some current trends in satellite TV receiving hardware, like electronic polarisation systems, have overtaken it. The inability to pick out individual transponders is hard to forgive in an instrument costing well over £500 when most buyers will want to use it for satellite installations. On the credit side it's robust, well built and accurate.

I would not regard the Sadelta TC90 as the best possible investment for those who want a clear indication of reception at s.h.f., especially since simple meter or tone type dish peakers can be bought for less than a quarter of the price and will in many cases answer as well. If we leave to one side the satellite aspect, we have a very good and credible signal-strength meter for v.h.f. and u.h.f. use at a price that's no less than it should be.

Availability

The Sadelta TC90 is available from B.K. Electronics, Unit 5, Comet Way, Southend-on-Sea, Essex SS2 6TR, telephone 0702 527 572.

Abridged specification for the Sadelta TC90.

Frequency range: 45-862MHz in four bands; 950-1,750MHz for satellite use.

Frequency display: 4 digit LCD, accuracy ±1 per cent, ± 1 digit.

Resolution: 100kHz v.h.f. and u.h.f., 1MHz for satellite use.

Tuning: Precision 10-turn potentiometer.

Inputs: BNC for v.h.f. and u.h.f., F type for satellite use. Both 75Ω.

Indication range: 20μV to 3V v.h.f./u.h.f.; −70dBm to −10dBm satellite.

Measurement accuracy: ±2dB v.h.f. and satellite, ±3dB u.h.f., using the correction chart.

Calibration: μV, mV, V, dB/μV, dBm.

Scale length: 10dB.

Audio: For v.h.f./u.h.f. a.m. and f.m. detected. Variable tone for satellite use. Output 200mW.

Bandwidth: 600kHz v.h.f./u.h.f.; 27MHz satellite channels.

LNB supply: 15V/600mA. 0-600mA meter indication.

Ohmmeter: 0-500Ω. 50Ω centre scale.

Power: Internal rechargeable battery 12V/2·6Ah. 9 hours running time for v.h.f./u.h.f. use, 4 hours for satellite use with 150mA LNB drain. Charging time 8 hours.

Size and weight: 220 x 105 x 235mm, 3·4kg including battery.

Accessories supplied: Carrying case, battery charger, ohmmeter test prods, correction diagram.

Price: £540·50 including VAT.

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VBKIT 13	SANYO	VTC5000	2
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VBKIT 11	SHARP	VC7300	4
VBKIT 4	SONY	SL8000AS, SL8000E, SL8000SA, SL8000UB, SL8080AN, SL8500, SL8600, SL8600A, SL5400, SL5800	6
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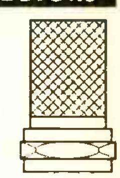

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2 adaptors:	Phono socket to UHF plug

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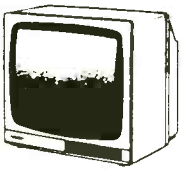

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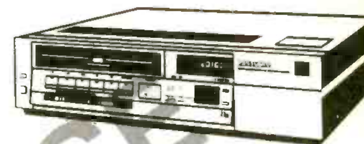

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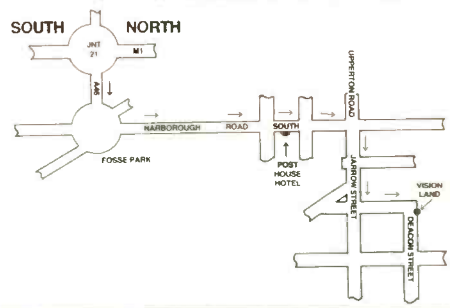

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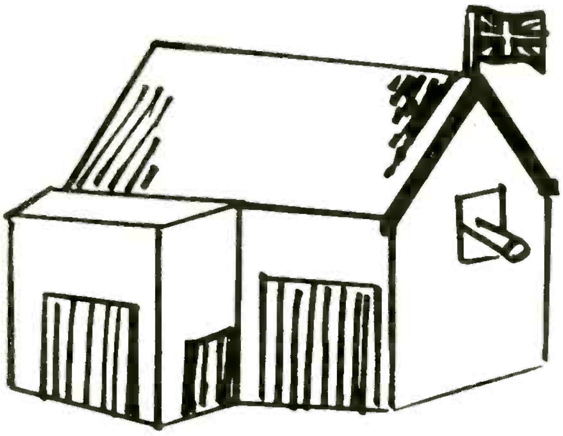

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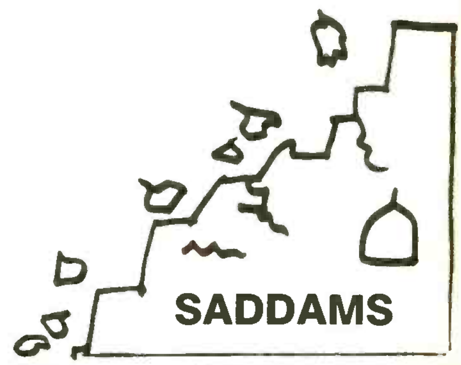

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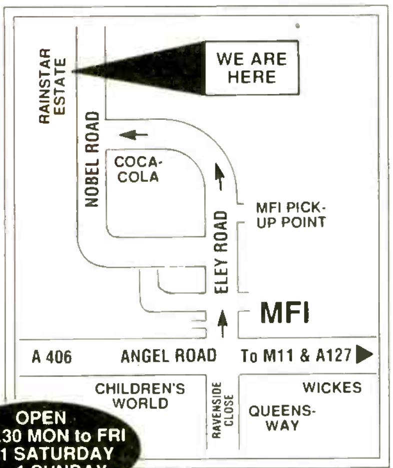

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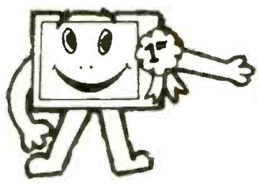

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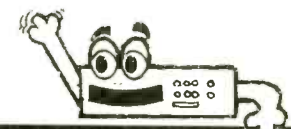

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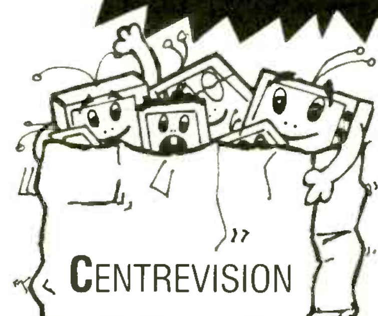

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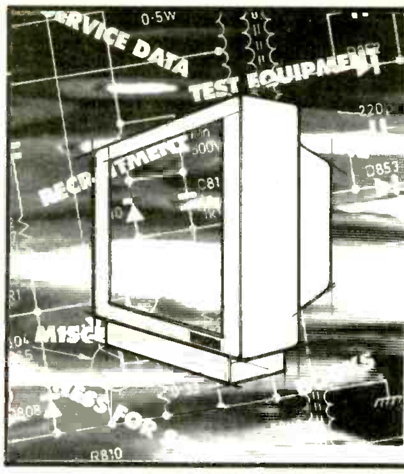

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9mm Black	per 100	0.95
11mm Black	per 100	1.05
Adhesive Tape		
20M ¾" Black		0.32
10M Self Amalgamating		2.99
Cable Connectors		
Coax Plug Alloy per 100		12.95
Coax Plug Alloy each		0.17
Coax Cuppler per 50		5.95
Coax Cuppler each		0.17
F Screw On 1mm		0.20
Attenuators		
3, 6, 12, 18 & 24dB		1.25
Fly Leads		
2M Plug to Plug		0.60
2M Plug to Socket		0.66

Wall Fixings

Welded Wall Brackets	
6" x 6" Painted	0.97
6" x 6" Galvanised	1.97
6" x 9" Painted	1.48
9" x 9" Painted	2.26
12" T&K Painted	3.75
18" T&K Painted	4.75
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24" T&K Painted	5.35
16" Tripod Galvanised	12.95
Drills, Plugs, Screws	POA

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Three Set 12&9dB	12.99
Four Set 12.9 & 6db	16.99
Q260/P20 26dB	16.99
Amerthyst U 60dBmV	135.00
Amerthyst W 60dBmV	165.00
J.W. Hardy communications	
4 Way Amplifier 2dB	12.99
8 Way Amplifier 2dB	19.95
Silver 20dB 46dBmV	32.56
Silver 28dB 46dBmV	38.95
Booster 20dB 54dBmV	49.50
Booster 20dB 60dBmV	75.50

Splitters & T Units

Wolsey Electronics	
Die-Cast T Units	4.12-9.65
Die-Cast Splitters	7.14-11.52
Die-Cast Outdoor Lid	0.99
Indoor Lid	0.55
Line Terminator 75ohm	0.42
Mini Splitters	POA
Mini T Units 2 Way	4.25
Altai In Door	
2 Way "Y"	0.65
3 to 6 Way	1.45-2.25
SAC Splitters	
2 Way Resistive	2.00
2 Way Inductive	2.65
3 Way Resistive	2.38
Diplexer UHF/VHF	2.65
Diplexer A/E	2.65
Diplexer K/CD	2.65

Coax Outlet Plates

Altai Surface Socket	0.48
Altai Surface Twin	0.75
Altai Flush Wall Socket	0.65
Altai Flush Twin	0.95
PO1U Single Isolated	2.41
PO1U 12 to 38dB	3.69-6.06
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PO2U RSI TV Showroom	3.58
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