OCTOBER 1989

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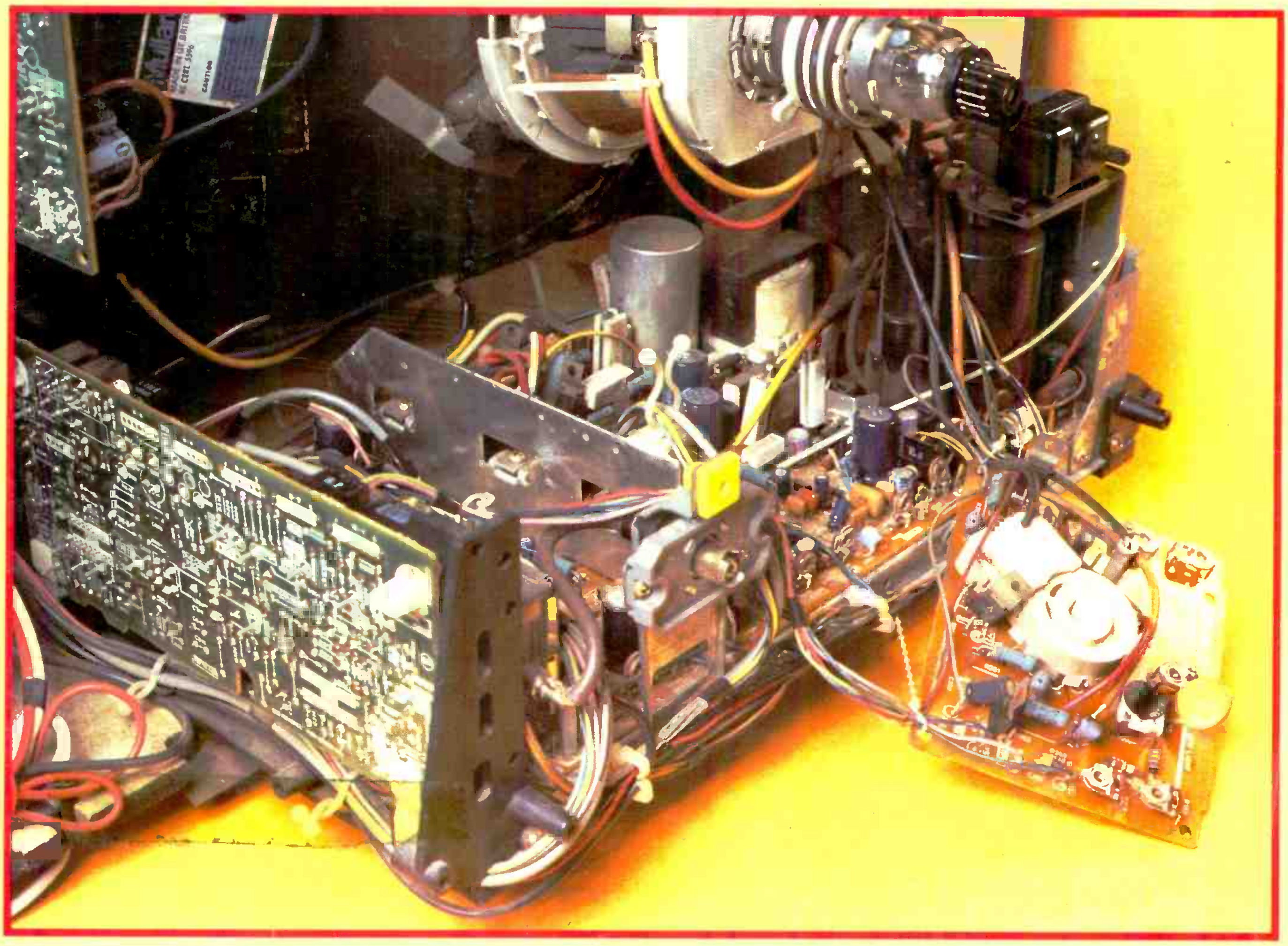

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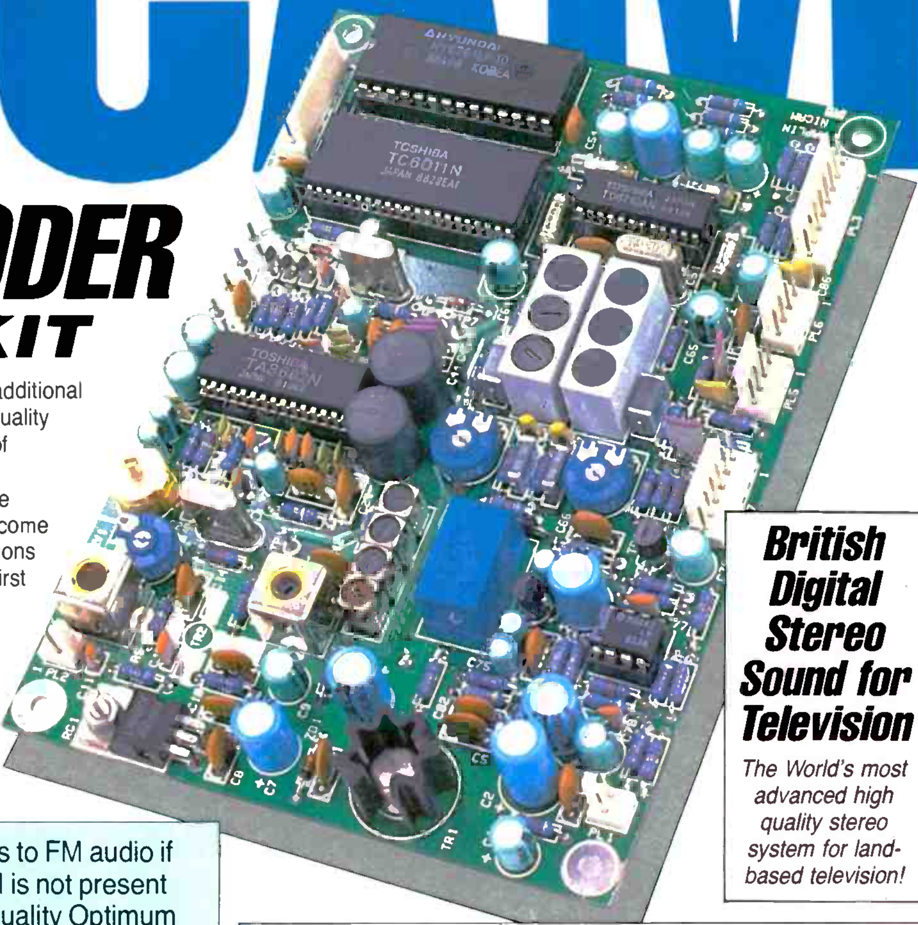
NICAM

728 DECODER
PROJECT KIT



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

This fully working system is based upon the Toshiba NICAM chip set which has only just become available. For full introduction, text and illustrations plus an introductory article by the IBA, see the first part of our 3-part series in the October 1989 edition of Electronics – The Maplin Magazine (XA34M price £1.00). It's on sale from September 8th, so order your copy TODAY!

*Currently being transmitted from Crystal Palace and Emley Moor. See the Maplin Magazine for IBA launch schedule.

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TELEVISION

October 1989

Vol. 39, No. 12
Issue 468

On sale September 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
Indexes to Vols. 36 and 37 are available at 80p each from the Editorial Office (address above).

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

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this month

OUR NEXT ISSUE DATED NOVEMBER WILL BE PUBLISHED ON OCTOBER 18

AA119	9p
AAY32	9p
AC107	40p
AC125	25p
AC126	25p
AC127	21p
AC128	21p
AC128K	26p
AC141K	30p
AC142K	30p
AC176	22p
AC176K	28p
AC187	21p
AC187K	28p
AC188	21p
AC188K	28p
ACY18	48p
ACY19	48p
AD142	100p
AD149	60p
AD161	35p
AD162	35p
AF124	50p
AF125	50p
AF126	50p
AF127	50p
AF139	30p
AF239	30p
AF379	45p
ASZ15	100p
ASZ17	100p
BA145	10p
BA148	10p
BA154	6p
BA157	12p
BB105B	18p
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Freq in MHZ

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2.00	200p
2.45670	180p
2.5	200p
3.276	115p
3.5795	95p
4.0	110p
4.194	130p
4.43	95p
4.9152	150p
5.0	130p
6.0	115p
8.0	125p
8.867	125p
10.0	140p
11.0	250p
12.0	120p
14.0	125p
14.756	200p
15.0	160p
16.0	130p
18.0	130p
18.432	130p
24.0	250p
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7818	35p
7824	35p
7905	35p
7906	40p
7908	40p
7912	40p
7915	40p
7918	40p
7924	40p
78L05	28p
78L08	28p
78L12	28p
78L15	28p
78L18	28p
78L24	28p
79L05	40p
79L08	40p
79L12	40p
79L15	40p
7818KC	100p
7824KC	100p
LM309K	100p
LM317K	220p
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LM323K	420p
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EBF80	45p
EBF89	50p
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ECC83	80p
ECC84	70p
ECC85	80p
ECH81	100p
ECH84	70p
ECL80	65p
ECL82	80p
ECL84	70p
ECL85	70p
ECL86	90p
EF80	65p
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EF183	75p
EF184	85p
EL34	250p
EL36	90p
EL84	75p
EL95	85p
EL500	100p
EL504	130p
EY86	45p
EY87	45p
EY88	65p
EZ35	65p
EZ80	70p
EZ81	55p
GZ34	200p
PC97	100p
PCC85	60p
PCF80	80p
PCF200	135p
PCF801	110p
PCF802	80p
PCF806	115p
PCH200	100p
PCL81	62p
PCL82	80p
PCL84	50p
PCL85	80p
PCL86	80p
PCL805	80p
PFL200	110p
PL36	120p
PL82	60p
PL83	60p
PL84	80p
PL95	180p
PL500	110p
PL504	120p
PL508	200p
PL519	450p
PY81	90p
PY88	70p
PY500A	190p

L.E.D.'S

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

RECTANG. L.E.D.'s

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AN-210	165p
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AN-241	135p
AN-245	290p
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AN-252	150p
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AN-262	140p
AN-271	230p
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TDA-2600	560p
TDA-2611A	115p
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TDA-8170	320p
TDA-8190	280p
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TDA-9503	240p
TDA-9513	350p

LINEAR IC'S — Cont.

TEA-1002	650p
TLO-61	40p
TLO-64	80p
TLO-71	38p
TLO-72	55p
TLO-74	92p
TLO-81	40p
TLO-82	48p
TLO-83	67p
TLO-84	80p
ULN-2002	70p
ULN-2003	69p
ULN-2004	69p
ULN-2068	270p
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ULN-2804	170p
UPC-16C	160p
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UPC-554	130p
UPC-555	60p
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UPC-566	60p
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ZN-448	510p
ZN-459	190p
ZN-1034	170p
ZN-1040	640p
ZNA-134H	2150p
ZNA-234E	920p

JAPANESE TRANSISTORS

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2SD-666	70p
2SD-667	70p
2SD-668	120p
2SD-669	40p
2SD-673	350p
2SD-676	250p
2SD-716	115p
2SD-717	180p
2SD-718	100p
2SD-722	240p
2SD-725	400p
2SD-734	60p
2SD-741	120p
2SD-743	130p
2SD-756	100p
2SD-757	120p
2SD-758	140p
2SD-762	140p
2SD-763	140p
2SD-768	180p
2SD 772	200p
2SD-773	40p
2SD-774	60p
2SD-777	400p
2SD-784	650p
2SD-786	100p
2SD-787	80p
2SD-788	100p

2SD-789	80p
2SD-792	400p
2SD-794	100p
2SD-795A	140p
2SD-811	450p
2SD-819	400p
2SD-820	450p
2SD-821	550p
2SD-822	400p
2SD-826	100p
2SD-836	150p
2SD-836A	200p
2SD-837	80p
2SD-838	400p
2SD-841	160p
2SD 844	200p
2SD-845	250p
2SD-850	260p
2SD-856	80p
2SD-858	250p
2SD-863	60p
2SD-864	200p
2SD-866	120p
2SD-866A	140p
2SD-868	450p
2SD-870	400p
2SD-871	450p
2SD-879	60p
2SD-880	40p
2SD-882	80p
2SD-892A	100p
2SD-894	120p
2SD-895	200p
2SD-896	200p
2SD-900	400p
2SD-905	600p
2SD-916	130p
2SD 917	300p
2SD-921	320p
2SD-923	360p
2SD-946	120p
2SD-947	100p
2SD-950	300p
2SD-951	350p
2SD-957A	520p
2SD-958	60p
2SD-965	100p
2SD-970	170p
2SD-973	60p
2SD-973A	70p
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	250p
2SD 1398	210p
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
2SO-1428	450p
2SD-1429	410p
2SD-1430	280p
2SD-1431	400p
2SD-1432	600p
2SD 1433	750p
2SD-1438	140p
2SD-1439	320p
2SD-1441	440p
2SD-1448	140p
2SD-1450	60p
2SD-1451	260p
2SD-1453	170p
2SD-1455	320p
2SD-1457	220p
2SD-1459	120p
2SD-1468	60p
2SD-1496	450p
2SD-1497	450p
2SD 1505	120p
2SD-1554	500p
2SD-1555	450p
2SD-1576	450p
2SD-1577	480p
2SD-1579	120p
2SD-1591	310p
2SD-1595	160p
2SD-1604	200p

2SD 1608	210p
2SD-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

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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
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SG613		850p

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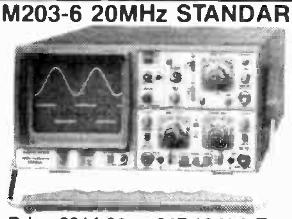

SPECIFICATION
- ★ 2 Channels
- ★ Bandwidth: DC-20MHz
- ★ Sens: Ch1., Ch2., 2mV/cm
- ★ Timebase: 0.2s-20ns/cm
- ★ Triggering: DC-40MHz
- ★ Active TV-Sync-Separator
- ★ Variable hold-off
- ★ Trigger LED indicator
- ★ Calibrator: 1KHz Square wave
- ★ Component tester
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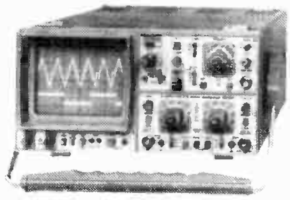
- ★ Bandwidth: DC-60MHz
- ★ Sens. Ch1., Ch2., 1mV/cm
- ★ Timebase: 2.5s-5ns/cm
- ★ Triggering: DC-80MHz
- ★ Active TV-Sync-Separator
- ★ After delay trigger
- ★ Sweep delay ★ Delay line
- ★ Trigger LED indicator
- ★ Calibrator: 1KHz & 1MHz Sq. Wave
- ★ Component tester
- ★ Plus many more superb features



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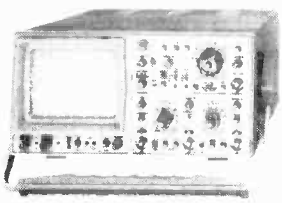

3 CHANNELS-UP TO 6 TRACES

SPECIFICATION
- ★ 3 Channels
- ★ Bandwidth: DC-100MHz
- ★ Sens. Ch1., Ch2., Ch3. 1mV/cm
- ★ Timebase A: 2.5s-5ns/cm
- ★ Timebase B: 0.2s-5ns/cm
- ★ Triggering: DC-130MHz
- ★ After delay trigger ★ Delay line
- ★ Trigger LED indicator
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- ★ Calibrator: 1KHz & 1MHz Sq. Wave
- ★ Plus many more excellent features

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SPECIFICATION
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- ★ Analogue real time (Same as 203-6)
- ★ Bandwidth: DC-20MHz
- ★ Sens: Ch1., Ch2., 2mV/cm
- ★ Timebase Analogue: 0.2s-20ns/cm
- ★ Timebase Digital: 5s-2μs/cm
- ★ Triggering DC-40MHz
- ★ Active TV-Sync-Separator
- ★ Max sampling rate: 2×5MHz
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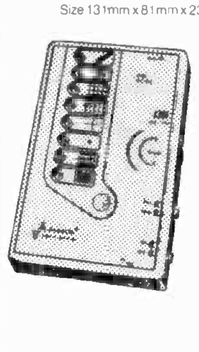

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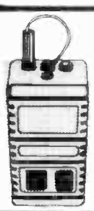

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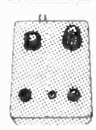

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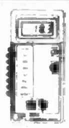

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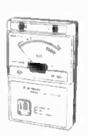

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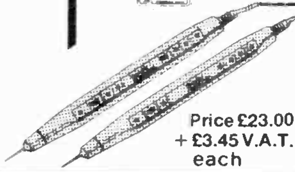

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Up to 1K ADD £1.00 per order P+P (U.K.). Heavier parcels e.g. cable, service aids, degausing coils please allow £3.25 P+P (U.K.). Export orders charged at cost. First Class Mail is used whenever possible. Add 15% VAT to total except where it states zero rate. Bulkier items will be sent by carrier £8.50 + VAT up to 25K (except tubes).
We do not despatch on Saturdays.

THERE IS VAT ON P+P.

BOOKS AND MANUALS ARE ZERO V.A.T.
Goods are despatched on the day we receive your order. If for any reason we are out of stock we will try to inform you as quickly as possible. We try our best to give a speedy, fair and efficient service. V.A.T. invoice on request. Give us a ring – we'll give you service. Please ask if what you need is not listed – we will try to help. Prices are subject to change without notice. In some cases we may have to supply an equivalent.
We need expiry dates for credit card orders.
MINIMUM ORDER £5.

VIDEO HEADS

PRICES DOWN AGAIN

3HSSV FERG/AKAI etc	16.50
3HSSN NAT PAN	16.50

WE HAVE A FULL RANGE OF VIDEO HEADS IN STOCK FOR MOST MAKES. JUST ASK.

NEW TYPES ADDED RECENTLY

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GOLDSTAR	3HSSOB	26.00
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VXL2	3HSSR	25.00
VXL4	3HSSR	25.00
VXL5	PSF1	25.00
VXL6	PSF2	25.00
VXL35	3HSSR	25.00
SAMSUNG	UNIVERSAL	24.45

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AKAI MI32773	5.63
AKAI BV327815	4.87
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VHS gen THORN/JVC	4.95
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FISHER 420400300/400	4.50
FERG 3292 F/F	1.46
FERG 3V00 F/F	1.46
FERG 3V00 TAKEUP	4.95
FERG 3V00 TAKEUP late	5.85
FERG 3V16 TAKEUP	4.95
FERG 3V16 TAKEUP late	5.85
FERG 3V22 TAKEUP	4.95
FERG 3V22 TAKEUP late	5.85
FERG 3V29 TAKEUP CL	2.08
FERG 3V29 TAKEUP SPL	2.13
FERG 3V29 TAKEUP IDL	1.44
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HITACHI F/F 6886971	2.90
HITACHI 6413663	2.68
HITACHI 6414221	5.04
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HITACHI 6861471	2.43
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HITACHI WIND ROLLER	0.78
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NAT PAN VXP0401	1.08
NAT PAN VXP0344	1.22
NAT PAN VXP0331	1.28
NAT PAN VXP0521	4.08
NAT PAN VXP0433	5.50
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SANYO 5000 RLR ASSY	1.85
SAMSUNG	1.75
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SHARP 0006	2.20
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CM7065	UHF/VHF H8	16.18
CM7066	UHF/HB	14.74
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CM7243	SECOND SET AMP	14.73
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CM7108/7298	8+1 DIST.AMP	49.96
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CM9003/00	FLUSH SING.OUTLET	1.95
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CM7274	4 WAY DIST.AMP	26.15
CM7082	UHF/VHF DIST.AMP	74.15
CM7080/10	UHF MHA	16.89
CM7271	UHF WIDEBAND 15 db	9.09
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LABGEAR SATELLITE RANGE

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CM5110	IF Line Pump	17.00
CM5112	Block Converter with PSU	143.34

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3V31	IR8945	14.95
3V35	IR8946	14.95
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CRIMP TOOL	29.95
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SAKURA STEREO SYSTEM	229.00
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AND A COMPLETE RANGE OF AERIALS AND ACCESSORIES ON PAGE 23 IN CATALOGUE

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817S SHORROCK	22.50
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plus all the extras you may need to fit a complete security package.

WE STOCK CABLE, CLIPS, BELLS, BOXES, BATTERIES, SOUNDERS, BUZZERS, XENONS, CONTACTS, SMOKE ALARMS, TRUNKING, PRESSURE MATS, FOIL BLOCKS.

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WE NOW HAVE A CONTINUOUS SUPPLY OF REFURBISHED TVs AND VIDEOS

NEW STOCK DAILY

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ALL IN EXCELLENT CONDITION COMPLETE WITH REMOTES AND ALL TRIMS
NO SCRATCHED CABINETS
VIDEOS HAVE OPERATING INSTRUCTION LEAFLETS. TYPICAL EXAMPLES:

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Top Loader Stereo.	£108	3V44 Front Loader Remote	£128

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Pye. Standard	£69	Pye K30. Remote. Text	£112
Fidelity. Standard	£87	22". Standard. Toshiba	£65
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Ferguson. Remote	£95	Philips. Remote. Text. CTX	£139
Philips. Standard	£90	Ferguson TX100 Stereo. Remote. Text	£113
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AVAILABLE MID OCTOBER 21" & 24" FSTs

Please Ring for Availability

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STR58041	9.30

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TIP41C	0.25
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ICPF15	0.98
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DY802	0.98	PC805	1.40
DY86/87	0.66	PCF80	1.00
ECC81	1.50	PCF200	1.35
ECC82	0.98	PCF800	1.38
ECC83	1.23	PCF801	1.13
ECC84	0.80	PCF802	1.12
ECC85	0.98	PCF805	1.80
ECC88	1.35	PCL82	1.20
ECF80	1.30	PCL84	1.20
ECF82	1.25	PCL805	1.09
ECH81	1.60	PCL86	0.92
ECH84	0.66	PFL200	1.86
ECL80	0.84	PL36	1.87
ECL82	1.30	PL81	0.94
ECL84	0.74	PL84	0.78
ECL86	1.99	PL95	2.25
EF80	0.95	PL504	1.65
EF86	2.20	PL508	1.50
EF183	0.99	PL509/19	5.25
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EL90	1.75	PY500A	1.75
EL34	3.50	PY800/1	0.69
EL84	1.26	UCH81	2.25
EY36/7	0.68	UCL83	1.82
EY500A	2.25	UY85	1.35
EZ80/81	0.56	PL802T	4.00
GY501	1.45	40KD6	5.93
GZ34	3.50	21LUB	3.00
KT66	9.75	17DWB	4.50
KT77	8.50	3AT2A	5.00
KT88 Alt typ.	12.00	12BY7A	3.75
PC92	4.50	6L6GC	3.68
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MC1488	0.75
MC1489AP	0.77
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QL ROM 128K	7.20
TC74HC04	0.86
TMS1000	8.95
TMM23128P-1951	10.66
ULA6C001E (SPEC)	6.50
ULA1305T	2.50
Z80A CPU	1.70
2N7400E	11.25
SN7438N	2.00
74LS00	1.12
74LS32	0.90
74LS157	0.78
74LS132	0.63
74LS260	0.83
251641-02	P.O.A.
2732	4.12
2764	3.75
27128	4.95
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RAM 4116-4	1.10
RAM 4116-2	1.10
8249	3.00
8247	3.50
8271	60.00
BBC UID ULA	15.00
4164/4564-15	2.00
41256-15	8.95
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6522	4.00
6264 COMMODORE	7.50
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6526 COMMODORE	8.50
6561 COMMODORE	7.74
6569 COMMODORE	21.25
6581 COMMODORE	12.00
8360 COMMODORE	19.61
8501 COMMODORE	6.90
8701 COMMODORE	5.46
906114 PLA.COMM	7.00
901225 CHA ROM.COMM	3.37
901226 BAS ROM.COMM	8.71
ZTX182/BC182	0.07
ZTX213	0.15
ZTX214	0.17
ZTX313	0.24
ZTX510	0.39
ZTX551	0.39
ZTX650/1	0.27
ZTX750	0.38
IS 2472	0.31
901227	10.44

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9	2.85
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Sharp Reel Drive Unit VID1200, 651, 682, 684, 685, 693, 783	£5.95
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WAREHOUSE PACKED WITH THORN & GRANADA STOCK

COLOUR TVs WORKING FROM **£10**

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SUPERVISION

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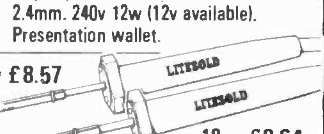

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High efficiency irons for all electronic hobby work. Non-roll handles with finger guards. Stainless steel element shafts. Screw-connected elements. Slip-on bits available from 1.6 to 4.7mm. LA12 model, 12w, 2.4mm bit. LC 18 Model, 18w, 3.2mm bit. 240v Std – 12v available. Presentation wallet.

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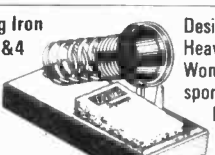

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SEE ORACLE PAGE 671

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(All Single Ended PCB Type)

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20mm Q/B: (Pkts of 10) 500MA, 630MA, 800MA, 1A, 2A, 2.5A, 3.15A .... .60

INTEGRATED CIRCUITS

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AN305	3.50
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HA1339A	2.95
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HA1377	2.95
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LA1201	1.25
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SAA1251	4.95
SAA3027	3.95
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SAA5030	5.95
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STK435	5.95
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STK459	8.55
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STK463	9.95
STK465	11.95
STK5332	6.95

TYPE	PRICE (£)
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STK7308	8.95
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STR4211	3.95
STR441	4.95
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TA7227	2.95
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TBA120U	1.00
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TBA810S	1.25
TBA820	1.50
TBA820M	1.25
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TBA950/2X	2.25
TBA1440G	2.95
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TDA1180P	2.65
TDA1190Z	2.85
TDA1470	3.25
TDA1506	4.35
TDA1510	3.80
TDA1512	3.50
TDA1515	4.50
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TDA1770A	3.70
TDA1870	6.95
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TDA2003	1.55
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TDA2020	3.20
TDA2030	1.80
TDA2170	2.95
TDA2270	2.95
TDA2525	2.95

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TDA2532	2.10
TDA2540	1.70
TDA2541	2.70
TDA2560	1.95
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TDA2577	2.95
TDA2578A	2.95
TDA2579	3.75
TDA2581	2.00
TDA2582	1.95
TDA2591/3	1.95
TDA2594	2.95
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TDA2653A	3.50
TDA2655B	5.95
TDA3190	1.95
TDA3330	3.95
TDA3540	2.95
TDA3541	2.95
TDA3560	4.95
TDA3561A	4.95
TDA3562A	5.50
TDA3565	4.95
TDA3571 B/Q	3.95
TDA3650	4.75
TDA3651	1.95
TDA3651AQ	3.80
TDA3652	2.95
TDA3653AQ	4.95
TDA3654AQ	4.75
TDA4500	3.95
TDA4503	4.65
TDA4600/2	2.85
TDA4600/2D	3.30
TDA7270	3.35
TDA8180	6.95
TDA8190	2.80
TDA9503	2.95
TDA9513	3.95
TEA1014	3.95
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UPC1181H	1.70
UPC1182H	1.70
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FERGUSON TX100 110	20.95
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BC148	.10
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BC328	.12
BC337	.11
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BC546	.10
BC547	.10
BC548	.10
BC557	.10
BC558	.10
BC639	.25
BC640	.25
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BD132	.50
BD222	.50
BD225	.50
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BD238	.40
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BD437	.40
BD438	.40
BD677	.65
BD701	.95
BD707	.95
BD807	.95
BF337	.28
BF338	.30
BF422	.35
BF423	.35
BF458	.35
BF460	.95
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BU126	1.50
BU205	1.40
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BU407	1.25
BU407D	1.50
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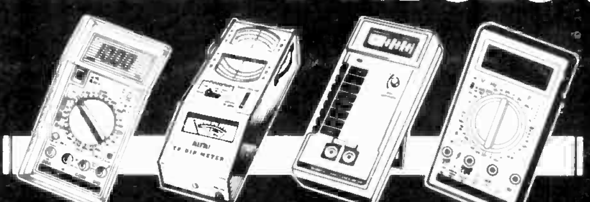

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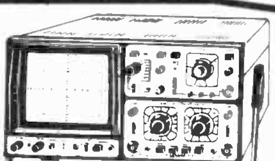

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1989 Catalogue — over 200 pages incl. Credit Tickets (3), Special Offer sheets, Prepaid Envelope & Order Form — £1, or free on application with orders of £15 and over. Prices in Catalogue may vary as material for advert is prepared 6/8 weeks before issue.

PLEASE NOTE – ALL PRICES NOW INCLUDE 15% VAT

OCTOBER SPECIAL OFFER

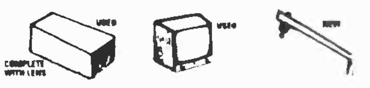
BATTERY TESTER

A compact dry cell battery tester capable of testing 15 voltage/battery types from 1.35V hearing aid batteries to 22.5V batteries. Test leads store in rear of case. Packed on attractive display card.
Dims: 105 x 64 x 32mm

PRICE: £9.99

"CLOSED-CIRCUIT" TELEVISION SYSTEM

PRICE £160.00 CARRIAGE £12.00
Comprising: 1 × CAMERA 1 × MONITOR 1 × CAMERA BRACKET



Illustrations not to scale. For guidance only — actual items supplied may vary from those illustrated.

QUARTZ-HALOGEN SPOTLIGHT

Hand held or hanging. Heat resistant poly-carbonate housing; highly polished reflector. Protective lens cover, doubles as base stand. With On/Off switch and 12ft curly cable terminating in cigar lighter plug. Produces 250,000 candle power – 5 times the intensity of average car headlamps.
Power: 12Vd.c. 4.5A. 55W. Dims: 160 × 88 × 110mm

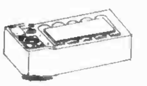
£5.99

12V Twin Fluorescent Lamp

12" Double Tubes
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.
Ideal for Caravans, Boats, Vans etc.

	1+	10+	50+
PRICE	£5.99	£4.99	£4.50

12 VOLT RECHARGEABLE UNIT

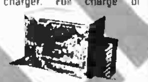


10 × D × Size Ni Cads (4 Ah) encapsulated in a black plastic case. Fuse holder. Gives 12 volt output when charged. Ex-equipment. Fully guaranteed. Dimensions: 245 × 75 × 75mm.

£9.19 each + P&P £1.85
£8.34 for 10 + P&P £4.50

CHARGING UNIT FOR THE ABOVE 12V UNIT

Manufactured by Saft, these chargers are suitable for the above battery packs (as advertised in the May issue of "WHAT VIDEO" — Page 6). The chargers are stated as we have modified them to a standard charger. Full charge of the packs is obtained after 10-12 hours (overnight) charging. Supplied complete with main lead and charging lead fitted with a 4-pin plug (6-pin plug version available upon request). Although ex equipment, these chargers are fully tested and guaranteed. Dimensions 335 × 260 × 150 mm



4-PIN £11.50 6-PIN £11.50 + £1.85 P&P

OSCILLOSCOPES

TEKTRONIX D755 – 50 meg. Solid State
Price £295.00 incl. V.A.T.
Carriage £12.00

NI-CAD BATTERY CHARGER

Universal	1+	£4.99 each
PRICE:	10+	£4.75 each
4 × AA Charger		£4.95 each

NI-CAD BATTERIES

AAA	£1.50 ea	£1.30 ea/10
AA	.95 ea	.85 ea/10
C	£1.95 ea	£1.80 ea/10
D	£2.00 ea	£2.20 ea/10
PP3	£3.90 ea	£3.75 ea/10

HELPING HANDS WITH MAGNIFIER
GLASS LENS 6.50
PLASTIC LENS 4.50

BLACK STAR FREQUENCY COUNTERS

Meteor 100 100MHz	115.00
Meteor 600-600MHz	149.00
ALL NEW Carriage	2.50

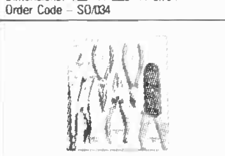
SAFEBLOC
MAINS VOLTAGE QUICK TEST
£9.99

Full range of **WIREWOUND RESISTORS** now in stock – 2.5W/4W/7W/11W/17W/25W/50W see our new catalogue.

FM TRANSMITTER

Very High Quality 'MINI-BUG' – Ideal for Baby Alarm etc.!!
A Very good range is obtainable – we have obtained over ½ mile, but it does depend on conditions.
Simply remove cover – insert battery – and you're ready to go
Reception can be obtained on any FM Radio
Frequency: 105-109 MHz FM
Power: PP3 9V Battery (not included)
Dimensions: 4.25" × 2.25" × 0.75"
Order Code – SO/034

Price: **£9.99**



5 PIECE PLIER SET

£9.99

VALVES

Type	Price (£)	Type	Price (£)	Type	Price (£)
DAF96	0.70	EF85	0.50	PCH200	1.45
DF96	0.72	EF86	2.65	PCL82	1.35
DK96	3.10	EF95	0.80	PCL83	2.95
DY86/87	0.80	EF183	0.52	PCL84	0.95
DY802	0.98	EF184	0.64	PCL86	1.15
E88CC	4.75	EH90	0.45	PCL88	2.95
EABC80	0.85	EL34	3.95	PCL805	1.20
EAF42	1.78	EL36	1.60	PD500	3.75
EB91	0.65	EL81	8.05	PFL200	1.15
EBC41	1.45	EL84	1.30	PL33	1.80
EBC81	1.10	EL86	1.45	PL84	1.20
EBF80	0.60	EL509	7.25	PL504	1.80
EBF83	1.35	EL519	7.25	PL508	1.35
EBF89	0.85	EM80	1.50	PL519/509	5.55
EC92	2.10	EM84	0.80	PL802	8.40
ECC81	1.75	EM87	4.75	PY81/800	1.35
ECC82	1.08	EY51	1.10	PY88	0.85
ECC83	1.40	EY86/87	0.85	PY500A	2.35
ECC84	0.65	EY88	0.85	PY801	1.35
ECC85	1.20	EY500A	2.55	UABC80	0.55
ECC86	3.25	EZ41	3.45	UAF42	1.85
ECC88	1.50	GY501	1.65	UBC41	2.90
ECC189	1.75	GZ32	2.45	UBC81	2.05
ECF80	1.35	GZ34	3.80	UCH42	2.45
ECF82	1.35	KT88 (GEC Mullard)	43.50	UF41	1.50
ECF83	2.25	KT88 (Foreign)	18.80	UL84	1.05
ECH35	4.35	PC86	0.55	UY41	3.85
ECH42	1.75	PCC84	0.50	UY85	0.95
ECH81	1.15	PCC85	0.92	2D21	2.65
ECL80	0.80	PCC88	0.85	6AU6	1.60
ECL82	2.11	PCC89	0.85	6BA6	1.45
ECL83	3.80	PCC189	0.85	6BE6	2.20
ECL84	1.25	PCF80	1.35	6C4	1.20
ECL85	1.20	PCF82	0.75	6K7G	3.05
ECL86	1.25	PCF86	1.35	6X4	1.75
EF37A	4.25	PCF87	1.35	12AU6	3.20
EF80	0.50	PCF200	2.75	12AV6	1.35
		PCF800	1.05	30FL2	2.00
		PCF801	1.50	30PL1	1.95
		PCF802	1.10	FULL RANGE IN CATALOGUE	
		PCF805	1.65		

SOLDERING SECTION

Soldering Gun Kit – 100W Pistol Type – complete with 2 Tips, Solder & Solder Paste	15.99
XS25 W Iron kit/complete with stand, 1m lead & plug attached	10.85
CS17 Iron Kit	10.75
C15 Iron Kit	10.75
Antex 15W iron	7.65
Antex 18W iron	7.75
Antex 25W iron	7.85
Antex elements	3.75
Antex bits	1.60
Antex stands	2.99
Soldersucker	3.44
Spare nozzles for Soldersucker	0.69

ORVX PORTASOL GAS SOLDERING IRON

PRICE £18.75 each   SPARE TIPS – 1, 2.4, 3.2, 4.8mm £5.50 each

SOLDER: 60% TIN 40% ALLOY

22g. Non-corrosive Multi-core Solder   500gm Reel £5.75 each.
18g. Non corrosive Multi core Solder   500gm Reel £5.75 each.

RESISTOR KITS – each value individually packed

¼W pack 10 each value E12 – 10R to 1M 610 pieces	5.10
¼W pack 5 each value E12 – 10R to 1M 305 pieces	3.75
¼W pack Popular – 10R to 10M 1000 pieces	6.99
½W pack 10 each value E12 – 2R2 to 2M2 730 pieces	8.75
½W pack 5 each value E12 – 2R2 to 2M2 365 pieces	5.40
½W 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

VERO - VERO - VERO - VERO

17.9" × 3¾"	£6.75
3¾" × 3¾"	£2.36
5" × 3¾"	£1.99
Easiwire Kit	£15.00
Verobloc	£6.71

ATTENTION RETAILERS — Trade prices available on full Vero range — minimum order £25

20mm FUSES

QUICK BLOW – 80mA, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1A, 1.25, 1.5, 1.6, 2, 2.5, 3.15, 4, 5, 6.3   45p/10
TIME DELAY – 50mA, 60, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1A, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3, 10   1.20/10

1" DOMESTIC MAINS FUSES

2A, 3A, 5A, 13A   £1.20/10

1 1/4" QUICK-BLOW FUSES

500mA, 1A 1.25A, 2A, 12A   50p/10

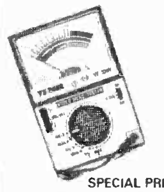
BT APPROVED EQUIPMENT

Master Socket (Flush)	£3.30	Wiring Tool	0.35
Master Socket (Surface)	£3.25	Plug 431A	0.35
Secondary Socket (Flush)	£2.05	Slimtel Phone	£19.95
Secondary Socket (Surface)	£2.50	Betacom Flamingo Phone	£9.95
B.T. Cable (per metre) 15 100M	£12.00	Cordless Phone - Freeway	£89.95
Line Jack Cord with Plug	£2.20	Conversion Kit & Wiring Diagram	£9.50
Extn. Lead 5 metres	£4.30		

SERVICE AIDS

Goldklene Degreasing Solvent	2.19	Super 40	2.25
Switch Cleaner Lub	1.50	Silicone Grease-Tube	2.25
Supa Freeze-it	1.88	Silicone Grease-Spray	1.85
Foam Cleanser	1.50	Heat Sink Compound	1.45
Video/Tape Head Cleaner	1.30	**Solda-Mop**	
Plastic-SCal	1.75	Light Guage 0.08mm	0.98
Aero-Klene	1.38	Standard Gauge 1.2mm	0.96
Anti-Static Spray Mist	1.50	Industrial Reel 1.2mm	3.65
Excel Polish	1.36	Drive Cord	2.99
Elece. Condutive Paint	3.55	Super Glue	0.99
Aero Duster	1.99	Insulating Tape 25p/1 20p.ea/10	
		Parcel Tape 99p/1 85p.ea/10	

VIDEO HEAD TESTER



A VHS video head tester for determining whether a video head is in good condition by detecting the wear state and displaying it on a meter. Complete with carrying case and leads.

SPECIAL PRICE £35

VIDEO HEADS

AKAI	
VP-77	£19.99
VP-88	£19.99
VP-7100	£19.99
VS-1	£19.99
VS-2	£19.99
VS-3	£19.99
VS-5	£19.99
VS-10	£19.99
VS-77	£19.99
VS-9300	£19.99
VS-[illegible]	£19.99
VS-[illegible]	£19.99
VS-9800	£19.99
FERGUSON	
3V00	£19.99
3V01	£19.99
3V16	£19.99
3V22	£19.99
3V23	£19.99
3V24	£19.99
3V29	£19.99
3V30	£19.99
3V31	£19.99
3V35	£19.99
3V36	£19.99
3V38	£19.99
3V39	£19.99
8903	£19.99
FISHER	
FVE-P615	£40.50
FVE-P810	£40.50
GRUNDIG	
Full range now available PHONE FOR PRICE	
HITACHI	
VT11	£29.99
VT14	£29.99
VT33	£29.99
VT34	£29.99
VT3000	£29.99
VT4000	£29.99
VT4200	£29.99
VT5000	£29.99
VT6500	£29.99
VT7000	£29.99
VT8000	£29.99
VT8500	£29.99
VT9000	£29.99
VT9300	£29.99
VT9500	£29.99
VT9700	£29.99
VT9900	£29.99
JVC	
HRD110E	£19.99
HRD110E6	£19.99
HRD111	£19.99
HRD120	£19.99
HRD121	£19.99
HRD225	£19.99
HR2200	£19.99
HR3300	£19.99
HR3660	£19.99
HR4100	£19.99
HR7200	£19.99
HR7600	£19.99
HR7610	£19.99
HR7650	£19.99
HR7700	£19.99
MITSUBISHI	
Full range now available PHONE FOR PRICE	
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N831	£19.99
N832	£19.99
N833	£19.99
PVC-2300	£21.95
PVC-2400	£21.95
NATIONAL PANASONIC	
NV100	£29.99
NV230	£42.50
NV300	£19.99
NV322	£19.99
NV330	£42.50
NV333	£19.99
NV340	£19.99
NV366	£49.99
NV370	£29.99
NV380	£29.99
NV430	£27.99
NV450	£42.50
NV470	£42.50
NV480	£42.50
NV730	£48.95
NV2000	£19.99
NV3000	£19.99
NV7000	£19.99
NV7200	£19.99
NV7500	£19.99
NV7800	£19.99
NATIONAL (Cont.)	
NV7850	£19.99
NV8170	£19.99
NV8200	£19.99
NV8400	£19.99
NV8600	£19.99
NV8610	£19.99
ORION	
VH-1	£19.99
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VR-6460	£29.99
VR-6520	£29.99
SANYO	
VTC-3000	£29.99
VTC 5000	£45.00
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VC200/300/482/3300/9100 9300/9400/9500/9600/9700	£30.99
VC381/384/385/386/387/388/481	£28.50
SONY	
SL-C5	£22.50
SL-C6	£22.50
SL-C7	£22.50
SL-C9	£48.60
SL-C20	£34.50
SL-C24	£34.50
SL-C30	£34.50
SL-C30	£34.50
SL-C[illegible]	£34.50
SL-F1	£34.50
SL-F30	£34.50
SL-3000	£28.50
SL-8000	£28.50
SL-8080	£28.50
TELEFUNKEN	POA
THOMSON	POA
TOSHIBA	
V31	£35.00
V33	£35.00
V55	£19.99
V57	£19.99
V5470	£29.99
V9600	£35.00

REMOTE HANDSETS

AMSTRAD	
CTV1409	£17.50
CTV2200	£17.50
CTV2210	£17.50
TV/VID-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	
FDO9193 TEXT	£15.95
FDO9141 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

CASSETTE LAMP

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

MANUALS

SONY SL C5/6/7 £8

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
J.V.C. HR2200/3300/3330/3660/4100/7700	£3.99
N.E.C. 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. 200/381/384/385/386/388/390/3300/2300/6000/6200/6300/7300/7700/7750/8000/8300/9300/9500/9700	£3.99
SONY. SL-C5/6/7	£4.20
TOSHIBA. V5	£3.99

IDLERS

FISHER	143-0-4204-00400	3.85
FISHER	GEAR IDLER 143-0-4904-00900	6.00
FERG/JVC	TAKE UP IDLER PU51402/A	1.70
HITACHI	6886971	1.99
PANASONIC	VXP 0344	2.30
PANASONIC	VXP 0521	2.50
SANYO	REEL DRIVE PULLEY VTC 5150 143-0-662T-01201	6.50
SHARP	NIDL 0005 GE22	1.90
SHARP	NIDL 0006 GE22	2.10
THORN/JVC	PU48967B	2.99

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TRIPLER Universal	5.50
PHILIPS KT3	8.50

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Reel Motor SANYO VTC 5150 4-529V-10800	9.20
Reel Motor SHARP VC9300/9800 RMOTV 1008 GE22	18.95
Capstan Motor - FERG/JVC 3V35 PU55371V/M	27.50
Audio Motor Recorder 12V CW 34mm	4.20
Audio Motor 9V CW 34mm	4.20

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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 OOE2 158-001	0.95

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	3300/3330/3360	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	V31 & 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

BOOKS

DATA VOLUME 1 – Trans. data & drawings A-BUY	£9.99
DATA VOLUME 2 – as above C-Z	£10.75
DATA VOLUME 3 – 2N-2N6736	£10.20
Set of 4	£42.00
DATA VOLUME 4 – 2SA & on	£13.50
DIODES VOLUME 1	£10.75
DIODES VOLUME 2	£10.65
Both Volumes	£20.60
I.C. CMOS	£8.95
I.C. TTL	£19.50
I.C. LIN VOLUME 1	£6.95
I.C. LIN VOLUME 2	£6.99
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THYRISTORS A to Z	£10.45
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TRANSISTORS 2N-3N	£7.00
Both volumes	£13.00

Full range of BABANI Books on TV/RADIO/AERIALS Etc. e.g.

INTRODUCTION TO SATELLITE T.V.	£5.95
Fane Loudspeaker enclosure Design & Construction – 54 pages	£3.99

EAST CORNWALL COMPONENTS
119 HIGH STREET
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SHROPSHIRE SY4 5TT
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ORDERING: All components are brand new and to full specification. Please add £1.00 postage/packing (unless otherwise specified) to all orders. Minimum order £5.00. Either send cheque/cash/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 £1.00 per copy). Delivery by return on ex-stock items. All prices subject to change without notice. RETAIL shop open Mon-Sat 9.00-5.00. Sat 9-12.00. REMEMBER ALL PRICES NOW INCLUDE VAT

TELEVISION

Sky's Take-off?

Sky Television has made an astute move in offering viewers an "all-in" package for reception of its programmes. For £4·49 a week the viewer gets the receiving equipment installed, with maintenance, and access to Sky's four-channel service. The company is backing its move into the rental field with a £21m advertising campaign. Between September 2nd and the end of the year £10m will be spent on TV and press advertising. A further £11m has been earmarked for the first half of 1990. Sky Movies is to start scrambling on February 1st 1990 when a £2·29 weekly charge will be made to receive the channel: there will however be no extra charge for those who take up Sky's £4·49 a week offer. Subscribers also have to pay a deposit of £35. The minimum contract period is one year, after which anyone who decides to terminate the contract will get the £35 deposit refunded.

Installation is being handled by a 1,200 strong network of engineers able to carry out around 75,000 installations a month. The firms involved are Cranleigh Aerials, Satellite Aerials of Watford, StarTrak and Tele Aerial Satellite. Amstrad and Cambridge Computers are providing the basic receiving equipment, with Philips and Thomson contracted to supply decoders for the scrambled transmissions when these start. Apparently the initial agreement with Amstrad and Cambridge Computers is for the supply of over half a million receivers – Amstrad has orders for 460,000. There should be no problems here in view of the present excess production capacity in the industry. Sky is holding discussions with other suppliers.

Sky's move to supply the public directly is likely to upset the trade no end – its terms are certainly competitive and the move could represent a massive bypassing of the established trading system. Applications are being handled by Sky staff at Livingston and Peterborough, the aim being to arrange for installation anywhere in the UK within ten working days of the initial enquiry. During the next year Sky expects 55 per cent of its viewers to be direct subscribers, with 30 per cent buying their own equipment from High Street outlets and 15 per cent renting from the usual organisations. Those who already have equipment have not been overlooked: anyone who buys a dish before September 30th will be provided with a decoder for just a £15 refundable deposit and will be exempted from the £2·29 a week charge for the first six months after scrambling starts.

This looks like a make-or-break effort on Sky's part. It represents a huge potential investment, but the modest looking £4·49 a week could well prompt many waverers to equip themselves for Sky reception. With the deposit, the first year's charge comes to £268·48, which is perhaps not quite so cheap looking. The final outcome will depend of course on viewer satisfaction with the programmes provided. In this connection research commissioned by Sky shows that 81 per cent of present satellite TV viewers have expressed satisfaction with the services, with 60 per cent using satellite TV to complement their viewing of ITV/BBC programmes and 40 per cent viewing mainly the satellite TV transmissions.

Sky's aim in committing itself to this major investment and the extensive promotion is clearly to get its services accepted by the public prior to BSB's delayed launch. Sky hopes to get back on target of having its services available in 1·15m households by the end of January 1990. This would of course bring with it substantially increased advertising revenue. And in the long run Sky will benefit from subscribers paying their £4·49 a week indefinitely.

Meanwhile Rupert Murdoch made quite a stir with his James MacTaggart Memorial Lecture at the Edinburgh International Television Festival. This was a strange effusion – though such occasions are not known for down-to-earth contributions. There was reference to a "wide variety of channels" and mention of the possibilities of cable – apparently he sees fibre optic cable as being able to make available to all "a global cornucopia of programming and nearly infinite libraries of data, education and entertainment". If he feels too strongly about cable why is he playing about with Sky's satellite channels? Well of course Astra is giving him enough to worry about for the present. But haven't we heard all that about the potential of cable before? It's a matter of cost and whether there's a real need. Rupert the visionary doesn't seem to pay sufficient regard to the finite conditions in which every economic activity has to operate. One suspects that in practice he's far more concerned with the day-to-day nitty gritty than his lecture suggests.

Why did he feel it necessary to make such heavy-handed criticism of the existing TV arrangements in the UK? They have their shortcomings, but it's hard to envisage a greatly improved system, and the "private" services in parts of Europe hardly instil confidence. Television, our Rupert tells us, is "in transition to a future offering consumers new choice". Lack of competition can certainly lead to poor programming, but his suggestions of a great new TV world seem to be something of a mirage. But by all means let's see what Rupert can make of the opportunities he has siezed.

Binders

New arrangements have been made to enable readers to obtain binders for their copies of *Television* Each binder holds twelve issues and costs £4·50. Orders should be sent to Television Binders, 78 Whalley Road, Wilpshire, Blackburn BB1 9LF. Make cheques out to Television Binders.

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John A. Reddihough

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CORRECTIONS

The satellite TV servicing aid (see August issue) should not in its present form be used with the Grundig head unit. See letter on page 919.

A pin connection is omitted in Fig. 2, page 925. Pin 57 RAOV is an output from the RAM address generator.

HELD OVER

Due to shortage of space in this issue several items we had planned to include have had to be held over. This includes the Service Bureau page.

COVER PHOTO

This month's cover photograph shows a Panasonic Model TC2000. See U3/U3W chassis servicing article on pages 910-912.

Servicing the Panasonic U3/U3W Chassis

Nick Beer

The Panasonic U3 and U3W chassis are virtually identical. They succeeded the U2 chassis which was covered in the February 1985 issue of *Television*. Models fitted with the U3 and U3W chassis include the TC208, TC221, TC225, TC2000, TC2011, TC2024, TC2211, TC2213, TC2216, TC2221, TC2223, TC2226, TC2622 and TX2284. The range ran from 20 to 26in. tubes and from standard through to remote control with teletext. A large number of these sets are still in service but the life of some of them has been cut short by premature failure of the c.r.t.

Purple Electrolytics

Those who have worked on the U2 chassis will have noticed the number of faults caused by defective electrolytic capacitors. This was a problem with Panasonic sets of this era. As a rule only the dark purple capacitors are affected. When servicing these sets a check on all these capacitors should be the first job. There are two reasons for this. First the symptoms that occur when one of these capacitors is faulty can be very strange and misleading. Secondly you won't miss any that are beginning to show signs of deterioration, thus preventing call-backs. The troublesome capacitors are on the main horizontal section of the chassis and the c.r.t. base panel.

Your first check should be to wiggle and pull each of these capacitors. This will usually result in at least one of them coming away in your hand. What happens is that electrolyte begins to exude in a brown, powdery form around the positive leg. This highly corrosive material rots the leg away and begins to eat into the Paxolin panel. In really bad cases the powder can be found on the print side of the panel, having eaten its way through the PCB hole where the capacitor's positive leg once resided. The next step is to remove each capacitor in turn and inspect it for signs of leakage. This may sound like a lengthy job, but in practice it's soon done and definitely pays dividends.

Any leaky capacitors should of course be replaced, but make sure that all electrolyte on the panel has been thoroughly washed away with alcohol or something similar before you carry out any soldering in the affected area. The electrolyte spits when heated and if left will corrode the PCB. Use capacitors from Panasonic as replacements for the purple ones. Circuit references of the suspect capacitors include C572 (10μF, 250V), C551 (100μF, 35V). C558 (1,000μF, 25V), C356 (1μF, 350V),C854 (47μF, 250V), C856 (47μF, 35V), C809 (1μF, 250V) and C853 (100μF, 250V). Some of the symptoms that arise when these capacitors fail are: varying sound level; purity errors; one side of the screen dark while the other is progressively lighter; varying brightness level; a high pitched whistle from the power supply; ringing on the picture; and corrugated verticals on the picture.

Tuning System Faults

Failure of the tuning system has been a problem in recent years. These sets employ a search and store arrangement and the symptoms vary from not searching and/or storing to no front panel operation (remote channel change etc.) due to heavy loading on the 12V supply. The cause of the trouble is the tuning/memory chip which is IC1101 (TMS3452N2L) in some sets, IC1103 (TMS3453N2L) in others. If the supply is excessively loaded, lift pin 40 of this device as a check. On board TNP66035ZA this condition will usually be accompanied by overheating of R1214 (330Ω, 1W). These problems seem to occur when a set comes in for the first time since it was new, for example when being overhauled for re-renting. Note that these chips are static-sensitive devices, so the proper precautions should be taken when fitting a replacement. Also the auto-search must be operated immediately after the replacement in order to initialise the chip.

There are occasions when the 12V rail is low or missing and this is not due to excessive loading. On board TNP66035ZA a check around the 12V regulator circuit should reveal the cause of the trouble – suspect items are R1151 (22Ω, 0·5W), Q1124 (2SD762) and zener diode D1117 (QA116R2). Note that R1151 is a critical safety component. Board TNP66048ZA has a simple zener diode 12V regulator circuit. On one occasion I've had an open-circuit secondary winding on transformer T1101 (TLP15275).

No Go

The no go condition is usually accompanied by a scream from the power supply, indicating the presence of an overload. My approach to this is to check the following items. This will usually bring the culprit(s) to light. First the two diodes D552 and D553 in the EW modulator circuit. D552 is type TVSC27-15M and D553 type TVSC2406M. Check these as a pair – when one goes the other usually follows. If you have to replace them you may find that with the set working there's no EW correction as the driver transistor Q753 (2SD762) has been adversely affected by failure of the diodes. This sequence of events is also experienced with the earlier U2 chassis. Use genuine replacements. Many engineers are tempted to use a BYX71-600 or the heftier BY223. These will work, but their long-term reliability in this circuit is poor. As is often the case, European semiconductor devices don't last in Japanese line output or power supply circuits.

If the EW modulator diodes are o.k., check the following: the BU208A line output transistor Q551; the 2SC2653 line driver transistor Q501; the RH15 195V supply rectifier D555; the ERC24-06M 26V supply rectifier D554; the ERC24-06M 18V supply rectifier D556; the TVSC2408M h.t. supply (160V with 22 and 26in. sets, 128V with 20in. models) rectifier D851; and the RU3N 27V supply rectifier D852. Also check the ERZC10ZK241U protection diac D854 – very often it has a hole blown in its side. This item is connected across the h.t. supply. Measure the h.t. at TPS1 or the positive leg of the reservoir capacitor C853.

If you still have a non-working set, try lifting one end of the h.t. smoothing choke L851 and connecting a bulb as a dummy load across C853 (TPS1 is on the output side of the choke). If the h.t. comes up, you've got an overload. In this situation I'd be tempted to suspect the line output transformer. While Panasonic line output transformers are exceptionally reliable, I have had the odd one fail. If

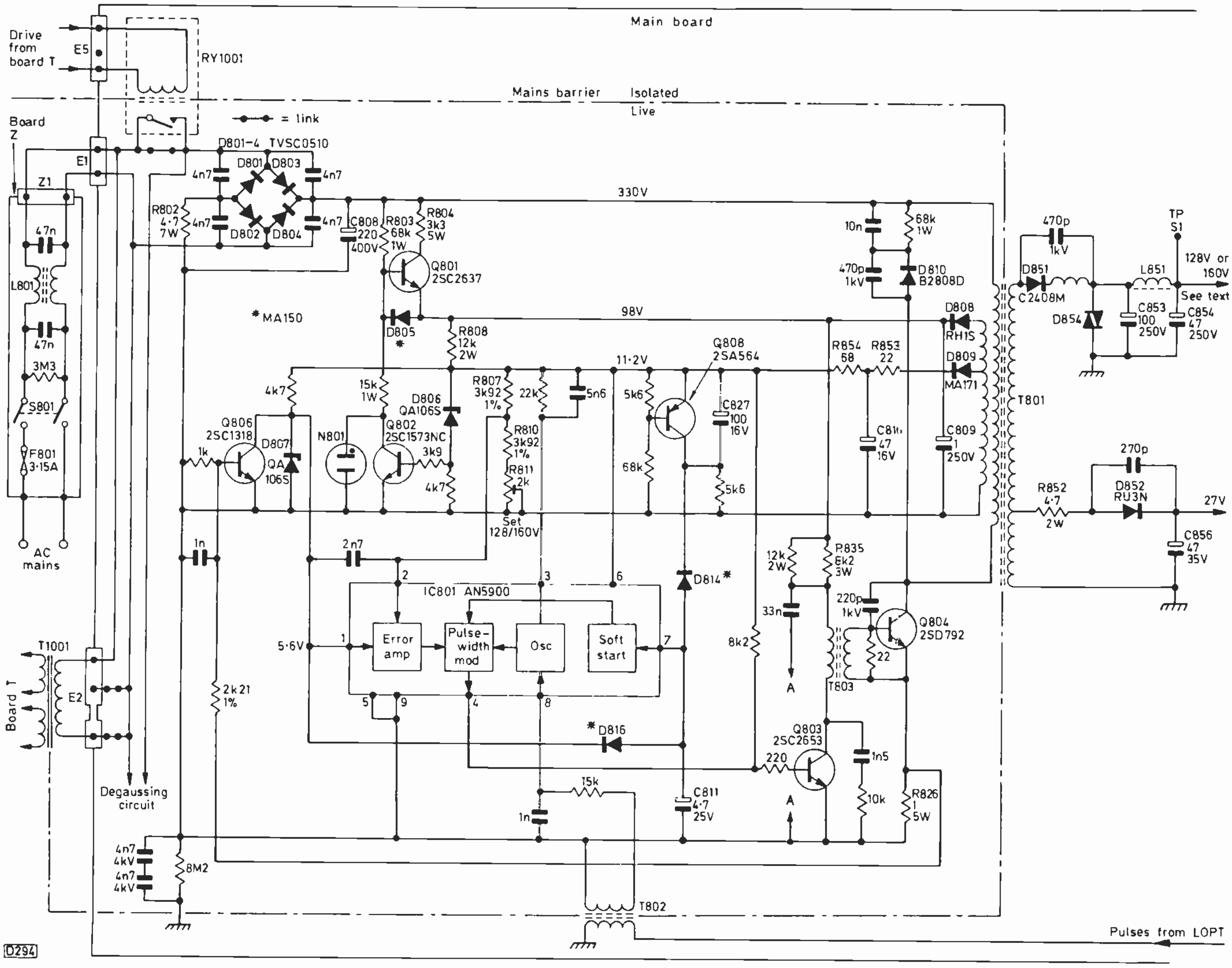

Fig. 1: Circuit diagram of the chopper power supply used in the Panasonic U3 and U3W chassis. The e.h.t., 195V, 26V and 18V supplies are derived from the line output transformer. The 18V supply feeds the 12V regulator.

possible check it out of circuit with a Megger. Check every other possibility before condemning the transformer – it rarely fails.

If the h.t. doesn't come up with the dummy load, the fault will be in the power supply. A check on the following items should reveal the cause of the fault. First check the 4·7Ω, 7W surge limiter resistor R802 – note that it's on the negative side of the mains bridge rectifier. It often goes open-circuit. We've also had cases where the 220μF, 400V reservoir capacitor C808 has become leaky. This is a silver can electrolytic, not one of the purple ones. If there's no voltage at the base of Q801 you'll find that R803 (68kΩ, 1W) is open-circuit.

No output from the power supply is very often caused by one of the transistors having gone short-circuit. The chopper transistor Q804 (2SD792) is an obvious suspect. If it's o.k., go on to check Q801 (2SC2637), Q802 (2SC1573NC), Q803 (2SC2653), Q806 (2SC1318) and Q808 (2SA564). Also suspect the QA1-06SB reference zener diode D807 and R835 (8·2kΩ, 3W). The resistors in series with the h.t. adjustment potentiometer R811 should be checked carefully – R807 and R810 have a tolerance of one per cent. It's rare for the AN5900 chopper control chip IC801 to be faulty but this can happen. And all the electrolytics should checked. A loud, high-pitched whistle from the chopper transformer, sometimes coupled with a line running down the screen and line tearing, can be caused by C809 (1μF, 250V), C853 (100μF, 250V) or C854 (47μF, 250V).

If the mains fuse F801 has blown you'll probably find that two of the TVSC0510 mains bridge rectifiers D801-4 have gone short-circuit. An alternative cause is an intermittent short-circuit in the degaussing posistor D812.

If the set intermittently goes into the standby mode when switched on, the contacts on the relay are probably carbonised – they can be cleaned.

A final point about the power supply: Panasonic mains switches are exceptionally reliable.

If the power supply is in order but the line output stage is dead check whether the h.t. feed resistor R559 (22Ω, 20W) is open-circuit. Failure of the line timebase has on occasion been traced to the AN5435 sync/timebase generator chip IC501.

Bowed Sides

If the sides of the picture are bowed in, check the EW modulator driver transistor Q753 (2SD762).

Intermittent Shutdown

Intermittent shutdown is not a common fault. When it does occur, try replacing the 11V zener diode D501. This usually clears the trouble. If not it will be necessary to provide the power supply with a dummy load bulb and carry out detailed checks – the trouble is usually due to thermal failure of one of the previously mentioned transistors in the power supply. The "heavier" components in the line output stage don't usually fail intermittently.

Field Faults

The most common field faults are lack of height and field collapse. They are often intermittent. Resoldering the connections to the field output transistors Q402 (2SD856) and Q403 (2SD837) used to cure this fault in nine out of ten cases. They are mounted, along with the EW modulator driver transistor Q753, on a large heatsink that runs across the depth of the bottom panel, about a third of the way in from the left as you look in at the back of the set. More recently we've tended to find that the transistors themselves are faulty – usually both leaky or one or the other short-circuit. Also check R430 (0·82Ω, 0·5W). The electrolytic to watch here is C414 (2,200μF, 35V).

Fault Guide

For no sound or vision with the raster present check whether there is 12V at the emitter of the 12V stabiliser transistor Q552 (2SD762). Check Q552, D558 (MA26WO) and zener diode D559 (QB111ZB) if this voltage is absent.

As previously mentioned, problems due to the tuning/memory chip are common. A not so common cause of no signals is the 33V regulator IC70 (μPC574J) having gone short-circuit. In this event you might well find that its feed resistor R71 (22kΩ, 1W) is open-circuit. A faulty tuner usually results in a snowy picture rather than no signals. Fit the improved type TNV87510F2T. For low gain in poor-signal areas fit modification kit XFMK83-1.

For no sound, first check that the 27V supply is present at pin 10 of the STK4019 audio output chip IC251. If not, suspect that R852 (4·7Ω, 2W) or R257 (3·3Ω, 1W) is open-circuit. If R257 is open-circuit suspect that IC251 is also faulty.

Varying sound is not as common a problem with this chassis as with the U2 – thank the Lord! The first thing to do – you guessed it – is to check the electrolytics associated with the sound circuitry. Next favourite is the RD12 zener diode D251.

There are no stock faults in the i.f. and colour decoder sections of the receiver. No colour has on occasion been traced to the crystal X601 (TSS116M1).

For no picture with the c.r.t. cut off check R323 (10Ω). For an overbright raster check the surge limiter R556 (22Ω) in the 190V supply. For varying brightness or one side of the picture being brighter than the other check C572 (10μF, 250V) and C356 (1μF, 350V).

For lack of either red, green or blue check D604/5/6 (MA1130), R313/4/5 (270Ω) or Q351/2/3 (2SC2923).

If the c.r.t.'s heaters are out check R558 (0·56Ω, 0·5W).

Tube Life

As with the U2 chassis, these sets use the A51-570X, A56-540X and A66-540X range of tubes, which tend to fail before their time – or are we expecting too much in comparing them with the tubes used in older chassis such as the CVC5 series? Economically, to us replacement seems to be a dubious proposition. Some engineers prolong tube life by shorting out R558. This is not something th
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Modifications

A number of production modifications were made. It's not really practical to check each set to see whether they've been incorporated. The following are worth noting where relevant to a particular complaint.

To improve the focus and peak white capability, change C351 from 180pF to 220pF, C352 from 120pF to 220pF, C353 from 180pF to 330pF, R351/2/3 from 10kΩ to 8·2kΩ (2W), R354 from 80Ω to 82Ω, R355 from 270Ω to 180Ω, R356 from 180Ω to 82Ω and R370/1/2 from 2·7kΩ to 1·5kΩ (0·5W). These components are all on the c.r.t. base panel. On colour decoder panel B change R303 from 2·2kΩ to 4·7kΩ, R309 from 68kΩ to 270kΩ and R325 from 22kΩ to 27kΩ.

To prevent ringing/ghosting change C303 from 120pF to 82pF and R305 from 1kΩ to 560Ω.

To improve the red chroma replace R619 with a wire link, fit a 1·2kΩ resistor (R631) in place of link J28 and add C629 (20pF). Additionally in Models TC2221/3 remove J14 and add R630 (6·8kΩ).

Manual Errors

A couple of errors in the manual are worth noting. The sub-contrast control should be adjusted for a drive of 2·4V, not 3V. The sub-colour control should be adjusted for a 1·8V peak-to-peak waveform, not 2·3V p-p.

In Conclusion

In conclusion, the vital thing with these sets is to check the electrolytics. Apart from the odd rogue set the experienced engineer will have no problems with these chassis. The usual precautions should of course be taken. Remove flux after soldering and varnish joints. Clean up electrolyte and muck around the e.h.t. cavity.

The successor U4 and U4W chassis will be covered in a future article.

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Teletopics

SATELLITE TV LATEST

BSB's first satellite, Marcopolo 1, has been successfully launched into orbit from Cape Canaveral, by a Delta II rocket. It's nearly 24ft in length and will spin at 50 r.p.m. for stability. The satellite's design life is ten years. It will undergo tests for about a month before being handed over to BSB by its builder Hughes Aircraft Company. A second satellite is due up later this year. The two satellites are costing BSB $300m to build and launch.

During its first five months Sky Television lost £75m. Losses are at present running at about £2m a week and profitability is expected to take at least two years to achieve. According to figures from Astra and consultants McKinsey, some 79,000 receivers had been sold or rented up to mid-July. The forecast is for some 500,000 installations by the end of the year. Manufacturing capacity is estimated to be around 1·2m a year. McKinsey's figures also show that Amstrad has more than 63 per cent of the market, Grundig has 12 per cent and Alba just over 10·5 per cent.

Tandy has introduced a satellite TV system which is being stocked in the company's 300 stores nationwide. The SR100 satellite system includes a remote controlled, preprogrammable, 16-channel receiver that's simple to operate and connects easily to an existing TV set. The system sells at £369·95 fully installed with a 12-month on-site maintenance contract or £299·95 for DIY installation.

The Grundig range of satellite TV equipment has been extended to include a 75cm offset steel dish to give extra signal pick-up. Like other Grundig dishes, the new one is a distinctive grey colour. It's compatible with existing Grundig systems and can be motorised.

TranSat Ltd (Berrycroft House, Ashbury, Nr Swindon, Wilts SN6 8LX) has introduced two new satellite TV products of particular interest to installers, the SAM and the Snapper. The SAM is a compact satellite/aerial alignment meter which gives very accurate signal measurement. It has both a visual display and an audio alarm and can be operated from the mains or via the company's portable, rechargeable power supply. There are two versions, analogue or digital. The meter can be conveniently combined with TranSat's u.h.f. converter and can be used for aligning conventional TV aerials as well as satellite dishes. The Snapper is a hand-tool that snaps and seals TranSat's unique range of waterproof connectors, effectively replacing traditional crimping tools and F connectors. An optional security lock that prevents tampering is also available. TranSat can be contacted on 079 371 353.

VIDEO NEWS

Sony has introduced a range of metal high-grade cassettes for use with 8mm equipment. According to Sony the tape gives a 12 per cent increase in picture sharpness and colour vividness and a 2dB improvement in video and colour signal-to-noise ratio. The P5-90HG cassette has a three hour recording time in the long play mode and costs £10·99, a premium of £2 over standard grade tape.

Sony is to launch what's claimed to be the world's smallest and lightest full-function camcorder this autumn. The CCD-TR55 measures just 106 × 107 × 176mm and weighs 790g. It features a ×6 zoom, 1/4,000 sec fast shutter, digital superimposer, fader, various editing features and a multi-angle viewfinder. There's single-speed recording/dual-speed playback and the machine has a 270,000 pixel CCD. The compact design has been made possible by using advanced PCB technology, a miniature video head drum and the new FL Mecha drive mechanism. The price is expected to be around £999.

Mitsubishi is setting up a third VCR factory at Livingston, Scotland. This will enable the company to increase production of both VCRs and components and will create 550 jobs during the next year.

CHANGES AT RUMBELOWS

Thorn EMI is reorganising its loss-making Rumbelows retail chain. There have been redundancies at head office and thirty shops have closed. A further 30-50 "marginal" stores are being closely monitored. The firm's servicing company Solutions has been closed down: servicing is now run on a regional basis and will gradually be contracted out to other companies. The product range has been reduced by forty per cent and new lines have been introduced. Thorn EMI blames depressed trading conditions, price cutting and increases in rents and rates. Under the restructuring scheme four regional boards are being set up. Some of the shops operate under other names, such as Atlantis, Hometech and Ketts. A rumour that the DER rental chain is to be closed down and the Radio Rentals and Multibroadcast chains merged has been denied by Thorn EMI.

COMPONENT SOURCES

Proops Distributors Ltd. of Heybridge Estate, Castle Road, Camden Town, London has opened its warehouse to the public. The 10,000ft warehouse stocks a wide range of new and surplus items from solar panels to back magnets and from PCBs to valves. It's open for six days a week, offering professionals and enthusiasts alike surplus high- and low-tech components at bargain prices. Proops originally traded in the Tottenham Court Road, where it was active for thirty years from the early Fifties. The shop closed down some ten months ago.

Double D has opened a new warehouse at Ringwood Road, Bournemouth. The firm is part of Willow Vale Electronics.

Cirkit has published a new catalogue for constructors, featuring over 3,000 products. The 184-page catalogue is now arranged in alphabetical sections for quick reference and all prices include VAT. It's available for £1·50 from Cirkit Distribution Ltd., Park Lane, Broxbourne, Herts EN10 7NQ.

Seleco (UK) Ltd. has moved its sales and servicing departments to 51-52 Heming Road, Washford, Redditch B98 0EA. The spares and service telephone number is 0527 510 785.

IN BRIEF

The government has decided to allocate the 40GHz band (40·5-40·5GHz) to microwave TV services . . . The Cable Authority has warned five franchisees that they would lose their licences if they fail to start building their networks by the end of the year . . . Bourns Electronics Ltd. (90 Park Street, Camberley, Surrey GU15 3NY) has developed a new, rugged high-voltage potentiometer for use as a focus control in monochrome and colour receivers. The cermet element used in the 3386-HV1 has a temperature stability of ± 150 parts in 10^6 per °C. Standard resistance values are 2·5MΩ and 5MΩ, the contact resistance variation being one per cent maximum.

VCR Clinic

Reports from Philip Blundell, Eng. Tech., Ian Bowden, Eugene Trundle, Nick Beer, E. Shirt and Jeff Herbert

Salora SV6600/Sanyo VHR1300

The complaint was of intermittently stopping in play or record, then being difficult to get going again. We ran the machine in the workshop for four days and it never stopped once. When it was returned the fault immediately occurred – isn't that always the way? – so back it came. This time we were able to see the fault. When play was selected the machine would lace up and would then straight away unlace and stop. Take-up was present, the capstan turned, so did the drum. As the machine started to unlace just after the capstan and take-up started, leaving insufficient time for a cutout operation from either of these functions, I checked the head switching waveform at pin 28 of IC4002 on the top PCB. It was absent. As it's fed to the system control chip to provide an indication of drum rotation (or lack of it) this was the reason for the machine stopping.

The pulses from the PG coil enter IC4002 at pin 25. There were no pulses here either, because the pick-up coil was open-circuit – the slightest pressure would correct the problem. To restore correct operation we had to order and replace the complete stator assembly. **I.B.**

Panasonic NV-G10

If the channel display comes on when the VTR switch is operated but there's no on-LED light, play or E-E, check the voltages around IC1001. If 13·5V is present at pin 6 there's a good chance that this i.c. is faulty. **P.B.**

Philips VR6180

This machine had severe colour crosstalk on playback and I hit a major snag when I looked at the manual – it had the 5V signal panel and I didn't have the supplement for this. Anyway I decided to start by changing the delay line 5102, which turned out to be the cause of the trouble. Rock on! **P.B.**

Grundig VS300

This machine wouldn't accept a cassette. If an attempt was made nothing happened except that F1 flashed on the display. On the basis of past experience with older models I homed in on the brake solenoid switch. This had dirty contacts, but when a new one was fitted it still didn't pull in. Its driver transistor T2141 (BC876) was open-circuit. For anyone not familiar with these machines, when the on/off switch is operated with no cassette inserted the brake solenoid should pull in for a moment. Sometimes the driver transistor goes short-circuit as a result of which the solenoid's thermal fuse blows. This is available as a spare part from Grundig. **P.B.**

Philips VR6660

This machine worked correctly in the playback and E-E modes. When record was selected however the monitor's screen went blank and nothing was recorded on the tape. When checks were made on the power supplies I found that the +12b line dropped in the record mode due to excessive current. Checks on the i.f. board led to the head amplifier can P400 where C2013 was found to be short-circuit. Along the way I had a wild goose chase around the P604 system control board which was fitted with a small subpanel. This isn't shown on the circuit diagram but is included in the manual for the VR6862. **P.B.**

JVC HRS10/Ferguson 3V33

Failure of the fast forward and rewind functions, with the motor whirring followed by shutdown, might be taken for slippage in the reel drive unit. First however check that the pin on relay lever assembly 10 in not slipping out of the toe of the L-shaped slot in slide plate 9 as the control cam approaches its fast forward/rewind position. If it is, check for wear in plate 9, the lubrication of assembly 10 and the operation of the spring in assembly 10. The numbers refer to those in the exploded view of the deck mechanics shown in the service manual. **E.T.**

Tatung VRH8495/Philips Equivalents

These machines use the deck with clockwise ring loading and the "road-runner" pinch wheel. If, especially after work on the deck, you get a fixed pattern of dropout blips spread all over the screen of the monitor, check the earthing of the lower drum block. It's linked to the deck by a metal retaining finger at the right of the drum. This finger clamps the lower drum to its plastic mounting and has a long "tail" that's bolted to the deck metalwork. **E.T.**

Hitachi VT530E

The symptom with this new machine was no playback picture, sound o.k. Close examination of the monitor's screen showed that there was a bit of unlocked chroma signal scudding about. An open-circuit low-pass filter, CP202, in the post-demodulator luminance circuit was the cause of the fault. Sometimes these *LC* assemblies have to be replaced. On this occasion however we were able to dismantle the filter and resolder the termination of the very fine wire from a tiny ferrite-cored coil. **E.T.**

Sony HVC4000P

These early and rather bulky cameras were excellent in good light and many of them are still about, as often as not working with VHS equipment via plug-in adaptors. This one had no picture, but slight noise was perceptible on the monitor's screen, changing as the sensitivity switch was operated. In addition the tint changed as the white balance was altered manually. All these things pointed to a stuck-closed iris, and sure enough the iris drive motor had seized up. A microscopic drop of oil at each end of the spindle restored pictures. **E.T.**

Ferguson 3V53

Play-only machines were never very popular but we've had two examples of this model in for repair recently. Both had the same fault – no go, power supply not operating. There's no write-up on this power supply's operating principle. Its in the form of a module and most problems seem to stem from failure of the i.c.-based oscillator to start up. If you encounter this, try replacing C23 (47μF, 25V) and zener diode D20. We've found that more reliable operation is obtained by using a 16V, 400mW zener diode in this position. **E.T.**

Panasonic NV333

There were several problems with this machine. First, there was considerable flutter on sound. This was quickly remedied by replacing the capstan motor. All belts, the idler and the reel clutch were then changed. When the machine was tried it went into a state of confusion: the record LED was on all the time, the machine wouldn't switch off and the clock and timer couldn't be set. After a bit of checking we found that the 2·5A fuse associated with the mains transformer's 17V a.c. winding was open-circuit due to overloading on the 5V rail. The cause of this was internal shorts in the MN1405VKK microcomputer control chip. **N.B.**

Salora SV8500/Mitsubishi HS304

This machine was being checked after coming back off rental. The customer had pointed out to the engineer who collected it that the sound was intermittent in E-E and playback. While thinking about getting to the heads to clean them I spotted the cause of the trouble – the r.f. modulator's audio pin had never been soldered. **N.B.**

Panasonic NV-F70

This machine was virtually dead, the characteristic squeal at switch-on being rather muted. We found that rectifier D1111 in the power suppy was short-circuit. This surprised us as it's a very large device that looks as if it's capable of carrying several amps. **N.B.**

Panasonic NV-M3

Diagnosis was not particularly difficult but the conditions may be of interest to those not familiar with camcorder servicing. The machine came in from a local factory, owned by a multinational electronics firm, for a routine service. Twaddle I thought, but it genuinely did need attention. Both the power zoom and the auto-focus motors were noisy, mechanically and electrically. As a result there was pick-up by the microphone. The belts and the pinch roller were worn, and the eyepiece rubber surround was, as so often, pretty distressed. On top of this the S4161P pick-up tube was in poor condition. The estimate was thus a high one, and to our surprise was accepted within a week. Excellent results were obtained after carrying out the repairs and setting up the unit. **N.B.**

Akai VS1/2/4

If the problem is poor sync with a single line on the tape about a quarter of an inch (six millimeters to the youngsters) from the bottom edge, look closely at the first tape guide. You'll find that the centre pin has pulled out of the plastic subdeck moulding and that the spring used is reminiscent of that used on the good old pogo stick. The waste bin is the only place for it (the spring). Replace it with something a lot lighter – old retractable pen springs work wonders. Glue the shaft back in place, pressing it well home, then reassemble using the new spring. I've

done lots of these repairs – when you've seen the spring for yourself you'll see why the fault occurs. **E.S.**

Akai VS1 and VS4

These machines have an on-screen display. A fault that can only be described as the space invaders syndrome occurs – a screen full of As that flicker at clock rate. The culprit is the character generator chip IC2 on the operation PCB (front panel). It's an MB88303. I've had this fault on several occasions. **E.S.**

Samsung V7 Series

No erase and no new sound track – yes, it's the bias oscillator. If you dismantle the erase block carefully you can replace the transistor. It's nothing special and usually goes open-circuit emitter-to-collector. **E.S.**

Samsung VI611

Tape left out when the cassette is ejected looks at first sight like a case of poor rewind torque. Usually however it's that biggest blight of our lives the mechanism state switch. You'll find it hidden between the subdeck and case moulding webs. **E.S.**

Sanyo VHR3100

The complaint with this machine was no record sound, playback sound o.k. A prerecorded tape produced a good picture and sound but, as the tape loading and front loading mechanism operated, the verticals in the E-E picture bent and hum bars appeared on the screen. The E-E picture returned to normal as soon as the mechanism drive motors stopped. With the machine in the record mode, once the tape was fully loaded and the hum bars had gone the E-E sound was lost (muted). Hence the no sound on record problem. As we've had power supply faults with these machines we checked all the regulated rails carefully with a digital meter. They were all within 0·2V of the readings specified in the manual, and no detectable drop occurred in the loading and unloading modes when the hum bars appeared on the screen.

As a working machine was available and the boards can all be removed easily we decided to isolate the cause of the fault by panel swapping. The top signals board seemed to be the most likely source of the problem as most of the sound processing is carried out here. But changing this then the system control panel and the front function and tuning boards made no difference. We finally swapped the power supply panel. This cured the no sound on record and the hum bars with the motors running problems.

A scope check soon revealed the source of the fault. There was ripple on the 12V and 13V rails. We then found that there was a dry-joint on the reservoir capacitor C5001 (2,200μF, 50V) at the input to the STR7226 regulator chip. As a result the chip could cope under low-load conditions, i.e. in the E-E and playback modes, but on record the extra load produced by the bias oscillator drive to the sound and erase heads caused excessive ripple on the switched 12V line. This upset the sound mute control in IC2001. **J.H.**

Letters

CD-GRAPHICS

I think I can solve the mystery of the extra subcode words mentioned in Part 7 of Joe Cieszynski's excellent series on servicing compact disc players. The R-W words, which account for approximately three per cent of the bits on the disc, have been set aside for a graphics display system called CD-Graphics (CD-G) or Back Ground Video (BGV). CD-G is part of the original CD digital audio Red Book specification and is thus an internationally agreed standard.

The idea behind CD-G is to allow simple graphics and text (e.g. song lyrics, artists' biographies, pictures etc.) to be displayed on a TV screen while a CD disc is being played. I first saw the system in Japan last year. The display looks very similar to a teletext picture, each CD-G display consisting of 288×192 pixels. Up to 16 colours can be selected from a palette of 4,096. A CD disc can store up to 1,500 graphic images, and up to 1,500 languages can be written on to it. The images and text can be scrolled on and off the screen.

The system is very popular in Japan, where many discs are encoded with graphics. I understand that several UK CD discs also have them. The graphics can be seen only when a special decoder is used however. It's attached to either the digital or subcode socket on a standard CD player and the TV set. Future CD players will incorporate the decoder. Rumour has it that JVC may launch a CD-G decoder in Europe later this year. A more detailed description of CD graphics will appear in an article currently being prepared for *Television.*

George Cole,
Peterborough.

SATELLITE TV SERVICING AID

I would like to make a couple of points regarding D.J. Stephenson's novel satellite TV servicing aid (August) to prevent potential builders from coming to grief.

First, the choice of mains transformer. The author states that "any transformer whose secondary winding is in the range 15-30V can be used". In view of the calculations the author provides this clearly isn't so. Iron-cored transformers typically have a load regulation of 10-15 per cent. Some small transformers are considerably worse than this. Taking the best case at the upper end of the range, a transformer with a nominal secondary voltage of 30V r.m.s. will produce an off-load terminal voltage of at least 33V. With a rectifier and reservoir capacitor added the output will be $33 \times 1{\cdot}414 = 46{\cdot}67$V, which is clearly well in excess of the maximum input voltage of 78 series regulators. A 15V r.m.s. transformer is about ideal and should be recommended for the project. If any reader wishes to use a transformer from a junk box, the maximum off-load terminal voltage of the one chosen must not exceed 20V r.m.s.

Secondly a word on upping the nominal output voltage of 78 series regulators. While adding a resistor in series with the earthy leg is in order, the load regulation does suffer quite badly as the author points out. A better way of producing a small increase in the output voltage without upsetting the load regulation is to take advantage of the constant 0·6V forward drop across a silicon diode. Two 1N400X type diodes in the earth return (see Fig. 1) will bring the output up to 16·2V which is very close to the originally specified 16·5V.

Thirdly an r.f. choke should be added to isolate the d.c. supply from the r.f. throughput. A few turns of enamelled copper wire wound around a small ferrite bead should be sufficient. Depending on the exact method of construction this could reduce the unit's through loss significantly. It may be particularly helpful where the signals are marginal.

I would also like to suggest a couple of inexpensive modifications to improve the unit's safety and possibly its operation.

78 series regulators are generally reliable devices and usually fail safe, i.e. with no output. Over the years however I've had several where the earth return has apparently failed internally. In this case the device fails with the output equalling the input. The same problem

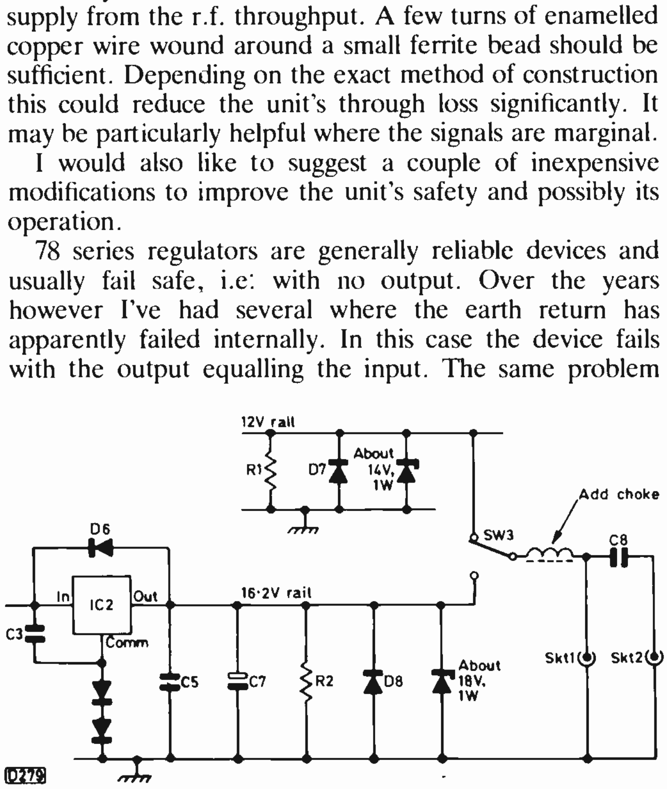

Fig. 1: Modifications to D.J. Stephenson's satellite TV servicing aid. See letter from G.R. Darby. The diodes in series with IC2's earthy lead are in the 1N400X series.

would arise in the event of failure of a component in the earthy connection to the 16V regulator. This condition could spell instant death to the LNB/polariser. Protection can be provided by adding across the regulator outputs zener diodes rated at a volt or so above the rail voltage. In the event of a voltage-rise failure the relevant diode will conduct heavily, probably going permantly short-circuit. This will shut down the regulator and the fuse will probably blow soon after.

Finally a few comments on decoupling. As suggested in the article, 78 series regulators are notoriously noisy and have a tendency to instability. In the circuit diagram the 0·1μF capacitors are correctly shown connected directly across the regulator terminals. This must also be the case physically – the capacitors should be mounted not more than a few millimeters from the regulator terminals. If the regulators are mounted off the board via flying leads the decouplers must be soldered directly to the i.c. pins.
G.R. Darby, Proprietor Monitech,
Earls Barton, Northampton.

The satellite TV servicing aid should include a u.h.f. choke between SW3 and the junction of Sktl and C8 otherwise the power supply will shunt the signal. A few turns of ⅛in. diameter will do. I would also suggest that two or three diodes in series would be better than RV1. Mixed germanium and silicon devices could be used if necessary to obtain 16V, anodes towards the regulator of course. Regulation will be better than with RV1 but a resistor between the output and the common connection of the regulator will be necessary with large diodes.
Ralph Taylor, MIEE, GW2HCJ,
Penrhyndeudraeth, Gwynedd.

IMPORTANT CORRECTION

A correction is required to my article on the design of a satellite TV servicing aid (August issue). The unit as described must under no circumstances be connected to the Grundig head unit without modification. No more than 5V should be connected across the magnetic polariser used in the Grundig unit and this should be 40-80mA from a constant-current source. The unit works perfectly well with any outdoor unit incorporating the popular V/H switched Marconi LNB.
D.J. Stephenson, B.A., I.Eng.,
Wirral, Merseyside.

REPAIRING CARBON CONTACT KEYS

In connection with Nick Beer's very informative article on remote control units (September) I'd like to add a hint on the repair of carbon contact keys. A much more permanent repair can be carried out by glueing a small disc of aluminium kitchen foil over the worn out carbon layer. I learnt this trick when I discovered a number of small clock-radios that had been discarded because it had become impossible to program the clock circuit. Nearly all of them responded to this treatment, each repair taking less than fifteen minutes.
Geoff Lewis,
Canterbury, Kent.

PLAYING 525-LINE TAPES

I am writing to describe the method I've used to play 525-line tapes with a 625-line VHS machine – the VCR used was an old Panasonic piano-key Model NV8600. The procedure is simple. First replace the 50Hz reference signal fed to pin 25 of IC201 on the servo board with a 60Hz reference. This can be generated by a 555 timer i.c. Then, with a 525-line tape inserted and the machine in the play mode, adjust R2116 (capstan free run) until the capstan servo locks and similarly R223 (drum free run) to obtain drum servo lock. Both of these adjustments can be carried out by looking at the playback picture.

The result should be a locked monochrome display. Most domestic TV sets should be able to display these pictures without any problems, though some may require a tweak of the field hold control.

Keith Hunter,
Ealing, London.

MORE ON PVC LEADS

As mentioned in a letter last month, PVC leads attack plastic because the plasticiser in the PVC can't wait to get out. The old TV and radio sets of the Fifties generally used brown-sheathed mains leads with red and black cores inside. Being thrifty, I often used to think that this was good stuff to salvage – until I found that it was far too tough and too brittle to reuse.

When PVC is in direct contact with other plastics the plasticiser has a direct migration path. I foolishly coiled a mains lead around a power supply that I'd built into a Verobox made of ABS plastic: the mains lead cut deep grooves into the case.

Things start to get dangerous when people mistakenly use large chunks of expanded polystyrene as a cheap form of loft insulation. This is invariably laid directly over PVC-sheathed mains wiring, and the insulation of the latter deteriorates. I understand that house fires have been caused in this way.

So this is a serious warning: keep PVC-covered cables away from other plastic. Incidentally this is why manufacturers use plastic bags to wrap cables separately inside those niches in styrofoam packing material.

By the way, our revitalised 405 Alive group for 405-line equipment enthusiasts is now going great guns, with 40-page newsletters. For details readers should send me an SAE.

Andy Emmerson, 71 Falcutt Way,
Northampton NN2 8PH.

The loss of solvent in the PVC covering of mains leads that are stored for long periods in contact with other plastic surfaces will make the PVC covering brittle and hence present a safety hazard. This problem also occurs when cable is supplied in boxes of polystyrene chips.

Don Trower, Engineering Operations Radio,
Broadcasting House, London.

VCR TIPS

In the June Service Bureau a Ferguson 3V23 suffering from intermittent switch off and eject was mentioned. This was a fault with the mechacon circuit and the modification for early boards PU49564A-D is to add a 68kΩ resistor in parallel with R86. With later boards PU10458A-M you add a 68kΩ resistor in parallel with R37 and a 10kΩ resistor across pin/socket connections 74 and 76. This modification effectively clips noise generated in the remote control receiver circuit.

With reference to John de Rivaz's letter (June) and Brian Renforth's subsequent letter (August) – my compliments to his memory! – I did indeed succeed in converting a Ferguson 3292 and a 3V23 to play NTSC tapes. The 3V23 conversion was very successful because both the drum and capstan reference signals are obtained by counting down from 4·43MHz to 50Hz in IC1 (servo-2 circuit). If the 4·43MHz crystal is replaced with an NTSC 3·58MHz chroma crystal and pin 6 of IC1 is disconnected this chip will count down to 60Hz. Slight modification to the drum and capstan speed potentiometers will enable NTSC tapes to be locked, unfortunately only in monochrome – I never did succeed in obtaining colour.

Possibly an easier solution would be to search through the piles of old mechanical ex-rental 8902 machines for an 8928 (JVC HR3330TR). This looks the same as the 8902 and was indeed installed as the 8902, the difference being that the 8928 is a triple-standard PAL/SECAM/NTSC machine. The little changeover switches are under the clock display but were blacked out by a piece of black tape. This machine will play (but not record) NTSC with 4·43MHz chroma. The only problem is to convert a TV set. I found that the easiest one to adapt is the old Ferguson TX9 with the PC1001 main board. The line speed takes care of itself. The field timebase needs only slight modification for speed and height. Chroma can be obtained by disconnecting pin 23 of IC52 to disable the PAL switch, short-circuiting TP2 to TP3 to disable the killer and shifting the U and V references to I and Q by adjusting L57/R75 (otherwise pictures are all blue/green).

Finally may I just say to all old colleagues from the old firm around the country that I'm still going strong!

Dave Plummer, I. Eng., FSERT,
Bexhill on Sea.

POTENTIOMETER TIP

Here's a tip I've used for years but have never seen in print. Noisy volume controls and dirty potentiometers, whatever their use, can be cured by putting a spot of fine oil on the track and then moving the wiper from end to end several times. This may not seem to be the right thing to do but I can assure you that it works – television and radio sets, even computers, respond to this treatment. The oil can be applied in situ, making the repair easy.

F. Gregory,
Walton-on-Thames, Surrey.

HELP WANTED

Could any reader supply a circuit diagram for the Matsui SX5260T double tape deck?

B.C. Harper, The Post House, Giffordtown,
Nr. Ladybank, Cupar, Fife KY7 7UW.
Telephone 0337 30 435.

A Grundig infra-red 13-function remote control unit, type VIF-KI, has been advertised in this magazine. Does anyone have any information on decoding the thirteen outputs from the receiver?

R. Hadfield, 45 Erica Way, Copthorne,
Crawley, W. Sussex RH10 3XG.
Telephone 0342 715 333.

Could anyone supply a circuit diagram for the Soverign Model C140 colour portable? I'm prepared to cover any expenses. The set requires slight attention before I can use it for DXing.

G. Adams, 64 West Grove, Gipsyville, Hull HU4 6RQ.

Review: Salora's Astra Package

Ian Bowden

Being a Salora dealer the firm for which I work handles the recently introduced Salora Astra satellite TV receiving system. We have thus gained experience of its operation under various conditions. In addition I've had from Salora one of these systems to try out and experiment with.

Outdoor Units

The 55cm offset dish is manufactured by Fuba in West Germany and is made of glass-fibre reinforced plastic with a flame deposited aluminium coating beneath the surface. It's beige in colour and elliptical in shape, the stated size refering to the minor axis (width). Rigidity is ensured by eight ribs on the rear side. There are two large vertical ribs fitted with a spring-loaded pivot shaft which clips into the mast clamp assembly. This together with four wing-nuts and their associated jamming plates clamps the dish securely once the correct elevation has been set with the plastic fine adjustment knob. The mast clamp is designed to fit on to any pole size from 40 to 66mm in diameter. The dish's half-power beam width is quoted as being less than 3°.

The LNB support arm consists of a 40cm length of inverted U-section extruded aluminium which slots neatly into a moulded socket at the base of the dish. A wing bolt clamps the arm in place. Two plastic clips on the underside of the arm retain the cables. The business end of the arm is fitted with a cast aluminium holder which clamps around the neck of the flared feedhorn.

The feedhorn is fitted with a sealing cap of the same colour as the dish (no garish red or blue!). Four small bolts and an O ring clamp the feedhorn and the magnetic polariser together. The latter is able to provide over 100° of rotation with a through loss of less than 0·25dB. This may sound relatively high for a magnetic type, but the loss varies with frequency and the quoted figure is the highest across the band 10·95-11·7GHz.

Another four bolts and an O ring clamp the LNB to the other end of the polariser. This is of the same type as used on some of Salora's earlier satellite TV systems and has a noise figure of better than 1·5dB. An F socket is used for the output connection. The unit comes with a plug, some adhesive tape and an eleven-stage pictorial fitting guide.

Mast

The dish assembly must be fitted to a mast. Salora provides a wall bracket that consists of a 39cm length of galvanised pipe (of 48mm diameter), two U-bolts, four stand-off legs and a strengthening strut. When assembled this gives a 35cm stand-off which provides a wide enough azimuth adjustment range for most purposes. The wall fixing holes are well spaced, unlike some mounts I've seen where all four bolts could almost be secured into the same block. Alternatively Salora can supply a patio mount (this arrangement was used with the test installation). It consists of an 80cm length of galvanised pipe with two three-section clamps. The bottom one attaches the three 50cm long angle section legs, the other one clamping the three struts from the legs almost half-way up the mast. All the components are galvanised and when bolted together the structure is very solid. There's a hole in each leg for bolting to the ground. With the dish fitted the complete assembly is around 100cm high.

The 5902 Tuner

The 5902 indoor tuner unit is compact and neat looking: it measures 38cm wide, 7cm high (including the feet) and 27cm deep (including the projecting sockets). A label on the front states "Stereo Satellite Receiver ASTRA". I'll come back to the significance of this later. The only button on the front is the red on/standby switch which operates on the secondary side of the mains transformer. It's to the right of the multi-function two-digit LED display. Everything else is done by remote control – the unit has the same case design as with 15L portable TV receivers.

The rear of the unit has provision for connecting two aerials, via male and female IEC connectors (the tuner comes with a screw connection female plug). A 6mm diameter hole in the back panel provides access to the a.g.c. test point, a through pin in the main PCB. Connection to this is a bit tricky as the pin is some 6mm inside. I'd have preferred the screw terminals or push-in connectors used with some other units but found that a miniature, insulated crocodile clip could be used. A standard IEC male/female connector is provided for r.f. loop-through, a male to female coaxial lead being provided for connection to a VCR or TV set. The r.f. output is adjustable over chs. 30-39, and a test pattern facility is incorporated.

There's a group of four phono sockets. The top two are labelled for use with a Sky decoder. They enable a baseband output and a composite video input to be connected. The lower two provide a second baseband output and a 0/12V switching signal for use with an external aerial swithing box which enables two dishes to be connected to one of the tuner's inputs. Thus a total of three dishes can be connected. Next to this there's a scart connector which provides composite video and stereo audio outputs to a VCR or TV set – there's no status switching d.c. Finally a 2·1mm barrel socket provides the current drive (0-150mA) for the magnetic polariser. A 2·1mm barrel plug is included. I'm sure that most installers would be much happier with something like screw terminals instead of having to solder the twin lead to the small plug. Apparently this connector is a design stipulation for use of the tuner in West Germany (the tuner is sold elsewhere in Europe). To make installation easier and quicker, I understand that Salora is to supply an adaptor lead with a barrel plug at one end and connectors such as Scotchlocks at the other end.

The 5902 tuner has 48 programme locations and a tuning range of 10·9635-11·74525GHz. This is sufficient to cater for the two projected Astra satellites as well as the current 1A. Frequency synthesis tuning is employed, the user simply calling up the required channel via the remote control unit which also provides for polarisation adjustment. For the latter you enter a number from zero (no current to the polariser) to nine (maximum current). This gives coarse adjustment, which is followed by fine tuning for best results. The final setting is then stored in the memory with the relevant programme.

The unit can be used with ten different sound systems. Four, designated A0-A3, have stereo sound on separate carriers, with narrow bandwidth (150kHz) and Panda 1 de-emphasis. Three, designated A4-A6, have narrow bandwidth (150kHz) mono sound with Panda 1 de-emphasis. The final three, designated A7-A9, have wide bandwidth (230kHz) mono sound with 50μsec de-emphasis. With any of these systems you can tune through the range 5·5-8·5MHz and store the required frequency. You can't change the preset bandwidth and de-emphasis. The factory preset frequencies cover the three main systems in use: A0 has 7·02 and 7·20MHz stereo carriers as used by MTV; A1 has 7·38 and 7·56MHz stereo carriers as used by Sky Radio; A7 has a 6·5MHz mono carrier as used by Screensport, Eurosport, Sky News etc.

Now back to the Astra label. The 5902 tuner can be used to receive MAC transmissions via the Astra satellite(s). An extra, external unit connected to the baseband output is required for this. It seems however that it will not be possible to use this tuner, or any other similar arrangement, to receive the BSB's MAC transmissions since BSB will supply the decoding/access chips required only for fitting in dedicated BSB tuner units or a panel for use inside a TV set or tuner. In addition you would need to use a DBS band LNB and the polarisation system is different.

Construction

A look inside the tuner reveals a main panel plus two small sound detector panels, a regulator board, a display panel and an infra-red remote control amplifier panel. From the top the main panel looks rather bare, with mainly i.c.s, links and the power supply components being visible. This is because extensive use is made of surface-mounted components on the underside of the board. The mains input is directly connected to the primary winding of the mains transformer, with the on/standby switch controlling three d.c. supply lines. This leaves the 5V supply to the modulator block for r.f. loop through. When you switch to standby via the remote control unit only the 12V video and audio supplies are removed. As a result you get a blank raster on a monitor/TV set tuned to the unit's output.

A look through the manual suggests that there's a version of the tuner capable of providing 13/18V polariser switching for use with the Marconi type head unit.

Installation

I'll describe how I got the loan system, with patio mount, working. After unpacking, the dish only required the mast clamp to be clipped on to its back and the fine adjustment knob located in its slot. The feedhorn holder was then fitted to the support arm by means of two screws and the arm was slotted into the dish and secured with the wing bolt. The feedhorn, polariser and LNB were next assembled, making sure that the polariser was the correct way round. This is the only fiddly bit: the spacing between the polariser body and its flange at the LNB end is very close, making it difficult to get the bolts started in their threads. The complete assembly was then clamped by the feedhorn holder. After unfolding the patio mount and tightening all the bolts the mount was placed in a suitable position, with a concrete block across each leg as this was to be only a temporary installation (unfortunately!).

The tuner was connected to the mains supply and a length of speaker cable was soldered to the barrel plug, connection at the other end being made with a couple of block connectors to the short leads from the polariser. I used about 12m of CT125 coaxial cable, which only just fits into an F plug if you trim down the insulator and file down the centre conductor so that it fits the LNB's F socket. With everything connected, the tuner was powered up and a preprogrammed channel was selected. Using a long coaxial lead, I positioned a TV set where I could just about see it but more importantly hear the sound whilst adjusting the dish.

I knew that the wall of the house faced approximately south but, without an inclinometer or an accurate compass, I had only a rough idea as to the direction and elevation. So the method I used was to hold the dish with a hand at each side and rock it up and down whilst turning slowly from a nearly south direction towards the east. In a matter of twenty seconds I heard the hiss from the TV set. It was then just a matter of slowing down the rocking motion to find the correct elevation, whereupon a relatively steady signal was received. The dish elevation, almost vertical, and the direction in which the LNB support arm was pointing were noted – the arm lined up with a large stone in the garden wall. The dish assembly was then fitted to the patio mount, lined up and clamped just tightly enough to hold it in position.

Polarity was adjusted via the tuner for best results, then a second length of speaker cable was connected to the a.g.c. test point and chassis via crocodile clips and run to a digital meter at the dish – the minimum meter resistance that can be connected between the test point and chassis is 100kΩ. The idea is to get the voltage level reading down to a minimum. Dish azimuth adjustment is done by loosening the two wing nuts on the mast clamp and turning the whole assembly. A slight problem here is that a piece of perforated sheet best described as a small cheese grater is fitted to the mast clamp surface to bite into the mast. Because of this the clamp nuts have to be undone until the dish is completely free before it will swing round, making fine azimuth adjustment more difficult. I did however find that a small azimuth movement can be made by tightening just one of the wing nuts to pull the clamp around very slightly. The fine elevation adjustment provides a very accurate setting, and when clamped by the jamming plates is firmly held. There's some flexing of the mast clamp itself, allowing the dish to move slightly from side to side, but even in windy conditions during the test there were no signs of signal degradation because of this.

Local installers tell me they prefer systems that use the Marconi front end as only a single cable run is required, making installation easier, neater and most importantly quicker. The separate polariser feed used with this system could be considered a slight drawback, but I understand that a special cable is available from Raydex to simplify matters. It's referred to as type SAT1002 and consists of a coaxial cable of CT100 type with two extra insulated conductors on the outside for connection to the polariser.

Performance

The system's performance was excellent. During the test period there were two heavy rain storms which produced a noticeable increase in sparklies on the reduced power test transmissions. Only a very few sparklies were visible intermittently on the programme channels however. Eurosport seemed to be the most susceptible to this. Thus the performance is comparable with both the 65cm offset dish systems I've seen in use.

Construction of the dish and mount assembly is the best I've come across with an Astra system, providing secure fixing whether on the wall or a patio mount. In particular the use of galvanised steel components secured bv plated nuts and bolts is far better than the other systems I've seen. The tuner is very impressive. Being designed specifically for Astra use it provides all the necessary facilities, i.e. audio de-emphasis characteristics and tuning range together with provision for future developments in transmission standards and encryption. The frequency-synthesised tuning and "dial-in" polarity settings make setting up easy and quick. Operation is straightforward and the unit is well designed and finished. Even the instruction book is well laid out and easy to understand – when you find the English section. Overall I'd say that this is the best Astra package I've seen. The only real disappointment was having to send it back.

Sales

Sales of Astra systems have so far been slow in this area (North Devon). It seems to me that there was greater interest back in February when the services started. This is a pity, since better receiving systems have become available in recent months. The public seems to be waiting for the situation to settle down before investing in satellite TV receiving equipment.

Acknowledgement

My thanks to Salora (UK) Ltd., and in particular John Breeds, for making available for test their Astra system.

The SEME-Panasonic Spares Operation

Fast, hassle-free provision of spares is vital to the efficient service department. It's important to the service engineer, the customer and, not least, the manufacturer's reputation. Realising this, more and more setmakers are appointing specialist components companies to handle the provision of spares to non-account dealers and service engineers.

The latest major company to have adopted this policy is Panasonic, which has appointed leading components distributor SEME Ltd. to handle, from August 1st, all orders from those outside the company's franchised dealership network. This arrangement will ensure that non-account dealers and service engineers have speedy access to all original Panasonic spares.

Commenting on this, SEME's managing director Colin Richardson makes the point that "service spares turnover probably accounts for a very small percentage of a manufacturer's sales but a large proportion of his invoice queries, bad debts, returns and other problems: by allowing SEME to deal with the trade's need for low unit price spares required with a fast turn-round a manufacturer can limit his sales invoicing, delivery and accounting volumes to his major dealers." SEME's extensive coverage of around 10,000 delivery points throughout the UK will ensure that the public has to travel no farther than a local High Street outlet for service help. In addition, SEME's computer tracks orders and invoices to give an accurate split between FOC warranty supply and chargeable repair work. Tailor-made reports can also be easily prepared to assist management and inventory control.

SEME has established a new sales office at Buckingham specifically to deal with orders for Panasonic spares. It's staffed by three new sales people and a technical liaison engineer, all of whom have been jointly trained by SEME and by Panasonic at the latter's Bracknell head office. The Buckingham office is linked by computer with SEME's warehouse at Melton Mowbray to ensure a fast and efficient response.

SEME was founded by Colin and a former colleague at Radio Spares, Basil Johnson, more than seventeen years ago. When Radio Spares decided to move away from the domestic electronics market and concentrate on industrial customers Colin and Basil saw that there was a business opportunity. Operating very modestly from two small vans, they started to supply spares to the domestic market, Colin as South Midlands Electronics and Basil as East Midlands Electronics. Apart from meeting every Wednesday to purchase spares they ran completely separate operations. It was not long however before they decided to join forces in order to buy in bulk at discount prices. The next step was joint warehousing and finally, on August 17th, 1972, SEME came into being.

And this is where the famous elephants, which are the company's trade mark, came on the scene. The company couldn't be registered as South East Midlands Electronics because this conflicted with an existing trading name. Instead it was decided to use just the initials SEME. When the registrar asked Colin what the initials stood for he replied, quick as a flash, "small elephants, medium elephants".

SEME grew very quickly from the two-van operation and soon took on a small sales team. Colin had family support in the form of his wife Jeanette, now company secretary, his brother-in-law Ken Cheesman who is now technical director and his brother Malcolm who is sales director. Today the company employs some 90 people and has 25,000 sq. ft of warehousing at Melton Mowbray, about 2,500 of it devoted to Panasonic spares. The sales team of sixteen visits customers on a two, four or six-weekly basis to collect orders which can also be placed by phone of fax. Orders are dealt with on a same-day basis and are despatched either by first class post or Securicor delivery. SEME also employs a team of technical assistants who check all pattern parts against original spares.

In addition to stocking spares for many other manufacturers, SEME is the sole source of under-guarantee parts for NEC and Fidelity.

The new SEME telephone number exclusively for Panasonic spares is Buckingham (0280) 823 523. The fax number is (0280) 814 916. Orders by post should be sent to SEME Ltd., Chandos House, School Lane, Buckingham MK18 1HD. When ordering, dealers should ideally have the part number. In the absence of this, the product type (e.g. TV, VCR etc.) and model number should be quoted along with a description of the part required.

Servicing Compact Disc Players

Part 8: Signal Decoding

Joe Cieszynski

Over the past three months we've outlined how the audio signal is converted into digital words which are then encoded and stamped on the disc. This month we'll consider the decoding process in the player.

The decoder receives from the r.f. amplifier a signal in eight-to-fourteen modulated form. We've already discussed the r.f. section but will recap briefly to avoid the need for too much referring back. The r.f. signal provided by the laser unit's pick-up detectors contains information representing the transitions from land to pit and pit to land on the surface of the disc. These transitions produce a sinusoidal rather than a squarewave voltage signal however. The off-disc signal is thus unsuitable for digital decoding in its initial form. Remember also that the transitions represent only the ones in the data stream: you can argue that the zeros are not stamped on the disc and must therefore be reinserted by the decoder.

To convert the sinusoidal r.f. signal into a squared, digital waveform it's amplified and sliced by an operational amplifier. This circuit, see Fig. 1, incorporates auto-asymmetry control which compares the output from the slicing amplifier with a fixed d.c. level. The purpose of this circuit is to smooth out any amplitude variations introduced by disc eccentricity. Such variations would result in a phase shift in the sliced data – this would cause problems in the decoder.

The following decoder description is based on the Sony CX23035 chip, see Fig. 2. This particular chip has been chosen for two reasons. First, it's widely used by CD player manufacturers other than Sony. Secondly, when we looked at the r.f. amplifier section in Part 4 (June) we referred to the circuit used in the Sony CX20109 chip which is designed to work with the CX23035 decoder chip. By using the same chip set throughout the series the descriptions should follow each other more clearly.

The Phase Locked Loop

The e.f.m. signal from the slicing amplifier shown in Fig. 1 is applied to a phase locked loop via pin 5 of the CX23035. The oscillator in this loop is varicap controlled and has a free-running frequency of 8·6436MHz. The two inputs to the phase comparator are the 4·3218MHz e.f.m. and the divided-by-two output from the 8·6436MHz oscillator. Its output appears at pin 11. When this d.c. control voltage is applied to the varicap diodes, the oscillator becomes locked to the incoming e.f.m.

The phase-locked oscillator controls much of the decoder operation and also the disc servo. Thus before making any other checks in the decoder or performing any other adjustments it's important to ensure that the oscillator is correctly set up. In their service data manufacturers give various ways of carrying out this adjustment. In most cases it's a matter of setting the d.c. control voltage applied to the varicap diodes to a specific figure. If you don't have the service data available you may decide to set the oscillator with the aid of a frequency counter. Be warned however that in some cases the frequency counter will not give a correct readout, probably due to harmonic distortion in the oscillator's output. Also note that in some players the oscillator operates at 4·3218MHz.

I've emphasised the importance of this adjustment because the timing of all the data in the decoder will be incorrect if the oscillator is not running at the correct frequency. The result will be no sound output. In addition because data in the e.f.m. signal is used as a sample by the disc speed servo, problems may well occur in this area. In this case the disc will rotate at some incredible velocity until the central control microcomputer shuts down all operations. In some cases the disc may even run backwards at high speed. If these symptoms are intermittent, it's likely that the oscillator is working at the edge of the control range because someone hasn't set it up as per the manual. The importance of this adjustment is highlighted by the fact that in most manuals it's the first one given. In other words there's no point in attempting any other adjustments until this one is correct.

The squared e.f.m. data contains the logic one information. Thus the zeros still have to be reinserted. This is in effect done by the phase-locked loop. Because the oscillator is locked to the data, the spaces between the ones can be counted at the oscillator's rate of 4·3218MHz. The decoder can thus clock in the missing zeros. This is illustrated in Fig. 3: where a transition coincides with a phase-locked loop (PLL) clock pulse a one is inserted; where there's no coincidence between a clock pulse and a transition a zero is inserted. This makes it clear why the PLL clock must be set up correctly: any error will result in a phase shift between the clock and the incoming data as a result of which the one transitions will be missed.

Following this operation the e.f.m. data is latched into the decoder by the PLL signal. The system ensures that the PLL remains synchronised with the off-disc signal. An edge detector ensures that the correct data is then passed to the 23-bit shift register.

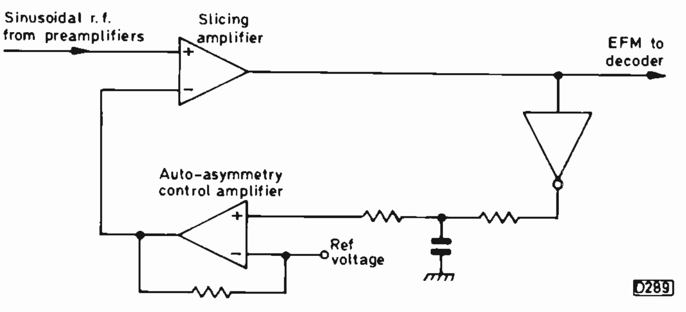

Fig. 1: The signal squaring system.

EFM Demodulation

It's now time for the 14-bit words to be converted to the original 8-bit audio data symbols. This is done by the e.f.m. demodulator, which contains a look-up table in its ROM. Those interested will find this in many manufacturers' training manuals. It's not really of any practical use to the service engineer however. A random selection of three lines from this table is shown below:

14-bit word		*8-bit symbol*
01001000100000	=	00000000
00100001000000	=	00001111
00100000010010	=	11111111

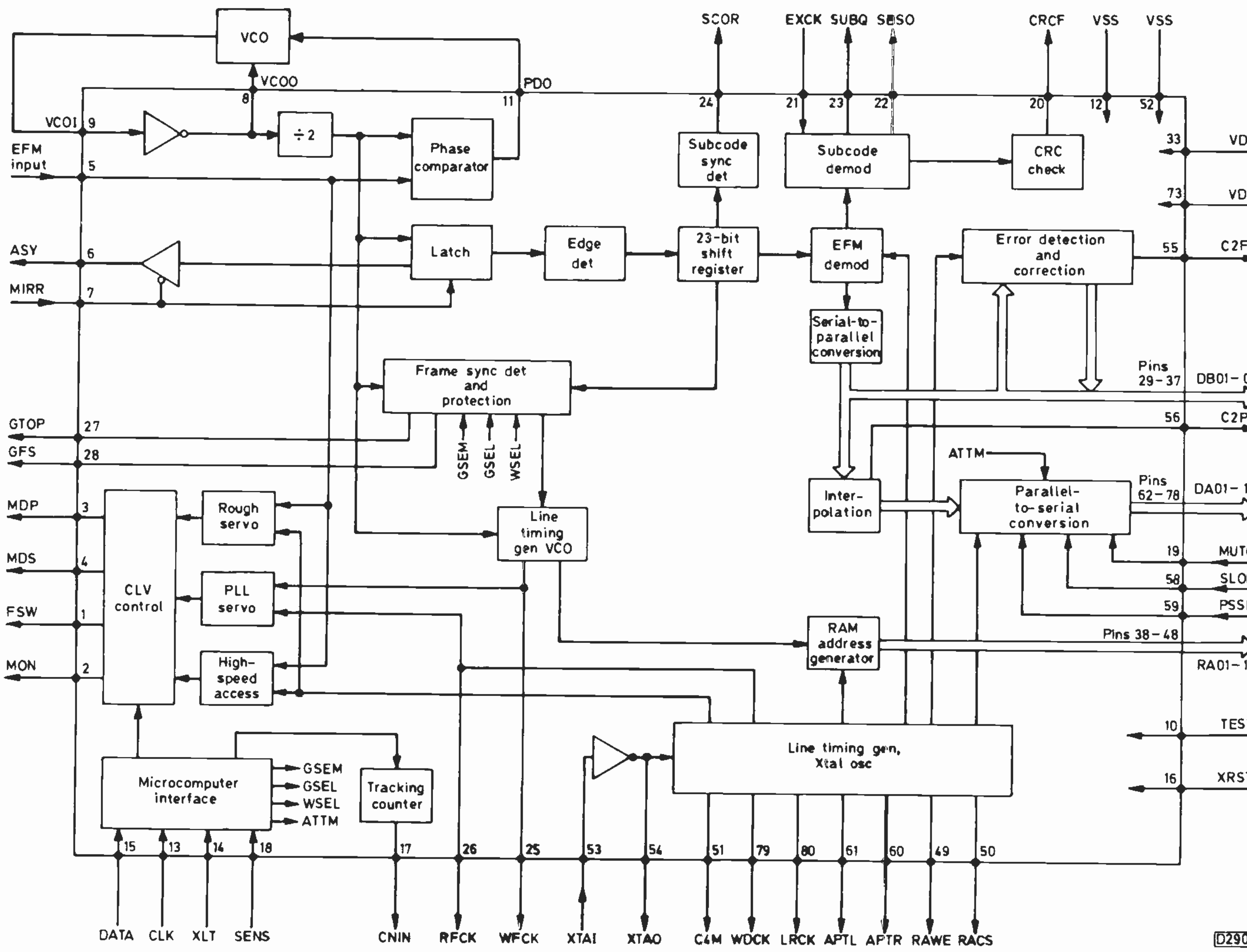

Fig. 2: Block diagram of the Sony CX23035 decoder chip.

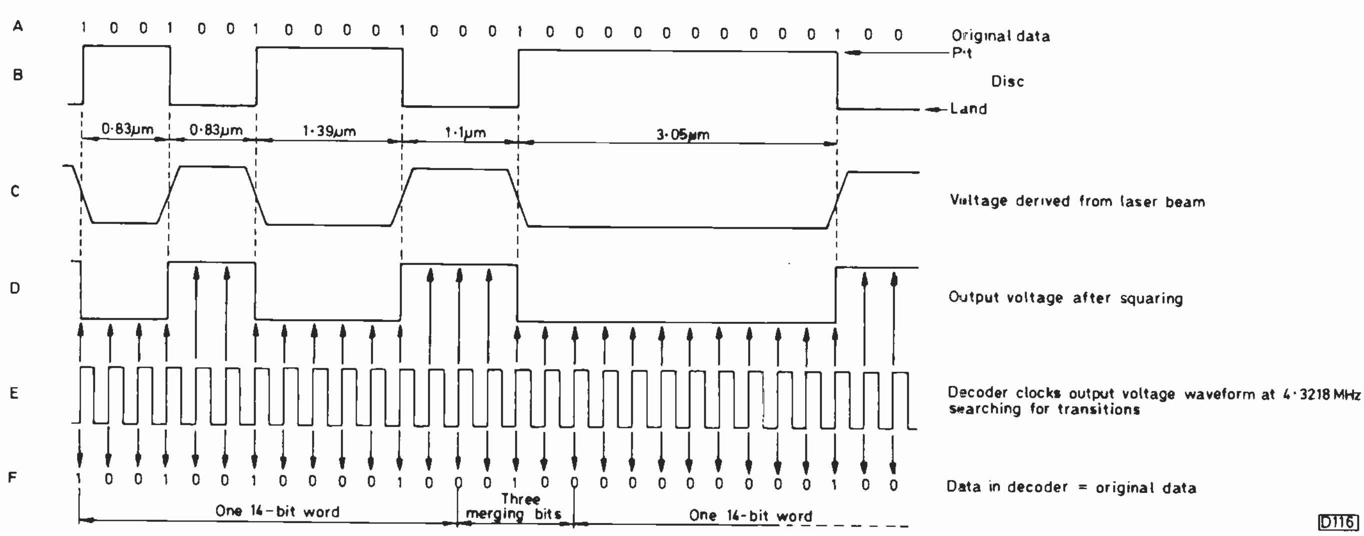

Fig. 3: The decoder checks for transitions in the off-disc signal then generates the appropriate ones and zeros.

In case you're trying to recall how the 8-bit symbols came to be in the form of 14-bit words, let me remind you of the relevant points made in Part 5 (July). In that instalment we considered in some detail the problems that would arise if data words containing either consecutive ones or more than ten consecutive zeros were to be stamped on the disc. Because the original 16-bit audio samples inevitably contain such binary combinations they are first split into 8-bit symbols which are then converted into 14-bit words that obey the e.f.m. rule – not more than ten consecutive zeros and not less than two consecutive zeros.

Error Correction

The 8-bit symbols are next converted to parallel form and are then put through the error detection and correction processes discussed in Part 6 (August). Error correction relies heavily on the additional data added in the Q and P parity blocks (see Fig. 11, Part 5, July).

A more detailed view of the error detection and correction (ERCO) and interpolation blocks is shown in Fig. 4. After serial-to-parallel conversion the data from the e.f.m. demodulator is stored in an external RAM (the connection is via pins 29-37 of the decoder chip). The RAM first makes the data, in the form of 24 8-bit audio symbols, four 8-bit P parity symbols and four 8-bit Q parity symbols (32 symbols in all), available to the C1 decoder where the P parity bits are used to detect and correct any single error per block of 32 symbols. If more than one error is detected the C1 decoder will be unable to carry out correction. Instead it places a flag on the remaining 28 symbols (the four P parity symbols are now redundant), marking them all as unreliable, and passes them on.

The symbols are next de-interleaved by introducing different delay times for different symbols. Any symbols that were given error flags by the C1 decoder will now be scattered and interleaved between a number of correct symbols. The C2 decoder thus receives a combination of correct and unreliable symbols. If there are no more than four errors over 16 frames it will use the Q parity bits to correct the errors. If there's a larger error the C2 decoder will pass the remaining 24 8-bit audio symbols in uncorrected form to the following descrambling and interpolation circuits.

The interpolation block converts the 8-bit symbols back into the original 16-bit word (L/R audio samples). It also looks for any words that carry a flag inserted by the C1 decoder, replacing such words with an interpolated one. This completes the decoding process.

The Sony CX23035 decoder chip provides the 16-bit audio data output in either serial or parallel form. Pin 59 (PSSL) is for serial/parallel selection – a low for serial and a high for parallel output. Most manufacturers including Sony seem to opt for a serial output which, being slower, greatly simplifies CD player design. Pin 78 is used for the serial data output. The other output pins 62-77 can be used for various read/write data: with many players that use this chip in the serial output mode these pins are left disconnected. When used in the parallel output mode pin 62 carries the least significant bit while pin 78 carries the most significant bit. In this mode the read/write data is not required.

The RAM

The RAM used in the decoding system has three main functions as follows: (1) It's used for for de-interleaving the 8-bit symbols which were scattered amongst the frames during the recording process. (2) It serves as a buffer between the error correction processes. (3) It absorbs jitter, i.e. wow and flutter.

The RAM's capacity is of the order of 8 × 2K bits (in other words it can store up to 2,000 symbols) but it's not allowed to fill up completely. A detailed description of the movement of data into and out of the RAM would be tedious and probably send readers to sleep before the end. In view of this I've devised a simplified description that should satisfy all but the most probing minds.

The data comes off the disc in serial form but the 8-bit symbols fed to the error correction stages are in parallel form. This is necessary because the 8-bit symbols are still scrambled within each frame and are interleaved across several frames: in order to de-interleave and unscramble the symbols (or, to put it simply, to reshuffle them) they must be handled as complete units rather than one bit at a time. As we've seen (Fig. 4) the symbols move from the e.f.m. demodulator to the RAM, from the RAM to the C1 decoder and back again, from the RAM to the C2 decoder and back again after descrambling, and finally from the RAM to the interpolation block. After parallel/series conversion (if required) the data is fed to a digital-to-analogue converter.

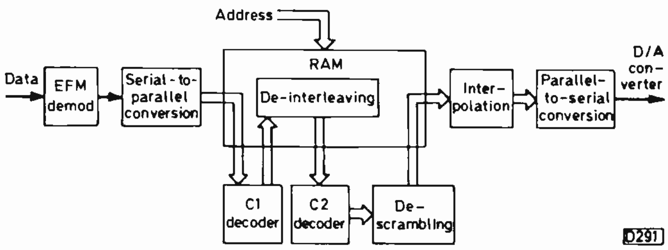

Fig. 4: How the signal is handled during the error correction processes: the RAM makes it available to the various decoders and carries out de-interleaving.

In practice the movement of data is not as straightforward as Fig. 4 might suggest. There are several reasons for this. First, as we saw in Fig. 9, Part 6 (August), after C1 decoding the symbols pass through a series of unequal delay lines in order to carry out the de-interleaving process. This delay is performed by extracting the symbols from the RAM in a different order from that in which they were fed in. Secondly you can't write into and read out of a RAM at the same time. Thus the symbol shuffling that occurs during the ERCO processes has to be done in a particular order – in reality not more than three symbols are moved at any one time. Finally, don't forget that fresh data from the disc continuously enters the e.f.m. demodulator and has to be stored in the RAM fairly quickly.

Movement of the symbols through the decoder is clocked at a rate of 2·16MHz by the crystal oscillator connected to pins 53-54 of the CX23035 chip.

Correction Capability

The ERCO section of the decoder can correct an error up to 448 symbols long, which is equivalent to fourteen frames. Thus an error burst of up to 1·9msec duration will go unnoticed, this duration being equivalent to a 2·5mm flaw in the disc. After interpolation a dropout to an extent of 48 frames can be concealed, representing an area of 8·7mm on the disc – which is how the idea of drilling a half-inch hole in the disc and hearing no dropout arose. Bear in mind however that a minute scratch travelling along the track could cause an error of greater than 48 frames. This will result in audio mute and probably track jumping.

Jitter Absorption

We mentioned earlier that the RAM absorbs wow and flutter. CD player specifications usually quote the wow and flutter as being unmeasurable: Sony try to be a little more precise in stating that its players have "quartz precision". Having read this, the uninformed person may conclude that the disc rotates at a very precise speed. Nothing could be farther from the truth! The disc servo is designed to ensure that the disc rotates at a velocity that results in a data rate of approximately 4·3MHz. If this velocity fluctuates slightly however it won't affect the rate at which the RAM is read, it will alter only the rate at which the data from the e.f.m. demodulator is written into the RAM. Thus the wow and flutter are literally determined by the precision of the crystal clock oscillator.

One possibility had to be considered by the designers. What would happen if the RAM became full because the disc was rotating a little too fast? The answer is that some of the music data would be lost. To prevent this, the disc servo is linked to the RAM. If the RAM begins to overfill, the servo slows the disc for a moment, reducing the data input rate. Conversely if the RAM starts to look empty the servo speeds up the disc a little. With the CX23035 decoder the margin of correction is ±4 frames.

Subcode Decoding

We must not forget the 8-bit subcode symbol at the start of each frame. Each 96-bit subcode word starts with a distinct subcode sync pattern. This sync symbol is detected by the chip which also diverts the 8-bit subcode into its own decoder. The sync signal is fed out at pin 24. It goes to the central control microcomputer chip which contains enough RAM to store 96 8-bit symbols. On receiving a sync signal the microcomputer clears part of its RAM and prepares to write in the latest subcode data. Once 96 8-bit symbols have been arrayed in this RAM the subcode word can be read and the mute and front display activated as required.

The Q subcode containing the display data appears at pin 23 of the CX23035 chip. The output pin for all the other data (P, R, S, T, U, V, W) is pin 22. Only the P and Q data is used at present. In the event of the other words being brought into use in the future existing players would simply ignore the additional data as the central control microcomputer chip would not be programmed to interpret and act on it. If there's an error in the subcode, the CRC output at pin 20 goes low to inform the microcomputer chip that the subcode is erroeous. The microcomputer will then perform the CRCC operation mentioned in Part 7.

Frame Sync Detection

Each frame of data starts with a 24-bit frame sync signal. When the disc speed is correct this will have a repetition rate of 7·35kHz. Since disc speed variation will alter the frame sync frequency the sync signal serves as a disc servo sample.

As you can see from Fig. 2, the frame sync signal is extracted from the data stream before the e.f.m. demodulator. This is because the frame sync signal is the only data on the disc – apart from the merging bits – that's not eight bits in length and has not been converted into a 14-bit word.

The sync passed to the disc servo is known as guard frame sync (GFS) because the detector is designed to protect against errors. These errors will be present not only when there's a dropout. They also occur during the disc run-up period when the disc is being brought up to normal speed and the data rate is thus slow. You may recall that the detector is designed to look for the very distinct pattern 100000000001000000000010, which is the only time that so many consecutive zeros are present. The detector operates on a "window" principle, i.e. it not only looks for the distinctive double burst of ten zeros but also expects them within a certain time period, the window. During the run-up period when the data rate is slow the detector would miss the sync signal. As this would cause disc servo problems the window is ignored during the disc run-up. In Fig. 2 you'll see that there are inputs WSEL (window select), GSEL and GSEM. These come from the microcomputer and are used to switch the sync detector's action.

A signal generator is incorporated in the frame sync section to provide protection: it supplies pulses that act as substitutes for any missing ones. In addition the phase of this internally generated signal is compared with that of the off-disc frame sync signal. When the two are locked, the window width is set for "normal speed" operation. When the two are not locked (during the run-up) the GSEL and GSEM inputs alter the action of the detector to enable it to pick out the lower frequency frame sync signal.

Fault Diagnosis

Any fault in the decoder will result in loss of sound. This is not very helpful however since almost every fault in a CD player will remove the sound. Furthermore because of the complex links between the decoder chip and the central control microcomputer chip it's very difficult to prove that the decoder i.c. has failed – unless it's approaching melting point. So where can you begin?

Let's first consider the possibilities when the disc is rotating but there's no sound output. If the disc speed is correct, the servo must be receiving the frame sync signal. This means that the early stages of the decoder are working. My first checks would be on the supply lines, the PLL oscillator and the clock oscillator (pins 53/4 of the CX23035 chip). I would then check the focus and tracking servo adjustments, but as we've not covered these areas I'll not go into any detail for the present.

The next step would be to scope significant data lines, such as the serial audio data (pin 78), RAM address (pins 38-48), GFS (pin 28) and the microcomputer clock (pin 13). In some cases it might be helpful to check for P and Q subcode outputs (pins 22 and 23). The presence of these outputs would lead me to doubt whether the decoder chip has failed – large chips such as the CX23035 rarely fail in just one section, which would be the case since only the ERCO blocks remain after the subcode take-off point.

Let's now consider the situation when the disc either fails to rotate or takes off uncontrollably. There are once again many possible causes of these symptoms, and to isolate the cause to the decoder chip can be difficult. With the CX23035 you may find yourself arriving at this chip quite quickly because it contains the disc servo. This is not the case with some other chip sets. In addition if the disc won't run at approximately the correct speed it will be impossible to scope any relevant signals. The only advice I can offer here is that in most cases these symptoms are produced by faults in the focus or tracking servos and that you should therefore start by ruling these out. If these servos appear to be operational and you've carried out the other basic checks such as supply lines, oscillators, etc. there's little choice but to check the decoder chip by substitution. This step is not to be taken likely with the CX23035 since it's an 80-pin surface-mounted device.

Finally there's one decoder fault that doesn't result in total loss of sound. This is when a single RAM address line fails. In this case the result is a very coarse "rushing water" sound on both channels. The same effect may be produced when the RAM chip fails.

Next month we'll consider the final stages of audio signal processing – the digital-to-analogue converter, L/R signal separation and filtering.

CCTV Faults

Peter Graves

As with all complicated electronic equipment, closed-circuit television presents its own particular problems. You think you've seen it all, then something unexpected occurs. Here are some of the more uncommon problems we've encountered in the field.

Misting Windows

Camera housings designed for outdoor use have a heater under the front window to keep it clear of condensation. In modern housings the heater consists of one or more high-wattage, aluminium-clad resistors connected across the mains supply. A thermostat inside the housing brings the resistor(s) into circuit when the temperature drops to a point where condensation is likely to form. A small metal shield above the resistor(s) guides the warm air flow.

Several cameras in housings were installed around the edge of a large site. After a short period of operation we received a complaint that the windows were misting up. This is not unusual in a new installation, particularly if moisture has been trapped inside the housings when installed. A visit to the site during the day showed nothing out of the ordinary.

The complaints persisted and a second visit was made. Visual inspection of the pictures showed some apparent misting so we decided to clean the housings. When the first camera was swung down on its pole we realised that the weather was too warm for condensation to form – then the cleaning cloth showed a black deposit! The housing manufacturer had used ordinary mains cable to wire the heaters and black rubber sleeves to insulate the connections to the resistors. The heat produced by the resistors had been enough to melt the sleeves and the cable insulation, the fumes produced being responsible for the "misting" problem.

A heat-resistant type of cable was fitted, with silicone rubber sleeves – and the manufacturer was made aware of his mistake.

Sticky Iris

On several occasions a customer complained about a "no picture" fault. It would sometimes clear itself, but at other times was still there when an engineer called. You could see from the picture and the video waveform that the iris appeared to be sticking open.

The camera is used to supervise an outside area and is mounted in a weatherproof housing with an infra-red lamp for night-time illumination. It's fitted with a low-light tube and a zoom lens. The lens iris is motorised, being driven by an auto-iris circuit within the camera. When the scene illumination drops, the output video level falls. The voltage change is detected by the auto-iris circuit, which responds by opening the iris to restore the original video level. Conversely when the scene illumination rises the iris is driven towards the closed position. Fig. 1 shows the arrangement. The circuit tries to keep the video waveform at a constant level.

Access to the camera is poor – it's some twenty feet up a vertical pole and is difficult to get at from a ladder. As soon as the camera was disturbed by removing the cover of the weatherproof housing the lens iris would come unstuck and operate correctly. It then couldn't be made to stick. Several days later the customer would be on the phone again. In the end we had to remove the camera and lens from the housing and take it back to the workshop for a closer look.

To prevent the drive motor stalling and possibly damaging the lens when the iris reaches the end of its physical travel microswitches are incorporated in the auto-iris circuit – see Fig. 2. Suppose that the iris has been driven far enough for the cam on the lens to operate microswitch S1. This will bring diode D1 into circuit. Its polarity is such that it is reverse biased, thus preventing further movement of the motor in the direction concerned. Should the motor voltage reverse, D1 will be forward biased and the motor can run, moving the lens towards the other end of its travel. The arrangement is such that the motor can be driven in either direction provided it doesn't reach one end. D2 operates at the other end of travel.

Both switches appeared to be working correctly – they make a distinct click when they operate, and the motor would stop – but we decided to check them with an ohmmeter. As a result we discovered that one of them had developed a high-resistance path internally. This meant that when it operated it effectively added a resistor in parallel with the diode.

When the light dropped at night the iris would open until the microswitch operated. The diode should then have stopped the motor from turning any farther, but the resistance allowed current to flow. As a result the motor continued to turn until it stalled. Sometimes it turned far enough to jam the lens iris which would stick until physically disturbed. There was no obvious cause of the microswitch failure and a replacement provided a complete cure.

Auto-pan Problem

Maintenance at this site, with elderly equipment installed, had previously been carried out by other companies. It was a very large site and the cameras were controlled from a central point via a telemetry system. As the camera controls were operated, digital signals were sent to a receiver at the selected camera. They were then decoded and used to operate the relays that activate the camera functions – Fig. 3 provides an outline of the system.

The faulty camera was used to watch a large open area and had an auto-pan facility. When auto-pan was selected, the pan-and-tilt head continuously moved the camera from side to side. No problem here but the camera would sometimes, without auto-pan being selected or any of the other camera controls being operated, move across from right to left until it reached the end-stop at the far left-hand side. It would then stop.

The previous maintenance company had blamed noise on the phone lines carrying the telemetry signals and had done nothing about the problem. Telemetry systems are not normally troubled by noise however since error detection is built into the system. In addition, noise would be unlikely to initiate just one of the control functions.

Since the other cameras worked correctly it was unlikely that the fault was at the control room end. A quick

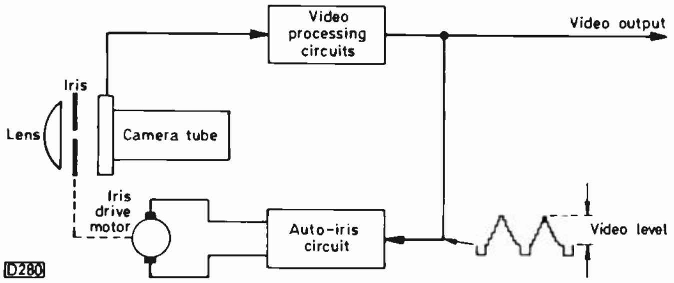

Fig. 1: Auto-iris system. The auto-iris circuit drives the iris so that it opens or closes to maintain a constant average video level.

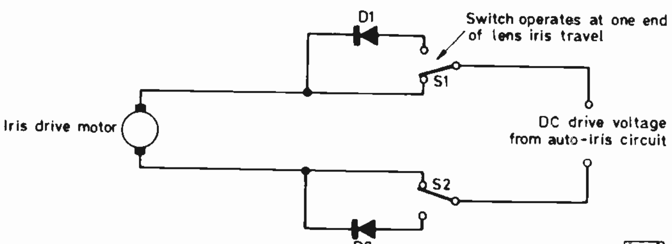

Fig. 2: The microswitch arrangement.

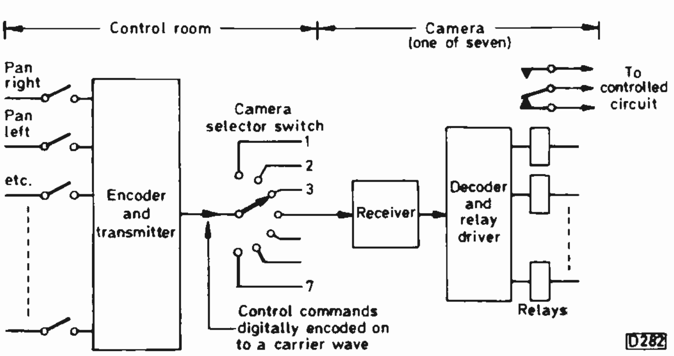

Fig. 3: Outline of the telemetry control system.

check on the receiving unit revealed that the smoothing capacitor in its power supply had partially failed, as a result of which there was some 2V of hum on the 12V rail. Presumably this was upsetting the decoder and relay driver as fitting a replacement cleared the problem.

Vandalism

Running the connecting cables to a camera on a pan-and-tilt head that can be moved over a wide range always presents problems. There must be enough slack to allow it to move freely, but if there's too much slack the cables can get caught in the mountings. Pan-and-tilt head motors are powerful enough to rip the cables off. In modern installations the cables are run up the inside of a length of flexible conduit to provide protection. The conduit is less likely to get caught and gives the job a neat, professional appearance.

The pan-and-tilt camera concerned was one of two used for surveillance at a car park. They were in continuous use and were fitted with infra-red lamps for night-time operation. As the light level changed the lamps were automatically switched on and off by photoelectric cells at the rear of the lamp housings.

The first hint of trouble came when one of our engineers was called out because "both cameras were dead". On arrival a rather apologetic security officer told him that the problem was due to the earth leakage circuit breaker coming out and that it had been reset. Both pictures were present and as the security staff were satisified with them our engineer returned to base. On the following day we received another call because one on the pan-and-tilt units had apparently stopped tilting. The camera was on a pole, and visual inspection from the ground showed that the flexible conduit had kinked into a tight loop, preventing the tilt axis operating. While making preparation to winch the camera's mounting pole down we noticed that the photoelectric cell from one of the lamps was lying on the ground next to the pole – an unusual occurrence as they have a tigh bayonet fitting and don't usually fall out by themselves.

Closer inspection showed that the camera had been severly stoned from a nearby bridge. The stones had knocked out the photoelectric cell and we guessed that the ingress of rain into the open socket had been responsible for the earth leakage breaker trip operating on the previous day. The stones had also distorted the camera housing and damaged the nut that held the flexible conduit, allowing it to rotate. This had in turn made the conduit kink, locking the tilt axes. Fortunately the camera had been pointing away from the direction of attack, so that the glass camera housing faceplate and the lenses and filters of the infra-red lamps had escaped damage.

Our experience is that deliberate vandalism like this is rare but it brought to mind several other cases, like the poor picture fault with an indoor camera looking at an exit door. It was mounted without a housing some seven feet from the floor and the lens had been sprayed with some oily liquid. Another indoor camera had to be put into a housing to prevent persistent fiddling with the lens settings by persons unknown.

Camera Development Problem

Vidicon cameras were built by a small company. To start with each camera was hand-built in the development department by a technician, using rat's nest point-to-point wiring. The cameras worked but tended to be unreliable, could be built on only a one-off basis, and looked extremely untidy. As demand increased it was realised that a more professional approach was needed, and that construction would have to be turned over to non-technical wiremen. The plans were redrawn in the production department, with the interconnecting cables redesigned as cable looms. This took place against dire warnings from the development department that the cameras would never work with looms because of the extra cable lengths and interaction between them.

The first camera to come off the production line was put on the test bench. It set up well on a test chart, except for the fact that the top of the picture appeared to be pulled over slightly. Consternation in production, cries of "we told you so" in development!

The test engineer started his investigation. He progressively replace the loomed wires with a point-to-point rat's nest. Eventually the looms had been removed completely and the wiring was back to the development department's standard. Unfortunately the fault was still present!

Further investigation was carried out by the production department. It was eventually found that the distortion was caused by an incorrectly specified capacitor in the line output stage. It was an original design fault, not an assembly error. In fact all the cameras had the fault. It was just that no one had looked at them as critically as they had looked at that first one off the production line!

Servicing Salora Colour Receivers

Part 3: G and H Chassis continued **Nick Beer and Ian Bowden**

Last month we described the operation of the Ipsalo-1 circuit used in earier versions of the G and H chassis. The Ipsalo-2 circuit is totally different. Fig. 1 shows the overall Ipsalo-2 circuit as used in the H chassis while Fig. 2 shows the circuitry within the LF0034A hybrid chip that provides the drive for the chopper transistors TB700 and TB701. The G chassis uses an LF0034 hybrid chip which is slightly different from the LF0034A and there are several other differences in the implementation of the Ipsalo circuit, with a completely different set of component reference numbers as well. The following description applies to the H chassis version of the Ipsalo-2 arrangement.

The mains input is rectified by the diode bridge DB708-711 which develops about 320V across its reservoir capacitor CB721. Note that CB721 and the smoothing capacitor CB722 are two sections of a double unit.

Start-up Action

As these sets and subsequent models have no transformer derived start-up/standby supply, a simple start-up pulse generator circuit is used to get the chopper transistors going initially. Once the circuit is operating normally, the hybrid chip HB1 takes over the supply of drive to the chopper transistors. The start-up pulse generator consists of resistors RB734/716/715, capacitor CB715 and diac DB725. CB715 charges via the three resistors from the 320V supply. When the voltage across it reaches approximately 35V the diac fires, discharging CB715 via RB705 and CB712 to provide a short base drive pulse for TB701, the "lower" chopper transistor. As the diac is also connected to one of the two secondary windings on the driver transformer MB700, a drive pulse will also be induced in the other secondary winding. This is coupled to the base of the "upper" chopper transistor TB700. Thus both transistors receive drive pulses and the full 320V is switched on and off across the primary winding (pins 2-1) of the combi transformer MB500. As the voltage across CB715 falls, the diac will cut-off. CB715 will then start to charge again and the cycle will repeat.

This repeated switching of the chopper transistors results in a voltage being developed across the close-coupled secondary winding (pins 17-18) on the combi transformer. DB504 rectifies the output from this winding, producing a d.c. supply that's fed back to pin 19 of the hybrid chip. An emitter-follower (Q1) within the chip produces, in conjunction with the 9·1V zener diode connected to pin 20, a regulated 8·5V start-up supply which appears at pin 18. It's used to supply the bistable circuit (pulse-width modulator) within the chip and provides a start-up voltage for the TDA2593 sync/line generator chip ICB501, the chopper driver transformer MB700, the line driver transistor TB500 and the line pulse lengthening circuit TB508/9 etc. The line generator will then produce pulses to drive the line output stage and the bistable in the chopper control hybrid chip – the input to the chip is at pin 15. Thus normal drive to the chopper transistors will be established, but with a very short switch-on time. As the line output stage comes into operation a supply of 142V (125V in 16 and 20in. models) will be developed across CB513. This is fed to pin 12 of the hybrid chip, and as a result the ramp charging circuit comes into operation, increasing the on time of the chopper transistors. In this way a soft start is achieved. As the chopper transistors come under the control of the hybrid chip their on-to-off time will be far greater than that provided by the start-up pulse generator, which is overridden by connecting the junction of CB715/DB725/RB715 to the collector of TB701 via DB714 and RB708.

The set has now reached its normal operating state. What can be a problem when fault finding is that this start-up sequence takes very little time – from switch-on to normal running takes about one second.

Regulation

Regulation of all the supply lines is based on feedback of the voltage developed across CB513. This voltage is connected directly to pin 12 of the hybrid chip. A resistor within the chip provides a link to pin 13, which is connected to the smoothing capacitor CB719. The voltage at pin 13 depends on the conduction of Q6. It's fed via RB718 to a charging capacitor within the chip, connected between pins 6 and 8. This capacitor charges, producing a ramp waveform which is applied to the base of Q3. When the ramp voltage reaches a certain level Q3 switches on and the bistable circuit changes state. When the next pulse from the line generator chip arrives at pin 15 it switches on Q5 to discharge the ramp capacitor. Since Q5 shorts the base of Q3 to chassis the state of the bistable changes back again.

Should the charging voltage at pin 13 of the hybrid chip rise above the normal level – in this case the voltage across CB513 will have fallen – the ramp developed by the charging capacitor will reach the triggering point earlier. Thus the mark-space ratio of the bistable will increase, Q3 remaining on for a longer time before the next line pulse switches it off again. The chopper driver transistor Q4 is held conductive by the d.c. voltage, derived from the combi transformer, fed in at pin 3. Q4 switches off when Q3 switches on. So with Q3 remaining on for a longer period Q4 will be switched off for a longer period. When Q4 switches from on to off the energy built up in the primary winding of the driver transformer MB700 is released into the secondary windings, producing drive pulses for the chopper transistors. Under the conditions so far outlined the length of the drive pulses will increase, keeping the chopper transistors on for a longer time. Thus more energy will be built up in the combi transformer before the chopper transistors switch off again. The result is more energy being transferred from the mains to the secondary windings on the combi transformer, bringing the output voltages back up to the correct level.

Note that a fall in the voltage across CB513 leads to an increase in the voltage at pin 13 of the hybrid chip. This is because of the inverting action of the regulating transistor Q6: when the voltage across CB513 falls, Q6's base voltage is reduced and its collector voltage rises. The

opposite occurs when the voltage across CB513 rises.

Circuit Protection

In the event of very heavy loading across CB513, for example the line output transistor being short-circuit, the voltage at pin 12 of the hybrid chip will be very low. As a result there will be virtually no charging voltage at pin 13 and the bistable will be switched only by the line pulses fed in at pin 15. As these are of short duration (8μsec), the drive pulses used to switch on the chopper transistors will also be of short duration and the minimum amount of energy – just enough to produce the 28V supply – will be transferred from the mains to the secondary side of the combi transformer, preventing damage to the power supply.

Should the regulating section of the hybrid chip try to increase the energy supplied to the set above a safe level (this would mean an increase in the voltage at pin 13) zener diode DB720 will conduct, switching on Q5 to short out the charging capacitor. The bistable will then be driven by the line pulses alone, giving power supply protection. In this state enough energy should be supplied to the close-coupled secondary winding on the combi transformer to keep the line oscillator and Ipsalo circuit going. To unlatch Q5 the set must be switched off for a few seconds.

If for any reason the voltage across CB513 rises, the action of the regulation circuit will cut back the charging voltage, shorten the conduction time of the chopper transistors and thus provide over-voltage protection.

Standby Operation

When an 18V standby signal is produced by the remote control panel it has two effects. First, it's coupled to the base of the regulating transistor Q6 via DB721 and RB719, as a result of which Q6's collector voltage falls to a low level. As we've seen, the effect of this is to reduce the energy supplied to the secondary side of the combi transformer to a minimum level, all that's needed being the 28V supply to keep the line oscillator, Ipsalo and remote control circuits going. The second action is to bring transistor TB507 into action to invert the lengthened line drive pulses applied to the line output transistor. As a result the line output stage removes energy from the secondary side of the combi transformer instead of adding to it as it does via the action of the flyback pulses during normal operation. This stops any build-up of unwanted energy.

Fault Finding

Now for some hints when fault finding in this circuit.

First remember what's required to get the set into the normal running condition: (1) a mains input, (2) a rectified supply across CB722, (3) operation of the start-up pulse generator so that the 28V supply is produced, (4) development of an 8·5V start-up supply at pin 18 of the hybrid chip and (5) a line pulse output at pin 3 of the TDA2593 chip ICB501, with the pulses reaching pin 15 of the hybrid chip. We'll consider each of these in turn.

No mains supply to the rectifiers probably means a blown mains fuse or an open-circuit mains switch contact. We had one case where pressing the mains switch in produced a burst of mains energy that was just enough to get the set started before the switch went open-circuit and the set died.

No 320V supply across CB722 usually means that the filter resistor RB713 (22Ω, 5W) is open-circuit. The usual reason for this is that one or both of the chopper transistors has gone short-circuit. Replace them as a pair and check by lifting one end of each that all the rectifier diodes on the primary winding side of the combi transformer are o.k. A common cause of this condition is a dry-joint at or a defective line scan coupling capacitor. This is CB532 (330nF, 250V) which should always be checked when you look at one of these sets.

No 28V supply could mean that the start-up pulse generator circuit isn't working. This is usually due to the diac being open-circuit or a dry-jointed or open-circuit 33kΩ resistor (RB734/715/716). If there's a continuous whine at approximately 5kHz from the combi transformer the start-up circuit is working. If the voltage at the cathode of the 28V supply rectifier DB504 is very low, look for a short across the supply. The usual cause is a faulty audio output chip (ICB100, TDA2030) or a short-circuit 18V regulator chip (ICB502, MC78M18BT).

For no 8·5V start-up supply at pin 18 of the hybrid chip, check the voltage at pin 19. If this is less than 15V, check at pin 20. Zero voltage here indicates that zener diode DB722 is short-circuit, something that does happen from time to time. If approximately 9·1V is present at pin 20 the internal transistor is open-circuit, so the hybrid chip will have to be replaced. On one occasion the decoupling capacitor CB717 was short-circuit, as a result of which the voltages at pins 18, 19 and 20 were at nearly zero.

If there are no line-frequency pulses at pin 3 of the TDA2593 chip ICB501, check that approximately 8·5V is present at pins 1, 2 and 4. If so, try another i.c. On the only occasion when we had a fault in this area the chip was defective.

If there are line pulses at pin 15 of the hybrid chip the set should be able to start up. If the set is dead, it's likely that there's an overload condition. In this case proceed as follows.

Overload Checks

Check the voltage at pin 7 of the hybrid chip. If it's around 0·6-0·7V, zener diode DB720 is conducting. So there's either excessive loading on the secondary side of the combi transformer or DB720 is faulty.

Also check the voltage across CB513, i.e. at pin 14 of the combi transformer. If it's zero or very low there's likely to be a short in the line output stage. If the voltage is between 40V and its correct level of 125/142V (depending on tube size, see earlier) look for loading on one of the other combi transformer outputs, e.g. a faulty tripler (check by disconnecting the input lead). One of the secondary winding rectifier diodes might be short-circuit or there might be a short across one of the supplies – make resistance checks to find out which one is shorted. Another possibility is a leaky diode (DB510/DB511) in the EW modulator circuit. If the line output stage is suspect, a simple check is to unplug the scan coils and connect two suitable diodes in series between pin 13 of the combi transformer and chassis – cathode to pin 13, anode to chassis. When the set is switched on the 125/142V and all the secondary supplies should be present. Don't leave the set in this condition for longer than you have to.

The same symptoms, i.e. no results with a high voltage at pin 13 of the hybrid chip and some 0·6-0·7V at pin 7, will be present when DB717 or DB718 is open-circuit, cutting off Q6. Alternatively Q6 could be open-circuit.

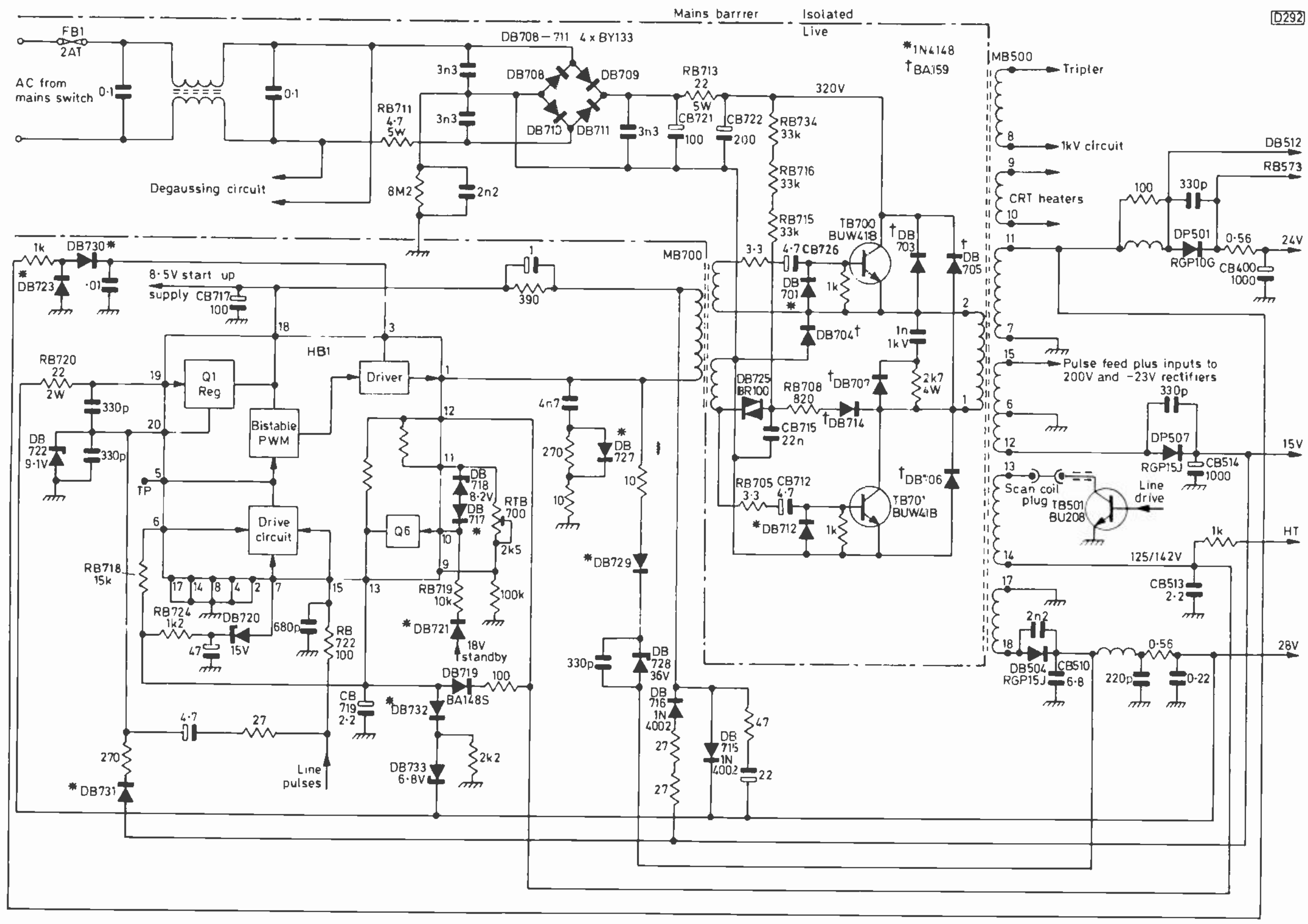

Fig. 1: The Ipsalo-2 circuit as used in the H chassis.

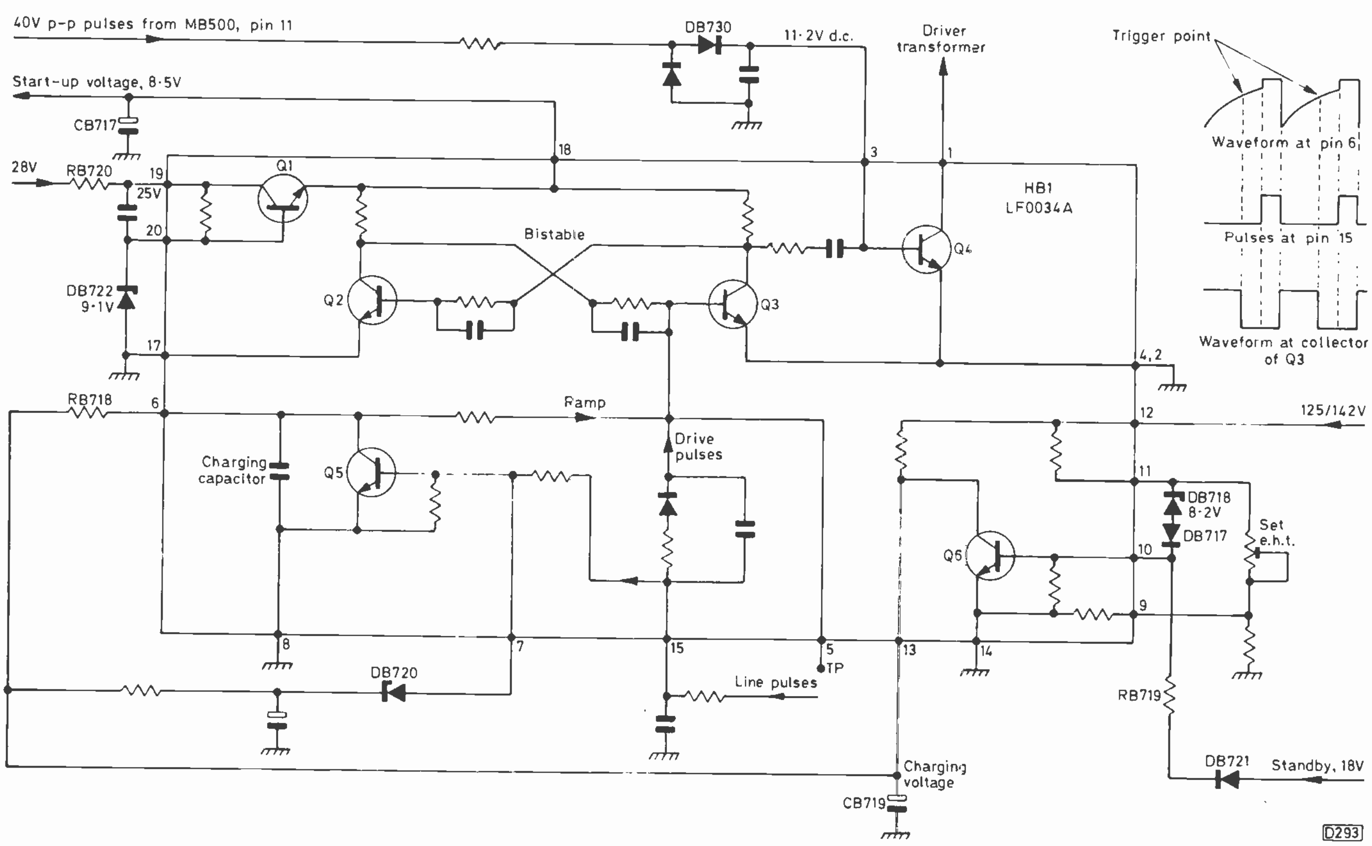

Fig. 2: Circuitry in and around the LF0034A hybrid chip HB1.

We once found that DB732 was leaky, producing around 21V at pin 13.

If the voltage at pin 7 is at the correct level (0·12V) or less, the overload should be along the lines of a complete short-circuit across the 125/142V supply, e.g. a short-circuit line output transistor.

G Chassis Fault Guide

We will finish this instalment with fault lists for the G and H chassis, starting with the G chassis. Where a fault depends on whether the Ipsalo-1 or -2 circuit is used this will be specified.

(1) Patterning on high chroma levels. Realign the sound trap LA1 on the tuner/i.f. motherboard.

(2) Field collapse. The usual cause is the TDA1170S field timebase chip ICB1.

(3) Low brightness, contrast and colour levels, Ipsalo-1 sets. Check the BC307 transistor TA6 in the beam limiting system.

(4) Intermittent tripping, Ipsalo-1 sets. Try replacing the 18022 regulation thyristor THB1. Also ensure that a heatsink has been fitted to it. If not, fit one – part no. SCX077 (this part no. includes the thyristor).

(5) Set will not switch to standby from remote control, Ipsalo-1 versions. The 9·1V zener diode DB5 is probably faulty.

(6) Set carries out search tuning but will not store a channel. Check that the −23V supply is present at pin 2 of ICC8 (ER1400). If it is, suspect the chip.

(7) Set searches but will not stop when a channel is found. TC11 (BC237A) open-circuit base-to-emitter.

(8) No sound or picture, intermittent raster, Ipsalo-1 sets. TB17 (BFR80) on timebase motherboard faulty. A BD136 can be used.

(9) Low brightness. RH7 (1MΩ) on c.r.t. base panel open-circuit.

(10) Intermittent random channel change. Suspect ICS1 (MC74C922) on front panel, also the remote control decoder chip if fitted.

(11) Tuning drift. Usually a faulty AY-3-8203 microcomputer chip (ICC7). See (16).

(12) Reluctant to change channels or sticks on one channel. Suspect ICC7. See (16).

(13) Noise through speaker at switch on. Check CA55 (47μF) in the audio output stage by substitution.

(14) Set will not start from standby but starts from cold, Ipsalo-1 version. TB15 (BFR80) intermittently open-circuit.

(15) Width and height variation, Ipsalo-1 sets. DB11 (8·2V zener diode) faulty, causing h.t. variation.

(16) The AY-3-8203 chip has been replaced with a type suffixed A. For compatibility the following modifications (boards STC0072-75) need to be made: add a 330Ω resistor in series with DC25; change RC47 from 10kΩ to 27kΩ; add a 220Ω resistor in series with the store line; change CC38 from 68nF to 100nF.

(17) Excessive crackle on audio at switch on. Connect a 100kΩ resistor (RA97) between pin 5 of EJ1 and chassis.

(18) The Toshiba tubes used in some sets magnetise and are difficult to degauss. Change CH1 from 1·5μF to 3μF and RH30 from 10Ω to 22Ω. These components are on the c.r.t. base panel.

(19) For tuning drift caused by a varying varicap voltage, particularly with 8-button models, reduce RCP1 from 470kΩ to 100kΩ and increase RCP2 from 12kΩ to 15kΩ.

(20) For poor degaussing, try the following remedies. Reverse plug H2/1 on the c.r.t. base panel, add a 10nF capacitor between the gate and cathode of THH1 and a 1·5μF capacitor in parallel with CH1.

(21) Intermittent tripping with high beam current, Ipsalo-1 sets. Check that RA28 and RA29 are 33Ω. Add a 3·3kΩ resistor between the base and emitter of TA6 and a 12kΩ resistor from the base of TA6 to pin 7 of connector A1 – cut the existing print to pin 7. On the tuning/memory panel, remove RC75 and DC9 and fit a 1N4148 diode with its anode to pin 13 of connector C2 and its cathode connected via a 12kΩ resistor to pin 22 of ICC1 and via a 1kΩ resistor to pin 20.

(22) Difficulty in starting sets with battery kit via the remote control unit. Add a 2·2Ω resistor and an RGP10G diode connected in series between pin 19 (resistor) and pin 15 (cathode of diode) of transformer MB1. Also add a 6·8kΩ resistor between pin 5 and chassis.

(23) Incorrect tuning potentiometer selected for number displayed. Poor plug and socket conection (S2) on front top control PCB or a dry-joint on one of the three data bus leads on the tuning potentiometer PCB.

(24) Cannot select correct tuning potentiometer. ICCP1 or ICCP2 on tuning potentiometer panel faulty.

H Chassis Fault Guide

The H chassis list is as follows.

(1) Peak white raster with flyback lines. RH7 (680kΩ, 0·5W) on the c.r.t. base panel open-circuit. This removes the beam current limiting feedback.

(2) Width and height variation, Ipsalo-2 sets. DB718 (8·2V zener diode) leaky, causing variation in the 125V/142V supply.

(3) Excessive width, Ipsalo-2 sets. Width control RTB502 open-circuit.

(4) Set dead, Ipsalo-2 versions. 15V supply rectifier DB507 open-circuit or dry-jointed. This seems to be more common with Models 1H4/8.

(5) Slight width quiver, Ipsalo-2 sets. 142V supply slightly low. HB1 faulty.

(6) Crackling or shriek on sound. Audio output chip ICB100 (TDA2030) or, with Ipsalo-2 sets, intercarrier sound chip ICD2 (TDA1236) faulty.

(7) No sound, low contrast. ICC7 (AY-3-8203A) on the remote control panel faulty.

(8) No or intermittent failure to start at switch-on, Ipsalo-2 sets. DB722 (9·1V zener diode) faulty, causing loss of the start-up supply.

(9) Mains fuse and RB711 open-circuit, chopper transistors o.k., Ipsalo-2 sets. Reservoir/smoothing block CB721/2 faulty.

(10) Field distortion at top of screen with reduced width. ICB400 (TDA1170S) faulty.

(11) Set running with very low 142V supply (around 50V), Ipsalo-2 version. DB732 (1N4148) short-circuit.

(12) Top of picture stretched with a white line across the middle of the screen DB400 (1N4002) faulty.

(13) Set won't go to standby via remote control. Switch on back in wrong position – should be in position 2 (open-circuit). Alternatively TC102 (BC307) on remote control panel open-circuit base-to-emitter. With Ipsalo-2 sets TB100 (BC307) short-circuit will cause this fault – it's on the main panel.

(14) Field roll. ICB501 (TDA2593) faulty.

(15) Chopper transistors blowing, Ipsalo-2 sets. This can be caused by cracks or chips in driver transformer MB700 or a faulty hybrid chip (HB1).

(16) Tuning range too low, also drifting. CB105 (2·2nF) leaky.

(17) Sound muted and contrast low. ICC4 (4049 on remote control panel) faulty with permanent high at pin 6

– same effect as holding in the store button. Models 1H1 and 1H6.
(18) Slow to start and when running hum on vision causes flaring, Ipsalo-2 sets. CB712 and CB726 (both 4·7μF) in chopper transistors' base circuits faulty.
(19) Twitching or varying width. EW amplitude control RTB503 (10kΩ) noisy.
(20) When teletext is fitted with early production sets poor reception and data corruption may well occur. If so ensure that improved tuner/i.f. pair (types SK4743 and STD0063AM) have been fitted and that a 330Ω resistor is connected between pin 1 of the tuner and chassis.

The following two faults relate to 1HC and 1HG sets.
(21) Chroma displaced to right of luminance. Change RB291 and RB292 from 1kΩ to 470Ω. After doing this, RTB203 may well have to be adjusted to remove Hanover blinds.
(22) Poor definition coupled with tendency for the tuning not to lock at the optimum point. Particularly with early versions of these sets this is sometimes due to incorrect adjustment of the a.f.c. coil LD6. One eighth to a quarter turn is usually enough.

The following four faults apply to Models 1H4 and 1H8.
(23) No sound or picture, noisy raster on screen. ICC1 (MC7805) on remote control panel faulty, causing loss of supply to the tuner prescaler circuit.
(24) Only snow on screen. Faulty prescaler circuit inside tuner.
(25) No on-screen channel number display. ICC101 (SAA1075) on remote control panel faulty.
(26) Set comes on at number 17 instead of number 1 and cannot be switched back to numbers 1-16. TS1 (BC307) on front panel short-circuit.

Long-distance Television

Roger Bunney

The general view amongst DX-TV enthusiasts seems to be that the present Sporadic E season has not been a particularly good one. I tend to agree. There were openings throughout the month and the log (below) suggests that July was very active. Those who could spend much of the day with the receivers switched on were able to log many signals, but those who had to rely on random on/off operation missed many of the small openings. During a good year random viewing will catch many more signals. Over the years I've noticed that SpE tends to be less fruitful during periods of high sunspot activity. As the peak of cycle 22 approaches this winter, so we have once again experienced reduced SpE reception. Any comments on this?

The SpE log for July in the UK follows. It was compiled a little earlier than usual because of August holidays.

5/7/89 TVE (Spain) ch. E2; DR (Denmark) E3, 4; CST (Czechoslovakia) R2.
6/7/89 TVE E2, 3, 4; TVE-2 E2; RTP (Portugal) E3; RAI (Italy) IA, B; TDF C+ (France, Canal Plus) L2, 3; JRT (Yugoslavia) E3, 4; CST R1; MTV (Hungary) R1; TVR (Rumania) R1, 2, 3; TVP (Poland) R1, 2; TSS (USSR) R1, 2.
7/7/89 TVE E2, 4; RAI IA; TSS R1, 2; NRK (Norway) E2.
8/7/89 TVE E2, 3, 4; RAI IA; NRK E2, 3, 4; SVT (Sweden) E2, 3.
9/7/89 TVE E2; RAI IA; JRT E3; +PTT (Switzerland) E2, 3.
10/7/89 TVE E2, 3, 4; RAI IA, B; C+ L2; ZTV Gwelo E2 (Zimbabwe via TE).
11/7/89 SVT E2; TVE E2, 3, 4; RAI IA.
12/7/89 TVE E2, 3, 4; C+ L2; RAI IA, B.
13/7/89 EPT (Greece) E3; JRT E3, 4; RAI IA, B; Ekalano (Italian private) E2; TVE E2, 3, 4; TVE-2 E2; C+ L2, 3, 4; MTV R1, 2; TVR R4, 5; ORF (Austria) E2a, E4; +PTT E2; RTP E2; TSS R1, 2.
14/7/89 TVE E2, 3, 4; RTP E2, 3; RAI 1A; JRT E3; SVT E2, 3; YLE (Finland) E3; DR E3,4.
15/7/89 RAI IA, B; Ekalano E2; C+ L2; TVE E2, 3, 4; RTP E3; TVE-2 E2; RTBF (Belgium) E3 (short skip into Midlands); RTM (Morocco) E4, M4; Arabic signals noted on E3, E4 (likely JTV-Jordan E3, Syria E4).
16/7/89 TVE E2, 3, 4; TVE-2 E2.
17/7/89 TVE E2, 3, 4; RTP E2, 3; RAI IA.
18/7/89 TVE E2, 3, 4; RTP E2, 3; TVP R2.
19/7/89 TVE E2, 3, 4.
20/7/89 RAI IA, TVR R2.
21/7/89 RAI E2, IA, B; JRT E3, 4; RTSH (Albania) IC; EPT E3; TVR R2; MTV R1, 2;ORF E2a, E4; C+ L2, 3, 4; TVE E2, 3, 4; +PTT E2; TVP R1, 2, 3;ARD (West Germany) E2; NRK E2, 3, 4; TSS R1, 2, 3, 4, 5.
22/7/89 TVE E2, 3, 4; RAI IA, B; JRT E3, 4; C+ L2, 4; EPT E3; ORF E2a; MTV R1, 2, 3;RTSH IC; TVR R2, 3; + PTT E2, 3, 4; CST R1, 2; TVP R1, 2, 3; TVR R2, 3; ARD E2; SVT E2, 3, 4; NRK E2, 3, 4; TSS R1, 2, 3; YLE E4; Tele Uno (Italian private) E3.
23/7/89 TVE E2, 3, 4; RTP E3; RAI IA; C+ L2; TVE-2 E2; TVP R1, 2; RUV (Iceland) E3, 4.
24/7/89 TSS R1, 2.
25/7/89 TSS R1, 2; JRT E3; ARD E2; RAI IA, B; Ekalano E2; +PTT E2, 3; C+ L2, 4; RTP E3;TVE E2, 3, 4; ch.E2 Dubai or Iran – Arabic programming at 1205BST.
26/7/90 TVE E2, 3, 4; RTP E3.
27/7/89 TSS R1, 2; CST R1, 2; RAI IA, B; Ekalano E2; Radio Tele Uno IA; JRT E3, 4;TVE E2, 3, 4; TVE-2 E2; ORF E2a, E4; C+ L2; ARD Grunten E2; AFRTS A2 Iraklion, Crete.
28/7/89 C+ L2; RAI IA, B.
29/7/89 TVE E3.

I'll briefly highlight the more important reception noted in the above log. The AFRTS (American Forces) reception from Iraklion, Crete on the 27th was by Bill Cotterill (Tipton) who logged programmes from 1034 onwards on ch. A2/E3. This was a 525-line transmission of course: the vision locked with reduced height and adjustment of the field hold control enabled the picture to be held steady without rolling. Bill noted Arabic signals in ch. E4 on the 21st, from 1430-1500, and on the 15th in chs. E3/4. Also on the 15th Simon Hamer (Powys) received Moroccan signals at 1925 BST in chs. E4 and M4 (the latter Band III). On the 10th Cyril Willis (King's Lynn) noted a rugby match at 1800 BST from Gwelo (ch. E2) Zimbabwe. This was via transequatorial skip.

Tropospheric Conditions

There was improved tropospheric reception on several days – the weather in the UK was mainly hot, sunny and settled during the month, producing a general enhancement on all Band III/u.h.f. channels. The first period around the 5-6th produced signals from Denmark, Norway and the Benelux countries. Simon Hamer was very active – he motors to a site on a nearby mountain, giving him a clear take-off to the horizon! Simon logged Danish signals in chs. E5, 6, 7, 8, 10 with TV2 signals in chs. E22, 26, 30, 35, 40, 53 and 56. In addition ARD (W. Germany) was present on several channels.

A second period with enhanced signals occurred on the 17-20th. The 17th was better towards the west, with RTE-1/2 signals throughout Band III/u.h.f. A peak on the 20th extended reception into the Midlands, again with signals from France, Denmark, E/W. Germany and the Benelux countries. As a result of ducting, the E. German signals were stronger than those from W. Germany. A further improvement came on the 23rd.

Matters Arising

Some points arising. Dalibor Frkovich (Yugoslavia) reports reception of the Egyptian low-power (900W) ch. E2/4 transmitters at Dumyat, also a signal on ch. E3. There used to be a ch. E3 transmitter at Port Said: could this have reopened? A mystery Belgian signal has been received on ch. E58, a PM5544 pattern with the identification "Andurlues, channel 58" but no BRT or RTBF. Could this be a new Canal Plus venture?

Tim Anderson (2 Burry Road, St. Leonards on Sea, East Sussex TN37 6QX) has for sale a 22in. Finlux receiver with stereo sound and SECAM/PAL/NTSC colour capability – in fact all standards except System D sound. Coverage includes chs. IC and R3/4/5. The set has a scart socket, remote control, etc. Asking price is £425 or near offer. To be collected/inspected, contact Tim directly.

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

News Items

UK: Nicam stereo sound transmissions are to start this September in the London and Yorkshire ITV areas. During 1991 coverage should extend to 75 per cent of the country. The BBC's transmissions will include Nicam stereo sound over 70 per cent of the country by mid-1992.
France: A new European pop video service called MCM (Monte-Carlo Musique) is to be broadcast by Tele Monte Carlo for 18 hours daily. It will replace the French M6 programme currently being relayed. RCL-TV has requested channel allocations in thirteen French cities for a non-stop news service to be called "Infos Cites 8". The La Cinq network lost £84m in 1988.
Denmark: The TV2 network is to be financed entirely by advertising starting some time in 1990. Most regional stations want to opt out of the network and become independent. A new TV2 transmitter is in operation at Nakskov, using ch. E52 with 100kW e.r.p.
Hungary: The town of Siofok 110km south west of Budapest made history when Hungary's first commercial station TV-S started broadcasting.
Gibraltar: A new test pattern with the identification "TV Algeciras" has been seen at low power, in ch. E48 with horizontal polarisation.

Satellite TV

BSB's first satellite has been successfully launched into orbit. Three of the Astra 1A satellite's transponders switched off recently: it's not certain whether an electrical fault or solar storm was responsible for the automatic power close down. Sky's entertainment and news channels may adopt scrambling next year. Advertising limited to three minutes between films may be introduced on the Movie channel.

Ian Waller (Lincoln) reports that the West German Kopernikus (DFS) satellite at 23·5°E is at present transmitting on three channels as follows: ARD-1 Plus and RTL+ share an 11·65GHz transponder with horizontal polarisation; Pro-7 is at 12·558GHz horizontal; colour bars are on test using half the 11·575GHz transponder with vertical polarisation. There's a suggestion that the aerial for the Intelsat 63°E craft has been repositioned to cover W. Germany. Tests are being carried out at 10·95GHz.

The La5 and M6 services are to be transmitted via the TDF-1 satellite. Early plans are being formulated by France/W. Germany for two high-powered, 12-transponder satellites to be launched in the mid-Nineties.

On a personal note, during the summer my reception to the east has been limited to (just) 10°E by trees in leaf. Matters should improve in the autumn! I understand that the ECS craft at 16°E is very active with up to five downlinks on test.

Books

I've been sent a copy of the *1990 World Satellite Annual* for review. It's a supplement to the *World Satellite Almanac* published in 1988 and is of much the same size. These are upmarket publications from the USA, covering

the international scene including Western and Eastern craft, their technical characteristics, programme/communication operations, history, footprints etc. Having used the Almanac I can vouch that it's an invaluable work of reference: the 1990 Annual goes a step further in presenting the latest information. The Annual costs £31 inclusive and the Almanac £32 inclusive from Swift Satellite TV Services, 17 Pittsfield, Cricklade, Swindon, Wilts SN6 6AN. Despite the cost these books are well worthwhile for anyone seriously interested in satellite work.

The MFT Company Ltd. (164 Station Road, Lower Standon, Henlow, Beds SG16 6JH) has recently published the *Fixed Dish Installation Guide* by M. Turff. It's an A4 format publication and is packed with information presented in a way that's easy to understand. Good value at £3·50 inclusive – the book comes free if you purchase a complete TVRO package from the company!

New EBU Listings

The following "private" W. German transmitters are now listed: Aachen ch. E27 100W; Bremen E29 63kW; Salzgitter E30 95W; Regensburg E34/38 5kW; Dortmund E47 200W; Bremen E49 63kW. Salzgitter with vertical polarisation, all others horizontal.

Help Wanted

Ian Uden (21 Crosbie Road, Harborne, Birmingham B17 9BG) intends to use a v.h.f./u.h.f. Pye model 99 for DXing. The set has four switched v.h.f. positions labelled A-B, C, D-H2. Can anyone provide frequency details?

TV Fault Finding

Reports from Philip Blundell, Eng. Tech., Alfred Damp, Ray MacDonald, J.S. Ruwala, J.K. Potts, Steve Leatherbarrow and J.R. Armagh

Philips CP90 Chassis

A number of these sets are coming in for repair now. These two were typical. The first one had low h.t. with a noise coming from the power supply. The line output transformer had shorted turns. A dry-joint at the earth connection to the combined focus/first anode control module was the problem with the second set – the symptom was an intermittent full-white raster. **P.B.**

Bush Model BC6004

If you have one of these sets that's tripping, don't leave it for long in this condition if you can help it. If D687 (SKE4F1) is faulty the 122V supply can go high. The result of this is that C836 and C835 explode, spraying the set – and your hair – with foil and wadding. R835 (3·9kΩ) flashes over to the TBA530 chip which also dies. Over the years I've had this state of affairs in the workshop on two occasions. In neither case did I cause the problem, but I had to clear up the mess both times! **P.B.**

Hitachi CPT2596 (G8Q Chassis)

When this set was switched on the h.t. would come up then trip out. We disconnected the outputs from the chopper transformer one by one but the fault persisted. Checks on IC901 revealed that some of the voltages were incorrect. In particular there was zero voltage at pin 2, which is the input to an error amplifier. There should be 2·3V here, supplied by R917 and D908 which is fed from a feedback winding on the chopper transformer. This winding read open-circuit to chassis. The transformer's chassis connection is pin 3: there was a hairline crack at the solder connection pad here. **A.D.**

Toshiba 210T6B

This set was dead and appeared to trip when switched on. We disconnected the 112V supply to the line output stage but this made no difference – in fact the 112V supply was missing, but the standby and remote control supplies were present. Transistor Q803 is used to kill the oscillator section of the chopper chip IC801 for standby or for the electronic trip action. In standby it's driven by QR01 which is in turn driven by the optocoupler DR10. QR01 was leaky collector-to-emitter but replacing it made no difference. The basic cause of the trouble was that the optotransistor in DR10 was faulty. Replacing DR10 restored normal results. **A.D.**

Ferguson TX10 Chassis

This set defied all logical attempts at repair. It would intermittently go to standby or either the volume, colour or brightness would increase or decrease. All the usual things were tried, i.e. a check for dry-joints around the chopper/e.h.t. transformer, changing the focus control, checking for a poorly earthed c.r.t. Aquadag coating etc. The only effective cure was to unplug the infra-red preamplifier – the set then behaved itself. A replacement preamplifier was tried, but if anything this made matters worse. Someone suggested extra earthing to the preamplifier's screening can, but that didn't help either. Another thought was c.r.t. flashovers. A second set was backed on to the faulty one, but within minutes it was back in standby.

As we were staring defeat in the face, memories from the very back of the mind were recalling the ITT80 chassis that changed channels if the house had an overhead mains supply. The majority were cured by fitting a ferrite ring in the mains lead. So a ferrite ring was fitted in the wiring loom to the infra-red preamplifier assembly. After a few anxious hours while the set behaved itself we began to sigh with relief. We've had no further trouble. **A.D.**

Panasonic TC2204 (U1 Chassis)

We all need experience, but sometimes it can be a hinderance. This old set suffered from very intermittent line jitter, affecting only the top half of the picture. I've not dealt with many of these sets, but having had similar trouble with later Panasonic receivers due to capacitor problems in the power supply this is where I started. After wasting much time in this way the cause of the trouble turned out to be the rather obvious C510 (100μF, 16V) which decouples the feed to the TDA2591 sync/line generator chip. These capacitors often show signs of strain, but this one was like new and read perfectly on my component tester. **R.M.**

Some Quickies

ITT CVC1175/Solarvox 20S09: After five minutes the picture brightness went low, with lack of width and field foldover. C716 (10μF, 350V) on the chopper module was leaky – it gets hot.

Sony KV2216U (YE2 chassis): For pincushion distortion replace Q802 (SG264A).

ITT CVC1120 chassis: With the dead set symptom check whether the line driver transistor's 1·2kΩ feed resistor R744 is open-circuit. **J.K.P.**

Sony 21XRTU

The complaint with this set was field collapse. We found that R802 (1·2Ω) was open-circuit. After replacing it we switched on. There was an e.h.t. arc from the line output transformer and R802 burnt out instantly. Another resistor was fitted and the line output transformer was replaced. This time there was an EW fault because D808 was short-circuit.

The arcing had also destroyed the chips on the teletext panel. So if you get one of these sets with a field fault make sure that the line output transformer is o.k. before you give an estimate – I understand that this is a stock fault. **J.S.R.**

Sony KV2704

The customer complained that the set would work for five-ten minutes and would then go to standby. When I switched it on I noticed that the width was excessive – in fact there was an EW fault. As soon as I tapped the line panel the set went to standby. I suspected a dry-joint but decided to deal with the EW fault first. A check on the SG264A gate-controlled switch which drives the EW modulator diodes revealed that it was leaky. When it was replaced the set worked perfectly and no longer went into the standby mode.

During the same week I had a call from another customer who reported a similar fault on one of these sets. This time the SG264A GCS was o.k., the problem being due to one of the EW modulator diodes. I fitted a BYW96E and it worked very well. **J.S.R.**

Hitachi CPT2260/2660/Salora Ipsalo-2

These sets use the Salora Ipsalo-2 circuit. This one was dead. The fuse was intact and the supply at the collector of TB700 was present. We changed the two 4·7μF chopper drive coupling capacitors CB712 and CB726, which are very often faulty in these sets, and checked whether the BR100 start-up diac DB725 was short-circuit. When the set was switched on the e.h.t. built up but the set started to trip. The h.t. supply across CB513 was correct at 142V but the 15V rail was at only 3·5V. Diode DB507 had gone high-resistance. When a replacement was fitted the set came to life. **J.S.R.**

Sanyo CTP7132 (80P Chassis)

For a dead set with 320V present at the collector of the choper transistor Q304 first check its 470kΩ base bias resistor R302. If this is o.k., check or better replace the 10μF drive coupling capacitor C312. It's just below Q304's heatsink. **J.S.R.**

Ferguson TX100 Chassis

There was sound but no raster (black screen). The e.h.t. and first anode supplies were o.k. but the c.r.t.'s cathodes were at 200V. The outputs from the TDA3562A colour decoder chip were low at only about 1V, so the chip was as usual changed. No good. Perhaps the field timebase/c.r.t. protection circuit had come into operation? A check revealed that there was no drive from the field output chip though its supply was present. So this chip was replaced, again as usual. Again no good! Then I found that there was no input from pin 1 of IC4. I followed the same routine: supply o.k. so fit new chip, but still no raster. As I was pressed for time I phoned our ever helpful Ferguson distributor. He said he hadn't had this one, but shouldn't I try the field feedback circuit? Well there are quite a few components here. I decided to follow the old principle of checking high-value resistors and low-value electrolytics first. My initial check on C101 hit the nail on the head (it's exact value depends on the type of tube).

Nowadays a lost raster is often caused by field collapse. It's a good idea to read and note the first anode voltage, then turn the first anode control hard up in case a tell-tale white line appears. In this particular case switching off and on again inside a second or so produced a clean, bright line which stayed on. **J.R.A.**

Toshiba 145R7B

There were no results with no output from the LED and the 5V supply was missing. Ra25 was found to be open-circuit, a replacement putting matters right. Don't try to make the chassis tracks correspond to the circuit diagram

however! There's an error on the diagram: Ra25 is not connected to the h.t. line as shown, in fact it obtains its supply from the bridge rectifier end of R801. I suggest amending the diagram in case this causes trouble. **J.R.A.**

Hitachi CPT1455

"Faulty on/off switch" it said on the label. It never is of course, but how do you explain this to the paying customer? The set was dead, as these usually are when they come in. The STR4211 chip in the power supply had failed. A replacement was fitted along with the precautionary bits (see Hitachi data and sheets) and the set was switched on.

The sound was poor, as if the loudspeaker was off centre with coil rubbing. It was also extremely weak. The 56Ω resistor that feeds the two output transistors was open-circuit and one of the transistors was short-circuit. Nothing unusual so far. The faulty items were replaced along with the 1N4148 diode. This produced clean sound, in a way, until the volume control was at about mid-setting. At higher settings there was no increase in volume and back came the distortion. The driver transistor was o.k. and all the voltages were about right. In despair we hooked up the scope and fed a sinewave into the TDA4503 chip. At above the half-way setting of the volume control the output became distorted. A new chip cured the fault. It didn't cure the customer when he read his bill for "a switch". **J.R.A.**

Ferguson TX85 Chassis

These sets employ a rather unusual line driver stage with three transistors. Two dead sets recently had problems here. The first simply had a dry-joint on one of the 100Ω, 12V supply resistors. With the second set we had to replace all three transistors: two were short- and one was open-circuit. **S.L.**

Ferguson TX90 Chassis

This set produced no results though the h.t. and 12V supplies were both present and correct. A scope check on the line drive waveform came next and I was rewarded. It was missing at the secondary of the driver transformer but was present at the primary. A base-emitter short in the line output transistor perhaps? No, simply an open-circuit wire on the driver transformer where it joins the print connection. We were able to remove and repair the transformer. **S.L.**

ECONOMIC DEVICES PO BOX 15, WOLVERHAMPTON, WV2 4AZ

15/80H	2.72
15/85R	3.28
17052	5.61
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	0.07
1N4148	0.03
1N4448	0.05
1N5401	0.11
1N5402	0.13
1N5403	0.18
1N5404	0.15
1N5408	0.14
1N914	0.04
1S1555	0.31
1S44	0.10
1S921	0.10
2N2219A	0.37
2N3053	0.35
2N3054	0.99
2N3055	0.79
2N3442	1.16
2N3702	0.14
2N3703	0.18
2N3705	0.16
2N3706	0.14
2N3707	0.16
2N3711	0.11
2N3771	2.04
2N3772	1.55
2N3773	2.20
2N3819	0.40
2N3823	1.17
2N3904	0.15
2N3908	0.62
2N4101	1.33
2N4240	2.00
2N4444	0.90
2N5293	0.50
2N5294	0.50
2N5296	0.48
2N5297	0.50
2N5298	0.61
2N6109	1.58
2N6130	0.85
2N6133	1.25
2N6180	0.73
2N6292	1.65
2SA1006	1.50
2SA1011	1.65
2SA1015	0.49
2SA1012	1.25
2SA1020Y	0.80
2SA1027R	0.45
2SA473	0.75
2SA766S	4.95
2SC1173Y	1.25
2SC1474	1.25
2SC1509	1.35
2SA1095	3.00
2SA1103	6.00
2SA329	0.40
2SA489	1.17
2SA490	1.32
2SA493	2.25
2SA562	0.57
2SA564	0.62
2SA614	4.88
2SA628	0.37
2SA639S	1.75
2SA659	0.49
2SA673	1.50
2SA684	1.20
2SA697	0.80
2SA699	1.25
2SA715	0.95
2SA748	1.95
2SA817	0.18
2SA835	2.50
2SA836	0.89
2SA844	0.65
2SA872	0.59
2SA884	2.15
2SA937R	0.97
2SA940	2.23
2SA940-2	2.14
2SA950	0.72
2SA951	1.75
2SA966-Y	0.85
2SA999	0.75
2SB774	0.65
2SB185	1.13
2SB375	3.87
2SB400	0.40
2SB405	1.03
2SB511	2.65
2SB54	1.39
2SB546	0.56
2SB56	2.80
2SB618A	2.22
2SB631	2.00
2SB643	0.50
2SB669	3.67
2SB681	3.96
2SB695	1.98
2SB774	0.65
2SB819	1.13
2SC1096	1.16
2SC1104	3.98
2SC1106	4.54
2SC1114	3.25
2SC1116	4.95
2SC1124	1.26
2SC1129	1.65
2SC1131	0.64
2SC1158	3.33
2SC1162	0.55
2SC1172	2.22
2SC1195	6.09
2SC1213	0.89
2SC1226	1.46
2SC1293	0.90
2SC1306	1.98
2SC1317	0.50
2SC1364	0.49
2SC1383	1.20
2SC1391	2.45
2SC1398	0.75
2SC1413A	5.00
2SC1446	1.25
2SC1447	2.07
2SC1475	0.60
2SC1505	1.00
2SC1514	1.37
2SC1573Q	1.63
2SC1583	0.34
2SC1617	3.89
2SC1678	1.98
2SC1741	1.25
2SC1810	1.70
2SC1815	0.20
2SC1826	0.67
2SC1829	2.25
2SC1875	4.50
2SC1893	3.02
2SC1906	0.98
2SC1921	1.37
2SC1923	0.30
2SC1929	2.25
2SC1942	1.98
2SC1959	0.26
2SC1957	0.95
2SC1953	1.93
2SC1962	1.93
2SC1969	1.78
2SC1983	3.28
2SC1985	1.55
2SC2009	0.34
2SC2029	2.33
2SC2028	2.11
2SC2063	0.99
2SC2078	3.39
2SC2073	1.54
2SC2085-Q	1.65
2SC2091	1.30
2SC2141	2.44
2SC2166	0.87
2SC2216	0.69
2SC2233	1.20
2SC2236	1.89
2SC2278	1.14
2SC2314	0.87
2SC2335+Kit	7.00
2SC2551	1.26
2SC2565	3.84
2SC2570	0.80
2SC2577	1.60
2SC2578	6.75
2SC2671	0.91
2SC288A	1.85
2SC3153	6.50
2SC372	1.40
2SC373	1.16
2SC383	1.33
2SC388	1.27
2SC394V	0.81
2SC403C	0.60
2SC458	0.34
2SC495	0.92
2SC515A	1.85
2SC535	0.79
2SC536	0.10
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	0.50
2SC717	1.28
2SC734	1.43
2SC783	3.98
2SC790Y	1.85
2SC828	0.28
2SC867A	3.04
2SC876	0.96
2SC930	0.54
2SC935	4.13
2SC940	4.68
2SD1128	2.90
2SD1138	0.94
2SD1273	1.30
2SD1453	1.33
2SD152K	2.64
2SD198	3.87
2SD234	0.47
2SD235	0.60
2SD24	2.29
2SD257	1.98
2SD292	4.09
2SD313	2.65
2SD325D	2.26
2SD350	3.05
2SD353	7.50
2SD389	2.41
2SD401	1.40
2SD414	1.98
2SD471	2.13
2SD560	2.95
2SD600	2.98
2SD601R	0.65
2SD613	1.03
2SD636	0.40
2SD639-R	0.72
2SD655	0.98
2SD657	2.80
2SD661A	0.80
2SD731	2.11
2SD773	0.60
2SD811	7.63
2SD823	1.98
2SD837	1.48
2SD841	2.00
2SD856	1.00
2SD857Q	1.84
2SD882	1.15
2SD894	1.75
2SD898	0.82
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	0.30
AD162	0.45
AF114	2.47
AF115	1.24
AF118	1.20
AF127	0.65
AF139	0.40
AF178	1.45
AF179	0.55
AF180	0.55
AF181	0.53
AF186	0.53
AF239	0.53
AF279	0.88
AN115	3.98
AN155	1.89
AN206	2.58
AN208	3.55
AN210	2.28
AN211	3.25
AN214Q	2.40
AN234	5.09
AN236	3.33
AN240P	0.99
AN241	1.71
AN245	4.90
AN253	1.80
AN260	3.85
AN272	7.92
AN295	5.52
AN301	2.45
AN302	3.09
AN306	8.88
AN315	2.46
AN316	5.53
AN318	9.35
AN320	5.47
AN321	2.25
AN322	6.78
AN337	5.37
AN340P	1.53
AN355	5.98
AN362	1.50
AN370	3.95
AN5111	3.43
AN5120N	4.50
AN5132	4.42
AN5250	4.40
AN5610	7.43
AN5612	2.07
AN5613	4.20
AN5630	3.95
AN5701N	1.66
AN6250	2.95
AN6300	4.40
AN6310	4.54
AN6340	6.46
AN6341	1.42
AN6363	16.00
AN6531	1.95
AN6551	0.50
AN6552	0.68
AN6610	1.65
AN7111	1.25
AN7115	2.52
AN7145	2.80
AN7146	9.90
AN7151	2.37
AN7156	2.85
AN7158	2.34
AN7218	0.80
AN7223	4.55
AU107	5.87
AU110	5.69
AU113	6.95
AY105K	2.08
AY106	1.09
BA524	8.94
BA310	0.14
BA1310	1.98
BA1320	1.38
BA1322	3.95
BA1330	2.75
BA145	0.19
BA148	0.25
BA154	0.40
BA155	0.12
BA156	0.05
BA159	0.09
BA182	0.19
BA222	1.66
BA302	1.24
BA311	0.65
BA312	1.45
BA313	0.76
BA317	0.04
BA318	0.09
BA328	1.65
BA333	1.37
BA335	6.27
BA5102A	2.50
BA511	1.95
BA514	1.00
BA521	1.20
BA524	8.94
BA526	7.98
BA527	2.98
BA532	1.50
BA536	1.70
BA6209	3.10
BA656	1.00
BA7100	11.35
BA841A	28.98
BA843	3.96
BA854	5.76
BAV18	0.06
BAV19	0.11
BAV20	0.35
BAV21	0.12
BAW62	0.11
BAX12	0.11
BAX13	0.11
BAX16	0.08
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	0.45
BC141	0.34
BC142	0.23
BC143	0.34
BC147	0.11
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	0.11
BC172B	0.27
BC173	0.17
BC174B	0.27
BC177	0.35
BC178	0.26
BC179	0.26
BC182	0.09
BC182LB	0.14
BC183LB	0.26
BC184	0.13
BC184LB	0.26
BC186	0.25
BC187	0.28
BC204	0.16
BC207	0.14
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	0.35
BC301	0.23
BC302	0.53
BC303	0.30
BC307A	0.06
BC308A	0.11
BC309	0.17
BC317A	0.13
BC327	0.08
BC328	0.11
BC337	0.09
BC338	0.12
BC368	0.18
BC440	0.69
BC441	0.46
BC454	0.36
BC460	0.42
BC461	0.47
BC462	0.51
BC463	0.30
BC478	0.32
BC479	0.41
BC532	0.17
BC546	0.17
BC547	0.10
BC548	0.10
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BC550	0.10
BC556	0.16
BC557	0.16
BC558	0.10
BC559	0.10
BC560C	0.14
BC635	0.34
BC636	0.18
BC637	0.24
BC639	0.36
BC640	0.24
BCX34	0.40
BD115	0.36
BD116	0.70
BD124	1.31
BD131	0.42
BD132	0.42
BD133	0.53
BD135	0.36
BD136	0.36
BD137	0.26
BD138	0.28
BD139	0.34
BD140	0.32
BD144	1.43
BD150	0.75
BD157	0.67
BD160	1.60
BD163	0.71
BD166	0.42
BD175	0.28
BD179	0.30
BD181	0.99
BD182	0.99
BD183	0.99
BD184	1.21
BD187	0.53
BD189	0.69
BD190	0.69
BD201	0.49
BD202	0.60
BD203	0.46
BD204	0.41
BD207	1.79
BD208	1.23
BD222	0.50
BD225	0.46
BD228	0.63
BD229	1.05
BD232	0.49
BD234	0.42
BD237	0.47
BD238	0.28
BD239	0.45
BD240	0.57
BD241	0.39
BD242	0.50
BD243A	0.37
BD243C	0.50
BD244	0.31
BD244C	0.72
BD245C	0.70
BD246C	0.80
BD253	1.05
BD278A	0.70
BD317	1.20
BD318	2.72
BD375	0.42
BD380	0.76
BD410	0.49
BD433	0.44
BD434	0.45
BD435	0.49
BD436	0.60
BD437	0.41
BD438	0.52
BD441	0.59
BD442	0.66
BD509	1.42
BD510	0.75
BD519	0.98
BD529	0.60
BD530	0.80
BD533	0.67
BD534	0.52
BD535	0.45
BD536	0.50
BD537	0.50
BD538	0.67
BD544B	0.83
BD677	0.40
BD679	0.57
BD680	0.52
BD681	1.48
BD696	2.47
BD699	1.85
BD700	3.70
BD707	0.60
BD709	0.60
BD710	0.80
BD809	0.80
BD810	0.69
BD879	0.74
BD895	2.18
BD901	0.99
BD902	0.65
BDW83C	0.99
BDW84C	0.99
BDX32	1.88
BDX53A	4.93
BDX53B	3.35
BDX54B	0.71
BDX62A	1.96
BDX63A	1.96
BDY20	1.21
BDY81	1.18
BF115	0.29
BF117	0.86
BF118	0.18
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	0.36
BF183	0.39
BF184	0.43
BF185	0.39
BF194	0.14
BF195	0.14
BF196	0.17
BF197	0.16
BF198	0.17
BF199	0.17
BF200	0.37
BF218	0.35
BF224	0.17
BF237	0.65
BF240	0.19
BF241	0.17
BF245	0.50
BF245B	0.79
BF246A	2.52
BF255	0.40
BF256	0.35
BF257	0.34
BF258	0.33
BF259	0.34
BF262	0.57
BF263	0.57
BF271	0.34
BF273	0.23
BF274	0.23
BF324	0.23
BF336	0.33
BF337	0.45
BF338	0.40
BF355	0.49
BF362	0.63
BF363	0.50
BF371	0.50
BF391	0.25
BF417	0.84
BF418	1.87
BF422	0.33
BF423	0.33
BF450	0.35
BF451	0.29
BF457	0.48
BF458	0.48
BF459	0.52
BF460	0.59
BF469	0.28
BF470	0.25
BF471	0.33
BF472	0.33
BF479	0.63
BF480	1.79
BF491	0.50
BF506	0.43
BF532	0.24
BF596	0.18
BF597	0.27
BF694	0.22
BF757	0.59
BF759	0.47
BF761	1.05
BF762	0.38
BF869	0.48
BF870	0.30
BF959	0.42
BF960	0.48
BF970	0.50
BFR39	0.48
BFR61	0.92
BFR62	0.50
BFR79	0.29
BFR81	0.29
BFR86	1.08
BFR89	1.63
BFR90A	0.85
BFX29	0.38
BFX84	0.37
BFX85	0.41
BFX86	0.35
BFX87	0.55
BFX88	0.38
BFX89	0.48
BFY50	0.30
BFY51	0.38
BFY52	0.27
BFY79	0.48
BFY90	0.42
BLY49	2.29
BR100	0.22
BR101	0.79
BR103	0.66
BR303	1.15
BRC84	2.08
BRX44	0.60
BRX49	0.34
BRY39	0.60
BSS38	0.67
BSTBD140G	4.98
BSTC0246	8.64
BSTC0233	6.12
BSTCC0143	3.07
BSTD1043	2.86
BSV57B	3.91
BSW68	0.60
BSX19	0.34
BSX20	0.19
BSY52	0.50
BSY79	0.57
BT108	1.45
BT119	1.76
BT120	2.17
BT121	2.48
BT123	1.98
BT151-800R	1.08
BTT6018	2.42
BU106	2.48
BU108	1.50
BU109	2.25
BU110	5.69
BU125	2.48
BU126	1.10
BU137	6.53
BU205	1.15
BU206	1.27
BU207	1.65
BU208	1.12
BU208/02	1.88
BU208A	1.12
BU208D	1.43
BU209	1.93
BU226	2.45
BU326A	0.99
BU406	1.49
BU406D	1.53
BU407	0.82
BU412	5.29
BU426A	1.67
BU500	1.45
BU508A	1.89
BU536	1.65
BU608	1.65
BU705	2.50
BU806	0.85
BU807	1.40
BU826A	1.95
BUW84	1.39
BUX84	0.50
BUX85	0.69
BY126	0.13
BY127	0.13
BY133	0.06
BY164	0.44
BY176	0.52
BY179	0.12
BY182	1.06
BY187	0.77
BY189	1.76
BY198	1.62
BY207	0.22
BY208	1.11
BY210-400	0.18
BY210-600	0.27
BY210-800	0.19
BY223	1.43
BY224-600	1.88
BY226	0.25
BY227	0.20
BY228	0.60
BY229-1000	1.12
BY229-600	0.92
BY255	0.13
BY295-600	1.03
BY298	0.20
BY299	0.60
BY407	0.90
BY409	1.49
BY448	1.35
BY713	0.65
BYW56	0.14
BYX55-600	0.23
BYX71-600	0.85
BYX71-350	0.62
BYY56	1.20
BZY93C30	1.86
C106D	0.37
C106M	0.76
CA3046	1.55
CA3089	0.83
CA3090AQ	3.25
CA3094	2.20
CA3131EM	2.95
CD4001	0.34
CD4002	0.27
CD4008	1.35
CD4011	0.29
CD4012	0.24
CD4013	0.33
CD4016	0.36
CD4017	0.40
CD4020	1.23
CD4021	0.39
CD4023	0.28
CD4025	0.64
CD4028	0.84
CD4040B	0.60
CD4047	1.06
CD4049	0.24
CD4052	0.64
CD4066	0.21
CD4069	0.29
CD4070	0.25
CD4081	0.14
CD4093	0.40
CD4511	1.10
CD4528	2.04
CD4556	1.47
CR02AM-8	1.70
CV12E	4.09
CX095D	3.14
CX104	8.77
CX108	12.48
CX109	7.86
CX130	8.76
CX134	11.10
CX136	11.49
CX139	11.83
CX157	5.52
CX158	5.50
CX177	8.75
CX187	5.26
CX755	12.95
CX885A	6.85
E1222	0.40
E5024	0.28
E5386	0.25
GD243	4.34
GF758	0.84
HA11215	1.75
HA11211	2.53
HA11225	4.29
HA11229	3.46
HA11235	1.75
HA11124	5.25
HA1125	4.29
HA1137W	1.38
HA1138	5.03
HA11414	5.65
HA1156	1.16
HA1160	4.79
HA1166X	6.60
HA1167	6.45
HA11706	3.61
HA11705	8.00
HA11703	4.22
HA11701	4.56
HA11710	3.45
HA11713	2.90
HA11711	2.00
HA11715	9.90
HA11714	7.76
HA11716	13.10
HA11725	18.26
HA11725MP	16.00
HA117555P	6.23
HA11781	21.15
HA1180	5.15
HA1196	7.43
HA13001	1.73
HA1306	2.26
HA13402	7.87
HA13342	2.65
HA13365	4.02
HA1366WR	1.38
HA1367	2.75
HA1368R	2.45
HA1368	2.07
HA1370	3.71
HA1374	1.80
AA117	9
HA1377	1.75
HA1389R	2.05
HA1389	2.39
HA1392	1.38
HA1394	2.37
HA1397	3.76
HA1398	2.95
HA1406	2.07
HA1452	0.85
HD14538	2.07
HD38702-A2	7.95
HD38750A53	5.77
HD38750A-7	7.25
HD38800A50	14.09
HD44801A05	12.50
HISH1010	8.59
HISH1004	6.00
HISH1002	9.50
HM6231	9.81
HM6232	10.95
HM6251	5.25
HM7103	4.85
HM9032	4.00
HM9012	3.22
HM9015	3.24
HT4207	13.25
HT4208	20.65
KA2101	1.00
KC581C	7.68
KC582C	4.85
L200CV	1.69
LA1201	0.75
LA1210	1.56
LA1230	1.44
LA1320	2.87
LA1357N	9.00
LA1363	1.05
LA1364	3.02
LA1365J	1.15
LA1385	1.53
LA1387	5.95
LA3350	1.43
LA3361	1.60
LA3390	5.52
LA4032P	2.35
LA4100	1.25
LA4101	1.30
LA4102	0.75
LA4112	0.56
LA4125	2.25
LA4138	4.98
LA4140	0.70
LA4192	1.50
LA4220	1.25
LA4420	1.72
LA4422	1.00
LA4430	1.29
LA4440	1.95
LA4445	1.80
LA4460	1.75
LA4461	1.70
LA5112N	1.18
LA7020	13.86
LA7025	11.97
LA7027	10.92
LA7040	9.20
LA7042	3.90
LA7800	1.03
LA7801	0.90
LB1274	3.61
LC7800	9.20
LD3120	1.13
LD3150	2.75
LM1017N	1.81
LM1877	3.50
LM2808	5.94
LM2877	7.45
LM317CKC	1.08
LM324N	0.98
LM339N	0.41
LM340K	11.85
LM348N	2.15
LM380N	2.80
LM567CN	1.71
LM6402/011	10.23
LM6402A093	10.15
LM748	0.69
LM8360	3.87
LM8361	3.57
LR3419	9.37
LR3471	9.37
LU1141	7.27
LU52012	5.95
LU52011	14.95
LU03112	12.37
M193	6.83
M21C	1.30
M23C	1.98
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M51231P	3.07
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M51381P	5.98
M51393AP	9.48
M51394P	12.50
M5142P	6.85
M5144P	3.77
M51513L	2.55
M51515BL	2.75
M51517L	2.90
M5192	2.20
M5194AP	5.74
M5231L	4.80
M53274P	1.33
M54532P	1.50
M54544L	1.22
M58478P	6.75
M58485P	12.75
MA06	1.07
MA8001	0.82
MA8003	1.16
MB3705	1.98
MB3712	1.85
MB3713	1.69
MB3730	2.09
MC13002	3.90
MC1310P	2.25
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MC1330P	1.98
MC1350P	0.90
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MC1352P	1.40
MC1357P	2.15
MC1358P	1.48
MC14493P	4.20
MC14494P	2.15
MC14497	3.46
MC14510BAL	3.75
MC14511BCP	1.10
MC14528BCP	2.15
MC1712	3.88
MC5192	19.50
MC7724CP	3.49
MCR106-5/6	1.23
MCR220/7	2.28
ME0411	0.75
ME6002	0.26
ME6102	0.28
ME8001	0.34
ME0411	0.75
MJ2501	3.30
MJ3001	1.43
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MJE491	0.99
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ML923	3.10
ML926	3.58
MM5314N	8.99
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MM5318N	3.11
MM5369N	2.01
MM5387AA/N	6.20
MM5841N	6.64
MN1400VL	13.65
MN1405	7.92
MN1435VX	9.50
MP1192	5.07
MP2794	4.00
MP2812	5.07
MP8512	1.57
MPC596	2.13
MPF256C	0.60
MPS6570	0.48
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MPSA56	0.08
MPSA92	0.45
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MPSU10	1.56
MPSU56	0.60
MPSU60	1.33
MR818	0.33
MR854	0.50
MR914	1.20
MSM5816RS	17.35
MSM5840H	13.95
MVS460-02	0.34
NE542	2.65
NE555	0.19
NE556	0.65
NP1106	11.51
OA202	0.11
OA47	0.16
OA91	0.14
OA95	0.09
OC28	2.52
OC29	2.15
OC36	7.53
OC44	0.35
OC45	0.18
OC72	0.44
OC75	0.44
ON236	1.06
ON782	1.98
OT121	1.45
PT6042	2.45
PT8504	4.98
R1038	2.19
R1039	2.19
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R2009	1.98
R2010B	2.98
R2029	1.33
R2030	1.33
R2257	2.35
R2265	1.49
R2305	1.18
R2322	0.67
R2323	0.76
R2354A	0.64
R2354B	2.01
R2443	1.36
R2461	1.50
R2540	1.91
R2540X	3.30
R2615	0.67
RCA2060	2.00
RGP01-15	0.70
RGP10	0.30
RGP30M	0.28
RT402	1.58
RT905A	2.38
S1299	5.34
S2800D	1.84
S2802	2.90
S2818	4.05
S3702S	5.21
S40W	13.10
S6080B	9.98
SAB063	5.17
SAA1006	1.85
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SAA1025	4.40
SAA1024	2.81
SAA1075	4.25
SAA1121	7.44
SAA1124	2.45
SAA1130	4.99
SAA1174	7.77
SAA1250	3.95
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SAA5020	5.78
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SAB3209	5.82
SAB3210	3.10
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SAS560T	5.42
SAS570T	5.42
SAS570S	2.61
SAS580	2.85
SAS6600	1.33
SAS660	1.33
SAS6700	1.33
SAS670	1.33
SAS6710	2.21
SBA750	1.61
SC84203	19.35
SC9504P	1.95
SDA2006	17.95
SDA2112/2	10.28
SG264A	5.26
SG613	8.75
SG629	8.27
SG6533	10.31
SI1125H	7.50
SI1630HD	20.50
SKE2F1/04	1.39
SKE2G3/04	0.85
SKE4F1/06	0.35
SKE4F2/08	1.07
SKE4F2/06	0.80
SKE4F2/10	1.33
SKE4G2/02	0.96
SKE5F3/10	1.60
SKS1/10	2.15
SL1310	3.14
SL1430T	2.31
SL414	3.69
SL432A	3.44
SL439	2.48
SL471	2.88
SL480	3.14
SL490	2.37
SL901B	8.32
SL918A	9.07
SN16861AN0	0.82
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SN7408N	0.27
SN7410N	0.27
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SN7420N	0.34
SN7430	0.49
SN7440N	0.27
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SN7474N	0.44
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SN76023N	2.97
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SN76131	0.82
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SN76226DN	2.00
SN76228N	3.27
SN76242	5.23
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SN76396	2.90
SN76533N	2.47
SN76532N	0.91
SN76545	4.87
SN76546N	3.47
SN76549	2.45
SN76570	3.08
SN76611	2.59
SN76620	2.59
SN76660N	2.48
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SN76708	4.86
SN76709N	5.94
SN76707N	1.23
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SN76730	5.54
SN76810N	0.60
SN76832N	1.35
SN94041	5.54
SN94042	4.35
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ST1702L	0.99
STA401	2.50
STA441C	3.10
STA471C	7.95
STK0029	5.54
STK0050	7.72
STK016	6.91
STK022	5.25
STK031	12.95
STK040	13.34
STK054	3.95
STK058	27.50
STK077	7.67
STK1039	5.75
STK2110	7.33
STK2145	16.95
STK2240	16.65
STK2250	18.95
STK3042	4.95
STK3044	5.75
STK4019	4.50
STK433	4.78
STK4332	6.25
STK435	4.95
STK4352	1.95
STK436	7.21
STK437	7.50
STK4372	13.13
STK460	7.02
STK466	11.77
STK4833	9.52
STK501	6.32
STK502	7.25
STK5314	12.40
STK5730	3.20
STK7216	13.10
STK772	3.71
STR1096	4.98
STR4090	9.52
STR440	5.37
STR451	4.93
STR453	8.16
STR454	4.95
STR6020	5.85
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T6035V	0.73
T6036	0.67
T6037	2.11
T6044V	0.97
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T6052V	0.87
T6058	3.08
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T9003V	1.25
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TA7136AP	1.89
TA7137P	0.98
TA7141AP	3.87
TA7146P	4.23
TA7148P	1.67
TA7149P	3.26
TA7152P	2.72
TA7161P	4.50
TA7162P	3.61
TA7172P	1.41
TA7176P	1.75
TA7193P	4.80
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TA7208P	2.15
TA7210P	1.45
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TA7215P	2.58
TA7217AP	1.45
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TA7226	3.57
TA7229P	4.22
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TA7233P	3.46
TA7240AP	2.55
TA7245P	5.92
TA7310P	2.15
TA7313AP	0.65
TA7314	5.94
TA7323P	3.15
TA7325P	1.15
TA7339P	1.85
TA7340P	5.95
TA7607AP	2.10
TA7609	2.65
TA7611AP	2.32
TA7616P	5.25
TA7622AP	8.94
TA7628P	2.50
TA7629P	7.50
TA7630P	0.95
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TA7726P	10.25
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TAA930	4.87
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TBA480Q	1.30
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TBA570A	1.71
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TBA720	2.30
TBA730	3.55
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TBA940	1.87
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TCA750	2.25
TCA800Q	5.95
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TDA4620	6.73
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TDA8190	3.96
TDA9403	1.50
TDA9503	2.92
TDA9513	3.15
TDB1033	2.68
TDE1081	7.05
TEA1002	2.30
TEA1009	0.80
TEA1014	1.50
TEA1020SP	4.93
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TIC106M	0.77
TIC44	0.72
TIC45	0.56
TIC47	0.77
TIP120	1.55
TIP110	0.53
TIP112	0.34
TIP117	0.95
TIP121	0.40
TIP126	0.38
TIP132	0.99
TIP137	0.96
TIP29	0.84
TIP2955	0.86
TIP29A	0.46
TIP29B	0.63
TIP29C	0.40
TIP29D	0.75
TIP3055	0.66
TIP30A	0.41
TIP30C	0.40
TIP31A	0.34
TIP31B	0.38
TIP31C	0.30
TIP32A	0.35
TIP32B	0.46
TIP32C	0.28
TIP33	0.85
TIP33A	1.02
TIP33C	0.80
TIP34	0.75
TIP41A	0.49
TIP41B	0.31
TIP41C	0.68
TIP42A	0.60
TIP42B	0.79
TIP42C	0.82
TIP47	0.65
TIS43	1.43
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TL011CP	1.56
TL494CN	8.95
TL072CP	1.45
TMP4320	15.00
TMS1024NLL	10.50
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TMS3720ANS	5.25
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TMS5102NLL	6.25
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UPC1025H	2.90
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UPC1161C	4.98
UPC1182H	1.50
UPC1186H	1.05
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UPC1362	4.10
UPC1365C	2.50
UPC1366	1.65
UPC1360C	4.51
UPC1378H	2.44
UPC141C	4.95
UPC1458	2.00
UPC151C	2.95
UPC2002	1.48
UPC30C	2.51
UPC324C	4.70
UPC32C	4.95
UPC339C	4.35
UPC41C	4.10
UPC4558C	2.15
UPC474	5.11
UPC554C	1.85
UPC575C2	2.40
UPC580C	6.60
UPC587C2	1.34
UPC592H	2.15
UPC595	2.95
UPC596	1.98
UPD1514C	4.76
UPD2819C	4.98
UPD553-164	19.52
UPD8049C-1	11.50
X0022CE	5.75
X0029CE	7.09
X0031CE	6.32
X0035TA	6.18
X0040TA	4.50
X0042CE	4.35
X0043CE	2.75
X0056CE	6.25
X0057GE	6.00
X0065CE	5.77
X0074GE	10.00
X0077GE	15.96
X0079CE	4.95
X0092CE	4.95
X0096CE	5.95
X0109CE	11.25
X0113CE	2.07
X0195CE	7.50
X0204CE	8.74
X0261CE	8.98
ZPY120	3.25

IF YOU DON'T SEE IT LISTED ASK FOR QUOTE. GIVE MAKE MODEL LOCATION. REMEMBER TO ADD 0.60p POST & HANDLING. U.K. MAINLAND ONLY. HANDLING CHARGE TO ALL EXPORT ORDERS AT COST. ADD 15% VAT TO TOTAL

The Universal Frequency Response Curve

Stan Amos, B.Sc., C.Eng., MIEE

We are all familiar with the *RC* coupling arrangement shown in Fig. 1 and know that the value of the capacitor must be large enough to maintain the response down to the lowest frequencies required. Below this, the increasing capacitive reactance introduces a loss.

If the frequency response of this series capacitance/shunt resistance combination is plotted the curve shown in Fig. 2 will be obtained. In this both the horizontal and the vertical calibrations are logarithmic, frequency is in octaves and amplitude in dB. This being so, the curve becomes a straight line at the higher and lower frequencies. At high frequencies the line is horizontal, representing the level response required of most amplifiers. At low frequencies the line has a slope of 6dB per octave.

If these two straight lines are continued towards the centre of the diagram they will meet at a frequency where the curve has a 3dB loss: this is usually known as the cut-off frequency. At one octave above this cut-off frequency the loss is only 1dB and at higher frequencies the loss becomes zero. At one octave below the cut-off point the loss is 7dB, but note that this is 1dB relative to the straight low-frequency roll-off line. At still lower frequencies the curve merges with the straight line, the response falling at the rate of 6dB per octave.

At the cut-off frequency the capacitor's reactance is equal to its resistance. Thus $1/(2\pi fc) = R$, from which the cut-off frequency is given by $f = 1/(2\pi RC)$. Now *RC* is the time-constant *t* of the coupling circuit, so we can say that $f = 1/(2\pi t)$, i.e. approximately $1/(6t)$. This is interesting because it shows that the low-frequency response does not depend on the individual values of the coupling capacitor and the shunt resistor but on their product, the time-constant. So there's an infinite number of combinations of *R* and *C* that will produce the same frequency response. If the capacitor's value is doubled, the resistor's value can be halved without any effect on the response curve. If the capacitor's value is doubled while retaining the same resistance value, the cut-off frequency is halved, i.e. the amplifier's frequency response is extended downwards by one octave.

As a numerical example, suppose we decide that an a.f. amplifier should have a loss of less than 1dB at 50Hz. This means that the cut-off frequency is 25Hz and, from the above relationship, the time-constant is $1/(6 \times 25)$, i.e. approximately 0·007sec. Any combination of *R* and *C* with a product of 0·007sec will do. A bipolar transistor stage of the type shown in Fig. 1 has an input resistance that's largely determined by the active device itself. This might be say 1kΩ. Thus the coupling capacitor should have a capacitance of 7μF.

If the second transistor had been a field-effect type with a very high input resistance, the resistor after the coupling capacitor might be a biasing component with a value of say 1MΩ. To obtain the l.f. response just described, the value of the coupling capacitor would have to be reduced to 0·007μF.

The relationship between cut-off frequency and time-constant given above applies to an *RC* circuit but has universal application and can thus be used for inductive circuits as well.

The curved portion of the response shown in Fig. 2 sits symmetrically in the angle formed by the two straight lines. The curved part has a −3dB loss at the cut-off frequency, the loss (relative to the appropriate straight line) being 1dB one octave away, 0·5dB two octaves away. Beyond these points the curve merges with the straight lines.

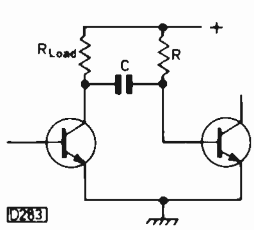
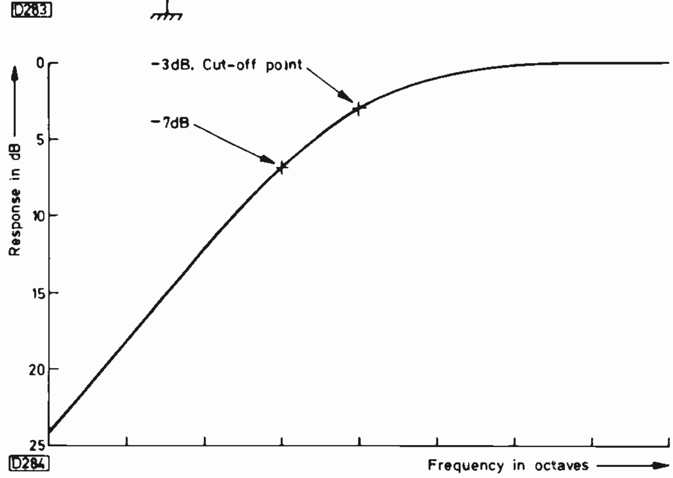


Fig. 1 (left): Basic features of a two-stage RC-coupled amplifier.
Fig. 2 (below): Low-frequency response of the amplifier shown in Fig. 1.



Universatility

Why is this curve so important? Because it applies not only to a circuit (e.g. Fig. 1) with low-frequency attenuation but to any combination of reactance and resistance, whether series- or parallel-connected. It's truly the universal frequency response curve, applicable to all the simple response shapes commonly encountered in electronics. The most familiar ones are the l.f. attenuation already considered, l.f. boost, h.f. attenuation and h.f. boost. These are all shown in Fig. 3.

For the frequency response characteristic shown in Fig. 2 to apply to all of these the horizontal scale must remain the same whether movement to the right indicates increasing or decreasing frequency. Similarly the vertical scale must represent gain as well as loss. Fig. 4 shows the universal frequency-response curve.

Bass Boost

As a second numerical example, suppose that we need to provide a rising low-frequency response as part of the tone control system of a hi-fi amplifier, say a lift of approximately 12·5dB at 50Hz. From the universal curve we can see that a 12dB lift at 50Hz corresponds to a lift of 7·5dB at 100Hz and 3dB at 200Hz. So 200Hz corresponds with the "cut-off" frequency, and this gives us a time-constant *t* of 1/(6f) = 1/1,200.

We could obtain the required frequency response shape from an *RC* circuit in the forward amplifying chain

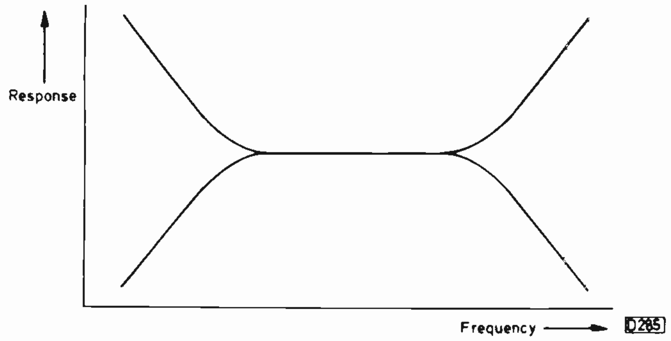


Fig. 3: Basic frequency-response characteristics.

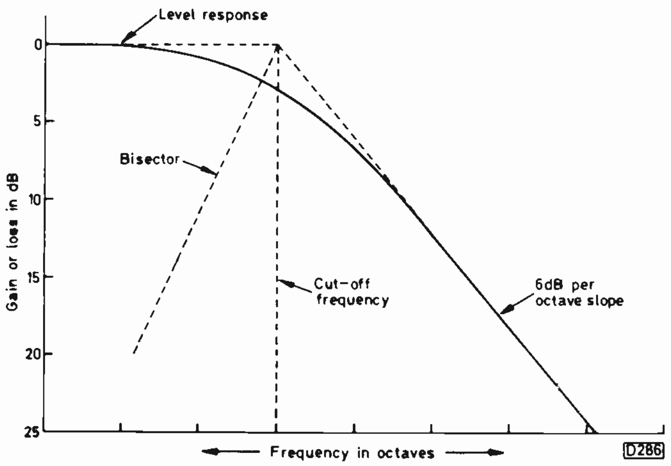
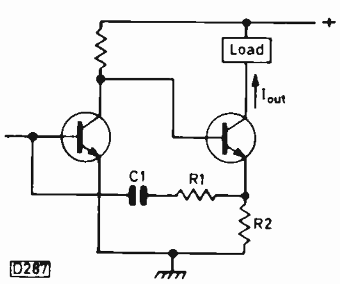


Fig. 4: The universal frequency response curve.



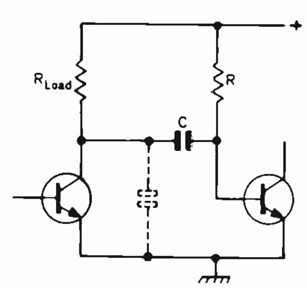
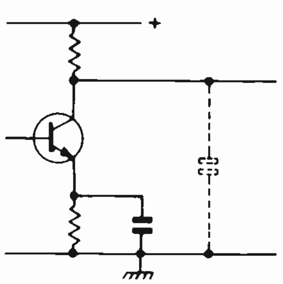


Fig. 5 (left): Two-stage current amplifier using frequency-discriminating negative feedback for l.f. boost.
Fig. 6 (right): The shunt capacitance that causes h.f. loss in a two-stage RC-coupled amplifier.



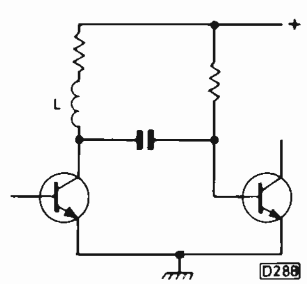


Fig. 7 (left): Use of negative feedback to compensate for h.f. loss caused by shunt capacitance.
Fig. 8 (right): Use of an inductor to maintain the h.f. response of a video amplifier.

of the amplifier, but an alternative method is to use frequency-selective negative feedback. Fig. 5 shows one possible way of applying feedback to a current amplifier. If considerable feedback is used, the gain and frequency response of the amplifier are dictated by the series connected components R1, R2 and C1. In fact the h.f. current gain (where the reactance of C1 is small) is given by R1/R2. The increasing reactance of C1 as the frequency progressively falls removes the feedback, giving the required lift. The time-constant controlling the frequency response is thus R1 × C1. So we have R1 × C1 = 1/1,200. If R1 is 50kΩ, C1 must have a value of 1/(1,200 × R1), i.e. 1/(1.200 × 50 × 10^3)F, which comes out at 0.017μF.

Parallel Networks

The two numerical examples considered so far have both involved series-connected *RC* circuits. Our next example involves a parallel-connected network and applies to the upper end of the passband. A simple *RC*-coupled amplifier of the type shown in Fig. 1 has an h.f. loss whose amplitude can be estimated by using the universal frequency-response curve. This loss is introduced by the capacitance that shunts the load resistor, effectively reducing its value as the frequency rises. There are three main components of this capacitance: the transistor's output capacitance, the following transistor's input capacitance and the inevitable stray capacitance. The total capacitance lumped together is represented by the single dashed-line capacitor in Fig. 6.

Because a transistor's input capacitance depends on the Miller effect and is not simply the physical capacitance between its base and emitter (or gate and source), it's not easy to estimate the value of this total capacitance. Let's assume however a total shunt capacitance of 30pF with a load resistor of 4kΩ. This results in a time-constant of $t = 4 \times 10^3 \times 30 \times 10^{-12}$sec, i.e. 0·12μsec. The corresponding cut-off frequency is $f = 1/(6t) = 1/(6 \times 0{\cdot}12 \times 10^{-6})$, i.e. 1·4MHz. At this frequency therefore the amplifier has a loss of 3dB and, from the universal response curve, the loss is 1dB at 700kHz, 7·5dB at 2·8MHz and 12·5dB at 5·6MHz. We are assuming that the gain of the transistors themselves remains constant at frequencies of this order – a fair assumption with modern devices.

The h.f. attenuation caused by the parallel *RC* network in Fig. 6 (from the a.c. point of view the non-collector ends of the load resistor and shunt capacitance are both earthed) can be compensated by using a parallel *RC* network in the emitter circuit to introduce negative feedback – see Fig. 7. It should be fairly obvious that for precise compensation the cut-off frequencies and time-constants of the two networks must be equal. Thus using the figures from the previous example the time-constant of the emitter network must be 0·12μsec. Suppose that the emitter resistor has a value of 500Ω. The value of the capacitor required in the emitter circuit is $t/R = (0{\cdot}12 \times 10^{-6})/500$F = 240pF.

Inductance

The method of calculating capacitance used so far applies equally to inductance. We'll conclude this article with an example. Inductors are not very often used to adjust the frequency response because they are fiddly to wind and respond to magnetic fields. Moreover the same effect can usually be achieved using capacitors, which are available in a wide range of values. Inductors are sometimes used in video amplifiers however to maintain the h.f. response. This forms the basis of our final example.

Fig. 8 shows an inductor *L* connected in series with a transistor's load resistor. We'll assume that the aim is to maintain a good frequency response over the video bandwidth despite the effects of shunt capacitance which, as we've just seen, produces a cut-off at 1·4MHz. To offset the effect of the capacitance, the *LR* circuit must similarly have a "cut-off" at 1·4MHz and the inductive time-constant must be equal to the capacitive time-constant, i.e. 0·12μsec. Now the time-constant of an inductive circuit is given by *L/R*. Thus the inductance required is $L = tR = 0{\cdot}12 \times 10^{-6} \times 4 \times 10^{3}$H $= 480\mu$H.

If this value was used in our video amplifier the results obtained would be disappointing – a check on the frequency response would show it to be far from level over the passband. This is because two important factors have been overlooked. The first is that we've not allowed for resonance. Since the inductance and the capacitance form a tuned circuit, by making both time-constants 0·12sec we've ensured that the resonant frequency is 1·4MHz – right in the middle of the video bandwidth. True, the 4kΩ load resistor in series with the inductor provides a high degree of damping, but the response curve will nevertheless have a significant hump centred at 1·4MHz.

To keep the boost to an acceptable level and ensure a reasonably level response the value of the inductance should be significantly less than the value worked out above. The mathematical concept of maximal flatness gives some idea of the inductance value to use. A maximally flat curve is one without maxima and minima, falling away from the ideal level response very gently as the frequency rises. This response can be obtained by using an inductance with a value of 0·41 of that previously calculated, i.e. 196μH.

The second factor overlooked so far is that with an amplifier designed to handle pulse-type signals the shape of the frequency-response curve is not the best criterion of performance. Phase response also matters, and to secure a good response with pulse signals it's useful to aim at securing a maximally-flat group-delay/frequency curve. This is attained by using an inductance value 0·32 times that initially calculated, i.e. 154μH. So an inductance value between 154-196μH would be suitable, suggesting a value of around 175μH. If inductive compensation is to be used a medium-wave tuning inductor could, if available, be used, saving a lot of work.

This final example of inductance calculation has led us into the further subjects of resonance and maximal flatness. It was worth including in order to illustrate the problems that inductors can introduce. The capacitive examples were straightforward and illustrated the simple method of calculating the component values required to obtain the desired response. The shape of the curve can be sketched once the cut-off frequency is known, the only figures required being the 3dB point (gain or loss at cut-off) and the 1dB gain or loss an octave away.

A Day in the Life of . . .

Les Lawry-Johns

I'd been at the shop on the previous day and decided to pay another visit after lunch to make sure that everything was all right and to attend to any customers. As there weren't many I thought I'd pop into the Coach and Horses next door to have a word with the landlord Dave. Perhaps he might know about the surveyor who'd called at the shop yesterday? I knew that he was looking it over on behalf of a building society, but didn't know who had initiated the interest. Dave's son had been looking around lately, and I felt he might know something. He didn't, so I sat back and started on my half of bitter, which is all I drink when driving.

A magician friend of mine sat nearby, with his daughter and her husband. I showed them the August issue which contained those lovely letters about my retirement. I've said thanks before for all your good wishes, but must do so again. I really didn't know you cared so much.

After finishing our drinks we went our various ways. Shortly after I'd returned to the shop Bob appeared. He looks after the radio bits and pieces at the local hospital and entertains the patients with music etc. With him was the hospital's ITT TV set which had given up the ghost. He plonked it on the bench and after removing the rear cover I switched it on. Apart from the degaussing buzz there was no response. It was an ex-rental set and I'd not seen one like it before, so I can't tell you the model number.

H.T. was present at the collector of the line output transistor, and when I went on to check the components in its base circuit the set started up. So I switched off and checked carefully for dry-joints. There were a few around the coil in the base circuit. After resoldering these and some more in the vicinity the set started up each time I switched on. I replaced the back and asked Bob for a couple of quid. He insisted on making it a fiver. So I wrote him out a bill and he carted the set off happily. That was about all the servicing required. A few friends popped in to pass the time of day, and shortly afterwards I locked up and drove back to the bungalow.

That was yesterday. I was up early this morning. Slide out of bed and step carefully over the dogs. Then start to dress, making a point of pulling my socks on whilst standing up. I'm determined to keep this up because when I have to sit down to do it I'll know I'm really getting old. Dressing complete, I walked up the road to collect the morning paper. We don't have it delivered to ensure that I keep active first thing. Back for breakfast and to feed the cat who won't live in the house but spends her time out on the roof of the shed. I hope she'll change her mind about this when winter comes. Spock's over sixteen now and won't last much longer.

After H.B. had departed on her morning's run around I looked out and saw someone familiar coming towards the front door. It couldn't be, but it was. Stan from SEME. He looked over the bungalow and the dogs didn't bark once. They know him well. After a few pleasantries Stan departed, without an order. H.B. returned shortly after and announced that one of her daughters wanted a remote control unit for her Philips TV set. So having seen Stan off I had to phone SEME for the unit.

Later another of H.B.'s daughters called, bringing with her an Alba PTV10 portable radio/TV set. I couldn't get a reading across the mains input, so I checked the transformer. It said there was a thermal fuse in series with the winding but I couldn't find it. In fact I destroyed the winding while trying to do so. Another order to make.

TEST CASE

322

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.

Reg runs a bed-and-breakfast guest house in a large coastal town nearby. It seems that his guests are becoming more and more demanding, especially those who book in advance. By all accounts, hot-and-cold in every room, sea views and lunches packed to order are no longer good enough. There must, for some guests anyway, be an en suite colour telly.

To meet the demand in the first floor front, Reg dug out an old TV which had been lying amongst the cots, teamakers and extra blankets in the lumber room. He'd had it mended a year or two ago but it had then developed a colour problem and hadn't been used since. Now here he was with the set, on our doorstep. Leaving a quick description of the fault, and a Bay View Guest House business card, he zoomed off in the direction of the sea.

The set was a Mitsubishi Model CT2023B, about six years old. It's problem was a bad colour "stain" in the picture, on the right-hand side about a third of the way up. Our first suspect was of course the degaussing system. A quick finger test was made on the degaussing circuit posistor R901. The fact that it was warm exonerated the degaussing system, which was indeed working correctly.

External degaussing was tried next. A mains-powered degaussing coil produced vivid and pretty patterns on the screen, but when it was withdrawn and switched off the colour stain remained as before. With a plain coloured raster you could see that the error was large but was confined to a small area, in which each electron beam spilled badly on to the phosphor of the others.

In this set the neck rings and yoke can be adjusted for optimum colour purity. We went through the procedure with little conviction – small but intense areas of bad purity are seldom affected by the setting of the tube neck's ring magnets. This was no exception. Setting up the purity worked in every respect apart from the problem area. After a couple more goes with the degaussing coil we decided that the problem was either in the deflection yoke or the tube itself, with the odds heavily on the latter possibility. A second-hand scan yoke was tried, not an identical one to the original but one that was sufficiently similar to prove the point. This it did: the yoke was blameless. By now it seemed almost certain that the cause of the problem was a localised defect in the tube's shadowmask.

A phone call conveyed the unhappy news to Reg. How and when did the fault arise we asked him? Apparently all had been well until the set had developed a sound problem, the details of which he couldn't recall. When the set was returned, the sound was fine but the picture problem had appeared. We came to the conclusion that the previous repairer had dropped the set when delivering it and had wrecked the shadowmask.

Thinking about this while he was driving home, the technician had a sudden thought – of such intensity that he turned around and returned to the workshop! Ten minutes later he emerged with a big smile. Well? See next month's *Television*!

ANSWER TO TEST CASE 321
– page 863 last month –

Last month's test case had John deeply involved with a Sharp VCR whose fault was intermittent shutdown during play or record. When it happened the tape and the spools stopped completely, as they would in the pause mode, with the head drum rotating. This VCR was not slyly entering the pause mode however: the cessation of reel sensor pulses sent the syscon into the emergency shutdown mode.

The initial theory of low take–up torque was wrong – if this had been the cause of the problem the capstan would have continued to operate, spilling tape into the machine. The ideas of excessive back tension or drum friction were nearer the mark, but tests proved that these were both normal. When he came to check the pinch roller pressure, a sensible move under the circumstances, John did what he should have done at the outset – he took a close look at the capstan and pinch roller. The cause of the problem was then immediately apparent. There was a great build-up of black gunge on the capstan shaft, thickest at points corresponding to the top and bottom edges of the tape. It was sufficient to hold off the roller from the tape's surface, so that the tape was not gripped tightly as it passed through.

In these circumstances traction depended on tape type, temperature, the time of day and Murphy. Loss of tape drive via the pinch roller stopped the reels, the syscon then instigating shutdown. A new pinch roller and a thorough clean of the capstan shaft, along with the rest of the tape path, restored normal working.

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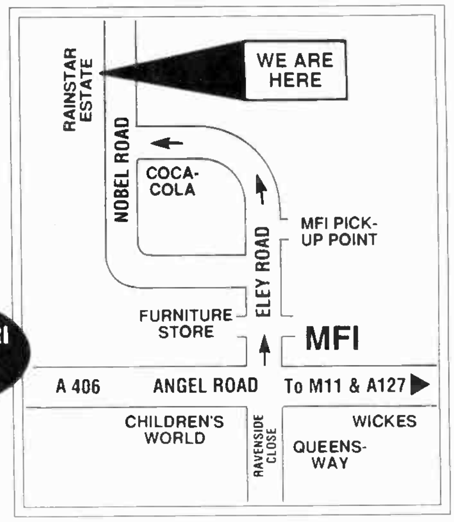

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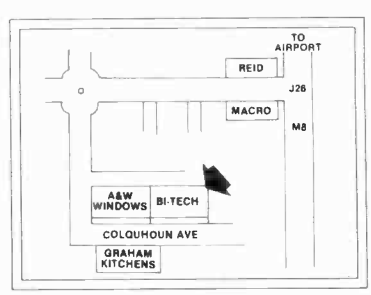

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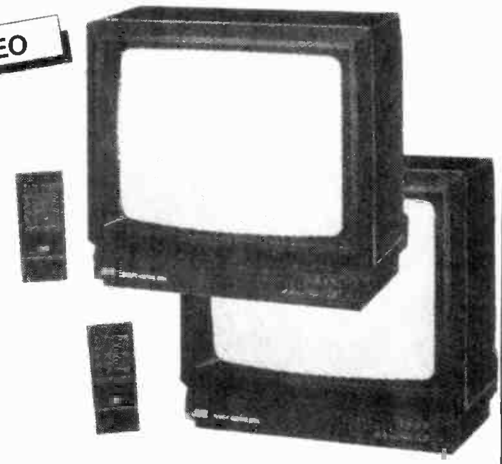

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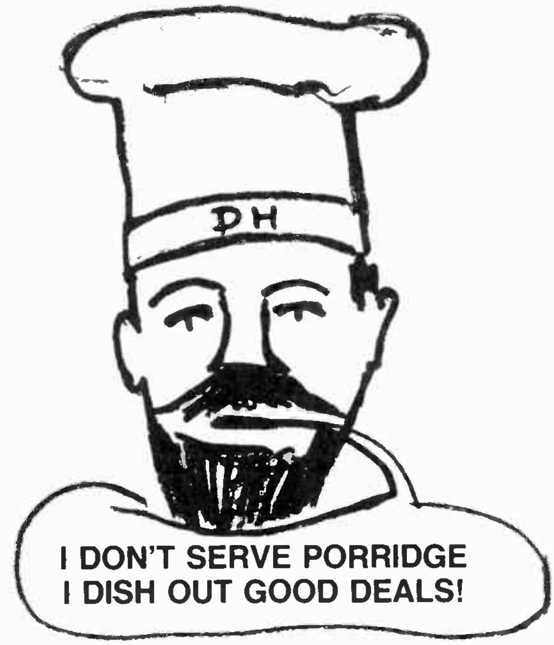

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AN271A	£2.50
AN274	£2.75
AN277	£2.50
AN295	£3.60
AN301	£3.50
AN302	£3.30
AN303	£2.75
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AN316	£3.75
AN318	£4.95
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AN362L	£1.60
AN363N	£3.50
AN366P	£1.70
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AN612	£1.80
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AN5151N	£6.50
AN5265	£3.20
AN5410	£5.50
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AN5512	£2.95
AN5612	£3.75
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AN5722	£1.60
AN5730	£1.85
AN5732	£1.85
AN5750	£3.75
AN5753	£1.95
AN6250	£2.30
AN6326N	£3.70
AN6327	£4.75
AN6328	£4.20
AN6330	£2.95
AN6340	£7.85
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AN6342N	£2.50
AN6344	£4.75
AN6350	£7.50
AN6356N	£3.85
AN6357N	£4.95
AN6360	£4.50
AN6362	£5.50
AN6363	£8.50
AN6371	£4.25
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AN6780	£2.30
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AN7178	£2.95
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AN7218	£1.75
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LA4430	£1.50

LA4440	£2.75
LA4445	£2.75
LA4460	£1.80
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TA7207P	£1.75
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TA7217AP	£1.60
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TA7222AP	£1.30
TA7223P	£2.30
TA7225P	£3.20
TA7227P	£2.20
TA7229P	£3.25
TA7230P	£1.95
TA7232P	£2.95
TA7233P	£2.95
TA7240AP	£2.95
TA7241AP	£2.95
TA7269P	£5.50
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TDA2611A	£1.35
TDA2653A	£3.80
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REPLACEMENTS

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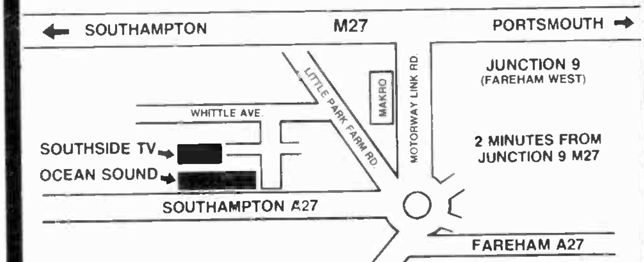

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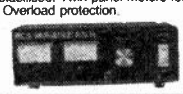

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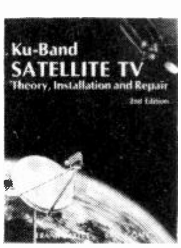

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R 2305	50p
R 2306	30p
R 2322/2323	pair 80p
R 2323	15p
R 2396	50p
R 2461	80p
R 2030	50p
R 2443=BD124	30p
R 2540	£2
R 2737	40p
R 2738=TIP41	30p
R 2775=TIP41c	40p
R 3129=TIP47	40p
R 4050	£1.00
S 2008b	80p
2SD898B	£1
2SC1942	£1
Hitachi sets etc.	
STR454	£2
STR6020	£2
S 2000AF line o.p.	£1
2SC940	£1
BU 105/04	80p
BU 108	£1
BU 124	50p
BU 126	80p
BU 180a	65p
BU 204	60p
BU 205	75p
BU 206	£1
BU 207	£1
BU 208	80p
BU 208A	75p
BU 208D	90p
BU 222	£1
BU 326	£1
BU 407	60p
BU 426A	45p
BU 426V	60p
BU 500	£1.10
BU 500D	£1
BU 508A	90p
BU 508V	£1
BU 705	£1
BU 806A	£1
BU 807	£1
BU 824	50p
BUT 11	50p
BUT13 600V-28A	£1
BUW 11	50p
BUW 84	60p
BYW 20-08-9	£1
BYW 95	10p
BUX39 25A-150V	£1
BUX84	50p
BUX85	50p
BUY49	20p
TIC 106a	30p
TIC 116m	30p
TIC 116n/Y 1003	30p
TIC 126N	30p
TIC 225S	30p
TIC 226E	30p
TIC 226m	30p
TIC 236m	30p
TAG 226/600	30p
TICV 106D (T092 case 2A/400V)	10p
TIP 29	25p
TIP 30	25p
TIP 30A	25p
TIP 30B	25p
TIP 30C	25p
TIP 31	25p
TIP 32	25p
TIP 33B	50p
TIP 33C	70p
TIP 34A	50p
TIP 34B	60p
TIP 34C	70p
TIP 35B	50p
TIP 35C	70p
TIP 35D	80p
TIP 36	50p
TIP 36C	70p
TIP 41	15p
TIP 41B	40p
TIP 41D	70p
TIP 42	10p
TIP 42/BRC 6109	10p
TIP 48	40p
TIP 49	30p
TIP 57	30p
TIP 110	20p
TIP 100	30p
TIP 102	30p
TIP 115	50p
TIP 117	50p
TIP 125	35p
TIP 126	40p
TIP 127	40p
TIP 130	30p
TIP 131	6p
TIP 136	30p
TIP 140	50p
TIP 142	80p
TIP 640	50p
TIP 2955	35p
TIP L761A-1000V/4Amp	75p
T 6032	30p
T 6036	40p
T 6040	40p
T 6047	40p
T 6049	40p
T 6051	40p

T 6052	40p
T 6054	40p
T 6068V	50p
T 6070V	£1.00
T 9004	40p
T 9005	40p
T 9051V	£1.00
ZTX 107	10p
ZTX 108c	10p
ZTX 109k	5p
ZTX 213	5p
ZTX 341	10p
ZTX 342	10p
ZTX 384	10p
ZTX 451	10p
ZTX 550	10p
MJ 2253	60p
MJE 3040	60p
MJE 2209	10p
SP 8385	50p
SAB 3205	£1.00
SAB 4209	£1.00
300M + 700 320V	£1.80
200 + 100 + 100 + 50 300V	50p
150 + 200 + 250M 300V	50p
Computer Transformer 20v/2.25A; 20v/1.5A; 17/.5A; 19/.5A; 28/.05A	£3

PHILIPS METERS

4T5003-SBC 851 Analogue Multimeter **£22.00**

GEC

20AX MkI Power Supply PC818 **£10**

Voltage Regulators

+5V/UA78PO5SC	30p
−8V/79M08c	30p
+6V/78M06c	30p
+10v/78LA10	20p
LM 317T	30p
LM 337	30p
LM 342/18	30p
LM 340T 5.0	50p
+12V/LM 340T12	50p
+18V/MC78M18	20p
+24V/78M24	30p
MC 7724cp	40p
MC 7824	40p
TIS 90	10p
TIS 92	20p
TIS 93	20p
U 19885	40p
U 3832	15p
U 3845	15p
MR 508	10p
MR 501	10p
MR 502	10p
BCW 71R	30p
BYF 1202	10p
BYF 1204	10p
BYF 3126	40p
BYF 3214	40p
BYX 10	10p
BYX 36/600	35p
BYX 38/300	25p
BYX49/600R	75p
BYX 55/350	10p
BYX 55/600 (Bead)	10p
BYX 71/350	20p
BYX 71/600	50p
BYX 72/300	20p
BYX 36/600	50p
BYV 95B	10p
BVY 95C	12p
BYV 96D	10p
BYZ 106	10p
BPW 41	15p
BYW 56 2A/1000v GII	8p
BYW 29/50	15p
BYW 95C	10p
BZU 15/24	54p
BZY 93c75	50p
BZV 15/18	30p
BZV 15/30	30p
BZW 70c6v2	10p
BZX 79.3v	10p
Bush thyristor RCA 76122	£1
Transformer 240v/20v-500Ma	75p
Chassis type Transformer 240v/12 Volts 500m/a	75p
CVC 20 tube base	£2
Tube Base Rank & GII	£1.20
Infra red led LD57CA	15p
15K-20 turn pots	20p
Thorn 3500 2A cut out	50p

BRIDGES

KBL 005	30p
KBL 02	30p
KBP 04	30p
W02	15p
W004	15p
W005	20p
800V Bridges 2½ Amp	30p

MAINS MICRO SWITCH

GEC & Double etc. **£1**

Varta Batteries 2.4V 100M/A	50p
TV Battery 1.2V NC. 2.4V NC.	50p each
4 amp-1.2V Nickel Cadmium Battery D Cell	£1.00
3.25V Battery	50p
12V Video Battery Packs 4Amp U2 Cells	£10
24V 4Amp (100VA) Trans	£4.00
Mains 240V (100VA) to 240V out fully shrouded	£5.00
ITT CVC45 8 way resistor unit for v/cap	£3
CVC40 8 button unit with mains lead & slider pots with sockets	£10.00
Book on An Introduction to Satellite TV	£5.95 No VAT
Book TV DX Handbook by R. Bunney	£5.95 No VAT
Electronics Hobbyists Handbook	£4.95 No VAT

NI.CD 5 Hours Battery Charger with battery test	£6
Hill Deluxe Universal Ni-Cad Charger	£6
Nickel Cadmium Battery Charger AA-C-D-PP9	£4.50
12 Volt Aerial Changer over Relays 144 Mc/s 45 watts	50p
6 Push Button Unit for GEC 2100 Series Replacement for Touch Button Unit	£8
8 SEG LED Display with driver I.C. LM1017	50p
PHILIPS' MIN. HEAD PHONES	£1.50
Electronic Buzzer 6 volt, 12 volt	40p
15V, 015V, 1A Print Type Trans	£1
12v DC Relay 1½×1½×2 print type 10 amp D.P. Changeover	£1

Regulated Power Supply 3-12 volts 1 amp in box with switch and mains lead	£4
Philips' Video Cleaning Cassette SBC461	£6
Philips' Headphones Compact Disc Stereo Type	£10
ITT Display Tuix 58705	50p
8 Seg Display FND500	20p
Model 3000 Pocket Personal D.M.M. Volts range AC, DC 200M/V to 400V R 2000Km	£20
Export PYE731 6 Push Button unit with (UHF-VHF) band switch	£4
ITT Micro Phone M5 50p with switch	
1½ Volt Sub Min Relays	25p
Philips Solar Scientific SBC1730 Calculator	£12
15v-0-15v 1 Amp Transformers	£1
RGP30K	10p
RGP30G	8p
RGP10B	5p
RGP15	10p
RGP15G	6p
T6024WGI	10p
GP10	5p
GP15Q	5p
THORN RGP80G	30p
DUBLE 7 SEG Displays	15p
FNS 26RA	or 10 for £1

Philips Digital Multimeter with memory and auto ranging 5BC812 **£63.00**

PHILIPS 25 Watt Solder Iron **£4.00**

Various Tools and Accessories

Self adjusting cutter stripper	£5.00
10 mixed tube bars	£4.00
5000 Diodes-Resistors	£3 pack
T/V V/Aerial 300Ω or 75Ω	£1.50
* D/P push mains switch	20p each
Mains lead & two pin socket for radio cassette	35p
T/V loop aerial	75p
Radio Telescopic Aerial	£1.00
Philips Neon Lamps for TV sets	5p
Freeze Philips	£1.20
Foam Cleaner Philips	£1.20
Contact Cleaner Philips	£1.20
Cans of Anti Static, Degrease Cleaner and Anti Corona	All at £1.40
Lorlin Full Remote Relay Switch fit most T/V sets, mains 4 tag, 2 tag 12 volt	£1.00
Mains timer. 13 amp — up to 2 hours: easy to use, plugs into socket	£3.00
Screen locking agent, large can	£1.50
Red E.H.T. LEAD and Anode Cap	£1.00
Weller solder iron 25 watt	£4.00
Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V	60p
100 Coax Plugs	£12.00
De-solder pump + 2 nozzles Philips	£4.00
Flat Red LED and Green	5p
500gm 60/40 solder reel	£6
Solder 1 kilo reel	£5.50
Dual v/u meter -20 – +10db	£1
K30 thermistor 23226629809	75p
De-solder Pump	£2.50
Portasol Flameless Gas Soldering Iron	£16.00
Green & Red. LED pack mixed	100 for £1.00
Hill Meter Leads. S/Rubber and Probes	£4.00

HILLS

Miniature Linesman Pliers	£2.20	Miniature Pliers	£2.20
Miniature Side Cutters	£2.20	Miniature End Cutters	£2.20

KT3 PANELS

Sound Output RGB Output Chroma Panel, I.F. Panel and Line OSC **£7.00 each**

PYE 6 Key Switch & Panel GII Front Panel	£10
SONY 1400KV Chroma Panel	£6
SONY 1400KV Touch button unit	£3.50
GEC Decoder Panel PC772A3 PC446A5	£6
12 Volt Mains Trans 500M/A	£1.00
NEW TX9 CHASSIS New Type Thorn	£15.00

Quantity Reductions

BY204/4	25 for £1.00
BY206	25 for £1.00
KT3 touch button black	6 for £1
GII touch button red	6 for £1
K30 full remote Dawer Ass with 3 I.C.	£7.00
K30 VHF. UHF Dawer Ass	£6.00
BY298 3 amp/fast/R	20 for £1.50
BU126	10 for £6.00
BU205	10 for £8.00
BU105	10 for £6.00
BF458	10 for £1.00
BF224	20 for £1.40
OA90	40 for £1.00
50 Ceramic Condensers	£1.50
Mixed Mounting Kit for Power Transistors	50p
300 Condensers	£1.50
300 Resistors	£1.50
150 Electrolytics	£2.00
15 Bulbs Philips	40p
GEC-Hitachi Thick Film Frame	£5

SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

MOD KIT PHILIPS VHS VCR

VR6467 or VR6760 and derived types gear box **£19.50**

Mixed Packs

TO66 12 Power Trans RCA 16182 NPN Replacement for BD124 and Mounting Kits	£1.00
25 Panel Mount Bulbs & Neons	£1.50
10A	£1.50
25 LED red/yellow/green	£1.50
20I/C Holders	£1.20
20 Large LED Red	£1.00
20 Small LED Red	£1.00
10×20 Turn 100K Pots	£1.00
Red & Green LED on Panel	1p each
Mixed 100 Transistor B.F. and B.C. and PET £1.50	1000 for £10.00
12 Volt 4 Amp Video Battery Pack 10 of Type D Cells	£8.50
40 glass reed switch	£1
10 press to make switch	70p
40 Pots	£1.50
With Focus Pin. 10 Tube Bases, mixed	£2.00
1,000 Diodes, Condensers, Resistors on Bandolier	£1.00
20mm Fuse Holders Chassis Mount	20 for £1
EHT Diodes, small	20 for £1
300 Mixed Diodes	£2
100 500M/A Fuse	£1
Mixed V/Cap Pots ITT-GEC-Hitachi-Philips etc.	20 for £1
ITT Mains Switch with Remont CMC113	£1
12v DC relay 1½×1½×2 print type 10 amp D.P. change over	£1

SENDZ COMPONENTS
TO ORDER SEE BACK PAGE

LA11440 £1

TAA7750 50p
HA 411485 £1
UPC1373 50p
M58657P £1
M491BB1 £3
M50441/550 £1
M58658P £1

Receiver TX100 Panel
I.C. No. SAB3035
—MAB8440P D066
—SAA1060
—PCF8571P

New Model Philips Meter £25.00

C. Cam Decoder with TDA3591 £5
Toshiba VHF/UHF EG522F £6

Mitsumi MEC1-F51 £5

Thorn Spares
New 9000 Decoder £8.50
9000 Frame panel £8
9000 Cyclops panel £1.50
8800 convergence panel £6
8500 convergence panel £6
4000 Power supply £3
1600 Mains lead, switch
1605 TxNPN T066 80v/6A 10p
9000 Sound output panel £1
3500 Focus unit £1.50
3500 Mains Trans £4
3500 cut outs 10 for £4
3500 IF panel £2
3500 Frame panel £3
3500 A1 Diode 20p
4000 Tube base £4
3500 A1 pots 50p
Beam limiter panel £1.50
3500 Power panel with Y969 £1
3 Way regulated adaptor 240V 6V/7.5/9V/300mA £3.50
Rank Toshiba preh unit 0354 £9.50
4 Push button unit preh £1.00
6 Push button VHF/UHF for v/cap. GEC-Decca type £7.00
7 Push button for CVC5 ITT £8.00
KT3 12 Push button unit £2.00
KT3 (Export) 12 P.B.u £2
6 Push button Unit Thorn £1.00
6 Push button GRC £6.00
6 Push button PYE 731 £6.00
Hearing aid unit £3.00
Rank Z718 4 P/B/Unit MECH £4.00
7 Button Unit GEC with Lamps £7.00
697 Push Button Unit £6.00
Z916B panel £5.00
T513AP panel £5.00

Video Tuner
V 6100/05 T/V and Tel/Text unit and hand set £90.00
Send for data

TT14 GEC TEX-DECODER
13 IC Panel with cable form £9.50

PHILIPS
K40 Text Panel £8.00

KT3-K30
OF-425
OF-550 E.W correction 10p
OF-513 10p
OF-557 50p

DIODES
BY 126 10p
BY 127 10p
BY 133 10p
BY 134 10p
BY 176 25p
BY 179 40p
BY 184 25p
BY 187 10p
BY 190 40p
BY 196 30p
BY 198 10p
BY 204/4 8p
BY 206 – BY 407 Eqv. 8p
BY 208/800 8p
BY 210/400 5p
BY 210/800 10p
BY 223 60p
BY 224/600: 4 8A/600v bridge 50p
BY 226 15p
BY 227 15p
BY 228 1500v 20p
Flat BY229 black 15p
BY 299 Red 20p
BY 229/400 30p
BY 299/60p Tag 30p
BY 237 5p
BY 254 10p
BY 255 30p
BY 298 10p
BY 299 10p
BY 406 8p
BY 527 20p
BY 407a 10p
BY 448 10p
BY 527 10p
BY 602 10p
BYV 26C 10p
F 247 10p
GP20G 5p
GRP80G (TX10) 30p
XK 3102 50p
BYV 28/200 20p
Bridge TX10 800/3 amps 30p
KBPC35-02 Bridge £1.50
Bridge Rec D35B10 40p

K35 Decoder £8.00
K35 Sound OP £4.00
Thick Film Daughter KT3 3122-127-43891 £3
12 CH K30 Tex Rec Front Panel with IC £5
K35 IF £5.00

Plug In
K4 Focus Pot £1.00

Fidelity Tube Base with transistor & focus pot £1.50

Bush Tube Base on panel £1.00

TX10 Tube Base on Panel £3.00

1100 L O P T Green Spot

TX100 Thorn

Line Transformers
G8 Lopt £5.00
G9 Lopt £4.00
6 Diode Tripler, Mullard 75p
Line O/P Trans Mono TX 12"-14"
Philips G8
27482 £10
4822 £10
10273 £10
Thorn 1690 LOPT £7.50
2 1 Pots 3,500 Loff each type £3.00
G8 Trans Philips £7.00
G11 Split Diode £12.00
CVC820 Split Diode ITT £10.00
Thorn B/W AD5308F + Stik + Lead £1.50
GEC 2040 £3.00
GEC 2110 £7.00
Mullard A1 2036 £1.50
Pye 169 Line Trans £3.00
Pye mono £3.00
Rank mono T704A £3.50
Split Diode Trans £7.00
GEC 20 AX Rank Z522 £3.00
Rank L O P T Z970 £3.00
CVC800 Line Trans £6.00
CVC825 Split Diode £10.00
CVC 45 £5.00
GEC Portable G1OT2041 £3.00
GEC Portable G1OT2046 £3.00
EHT Split Diode Leads ITT £1.00
3500 L O P T & HT Trans each £2.00
LOPT Rank Z763 £5.00
K35 Split Diode 3122/13835930 £10.00

Universal Tripler
with small focus pot Green type £7.00

Black Triplers
KT3 Triplers £6.00
STC Universal Tripler £6.00
11 TJJ £2.50
11 TGA £2.00
ITT CVC 5-8-9 £3.50
Rank T25LE Tripler £2.00
Rank 11TCP A823 £3.50
TU 25 30K Rank £3.00
11 TEZ Rank £3.00
G9 Philips £4.00
GEC 2110 £4.00
3500 Thorn £3.00
8500 Thorn £4.00
9000 Thorn £7.00
9500 Thorn £4.50
9600 Thorn £4.00
2040 GEC £3.50
GEC TVM25 Tripler £2.00
Universal Tripler £5.00
G8 Tripler £5.00
CVC20-32 £5.00
Decca 80 100 £4.50
Grundig TVK 52 £2.50
11TBQ Pye 731 £3.00
11TTY £4.00
D22 for Pye 18" colour portable £4.00
LP 1193 63 £4.00
BG 100 41 £3.25
EKO Tripler print type with focus PO7 BG2087 £5
I text ultrasonic rec'r panel £14.00
12-14V 20 for £5.00 200 for £25.00
GEC 8 touch unit assy complete with all ICs + pots £4.00
G11 E W Transformer 50p
G11 E W coils £1.00
G11 Transient Suppressors 245V 20p
G11 Scan Coils £5.00
G11 100K tuner pots 12 for £1
KT3 IF panel £6.00
KT3 line OSC transformer £1
KT3 K30 infra-red receiver head £1
K30 drawer unit with IC's (home) £10
K30 drawer unit with IC's (export) £10
KT3 AE Sockets 50p
KT3 receiver panel £8
KT3 line driver transformer 50p
Pye K30, GEC etc Pre-mains stand-by switch £1
Decca 80 100 IF panel £5
NPN PNP 80V 6 Amp TO66 O P Trans pair 25p
5 button touch tuner BBC1 2 ITV1 2 video with ic SAS 560T 570T £7.00
Control panel 5 sliders + mains lead £1.50
G11 8 touch button unit replaces old 6 P B U £24
Tube base + base unit for 820 Euro chassis £4.00
GEC Line O P Trans & Rec Stick for Portable £3.00
CVC 20/25 30 35 40 decoder panel £10
CVC 20/25 30/35 40 decoder panel (untested) £5
CVC 40/45 IF panel £5
40K Transducer 50p
PHILIPS NE511N £1.20
LM337M Reg 30p
20 GEC Black Spark Gaps £1.00
KT3 Front Panel Control Assy £2.50
BTW 30 50 50p

International Rectifier EHT Diodes G770/HV34 6KV 3 for 8p
6A/600V Stud Diodes 20p
6A/1000V Stud Diodes 20p
BTW 92 800R £3
25A473 PNP C/P 10p

Thorn TX90 Chassis with Line Linearity Width P C B PC1183 £20.00

S4471 £1.00
2SD1878 £1.00
TDA8443/C3 £1.00
TDA3506 £1.00
SAA5241 P/A £5.00
SAA7020 01 £3.00
HD614080SA90 £4.00

225m + 25m 380v £1.00
220m 385v £1.00
240m 400v £1.00
G11 470m 250v £2.00
400m 400v £1.00
175m/100m 100m 350v £1.00
TX9 500m + 500m 175v £1.00

C7 Hand Set £6.00

G8 LOPT Panel £7.00
G8 Tuner Unit + Panel £4.00
G8 IF & Chroma £6.00
G8 Chroma £3.00

G11 Chroma Panel £4.00
G11 LOPT Panel £6.00
G11 IF Panel £5.00

G11 IF Detector £3.00
G11 Selector gain module £3
Pye G11 Front panel with transducer, pots, tuner pots, 6 pb switch+lead £5.00
Pye 6 button switch portable £1.00
GEC V cap VHF/UHF tuner and IF + sound O/P PC 706B3 (Export) £12.00
GEC Line O/P PC 659B3 £6.00
2110 GEC Power Panel £8.00
CVC 20 Front panel with sliders + mains input panel £4

CVC 40 PUSH BUTTON ASSY with sliders complete with lamp assy + pots 8 button units £9.00
Universal Focus Fits Pye, Thorn and Decca Units
T147 Rank tube base on panel £1.00
Z718 Focus Unit £1.50
T20 Focus Unit £1.00
Large Type 75p
Decca Small 75p
KT3 Focus Unit 75p
K30 Focus Pot 75p
K30 Tube base on panel £1.00
TX10 Focus Units £8.50
CVC 32 Focus Unit 75p
Fidelity Focus Unit 14R–14S 30p
3500 Thorn Focus Unit £1.00
ITT Small for use with Split
Z718 Bush Focus £2.00
Diode 50p
Remo TV12SP 50p
1600 Thorn EHT Rec and Lead 50p
TV14 50p
TV20 £1.00
TV45 50p

TX9 8 Button Unit £6.00

TX90 8 Button Unit £6.00

TX90-TX925 8 Button

TX100 8 Button Unit £6.00

TX10 8 Button Unit £10.00

TX10/TX100 16 Button UHF-VHF BAND S W £10.00

G11 drawer ASS 3 pots Mains switch and lead £2.00

K30 Drawer Ass with pots cable forme £1.00

TX10 Drawer with 8 way pots. ass £2.50

TX10 Ex port with band switch (drawer) £2.50

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

Hills 9 piece tool kit in case £5.00

Abbey Security Smoke Alarm Model 101 £5.00

Philips Coaxial Cable Stripper SBC325 £7.50

560M 400V £50p
420M 400V £1.00
470M 380V £1.00
220/400V £1.00
1200PF 15KV 10p
01 2KV 10p
150m-385v 50p
1000m-160v TX90 £1.00
1+1 MFD Mains Filter ITT 3 Pin 15p
1 100 × 10 30p
22/100 10p
4 7M 100 6800pf-1000v 5p
470/100 20p
4700 100 75p
47/160 10p
300 300/300V in 1 6KV 80p
800/160 50p
1 250 Pulse 5p
2.2 250v 10p
7N5 1500V 15p
3n3/250 A C 10p
33 250V 20p
39 250V 15p
4n7/250 tested KV 25p
22 250 15p
47/250 10p
100/250 20p
GEC600 250 60p
700/250 £1
2 200PF-2Kv 10p
300+300 MFD 350v £1.00
800/250 40p
32/300 20p
4 350 5p
8 350 8p
4 7M 350v 10p
33 350 20p
220/350 30p
300/350 40p
400/350 50p
22/375 15p
220/385 (ITT) 75p
330/385 CVC 820ITT 60p
0 1/400 15p
K13 E/W 39/400 15p
56K 400v 20p
4700pf/400 10p
.22/400 10p
8/400 15p
33/400 20p
400/400 40p
394K 400V 20p
1000m-160v £1.00
220/450 40p
47/500 25p
0 1/600 15p
0 1/1200V wire end 20p
0 1 450 A/C wire end 20p
22/1000 20p
047 600 15p
0 047 1000 10p
0 01 1000 10p
0 11 1600v
150m 385v £1.00
47/1000v 65p
47/250V A.C 10p
001K 1250 10p
0.0047 1500 10p
005 1500 10p
0105 1500 10p
1n8/1500 15p
2n2 1500 15p
01/1600 15p
G11 8200/2KV 15p
0.1 2KV 20p
3n9/2KV 15p
0.0015 2KV 10p
6n2 2KV 15p
2n2 2KV 15p
470pf 4KV 10p
7500pf/2KV 10p
3000PF 3000V 10p
4n7 2KV 15p
6n2 2KV 10p
7n1 1500V 10p
8n2/1500V 10p
9n1/2000V 10p
8n2/2KV 10p
0 0082 2500 15p
150/3500 10p
1800/4KV 5p
4.7nf/5KV 10p
170/8KV 10p
180/8KV 10p
210/8KV 10p
1000/10KV 10p
47 100V 80p
Tube Thermpath 167 £1.00
Rank Secam Decoder Panel UHF & VHF 1115A £13.00
10 off 91 CAP G11 £2.00
Philips K4 CAP 150M 385V 50p
Philips Coaxial Cable Stripper SBC325

CVC 20-25-30 Mains Switches 60p
Infra Red and Ultrasonic G11 Teletext Decoder Panel £30
RANK & ITT Mains Remote On-Off Switch (720R) £1.50
RANK & ITT Remote Switch 2800 ohm £1.50
G11 Mains Switch 50p
4 amp Mains Switch 25p
GEC Mains Switch 4 amp 30p
KT3 Mainswitch £1.00
G8 Mains Switch 75p
G11 Preh Red LED P/Button for C.H. Change 20p
RANK TOSHIBA Transductors TPC 2011 50p
Mains Switch ITT Long Type Print 75p
Mains Switch Philip Long Type TAG 75p
Mains Switch GEC Long Type TAG 75p
2000 Chassis Fidelity Mains Switch (4 TAG) 60p
250V/4A White Lorlin Mains Switch 60p
KT3 K30-K35 Full Remote Mains Switch (6 TAG) £1
Teletext Adaptor Kit TY-500 Panasonic £12
Philips Battery Tester All Types and charger vis £6
Philips K4 Mains Switch with standby 80p

SENDZ

Philips Handset IC £3.00
SAA3010P £3
MAB8461AW063 £3

MAB 8420P C031 £3.00
MAB 8400B 6 £3.00
MAB 8440P-D070 £3.00
MAB 8440P-D033 £3.00
MAB 8440P D056 £3.00
MAB 8441P 1001 £3.00

M58484P £2.00

Hand Sets
Fidelity
£15.00 to £35.00

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

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

CMC 302 Panel with IC mains switch etc £5.00

CMD 800 Decoder £8.00

G11 £1.50
TEC Receiver Panel

3 IC Power Supply G11 Full Remote Receiver Panel £3.00

PHILIPS SBC 469 Stereo Microphone £23.00
Meters Hills 520 £17.00
Meters Hills 420 £10.00
Hills HD5000 Digital Meter 1000V DC 750AC 10 Amp 20 MRG Ranges £28

ITT 100 Multimeter £6.75
HT 300 Multimeter £7.75
HT500 Multimeter £9.00
HT700 £15.00
HD1000 Digital £20.00
HD3000 Digital £25.00
HD5000 Digital £25.00
HD5500 £29.00
HD6000 Digital £32.00
HD8000 Digital £37.00
HD9500 Digital with capacity Temp Trans Volts Ohms and Amps ranges £60

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

Handset Tester with LED £4.50

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

RC4001 Full Remote KT3 K30 Teletext Handsets exchanged £15.00

NEW Type RC4001 9 CH not 12 £6.00

GEC Full Remote Infra-red, 1983 models £15.00

TOSHIBA HAND SETS
CT918S £7.00
CT9176 £7.00
CT9133 £7.00

Rediffusion MK3 £5.00

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

THORN
VCR Front Display Panel £7.00

Large type ITT TV and VCR Handset £15.00

GEC Ultrasonic 8CH Full Remote £10.00

G11 Full Remote Ultrasonic £32.00
G11 Ultrasonic Teletext Handset £20.00
8 CH Ultrasonic GEC Full Remote C2014H/C2219H
New Replacement for G11 Ultrasonic Full Remote £12.00
Thorn 4000 insert with 7 buttons £5.00
Decca RC 11 £14.00
Decca RC 12 £14.00
G11 Infra-red full teletext £20.00
Dynatron-Full remote CTV 62 63 64 £19.00
Hitachi infra red handset £18.00
Philips full remote KT3, 16C928/20C934 7228 7324, K12 26C 797 1S1 66K 1826 £12.00
G11, Full remote top button assy £12.00
G11, Full remote repair service (exchange unit) £18.00
GEC infra red full remote 8 channel (IC SAA1250) £14.00
Philips infra red full remote 9 channel for 60 CP2605 £6.00
Philips infra red full remote 12 channel for 60 CP2605 £12.00
K35
KT3/K30 T'Text £12.50
KT3/K30 Full remote £15.00
KT3 Power supply £4.00
GEC infra-red 2236-2026 £4.00
GEC 8 button full remote £14.00
GEC push pad handset button blobs 10p each
Pye & Philips handset KT3 K30 chassis No RC5150-RC5176-RC5171-RC5177
Special Price £13.00
RC4001 KT3 and Teletex £14.00
IT CVC 32 handset repaired £15.00
CVC 32 Hand Set £15.00
CVC 45 3 and 2 Pin
TX10 Hand Set Text £12.50
TX9 with Text £12.50
TX9 & TX10 button print £2.00
TX10 Focus Pots £5.50

ITT
TV & Video Processor 1200 Type £10.00

PHILIPS
UNIVERSAL HAND SET £12.00 RC5
KT3 – K45

We have all parts for Philips Handsets

RC 5353 £15.00
RC 5300 £12.00
Philips RC5 £15.00

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

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

PHILIPS
RC 5171 £12.00

K35-K4 HAND SET
Repaired for £5.00