JULY 1990

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TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

De Luxe Component Tester Project
The Ferguson FV30's Chopper PSU
Philips' BSB Receiver • DX-TV
CD Player PS and Control Systems
TV Fault Finding • VCR Clinic
Test Report • CD Player Casebook

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TELEVISION

July 1990

Vol. 40, No. 9
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On sale June 20th

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

INDEXES AND BINDERS
Indexes to Vols. 36 and 37 are available at 80p each from the Editorial Office (address above).
Binders that hold twelve issues of *Television* are available for £4·50 from Television Binders, 78 Whalley Road, Wilpshire, Blackburn BB1 9LF. Make cheques out to "Television Binders".

SUBSCRIPTIONS
Annual subscription £20 UK, £24 overseas by surface mail (air mail rate on application). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

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

this month

OUR NEXT ISSUE DATED AUGUST WILL BE PUBLISHED ON JULY 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	5p
BA157	12p
BA526	188p
BB105B	18p
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BDW94	50p
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TIS93	20p
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VN.10KM	60p
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VN.88AF	115p
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ZTX108	11p
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ZTX302	16p
ZTX303	24p
ZTX304	17p
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ZTX500	13p
ZTX501	13p
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ZTX503	18p
ZTX504	25p
ZTX550	24p
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2N.697	22p
2N.698	40p
2N.706	22p
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2N.914	28p
2N.930	18p
2N.1131	28p
2N.1132	28p
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2N.2102	50p
2N.2218A	24p
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2N.2369	15p
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2N.2646	40p
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2N.2906	18p
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2N.6385	120p
2N.6403	160p
3N.143	65p
DIODES	
Rectifier Diodes	
AA119	9p
BY100	40p
BY103	32p
BY126	6p
BY127	8p
BY133	8p
BY164	40p
BY179	35p
BY184	32p
BY196	20p
BY206	11p
BY207	11p
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BY210	22p
BY225	120p
BY226	18p
BY227	19p
BY228	32p
BY296	20p
BY298	26p
BY299	28p
BYX10	15p
BYX55/350	30p
BYX55/600	30p
BYX70/500	32p
BYX70/800	36p
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OA90	6p
OA91	8p
OA200	7p
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18pin	12p
20pin	14p
22pin	16p
24pin	18p
28pin	20p
40pin	25p
ZENER	
400MV BYZ88 RANGE 2V7 to 39V	6p
1.3W BZX61 RANGE 2V7 to 39V	12p
CRYSTALS	
Freq in MHZ	
1.00	260p
2.00	200p
2.45670	180p
2.5	200p
3.276	115p
3.5795	95p
4.0	110p
4.194	130p
4.43	95p
4.9152	150p
5.0	130p
6.0	115p
8.0	125p
8.867	125p
10.0	140p
11.0	250p
12.0	120p
14.0	125p
14.756	200p
15.0	150p
16.0	130p
18.0	130p
18.432	130p
24.0	250p
48.0	160p
VOLTAGE REGULATORS	
7805	35p
7806	35p
7808	35p
7812	35p
7815	35p
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
LM317T	180p
LM323K	420p
LM723	40p
78HGKC	570p
78HO5KC	800p
78H12KC	700p

78GU1C	190p
79GU1C	215p
79HGKC	800p
VALVES	
DAF96	60p
DF96	50p
DL92	60p
DY86	50p
DY87	60p
DY802	75p
EABC80	60p
EB91	44p
EBF80	45p
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ECC82	80p
ECC83	80p
ECC84	70p
ECC85	80p
ECH81	100p
ECH84	70p
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EF183	75p
EF184	85p
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EL36	90p
EL84	75p
EL95	85p
EL500	100p
EL504	130p
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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
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PL84	60p
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	
RED	10p
GREEN	15p
YELLOW	15p
LINEAR IC'S	
AN-203	210p
AN-210	165p
AN-214Q	170p
AN-228	280p
AN-236	235p
AN-240P	150p
AN-241	135p
AN-245	290p
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AN-7146	210p
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AN-7156	240p
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AN-7168	260p

AN-7178	270p
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AY3-1270	800p
AY3-1350	450p
AY3-8910	360p
AY3-8912	400p
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BA-311	80p
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BA-340	150p
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BA-402	60p
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BA-516	150p
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BA-524	240p
BA-526	188p
BA-527	95p
BA-532	140p
BA-534	290p
BA-536	180p
BA-546	180p
BA-612	160p
BA-656	150p
BA-658	380p
BA-684	400p
BA-685	400p
BA-1310	160p
BA-1320	110p
BA-1330	160p
BA-1360	160p
BA-4403	220p
BA-5101	400p
BA-5102	250p
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TDA-7274	100p
TDA-8115	300p
TDA-8140	300p
TDA-8170	320p
TDA-8190	280p
TDA-8440	380p
TDA-9403	250p
TDA-9503	240p
TDA-9513	350p

LINEAR IC'S — Cont.

TEA-1002	650p
TLO-61	40p
TLO-64	80p
TLO-71	38p
TLO-72	55p
TLO-74	92p
TLO-81	40p
TLO-82	46p
TLO-83	67p
TLO-84	80p
ULN-2002	70p
ULN-2003	69p
ULN-2004	69p
ULN-2068	270p
ULN-2803	130p
ULN-2804	170p
UPC-16C	160p
UPC-20C	220p
UPC-554	130p
UPC-555	60p
UPC-556H	80p
UPC-566	60p
UPC-571	220p
UPC-574	60p
UPC-575C2	90p
UPC-576	200p
UPC-577	64p
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UPC-1001	220p
UPC-1018	170p
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UPC-1023	60p
UPC-1025	230p
UPC-1026	95p
UPC-1028	90p
UPC-1031H2	180p
UPC-1032	60p
UPC-1158H2	70p
UPC-1167CL	170p
UPC 1181	110p
UPC-1182	110p
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UPC-1185H2	230p
UPC-1186	80p
UPC-1187	150p
UPC-1188H	400p
UPC-1197	140p
UPC-1200	325p
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UPC-1365	320p
UPC-1368H	425p
UPC-1373	85p
UPC-1378	210p
UPC-1382	110p
UPC-1394	170p
UPC-1397	450p
UPC-1403CA	750p
UPC-1420CA	500p
UPC-1458	100p
UPC-1470	200p
UPC-1504C	400p
UPC-1505C	400p
UPC-1517CA	400p
UPC-1525C	400p
UPC-1536C	550p
UPC-1571C	300p
ZN-423	100p
ZN-424	100p
ZN-425	320p
ZN-426	260p
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ZN-428	425p
ZN-429	215p
ZN-435	340p
ZN-448	510p
ZN-459	190p
ZN-1034	170p
ZN-1040	640p
ZNA-134H	2150p
ZNA-234E	920p

JAPANESE TRANSISTORS

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2SA-509	120p
2SA-550	150p
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2SA-603	100p
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2SA-608	15p
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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	170p
2SD-1399	300p
2SD-1400	280p
2SD-1402	280p
2SD-1406	120p
2SD-1407	160p
2SD-1409	190p
2SD-1415	190p
2SD-1425	360p
2SD-1426	350p
2SD-1427	380p
2SD-1428	450p
2SD-1429	410p
2SD-1430	280p
2SD-1431	400p
2SD-1432	600p
2SD-1433	750p
2SD 1438	140p
2SD-1439	270p
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-1941	500p
2SD-1609	100p	2SD-1984	150p
2SD-1632	500p	2SJ-49	425p
2SD-1649	260p	2SJ-50	425p
2SD-1651	270p	2SJ-77	350p
2SD 1663	450p	2SK-19	45p
2SD-1666	120p	2SK 49	50p
2SD-1667	120p	2SK-55	100p
2SD-1668	120p	2SK 68	100p
2SD-1677	300p	2SK-134	415p
2SD-1739	450p	2SK-135	415p
2SD-1783	100p	2SK-147	160p
2SD-1815	100p	2SK-192	45p
2SD 1825	120p	2SK-195	150p
2SD-1843	100p	2SK-197	140p
2SD-1846	350p	2SK-312	750p
2SD-1884	300p	2SK-323	130p
2SD-1910	280p	3SK-88	70p

BRIDGE RECTIFIERS

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

TRIACS

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

THYRISTORS (SCR's)

2N.5061	— 0.8A/60V	20p
2N.5062	— 0.8A/100V	28p
2N.5064	— 0.8A/200V	29p
C106D	4A/400V	28p
TIC116C	8A/300V	59p
TIC116D	8A/400V	70p
TIC116M	8A/600V	79p
TIC126D	12A/400V	75p
TIC126M	12A/600V	90p
2N.4444		76p
BR103		37p
BR303		85p
BT106		180p
BT116		80p
BT119		100p
OT121		120p
TIC44		22p
TIC45		27p
TIC47		32p
17088		200p
17089		200p
17127		200p
15/80H		230p
15/85R		230p
SG613		850p

UHF TUNERS

U322LO	600p
U341	500p
U342	500p

VIDEO LAMPS

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

VIDEO LAMP FOR PANASONIC 60p

CASSETTE DC MOTORS

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

CASSETTE TAPE HEADS

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

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

VIDEO HEADS

JVC/AKAI/FERGUSON 3HSS (For all Models) £9.50
NATIONAL PANASONIC 4HSS = 3HSSN £9.40
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AKAI

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AMSTRAD

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FERGUSON

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3V43/3V53 £46.50
3V48 £36.50

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HITACHI VT7-17, VT35-38, VT39 £36.95
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HITACHI VT120, VT 220 £31.50
HITACHI VT3000 £14.00
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HITACHI VT65, 7000, 8000, 8300, 8500, 8700, 9300, VT9500, 9700 £16.50

NATIONAL

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NV 366 4 HEAD £28.50
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NV 370/NV 380 £14.00
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NVG 33, NVG 45, NVG 46 £41.00
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SANYO

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VTC 5100, VTC 5150, VTC 5300 £28.00
VTC 5350/5370, VTCNX 10/15/20/30, VTC 5550 £28.00
VTC 5100, VTC 5150, VTC 5300 £26.50
VTC 9100/9300/9455/9500 £28.80
VTC 9350/9355 £28.80
VTC 5500 £30.50

SHARP

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VC 486, VC 3300, VC 8381, VC 9100, VC 9300, VC 9500, VC 9700, VC 582, VC 583, VC 651, VC 681, VC 750, VC 781 £18.75

SONY

DSR-35R (FOR C20, 30, 40 SLF1, SLF1UB, SLF1E) £18.00
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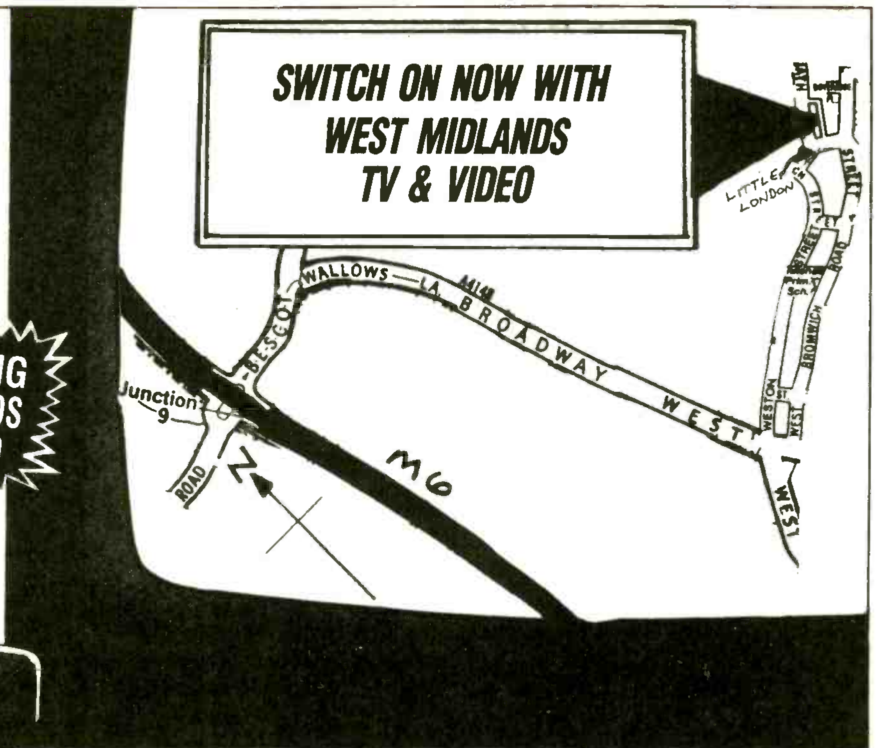

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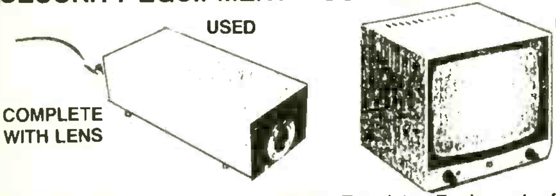

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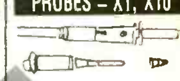
Output pulse rate	0.5 or 400Hz
Pulse width	10μS

PROBES – X1, X10



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VS-9700	£19.99
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3V23	£19.99
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High quality 12 Volt Universal Video Cassette Recorder Lamp and Head. Lead length: Approx. 30cm.
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PRICE – 60p

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TRIPLERS Universal	5.75
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3V29/3V32	£5.25
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VR 6560	£3.90
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TOSHIBA. V5	£3.99

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HITACHI	VT5000E/5500/3000	2.75
	VT/7000/8000/8500/9300	
	VT/8500/9700	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
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	NV332/333/366	1.99
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SANYO	VTC5150/6000/5000	1.20
	VTC9100/9300	2.80
SHARP	2300/381/384/385/386/390/9300/9500	1.50
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	V55 & 57	1.50
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SHARP	NIDL 0006 GE22	2.10
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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

1¼" QUICK BLOW FUSES

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

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Reel Motor SHARP VC93000/9800RMOTV 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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Type	Price (£)	Type	Price (£)	Type	Price (£)
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DF96	0.72	EF86	1.65	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	[illegible]	EM80	1.50	PL519/509	5.55
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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
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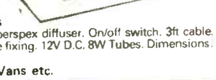

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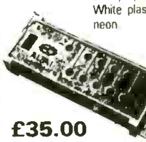

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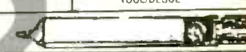

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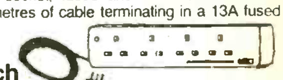

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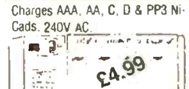

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COVER PHOTO

This month's cover photograph shows David Botto's De Luxe Component Tester being used witha Scopex oscilloscope (see article on pages 689-694). It was taken at Rawling's Radio's workshop in Bournemouth.

Last month's cover photograph showed the Ferguson TX100 chassis, not the TX10 as stated on page 597.

Satellite Success

Although it is still early days and the broadcasters are still making substantial losses it's beginning to look as though satellite TV is going to be a success story, at least in the UK. Another two-three years and both Sky and BSB could be breaking even, if not showing a profit. The significant factor is that the public is clearly taking to satellite TV. You see more and more dishes around. There are now well over 800,000 Sky Television installations in the UK. Possibly a significant help has been the trouble-free nature of satellite TV reception. The equipment has turned out to be reliable, apart from a few sillies. There has been nothing to frighten the public, like the expense of tube replacement in the early days of TV and damage to expensive tapes in the early days of the VCR. And the pictures are good. Early suggestions that PAL was not suited to satellite transmission have proved to be false. MAC is significantly better of course, especially with RGB interconnection, but the public has never been all that bothered about the quality of its TV pictures. The important points have always been acceptable programming and low cost. As far as equipment is concerned, satellite TV has turned out to be a bargain.

That Sky's programming has so far proved to be acceptable to the public is proved by its success in getting people to subscribe to its scrambled services. By early June Sky had something like 540,000 subscribers, a good proportion of the total number of Sky installations. Apart from films, sport has as expected turned out to be a major draw. During England's cricket tour of the West Indies Sky broadcast 175 hours of live cricket. According to Sky, 125,000 Sky TV installations were carried out during the period.

Despite the delays over the start of its services BSB seems to have got off to a good start. The company is well funded – the total investment now stands at some £1·35bn – and is expecting to break even in year three or four of its present fifteen year franchise, when it should have around three million subscribers.

Public acceptance of satellite TV and take-up of the equipment has turned out to be greater than in the case of either colour or the VCR in their early days. That alone should indicate success. For most people the cost of subscription to scrambled services is marginal, much the same as renting two-three video cassettes a week, which is common enough practice. It's certainly less than most people spend on other forms of entertainment. One wonders whether this will have an adverse effect on the burgeoning video chains, which have been a substantial growth industry over the last couple of years. One might have thought that the traditional moan about the cost of the TV licence would suggest reluctance to pay for TV. But it's a matter of psychology: a weekly or monthly sum looks less than an annual one.

Once the advertising revenue starts to build up, satellite TV should be made. But will there be enough room for both Sky and BSB, and what effect will they have on the ITV services – and on the still infant cable industry? Provided costs are kept down there should be room for both Sky and BSB. People seem to like the thought of lots and lots of channels, and as a precedent ITV and the BBC have coexisted successfully for about 35 years now. Once the number of satellite installations/hook-ups has increased satellite TV will have the advantage over ITV of a much larger potential audience. That's something which could concern the ITV companies, but the public is unlikely to desert its traditional viewing habits overnight. It will be up to the terrestrial broadcasters to get their programming right. What is beginning to look doubtful is the likelihood of the Ch. 5 service getting off the ground. Cable has the advantage of providing all the channels from a single source, but loses out on MAC. At one time the government, rather naively, seemed to look upon cable as being the vehicle for a great leap forward into an information-based society – or some such notion. The public showed little interest. It does seem to be the simplest way of getting the most channels, but then again the public is used to sticking up an aerial and plugging in and seems to have accepted the dish in the same way. There's growing alarm amongst environmentalists as the number of dishes increases, and many local councils have put their feet down. The Squarial is almost insignificant outdoors however while environmentally friendly dishes have now become available.

Satellite TV has not to date taken off in the same way in the main Continental European countries. It seems that continuing debate over transmission standards and unwillingness to invest in suitable programming are responsible for this. The greater reliance on cable networks could also be a factor. Perhaps they simply need Rupert Murdoch to give them a shove! Be that as it may, SES, the Luxembourg-based company that owns the Astra satellites, has turned out to be a success. It was a considerable gamble to put up a private satellite using what are officially non-broadcasting frequencies. SES is now in profit however and has paid its first dividend.

Further ahead, satellite TV is seen as the way to further technological advances – enhanced TV, high-definition TV and so on. This could be a major factor from the point of view of the electronics industry, but one wonders whether the public will take to such offerings. In the UK, certainly, what the public seems to want is simply lots of channels and acceptable programmes at little cost. Cheap and cheerful you could say. It will need a mammoth sales effort to get HD-TV across. But doubtless someone will come up with a way of doing it at little extra expense, and as usual we'll be left moaning about the lack of profit for the trade!

TV Fault Finding

Reports from Philip Blundell, AMIEIE, Eugene Trundle, Ian Bowden, Chris Avis, Mick Dutton, Nick Beer, Hugh MacMullen, T.J. Welford and Stephen Leatherbarrow

Philips G110 Chassis

This set would intermittently come on with the picture shifted over and a black vertical bar in the centre of the screen. I finally found that there was a leak from pin 12 of the TDA2579 timebase generator chip to chassis due to a solder bridge under chip capacitor C2460. **P.B.**

Philips 25GR57/63/25B

This set had no sound. I don't know whether the Nicam section was working as our transmitter doesn't have stereo sound yet, but the fault was on the Nicam panel. The mono a.f. signal was present at the input to IC7100 but there was no output. Fitting a new TDA8415 put matters right. **P.B.**

Finlux 1000 Series

We've found the cause of a blown 1·25A fuse to be a dry-joint at one end of LU3. Check this, especially in cases where a replacement fuse appears to cure the fault. If you don't you'll be back sooner or later. **E.T.**

Panasonic Z3T Chassis

This set frequently failed to start up. When the fault was present there was no drive to the power supply control octocoupler D811. In addition the set didn't respond to remote commands as it should have done since there's a separate standby supply for the remote control receiver and the microcomputer control chip. This is a 5V supply that's derived from a small transformer and regulator circuit. A check on the output from this circuit, at TPE2, showed that the voltage was 4·4V which was not too far down. After checking the regulator circuit we found that the 5·1V zener diode D1124 was leaky, with only 4·4V at its top end. This small voltage drop was enough to cause the fault. **I.B.**

Philips KT3 Chassis Edition II

The initial fault caused us no problems – the usual tripping tripler. A replacement produced sound and e.h.t. but no picture. When the setting of the first anode control was advanced we found that there was a blank raster with flyback lines. In went the usual TDA3560 colour decoder chip, and out went my last flicker of self-confidence – there was still no picture. Several voltages around the TDA3560 were very low, the blanking/reference input pin 8 being at virtually zero volts. This led me to the TDA2571Q chip IC367 on the sync panel. It wasn't producing the burst key output at pin 13. Fitting a replacement completed the job. **C.A.**

Bush 2044

This Amstrad clone had poor sound with erratic flashes on the picture. It's the chassis with the little intercarrier sound panel and a tweak of the quadrature coil restored normal sound. The flashes were caused by the tuner, but an impatient owner meant that we'd no time for an MCES repair. Hang on though, the tuner looks familiar. Yes, it's the one used in the old Ferguson/Baird VCRs (8930 etc.)! A quick exhumation in our scrap graveyard produced an identical tuner and another happy customer. **C.A.**

Hitachi CPT2050

This multi-standard Salora set had erratic height variations with simultaneous changes from pink to green faces. Pin 12 of the TDA2653 field chip provides a 50/60Hz control voltage for system switching. At 50Hz field frequency the voltage should be 0·2V. It was fluctuating wildly, which confused the decoder. Fitting a new chip cured the height problem and restored pink cheeks. **C.A.**

Mitsubishi CT2101TX

This set had suffered from line output transformer failure about six months previously. The failure had been spectacular, with a room full of black smoke that came from a pin hole in the transformer's plastic encapsulation. A new transformer restored perfect operation until a few days ago when the customer phoned to say that the picture had gone small all round but was super sharp.

When we collected the set we found that the output from the power supply was 145V instead of 115V. We'd no time to make any further tests since the chopper transistor failed and blew the fuse. A complete rebuild was necessary, changing all the semiconductor devices and checking the capacitors and resistors. We then powered the set via a variac. The output from the power supply reached 115V long before the input was raised to 200V. The set-volts control worked, but its range was limited. Substitution checks were the next step, starting with capacitors. When we came to C918 and C915 (both 33μF) which are in parallel we found that C915 had never been fitted. Replacing C918 provided a cure: a capacitance check showed that it was only 10μF, hence the insufficient control. If we'd taken more notice of the board rather than the circuit we would probably have found the fault more quickly. Wouldn't it be helpful to have accurate information and an update service? **M.D.**

GEC C1407H

This colour portable was dead except for a whining noise that came from the power supply. We suspected the regulator chip but the cause of the problem turned out to be the 3V zener diode 2D910. It was short-circuit. **M.D.**

Luxor SX9 Chassis

The customer's complaint was that the remote control sometimes didn't work. We put the set on soak test for a long time and confirmed that the remote control system stopped working on several occasions. Another handset was tried, and we found that by switching the set off and on normal operation was restored. One time while the set was on soak test we noticed the width jump in and out. A check around the switch-mode transformer revealed that there were several dry-joints, particularly at pin 1. Repairing these cleared both the width and the remote control problem.

Incidentally if you get one of these sets that switches on and goes straight to standby, check the diodes on the secondary side of the switch-mode transformer. If these are o.k. the problem is almost always due to shorted turns in the line output transformer. **M.D.**

Saisho CM260TT

This teletext set is fitted with the Fidelity ZX5000 digital chassis. The chopper transistor TR1 was found to be short-circuit between all its legs and the 1·6AT mains fuse was open-circuit. Replacing the BU145A still left us with the dead set symptom however – time to look a little deeper.

The operation of the auxillary 5V supply was found to be all right, but the TIL111 optocoupler IC13 was providing a negative voltage at the input to the chopper control chip IC1 (type UC3844 fitted). Fitting a new optocoupler cured the dead set fault but bearing in mind the nature of the chopper transistor's failure we also replaced IC1. **S.L.**

Ferguson TX90 Chassis (20in)

The problem with this set was occasional partial field collapse. After some very inconclusive cold checks I took some voltage readings. The upper transistor TR104 in the field output stage is biased by a chain of four resistors. The third resistor in this chain, R187 (6·2kΩ), was found to be going open-circuit. When removed its body had a tell-tale ring around it. **S.L.**

Schneider STT6010

If you find the on/off switch faulty in one of these sets don't panic. The "universal" PC mounting Sony switches fit perfectly. This set is similar to some Telefunken models of late, with a plug-in teletext module at the rear of the set. **S.L.**

Ferguson TX100 Chassis

The fault with this 110° set was lack of width. Both the width and the EW presets worked and the h.t. was correct at 119V, but the picture could not be made to fill the screen. The 110° version of this chassis has a separate EW/width correction panel fitted: it plugs into the main board. We eventually found that the cause of the trouble was that the width coil had been fitted – it should be present only in the 90° version. Linking it out brought full width. Watch out for that one! **S.L.**

Grundig CUC70KT

When this set was powered it would make a strained attempt to start then trip. The longest time it stayed on for was one and a half minutes – long enough for us to discover that the h.t. was low and that the line output transistor was hot. We soon found that D471 in the diode modulator circuit had gone short-circuit. Replacing it with a BY299 produced a good picture but there were EW problems. R571 was open-circuit. **S.L.**

Ferguson TX90 Chassis (20in)

There was excessive height with poor linearity and the height control had minimal effect. The cause of the trouble was that D137, a 68V zener diode, was faulty. It didn't measure short- or open-circuit however, nor did it have any reverse leakage. But a replacement cured all the symptoms. **S.L.**

Fidelity CTV140R

This remote-control set refused to budge from channel one, which is selected at switch on. Voltage checks suggested that the ML923 selector chip was faulty, so a new one was obtained and fitted. There was now a change in the voltages obtained around this i.c., but the basic problem remained the same. C221 (0.01μF) was eventually found to be leaky.

On soak test the set developed another fault. The signals would disappear intermittently or, more often, drift a little. Replacing the SL471 chip and the tuner put this right. **S.L.**

Philips K35 Chassis

The symptoms were a blank raster with brilliant, defocused flyback lines. A scope check showed that drive signals were reaching the RGB amplifiers on panel U10. The 155V and 13V supplies were present here but there were no clamp pulses at pins 3, 11 and 18. These 140V pulses come from the line output transformer via R455 (560Ω) which was dry-jointed. **T.J.W.**

Philips K30 Chassis

We've had two of these sets in recently. The problem with the first one was that the sound remained all right but after about half an hour there were just lines on the screen, with no luminance or chrominance information. We eventually discovered that R8380 (47Ω) was open-circuit. This resistor feeds 13V to pin 12 of the TDA2571AQ sync/line generator chip. It wasn't burnt in any way.

The second set would periodically switch off then come back on again. The usual faults were not apparent, but after a long time and some very careful listening we found that the bead at the end of the e.h.t. lead in the line output transformer socket was a dry-joint. Resoldering this put matters right. **H.MacM.**

Decca DT9476

Spurious channel changing with this set was caused by occasional flashovers in the focus gap at the c.r.t. base. **H.MacM.**

Ferguson TX10 Chassis

The display would fade out after a couple of hours or so. After prolonged examination we discovered that the c.r.t. heaters went out. The cause was that the two wrap-round connections for the c.r.t.'s heater supply were dirty. Soldering them cured the trouble. I've always hated these wrap-round connections. **H.MacM.**

Panasonic U3/U4 Chassis

A common fault with these sets is that they come on in standby permanently or intermittently when you use the mains switch on the set. We've found that the cause has always been carbonised contacts on relay RY1001 (TSE1827). The cover is easy to remove for cleaning but replacement relays are very reasonably priced. **N.B.**

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Philips' BSB Satellite Receiver

Ian Martin

Just over a year ago I wrote in these pages on my experiences in installing an Amstrad SRX200 Astra satellite TV receiver system. After many delays the BSB satellite is now on air and set-top receivers are beginning to become available from the four appointed receiver manufacturers. As a former "Sky Pioneer" and now a BSB "Launch Club Member" I awaited the arrival of yet another set-top box.

The Philips STU902 D-MAC receiver and aerial arrived four days after the official launch of the BSB services. I opened the aerial carton first as I was eager to find out which type had been supplied. It turned out to be the Matsushita flat-plate Squarial – compact dish aerials from Channel Master and Marconi are the other alternatives. Incidentally the Philips receiver is sold with the aerial unspecified, whereas with some brands either type can be ordered at cost.

Description

The STU902 appears to be quite large, with its VCR-sized front panel, but is less than ten inches deep and of light weight. Peeping through the ventilation slots I could see a double-sided PCB with surface-mounted components – and lots of empty space. I was glad to note that the receiver runs cool.

The only control on the front panel is the on/standby button. Accompanying it are two LEDS that indicate standby and stereo reception. All other functions are selected via the remote control handset. Ten channels can be selected, giving provision for the current five BSB channels and five future channels. Standby, TV/sat mode and a range of specific BSB functions are also catered for, and the handset can be used to control the volume and for programme selection with recent Philips TV sets.

The receiver's rear panel has three Belling-Lee type r.f. connectors, for aerial input, r.f. output and satellite TV aerial input. There's also a 21-pin scart socket for AV outputs, wired for both composite video and RGB, utilising both slow and fast blanking, plus stereo audio. Other connectors include jacks for future expansion of the internal data bus and access control module (the part that gives the receiver its identity and authorisation to receive programmes). With a view to the future, the STU902 has an option to provide video outputs with either the current 4:3 aspect ratio or the future 16:9 aspect ratio. This option is again selected via the on-screen menu system. There's no decoder loop-through, as external descramblers will not be required. Unfortunately there are no separate audio outputs for connection to a hi-fi system.

The Squarial, though larger than the original specification because of BSB's power reductions to cater for the extra channels (there were originally to have been three), seems small. It's solid and a joy to handle in comparison with the Astra dishes. In fact it seemed a pity to put it outside! The tubular metal wall bracket supplied is very easy to attach to a wall, using four 10mm bolts that were not supplied. The Squarial and its alternatives use an F connector for their output and power supply feed. All the BSB channels employ right-hand circular polarisation, so there's no need for a polariser cable as required with some linearly polarised systems. Although the BSB signals are at higher frequencies than those from Astra, the same type of signal cable can be used, e.g. RG59, as the i.f. output from the LNB is in the same range, around 1GHz.

Installation

And so to the ladder! BSB's Marco Polo satellite is at 31°W while Astra is at 19·2°E, i.e. the satellites are about 60° apart when viewed from the UK. Thus if you know the direction of Astra in your area, Marco Polo shouldn't be too difficult to find. In any case a map showing elevation angles and magnetic azimuth bearings is included in the aerial pack. As I don't have a signal-strength meter – though I do now have a compass – I set up the STU902 and a portable TV set near the proposed aerial fixing point and set the receiver to the set-up mode, using the back panel switch. This useful feature provides a split-screen display, one half showing the actual signal noise and the other an internally generated signal-strength bar graph and noise level indication. A picture was seen almost immediately, sliding sideways across the screen. It was a D2-MAC signal from the TDF-1 satellite. Moving the aerial further westward resulted in the noise disappearing and a welcome to BSB message appearing. The signal was so strong that maximum signal with zero noise could easily be achieved. To get the "centre" position I rocked the Squarial from side to side and up and down, selecting the mid-position. Even covering the aerial with my hands didn't reduce the signal level at the receiver.

After locking the Squarial in position I quickly ran cable round and through the wall, moved the receiver back indoors and connected it to my TV set via a scart lead. BSB's customer service centre was then called. A lady answered and asked me a few questions about the system. Shortly after I'd disclosed the receiver's identity number, which can be called up from the handset, it was authorised for reception and BSB's five channels came in, very loud and very clear.

Performance

Picture and sound quality are excellent via an r.f. link, superb by AV connection and simply stunning when connected to the receiver in RGB form. With a normal picture the extended video response can easily be seen in the RGB mode, the MAC originated picture having none of the PAL coloured "fluff" that snags the sharp edges. The stereo also seems to be better than with Astra transmissions, the digital audio having almost zero noise, though this does depend on the programme content and quality.

I found that in general the system performs very well, the picture and sound quality surpassing anything I've seen before. There are some niggles however. The lack of teletext is a major omission. It's a convenient way of finding out the day's programme schedule with terrestrial TV and Astra. We're promised teletext in the future with the BSB channels however. In the meantime a feature built into the Philips STU902 and other BSB receivers enables you to see details of the current programme, running time and classification rating, as well as those of the next programme. The classification system also works in conjunction with the parental lock, whereby a four-digit secret code can be entered via the handset to lock out certain groups of movies and other programmes.

When the receiver is switched on from standby it comes on in the RGB mode, using the composite video signal for synchronisation. At the same time the scart slow switch and fast blanking (pins 8 and 16 respectively) go high. This means that a TV set connected to the receiver via the scart connectors is forced into the external AV mode. If the TV set accepts external RGB but has no slow switch, the RGB will appear synchronised to the video signal from the set's tuner until the TV/sat button on the STU902's handset is pressed. The logic of going into the RGB mode at switch on is understandable from the point of view of offering the best picture quality. But a method of overriding it by presetting the receiver would be helpful, to accommodate customer preferences and TV set variations.

BSB's D-MAC transmission standard provides better quality pictures and sound than any other current source, including terrestrial and satellite TV. Thus if a choice is to be made between the two rival satellite broadcasters BSB and Sky on technology alone, BSB would be the one to go for. In the final analysis however success will go to whichever company offers the better programming. For the present, in my opinion the two systems complement each other. If you're after the BSB service the Philips STU902 can provide excellent reception of it.

Teletopics

LASER DISC ASSOCIATION FORMED

Philips has announced the formation of a European Laser Disc Association to promote the video disc system in Europe. Participating companies include Panasonic, Philips, Pioneer, Polygram, Sony, Telemedia Bertelsmann and Warner Home Video. The three main objectives are to create awareness of the Laser Disc System (formerly known as LaserVision or Compact Disc Video), to organise software availability and to maintain compatibility within the Laser Disc standard. According to Philips there are over 9,000 Laser Disc titles available in Japan and the sales of players are expected to reach the million mark this year. US sales are expected to reach 400,000 with over 4,000 titles available. Philips says that the European market is more difficult because of the diversity of languages and tastes.

TELETEXT LATEST

Channel 4 plans to start a teletext timer service next year. The system will work by inserting digital start codes in the Oracle teletext transmissions. To use the system consumers will have to buy a new type of VCR that will contain a teletext decoder and additional circuitry. To operate the timer, the user simply calls up the teletext TV listings page and selects programmes with a cursor: the timer details are stored and the VCR starts to record only when it senses the start code. In addition to its simplicity the system ensures that viewers don't miss programmes that start later than scheduled. The first of the new VCRs are expected to be on sale by the end of the year.

The latest top-of-the-range models from Sony incorporate Nicam decoders and a 200-page teletext memory. The memories are constantly updated, offering the viewer instant access to the 200 selected pages. The 29in. Model KVE2912 has a suggested price of £1,000 while the 25in. KVE2512 sells at around £800.

SATELLITE NEWS

The DTI's Radiocommunications Agency has applied for five additional channels, at present unallocated, to be made available for UK DBS use. Application has been made to the International Frequency Registration Board. The frequencies would be at the same orbital position as the UK's present five allocated channels. It's not expected that any new services using the extra channels would start for several years - the application has been made to provide for possible future growth in satellite TV services in the second half of the decade. To avoid possible interference to other radiocommunications services extensive consultation with other European countries will be necessary.

Amstrad has introduced the first integrated receiver/decoder, Model SRD400, for use with the Astra satellite. According to Sky Television the overwhelming majority of receiver installations during April were for its own subscription package - a total of 62,414 systems compared to some 14,000 sold by High Street outlets.

Marconi has developed a 60cm "squarish" satellite TV aerial with a 60° pick-up field, wide enough to cover the major satellites broadcasting to Europe including Astra and BSB's Marco Polo. Since no movement of the aerial is required the user would be able to record programmes from one satellite while viewing programmes from another. The aerial would cost around £400 but Marconi does not think production would be worthwhile until combined BSB/Sky receiver/decoders become available.

Now that there are a number of Filmnet decoders on the market many viewers have two or more decoders. Manually changing from one to another can be a chore. JDA Audio Visual (32 Branbridges Industrial Estate, East Peckham, Tonbridge, Kent TN12 5HF - telephone 0622 872 400) has thus introduced Proswitch, an automatic decoder switch which controls up to three decoders of automatic switching type at once. The unit is an electronic switching interface, not just a diode steering arrangement. The trade price is £15 plus leads.

HD-TV

The CCIR, meeting in Dussledorf, failed to agree on an international standard for high-definition TV. While agreement was reached on 27 characteristics, including such things as screen dimensions and colour shades, there was no agreement on the two main features - the number of lines and the field rate.

Philips and Thomson have signed an agreement to devote over £2bn to the development of a complete HD-TV system for Europe. The aim is to have the system in operation by 1995. The agreement includes the companies' work on the Eureka programme but goes far beyond this to include everything from

complete studios to flat-screen displays and i.c.s.

Thomson is due to start producing 36in. sets with 16:9 aspect ratio screens at its Anagni plant in Italy this autumn. Both Philips and Thomson have set up production lines for 33in. FS tubes in Europe.

TRADE NEWS

The Kingfisher bid for Dixons/Currys has been barred by the government following the Monopolies and Mergers Commission's report on the bid. Philips has taken a 25 per cent interest in Bang and Olufsen. The aim is to benefit from B and O's design and marketing expertise. Toshiba is to increase CTV production at its Plymouth plant from 500,000 to 600,000 sets a year.

The Sentra brand has returned to the market now that Sentra has been taken over by Roadstar UK Ltd. The new address is Roadstar UK Ltd., Roadstar House, Tavistock Industrial Estate, Ruscombe Lane, Berks RG10 9NJ - telephone 0734 321 032.

Poly Peck International plc has increased its holding in Sansui to 70 per cent. Poly Peck's Capetronic and Imperial subsidiaries are now part of Sansui. Capetronic is one of the world's largest original equipment manufacturers of consumer electronics products, with operations in the USA, Taiwan, Hong Kong, Malaysia and China. Imperial produces large-screen colour sets in Italy and distributes a wide range of consumer electronic products. It was founded in Germany in the 30s.

SERVICING NEWS

Sony has established a network of fifteen Video-8 repair centres to provide specialist camcorder servicing. Seven are SES companies (former Sony Service Departments) and a further eight have been chosen from Sony's 115 authorised service companies.

Willow Vale Electronics has published for the trade the second edition of its spare parts listing guide for all Grundig TV, audio and video equipment. In A4 size the perfect-bound catalogue is the most up-to-date Grundig components parts list available. It includes exploded diagrams and complete information on straight service exchange units. Thomson has appointed Willow Vale distributor for its range of consumer electronics spares. For further details contact Willow Vale Electronics, 11 Arkwright Road, Reading, Berks RG2 0LU - telephone 0734 876 444.

A.Z. Electrics has moved to 183 Acre Lane, Northampton NN2 8DX. Telephone 0604 847 800, fax 0604 844 382.

Charles Hyde and Son Ltd. has withdrawn, for policy reasons, from being an approved supplier of spares and components for Sharp UK Ltd. CHS is still able to obtain and supply the popular range of Sharp genuine spares usually required.

SEME's latest catalogue, with 230 pages, features a special video spares supplement for easy reference and also contains details of Fidelity spares. Since Fidelity ceased production some eighteen months ago warranty claims are no longer applicable, but SEME will continue to supply chargeable spares for as long as possible. SEME Ltd., Unit 2E, Saxby Road Industrial Estate, Melton Mowbray, Leics LE13 1BS - telephone 066 465 392.

Adcola has introduced an updated range of desoldering stations known as the 565 series. The units have proved to be virtually impossible to block due to the unique design of both the heating element and the combined stored vacuum system. They are now static free, following use of a polycarbonate static passive material, type D-FR. For further details apply to Adcola Products Ltd., Adcola House, Gauden Road, London SW4 6LH - telephone 071 622 0291.

3-D TV SYSTEM

A 3-D TV system has been on display recently at laboratories in Covent Garden, London. It produces the depth effect without the need for the viewer to wear special glasses. The principle used is to digitise the programme material, identifying focus points in each field and processing these to produce what are called stereo cues. These activate a special screen in front of the TV set, with the result that the eyes receive slightly different images. For obvious reasons technical information on the system is at present limited.

NEW PANASONIC CAMCORDER

Panasonic has relased details of a new camcorder that incorporates some interesting technology. The following specifications apply to the NTSC version, but Panasonic says that a PAL version would be similar. Model NV-S1 is a VHS-C camcorder weighing just 750g without battery and tape. The new C1 tape loading mechanism is 29 per cent lighter than a conventional mechanism. A lighter head drum and four-layer PCB that incorporates the camera and VCR circuitry contribute to the compactness. Other design features include a new lightweight lens system and a ⅓in. CCD imager with 270,000 pixels and the performance of a ½in. unit.

The electronic image stabilising (EIS) system is claimed to reduce picture shake by up to 15 per cent. Each field is stored in a RAM and analysed during record signal processing to check whether movement between successive fields is due to hand shake or a fast moving object being tracked by the camera. When shake is detected the EIS system cuts off the picture edge and enlarges the stable centre portion to fill the display area.

An 8-bit digital AF system is claimed to offer improved focusing performance. The NV-S1 also offers "snap shot" recording (a five-second still picture) and a still/strobe feature that records a still image every 0·2 sec for picture effects. No UK price has been announced but launch is expected before next Christmas.

Ferguson's R and D Activities

Our May issue leader gave a decidedly misleading impression in suggesting that research and development at Ferguson's Enfield headquarters have come to an end. We have since been briefed on Ferguson's current R and D activities and take this opportunity to put the record straight.

There have been redundancies at Enfield, a total of 104 of whom 70 are leaving the company. The main reason for this is the ending of manufacturing activities at Enfield. Many of those who have left were engaged in technical back-up activities for the plant, work which is obviously no longer required. Some of those made redundant at Enfield have moved to a new applications laboratory which has been set up at Ferguson's Gosport plant, where all manufacturing activities are now centred. A further sixty engineers at Gosport are engaged in test gear, production engineering, etc.

Research and development will continue at Enfield, as part of an eight-laboratory network operated by Ferguson's parent company Thomson Consumer Electronics. These laboratories are responsible for a wide range of activities from basic research through to applications technology. Together the laboratories employ over 1,200 qualified engineers and technicians and the number is growing. Each laboratory has specific expertise, but all contribute to overall development and the system gives each market access to a wide range of research and applications development work.

Thomson's R and D laboratories are situated at Enfield, Los Angeles, Indianapolis, Strasbourg, Hanover, Villingen, Tokyo and Singapore. Enfield's activities are obviously focused on product development for the UK market but subjects of special expertise include Nicam, Fastext, PAL and D-MAC systems and equipment. The highly specialised laboratory at Los Angeles concentrates on the development of complex software and operating systems for audio and video equipment. Interactive menu control is an example of the work carried out here. Indianapolis acts as the R and D centre for the Americas, concentrating on basic research and TV development, digital signal processing and the development of new chassis and i.c.s. The laboratory works in close collaboration with the David Sarnoff Research Centre, in particular on an HD-TV standard for the American market. In Europe, work on HD-TV and future TV systems is being mainly carried out at Strasbourg, which is also concerned with improvements to existing TV standards and digital signal processing in both the transmission and recording fields. Hanover is involved in fundamental research, in particular digital signal processing in the context of the Eureka and Race projects. The Tokyo laboratory enables Thomson to keep in touch with the Japanese research scene. Singapore is the product development centre for the Far East. It's engaged in audio, video and TV products for both local and world markets, and in conjunction with other Thomson laboratories develops key components such as tuners and modulators.

Villingen is the control centre for Thomson research worldwide and is by far the largest of the eight laboratories. Its responsibilities include audio, video and TV product development, the development of key components for micromechanics (CD drives, video decks, optical and magnetic pickups), the development of microelectronic components such as i.c.s, also h.f./s.h.f. components, SMD and hybrid technology and product-specific software. The laboratory is involved in fundamental work on new recording techniques including matrix scanning, and undertakes contract research for third parties.

As a major company in the international consumer electronics field – market leader in the USA and number two in Europe – Thomson is well aware of the need to invest in R and D and be at the forefront of product development. Enfield continues to play an important role in this work.

Servicing Compact Disc Players

Part 17: Power Supplies and CPUs

Joe Cieszynski

The power supply and central processor unit are the only two sections of a CD player we've not so far considered in this series of articles. Although there's nothing particularly novel about them, the series would be incomplete without some comments on these subjects.

Power Supplies

CD player power supply arrangements are straightforward and require little attention. It's important however to remember that the power supply circuitry is there! When fault finding it's all too easy to forget obvious things such as a missing supply rail. Such problems can cause havoc, especially when everything is under the control of a central microcomputer chip.

Perhaps the most important feature to bear in mind is the use of both positive and negative supply lines for motor direction control. When we covered the servos in parts 10-13 we saw that forward and reverse drive is required not only for the various motors (e.g. disc, sled and drawer) but also for the two-axis device. In most cases the direction of the current flowing through these motors and coils is controlled by a push-pull transistor arrangement. Fig. 1 shows two methods. The arrangement shown at (a) employs four transistors and a single supply line: current direction is controlled by switching on either Tr1 and Tr2 or Tr3 and Tr4. The second circuit shows two transistors connected across equal but opposite supply rails: because of the number of motors and coils that require two-way operation in a CD player this is the simplest approach and is used in most machines. In addition to this, some of the preset controls operate with the slider moving between a positive and a negative supply. An example was the focus offset circuit shown in Fig. 4, part 10 (December 1989).

When one considers the number of devices that require two-way drive it's easy to see why the loss of a single supply rail can give rise to any number of symptoms, from the sled racing to one end of its travel at switch on to the disc running backwards at great speed. Further problems may arise when a player has been left on for a long period, for example if it's part of a midi system and the customer continues to use the rest of the system for a number of weeks before sending it in for repair. In such cases be on the lookout for burnt out driver transistors, burnt out motors and possibly even an open-circuit coil in a two-axis device.

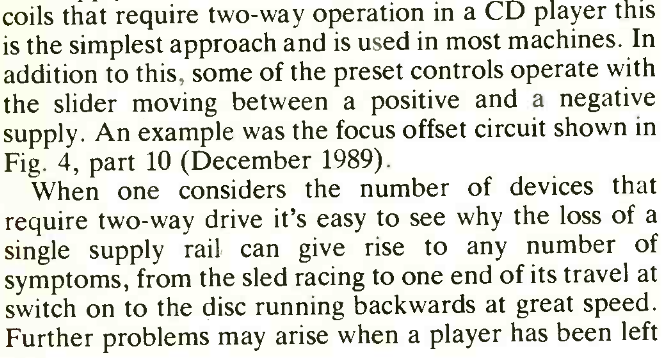


Fig. 1: Two methods of controlling the direction and amount of current flowing through a motor or actuator coil, (a) with four transistors and a single supply line, (b) with two transistors connected between positive and negative supply lines.

Such problems may not arise where adequate protection is provided by means of circuit protectors. But this brings us to another point. Although effective when a fault develops, these small devices can themselves be the cause of may complaints. When you encounter a player with a missing supply line a quick check on the circuit protection is always advisable.

Fig. 2 shows a typical CD player power supply. The +5V line will be used by i.c.s such as the CPU and decoder chips. Other i.c.s may make use of both the +5V and −5V lines to form an overall 10V supply. Motor driver circuits would use positive and negative lines as shown in Fig. 1(b). The regulators may consist of i.c. packages or discrete component circuitry.

The Central Processor Unit

One point we've emphasised during the course of this series is that a set of i.c.s is often found in the r.f., decoder and servo sections of players produced by different manufacturers. One chip that will always differ however is the central processor/ microcomputer, since this i.c. contains the program that customises the player to the manufacturer's specification. A CD player's CPU is very often a single VLSI chip that controls everything from the basic player operation to the front display. There will generally be some additional logic to control the servos, generally contained within the servo chip, and some of the more sophisticated players may have a separate display control chip. Despite its major role in the player, the CPU is generally a far less complex device than that found in VCRs and modern TV sets.

The CPU's inputs come from the customer keypad, the deck sensors and the decoder. One important piece of data is the Q subcode which, as we've seen, contains information such as track number, index, playing and running times and pre-emphasis control. The decoder also generates an error flag when the Q subcode is corrupt: this flag is sent to the processor which then carries out CRCC error correction. The Q subcode was discussed in part 7.

Another important central processor input is the focus o.k. (FOK) signal which is generated in the r.f. stage. We saw in part 10 how this signal is produced when correct focus is achieved, and that the CPU will not permit disc run up until it has received an FOK input. Thus the presence or absence of the FOK signal is a valuable clue when the player won't spin the disc at all.

Outputs from the CPU are sent to the drawer and deck driver circuits, the servo and decoder chips, and the front display. In addition the processor provides output signals to control the laser power supply, the de-emphasis circuit and the audio mute system.

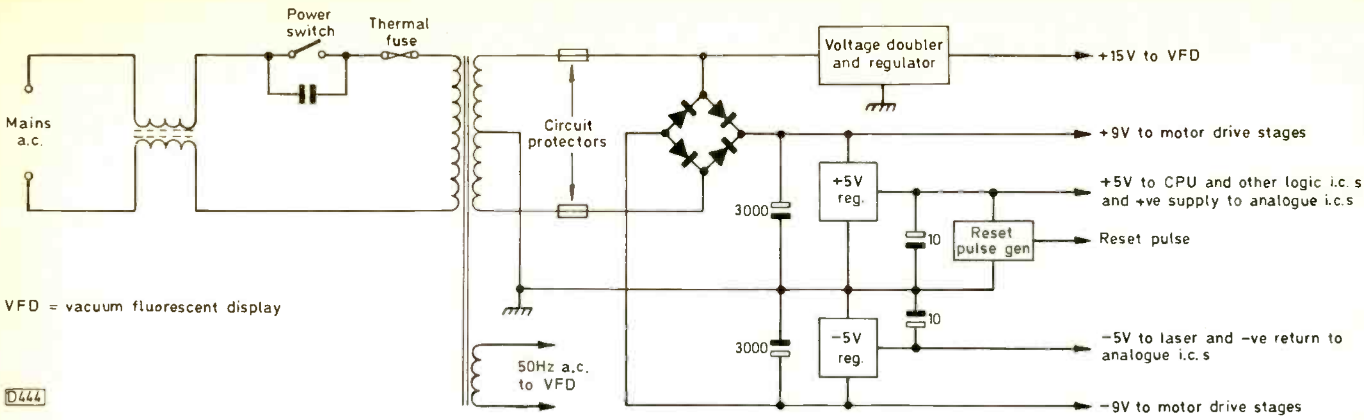


Fig. 2: A typical CD player power supply arrangement.

Fig. 3 shows in block diagram form the basic CPU arrangement.

When the player is dead or haywire it's all too easy to blame the CPU chip. Unfortunately such chips are often surface mounted and sensitive to static damage, as a result of which they are not easy to replace. It's important therefore that other possibilities are ruled out before the CPU is condemned. The following standard checks apply not only to a CD player's CPU but to any simple microcomputer chip.

(1) Check the supply rail(s). The microcomputer control chip will be powered from a 5V supply and this line should be one of the first checks to make when the player is dead, especially if the front display is out or is providing a very strange reading. In some cases there may be more than one supply to the CPU chip, so beware.

(2) The second thing to check is the clock oscillator. The CPU chip can't function unless this is working, and it's not uncommon for the oscillator to fail. The oscillator is normally within the CPU chip, but will operate in conjunction with an external ceramic resonator or quartz crystal. Most problems occur with ceramic resonators as they are prone to breaking loose inside their plastic encapsulation as a result of which they go open-circuit either permanently or intermittently.

It's best to check the oscillator using an oscilloscope. A signal in the 2-10MHz region should be seen, at an amplitude of about 5V peak-to-peak. The output may be sinusoidal but is more often than not some form of clipped sinewave. Don't fall into the trap of looking at a much lower-amplitude, "mushy" waveform and mistaking this for the real thing. When the oscillator is defective the usual culprit is the resonator or crystal, although it could be the part within the chip. Either way the recommendation is to change the resonator first – it has two legs rather than eighty!

(3) Check the reset pulse. This is generated at switch-on to clear the CPU of any rubbish that it may store in its memory during power-up. Many strange faults in audio, video and TV equipment can be caused by failure of a reset pulse generator, so it's wise to check this signal when the microcomputer chip is misbehaving. We'll return to the reset pulse generator circuit shortly.

(4) Check the earthing or, to be more precise, the lack of it. Don't forget to test for breaks in the PCB, the wiring, the plug connectors, etc. A common give-away is when you get a supply rail voltage reading at all the i.c. pins.

The above are the main tests that apply to any microcomputer circuit. If the fault persists it may prove useful, depending on the fault symptom(s), to check the following.

(5) The key scan signals, if used. These may be generated by the CPU chip or by an additional "function-control" chip and appear on the scope's screen as a constant data stream. If this is missing the most likely culprit is the chip from which it emanates.

(6) The input logic conditions. The signals here are not of the same type as the high frequency data signals. They come mainly from sensor switches in the player's mechanism and provide a simple high/low logic reading.

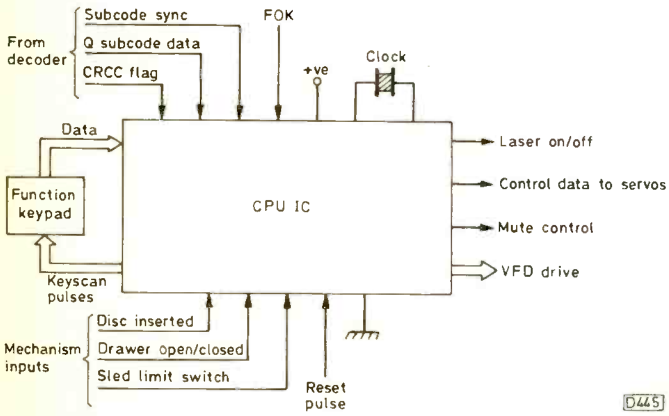


Fig. 3: The basic central processor system used in a CD player, showing the main input and output data lines and signals including the clock and reset pulse.

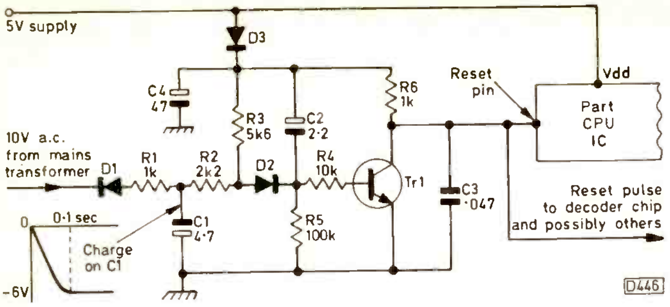


Fig. 4: Typical reset pulse generator circuit. This one is used in the Sanyo Model CP-08.

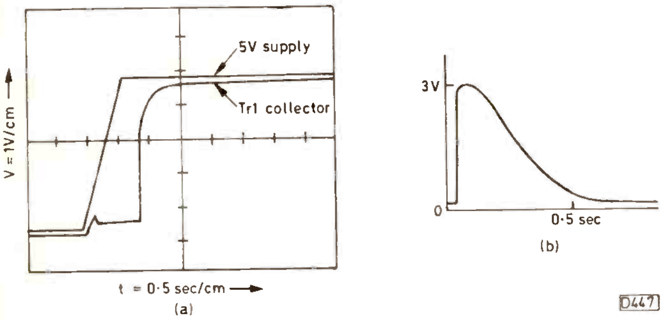


Fig. 5: Timing diagrams for the circuit shown in Fig. 4.

You can easily check them using a logic probe or a d.c. voltmeter. Where the condition is incorrect, be on the look out for such things as a defective switch, a worn or broken cam, worn belts, a sticking mechanism, an open-circuit lead or a defective buffer (transistor or gate) between a sensor and the relevant CPU input.

(7) The function keypad. We've already mentioned the key scan signals which are the outputs at several pins of either the CPU or a function control chip. The presence of these signals themselves is not an indication that the function selector keypad is operational. When a key is depressed there must be a signal that goes back to the CPU. It may be a key scan signal or an analogue signal that consists of a d.c. level – developed by a resistor ladder arrangement. Check that the appropriate input is present at the relevant pin of the CPU when a key is depressed. Possible faults are open-circuit keypads or hairline cracks in the front panel.

It's equally important that the CPU should not receive an input when no keys have been depressed. Short-circuits or resistive leaks in the function keys are not uncommon. In addition buffers or diodes between the keys and the CPU can fail, making a CPU input look as though a key is permanently depressed.

(8) The output conditions. Before condemning a CPU chip, check that its output conditions are in fact wrong. Although this is uncommon, it's possible for the observed symptoms to give the impression that the CPU is faulty when the fault actually lies in circuitry beyond this point.

Reset Pulse Generator

There are many variations in the way in which a reset pulse is generated. The basic idea however is to use an *RC* circuit with a short time-constant to take the CPU's reset pin (and the reset pins of any other chips containing memory) briefly either high or low after switch-on. The reset signal is necessary to prevent corrupt data being stored in an i.c.'s memory – this data is generated at random during the period when the supply rails are being established.

Fig. 4 shows an example of a reset pulse generator circuit. In this case when the mains supply is switched on capacitor C1 begins to charge to a negative potential via D1 and R1. At the same time the 5V rail starts to rise from 0V, this supply appearing at the CPU's Vdd pin. The positive supply also appears at the base of transistor Tr1, via R3, D2 and R4. Thus Tr1 conducts, taking the CPU chip's reset pin low. This condition continues until the point is reached where the negative charge developed by C1 reverse biases D2. Tr1 is then cut off and the reset pin rises to 5V. The timing of the circuit is such that the charge developed by C1 does not cut Tr1 off until the 5V supply has been fully established.

The trace shown in Fig.5(a), made using d.c. input coupling to the scope, shows the reset pin being held low until the 5V supply is firmly established. It was obtained using a digital storage scope set for a single sweep (the scope had a built-in printer). Such equipment is not generally available in a service workshop, but I've obtained the same trace using a standard dual-beam scope set for a single-shot trigger with the brightness turned up to make use of the phosphor's persistence.

The trace in Fig. 5(b) shows the waveform at the collector of Tr1 following switch-on, with the scope set to a.c. input coupling. This is often helpful as an initial check to see whether the reset circuit is doing anything at all.

If the reset generator fails, the player is likely to show all sorts of fault symptoms because the CPU and other chips such as the decoder will be operating with rubbish locked into their memories. This data will be lost every time the player is switched off, but new rubbish will be stored at the next power up. This can lead to the situation where the customer complains that the player is suffering from faults too numerous to mention, though the troubles are all due to a single component.

In Conclusion

So we come to the end of this series. I'm aware that in some sections there was rather a lot of theory, but wherever possible I've attempted to relieve this with practical comments and advice.

At the start of the series I commented on the value of having a good grasp of the theory on which CD players are based and concluded that such an understanding is helpful when you are faced with what appear to be difficult and obscure faults. The value of such an understanding extends beyond just CD players however. The principles of DA and AD conversion for example are used in a lot of other equipment today. I feel that the CD player provides a sound training for servicing much of the domestic electronic equipment that we will be encountering during the next few years, since it introduces the engineer to such new features as optical pick-up control and readout, digital servos, data handling systems, data storage and so on.

Acknowledgements

In conclusion some thanks are due. First to Ken Clements of Pioneer UK for his technical support in the early stages of preparing these articles, and more recently to George Cole for answering my queries on the unused subcode words.

De Luxe Component Tester

Part 1

David Botto

More and more TV/video service engineers are finding that a component tester makes their life easier. The de luxe component/signature tester described in this article is easy to construct and simple to use. You'll find that it's often quicker to use the tester to check every component on a PCB rather than having to spend time tracing out the circuitry then testing likely suspects. Colleague Pete, who has been using my first component tester unit since details of it were published back in 1984, now wants to get his hands on this latest one which incorporates many extra features.

The de luxe tester will rapidly check bipolar transistors, diodes, zener diodes, thyristors, LEDs, VCR end sensors, capacitors, resistors, chokes, mains transformers, loudspeakers and many other components. It also operates as a signature tester, and is particularly helpful when you're trying to identify unmarked surface-mounted or other components.

The tester can be used with almost any oscilloscope. If you've an old one that's gathering dust because it doesn't meet modern requirements you can connect it to the tester permanently. Set the scope to its X/Y mode: the internal timebase isn't used because the tester supplies a horizontal scanning voltage. The waveform displayed on the scope's screen instantly and accurately reveals the condition of the component under test.

The usual way of checking transistors and diodes is with an ohmmeter. This is o.k. when the fault is a dead short or an open-circuit, but it's not a completely reliable test procedure. The component tester really scores here, by revealing the slightest defect or leakage in a transistor or diode. Another benefit, except when testing thyristors, is that only two test leads are required. This is a lot easier than having to do the juggling act that some transistor testers call for, as you try to hold three prods in contact with a transistor's leads.

The unit also serves as a useful continuity tester for general servicing work.

Principle of Operation

The tester operates as an extension of an oscilloscope's circuitry. To obtain the best results, it's essential to understand exactly how the tester works.

Fig. 1 shows at (a) to (f) the operation of the tester. In Fig. 1(a) an a.c. voltage is connected across the two resistors R-low and R-high via terminals A and B. Almost the full a.c. voltage is applied to the scope's X (horizontal) input, producing a horizontal line on the screen – see Fig. 2(a). If terminals Ch and T are shorted across, as shown in Fig. 1(b), the entire a.c. voltage is applied to the scope's Y (vertical) input, producing a vertical line on the screen – see Fig. 2(b).

If a diode or transistor junction is connected across T and Ch (chassis), as shown in Fig. 1(c), the diode will conduct when the a.c. waveform at Ch is positive-going – the diode is reverse biased when the waveform at Ch is negative-going. Fig. 2(c) shows the resultant waveform display on the scope. Reverse the diode and you'll see the waveform shown at Fig. 2(d). With a good diode (or transistor) junction the waveforms displayed will be sharp and clear, with sharp right-angled corners.

A zener diode produces the waveform shown in Fig. 2(e). The diode's barrier potential produces one upright line, the other being produced by the reverse conduction zener characteristic.

Fig. 1(d) shows a thyristor connected with its anode to terminal T and its cathode to terminal Ch. With a good thyristor you'll see the waveform shown in Fig. 2(a). When a suitable d.c. voltage is applied to thyristor's gate the device will fire, producing a diode waveform of the type show in Fig. 2(d).

A resistor connected across T and Ch – see Fig. 1(e) – lowers the value of R-high. As a result less a.c. voltage is fed to the scope's X input while the a.c. voltage at the Y input increases. This produces an angled line, see Fig. 2(f), because an a.c. voltage is present at both the X and Y inputs of the oscilloscope. The angle of this line depends on the ohmic value of the test resistor. If the scope's sensitivity at its X and Y inputs is the same, the angle of the line will be 45° when the ohmic values of R-low and the parallel combination of R-high and R-test are equal.

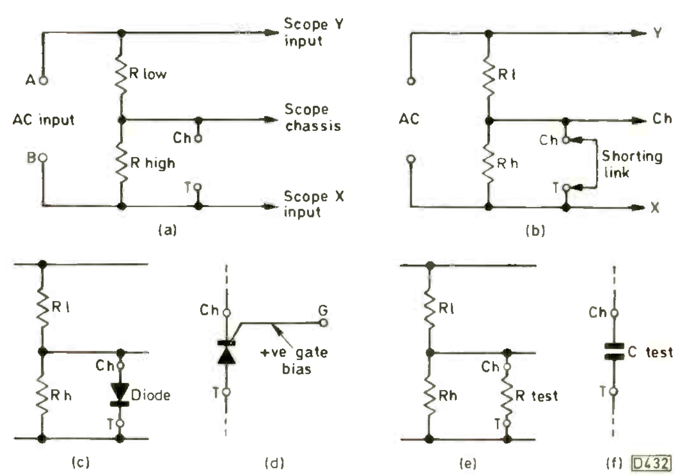


Fig. 1: Principle of the tester (a-b); (c) shows a diode test, (d) a thyristor test, (e) a resistor test and (f) a capacitor test.

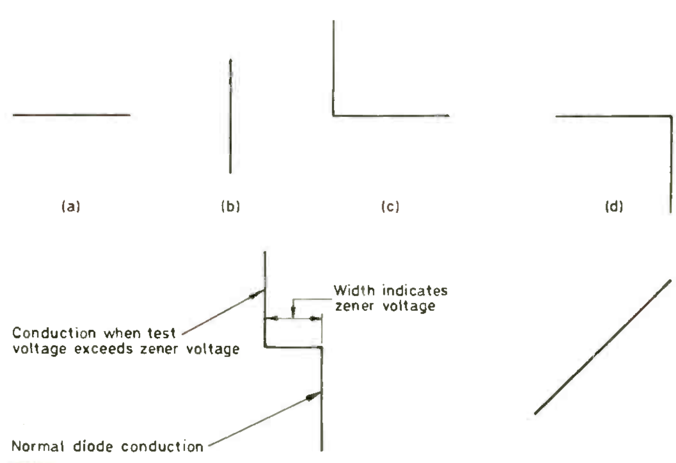
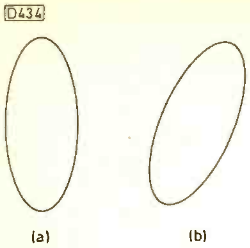


Fig. 2: Basic waveforms (a-d); zener diode waveform (e); resistor waveform (f).



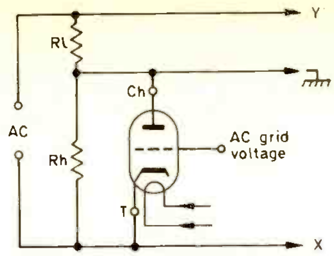


Fig. 3 (left): Waveform produced by a good capacitor (a) and a leaky capacitor (b).

Fig. 4 (right): Valve testing circuit.

A capacitor connected across T and Ch will charge first in one direction then the other. The result is an elliptical display on the screen as shown in Fig. 3(a). The size of the ellipse depends on the value of the test capacitor. Leakage in the capacitor shows up as a badly tilted ellipse – see Fig. 3(b) – since this is the same as connecting a resistor across R-high. Because of the low test voltage used, electrolytic capacitors can be checked.

The a.c. voltage applied to points A and B can range in frequency from 20Hz to 25kHz. The tester makes use of the 50Hz mains frequency because this is convenient and stable.

The tester's principle is not new – it dates back to the days when the valve was supreme in fact. When a diode valve is connected with its anode to Ch and its cathode to T it will conduct only when Ch is positive with respect to T. With a triode or multigrid valve the anode current will vary with changes in the a.c. or d.c. voltage at the control grid. If the a.c. grid voltage is of a different frequency to the mains the circuit operates as an effective dynamic valve tester. Anyone interested in servicing vintage equipment might find this feature useful. See Fig. 4.

Circuit Description

Fig. 5 shows the complete circuit of the de luxe component tester. The 240V a.c. mains supply is applied to points A and B, the miniature green neon N1 providing an indication that the instrument is powered. Fuses F1/2 and resistors R1/2 connect the mains input to the primary windings of the two miniature mains transformers M1 and M2. Resistors R1 and R2 limit the power applied to the component under test. With no load connected to the secondary windings of transformers M1 and M2 the a.c. voltage across their primary windings is 240V. When a load is connected across either secondary winding however the a.c. voltage across the primary windings drops. This limits the power applied to the component under test, protecting small diodes, transistors and i.c.s.

Two miniature transformers, from RS Components, were used to obtain the correct voltage drop and to save space and cost. It's best to use the transformers specified. The secondary windings are connected in series so that, off load, 20V, 40V and 80V a.c. test voltages are fed to switch SW4A. When a component is being tested these voltage levels fall considerably. SW4B is ganged with SW4A: when position 2 is selected the amber neon N2 lights, indicating that the correct a.c. input voltage has been selected for i.c. testing. By selecting position R on switch T4 the voltage applied to the i.c. under test is reduced still further. Switch SW4 is rated at 125V a.c., which is appropriate since it's connected to the centre tap on M1: the neon N2 still lights brightly at this reduced voltage.

User control VR1 sets the amplitude of the vertical trace. Initial adjustment is done with the "set" position of switch T4 selected. VR2 adjusts the horizontal drive output voltage applied to the scope's X (horizontal) input. It has a calibrated scale so that the user can measure the voltage of a zener diode under test. The zener voltage scale's range of 1·1-63V could be extended to cater for higher voltage zener diodes, but for general servicing a maximum of 63V is usually sufficient.

ICH1 is a 28-pin, zero-force insertion type i.c. socket. Switches SW1/2/3 together with toggle switches T1/2/3 select the i.c. pins so that waveform tests can be made between all adjacent pins. Each pin of socket ICH2 is directly wired to the same number pin of socket ICH1.

Small transistors or diodes can be inserted in sockets Q1 and Q2. Switch SW3B selects these sockets in turn: they are handy for making comparison checks between two devices.

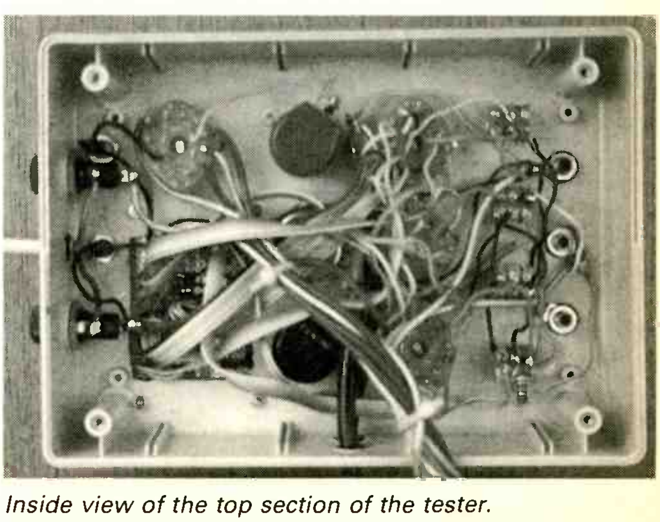
T is the thyristor test socket. VR3 adjusts the gate bias voltage applied to the device from the 1·5V battery. This socket is intended for use with small thyristors: larger ones can be checked by using three test leads plugged into the instrument's T, G and Ch sockets.

Construction

The accompanying photographs show the finished unit and its interior layout. Everything possible has been done to ensure ease of construction and reliability in use. The case, obtained from RS Components, is a tough one designed to stand up to everyday use in the workshop. It's made of a type of plastic that's easy to drill. The useful built-in battery compartment holds four batteries, though the tester uses only one. The case size is such that all the components can be housed without being packed too closely. It doesn't take up much room on the bench.

The components list includes everything you'll need to build the tester. The parts have been carefully selected taking quality, price and ease of construction into account. By using them you'll need only to drill some round holes and make the cut-out section behind the PCB. To ensure trouble-free construction and operation it's best to stick to the recommended parts. The specified resistors are of higher wattage rating than is strictly necessary, but this will contribute to long-term stability and reliability. To avoid scratching the case it's best to have a rubber instrument mat on the bench while constructing the unit.

Begin by drilling the round holes required in the top



Inside view of the top section of the tester.

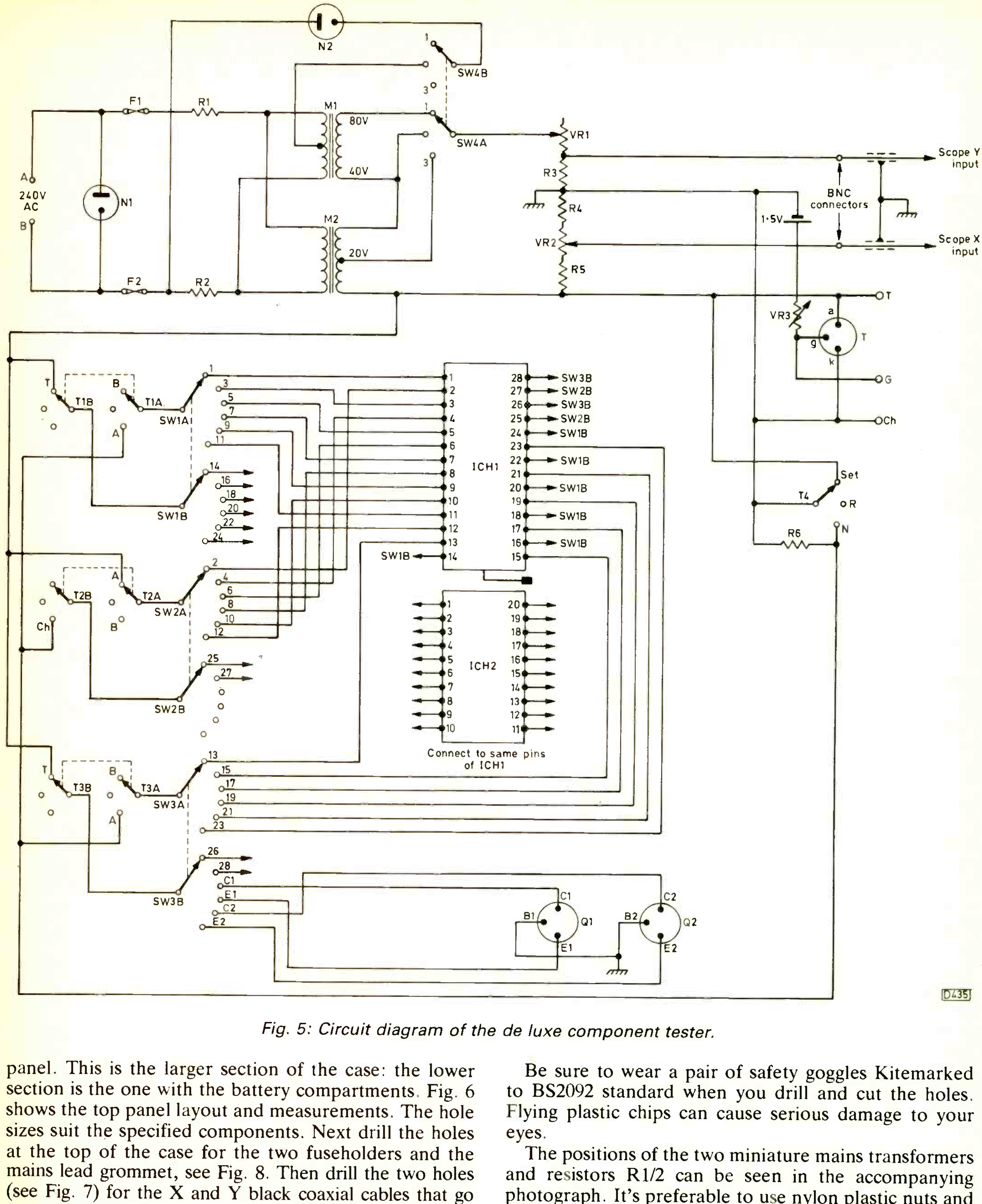


Fig. 5: Circuit diagram of the de luxe component tester.

panel. This is the larger section of the case: the lower section is the one with the battery compartments. Fig. 6 shows the top panel layout and measurements. The hole sizes suit the specified components. Next drill the holes at the top of the case for the two fuseholders and the mains lead grommet, see Fig. 8. Then drill the two holes (see Fig. 7) for the X and Y black coaxial cables that go to the scope: these holes are on the right-hand side of the case and are fitted with grommets.

You can now fit all the panel-mounted controls, lamps and sockets. Leave the fixing nuts for switches SW1/2/3 slightly loose. Fit the fuseholders and the grommets for the mains lead and the leads to the scope. Continue by drilling four small holes at each corner of the rectangular plastic section that has to be removed. Use the small PCB as a template. The rectangular hole is easy to cut out using a trimming knife with a suitable saw blade fitted.

Be sure to wear a pair of safety goggles Kitemarked to BS2092 standard when you drill and cut the holes. Flying plastic chips can cause serious damage to your eyes.

The positions of the two miniature mains transformers and resistors R1/2 can be seen in the accompanying photograph. It's preferable to use nylon plastic nuts and bolts to secure the parts to the case. Four heavy-duty self-sticking cushion feet should be fitted to the bottom of the tester: these will keep it rock-steady on your bench.

Complete the instrument wiring as shown in the circuit diagram but leave the wiring to switches SW1/2/3 and the small panel-mounted PCB for the present.

Fig. 9 shows the socket layout on the small PCB, which is available from Tandy. It's not necessary to make you own panel: the two i.c. holders and three transistor sockets fit nicely on the Tandy one. Use either

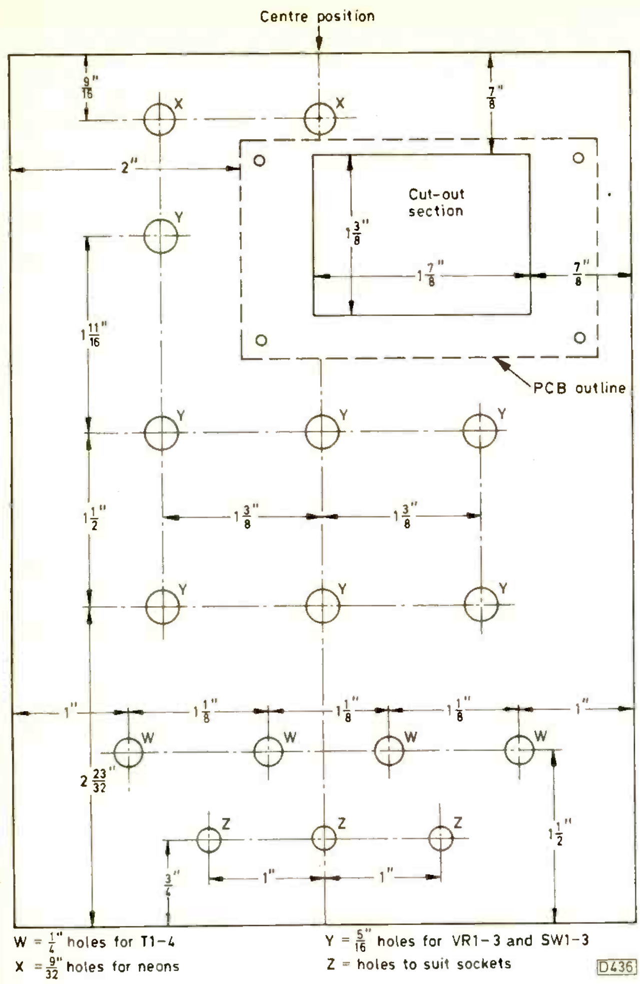
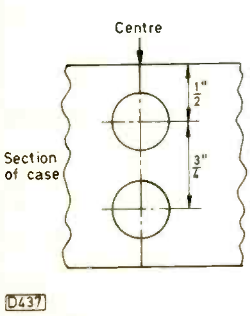


Fig. 6: Top panel layout.



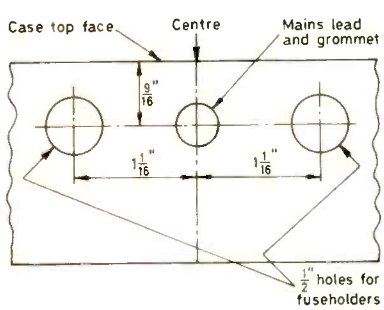


Fig. 7 (left): Side holes for the coaxial cable leads – sizes according to grommet and cable diameter.

Fig. 8 (right): Holes at top of case for the fuseholders and mains cable. Mains lead hole to suit cable/grommet.

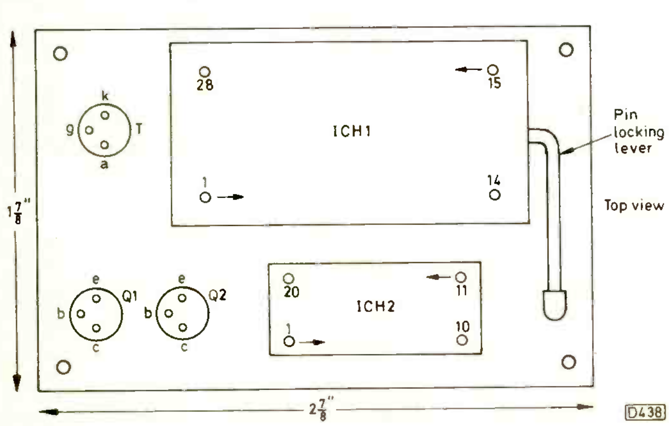


Fig. 9: Layout of the small PCB.

a small 17W iron or preferably a temperature-controlled iron fitted with a suitable bit to wire up the panel.

Wire pins 1-20 of holder ICH1 to pins 1-20 of holder ICH2, using light-gauge insulated wire. Take care when working on the PCB that solder blobs don't short sections of the copper print together.

Next solder strips of ribbon cable to the panel for connection to switches SW1/2/3. Cut and divide a sufficient quantity of ten-conductor bonded-ribbon cable into pieces of 14in. length – this length gives you a little extra tolerance during the wiring process. The specified cable is colour coded and the divisions and colours used in the original unit are shown in Table 1. Solder the cables to the i.c. socket pins, marking each bunch of coloured cables with the numbers of the i.c. pins to which they are connected. Bolt the PCB to the top of the case so that the cables feed into the instrument. You can

Table 1: Connections to SW1-3.

Suggested colour coding for ribbon cable divided into strips. Pin numbers are for holders ICH1 and ICH2.

Colour	*ICH pin*	*Switch*
Strip 1		
Brown	1	SW1A
Red	2	SW2A
Orange	3	SW1A
Yellow	4	SW2A
Green	5	SW1A
Blue	6	SW2A
Strip 2		
Green	7	SW1A
Blue	8	SW2A
Mauve	9	SW1A
Grey	10	SW2A
White	11	SW1A
Black	12	SW2A
Strip 3		
Brown	13	SW3A
Red	14	SW1B
Orange	15	SW3A
Yellow	16	SW1B
Strip 4		
Green	17	SW3A
Blue	18	SW1B
Mauve	19	SW3A
Grey	20	SW1B
White	21	SW3A
Black	22	SW1B
Strip 5		
Brown	23	SW3A
Red	24	SW1B
Orange	25	SW2B
Yellow	26	SW3B
Strip 6		
Green	27	SW2B
Blue	28	SW3B
Strip 7 to transistor holders	Q1/2	SW3B
Yellow	Q1 collector	SW3B
Orange	Q1 emitter	SW3B
Red	Q2 collector	SW3B
Brown	Q2 emitter	SW3B

Components List

Electrical items

M1, M2	6VA miniature mains transformers with 0-20V/0-20V secondary windings. RS Components stock no. 196-319
F1, F2	1AT 20mm fuses
N1	240V a.c. green neon light. Tandy stock no. 272-708
N2	240V a.c. high-brightness amber neon light. Tandy stock no. 272-707
VR1	1kΩ linear taper potentiometer
VR2	1MΩ linear taper control. Preferred type Tandy 271-211
VR3	3kΩ wirewound linear taper control
R1, R2	4·7kΩ, 5W small wirewound
R3	1·2kΩ, 1W
R4	10kΩ, 1W
R5	470kΩ, 1 W
R6	4·7kΩ, ½W

1·5V Ever Ready Silver Seal RS6 or equivalent battery

Switches

SW1-4	Rotary two-pole six-way switches. Tandy stock no. 275-1386. SW4 could be a three-way type
T1-4	Miniature d.p.d.t. toggle switches, on-off-on. Tandy stock no. 275-620

Case

Plastic instrument case, style 3, RS Components stock no. 505-117. 190mm long, 138mm wide, 68mm high

Four heavy-duty cushion feet, Tandy stock no. 642-342

Small sheet of thin transparent plastic to cover panel scale

Lettering plus Klarlack clear varnish. See text

Mechanical parts

Length of terminal block for transformer leads

4BA nylon nuts and screws to secure transformers and tagstrip. RS Components stock no. 522-055.

Two 2ft 6in lengths of good-quality black co-axial cable to connect to scope plus two BNC plugs

Mains cable, 3ft, white

Moulded grommets to suit mains and scope leads

Experimenter's i.c. Perfboard, Tandy stock no. 276-150. Four screws, nuts, washers and spacers to suit

One zero-insertion force 28-way i.c. socket. RS Components stock no. 402-248

One 20-pin i.c. holder

Three PCB transistor holders (Q1, Q2, T). RS Components stock no. 401-661

Ten-conductor bonded ribbon cable. Tandy stock no. 278-7050

Three 4mm insulated panel mounting sockets, two black one red

Three miniclip test leads with 4mm plugs, Tandy stock no. 278-1160

Nylon wire ties

Six moulded knobs with ¼in shaft fittings and white line indicator, ¾in diameter. Tandy stock no. 274-415

One moulded knob with ¼in shaft fitting and white line indicator, 1in diameter. Tandy stock no. 274-416

Circuit varnish

Panel scale – see text

Calibration zener diodes

1·1V, 2·7V, 3·3V, 4·4V, 5·1V, 5·6V, 7·5V, 9·1V, 12V, 30V, 47V, 56V, 61V

now cut the cables to the correct lengths to reach switches SW1/2/3. Allow a little extra length in case you need to remove the PCB. Fig. 10 shows the switch contact arrangement used by the two-pole, six-way Tandy switches which are well made and reasonably priced. Finally wire the PCB leads to the switches. At this stage it's worth making ohmmeter checks to ensure that the ribbon cables from the switch connections of SW1/2/3 go to the correct i.c. pins and transistor holders. Check all wiring carefully.

Fit 4mm plugs at one end and mini or micro clips at the other end of the three test leads that plug into sockets Ch, T and G. The small clips are useful when holding small devices and when making in-circuit tests.

The last job, after completing the construction, is to fit the scales with the zener diode voltage indications and the SW1/2/3 switch position indications. Fig. 11 shows the scale full size. Copy it on to white paper and then photocopy it on to a thin white card. The fixing nuts of the panel controls will hold the card in position.

The lettering on the front of the tester is best done with dry-transfer lettering. Apply a coat of Pelikan Klarlack clear varnish over each letter, using a tiny

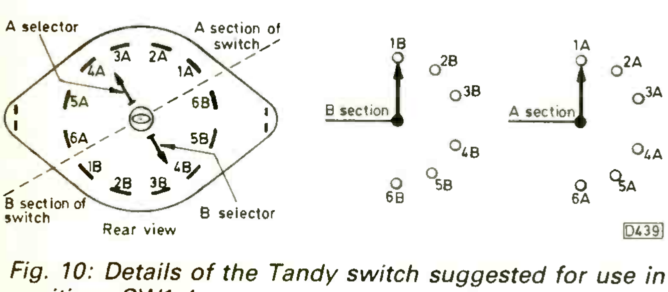
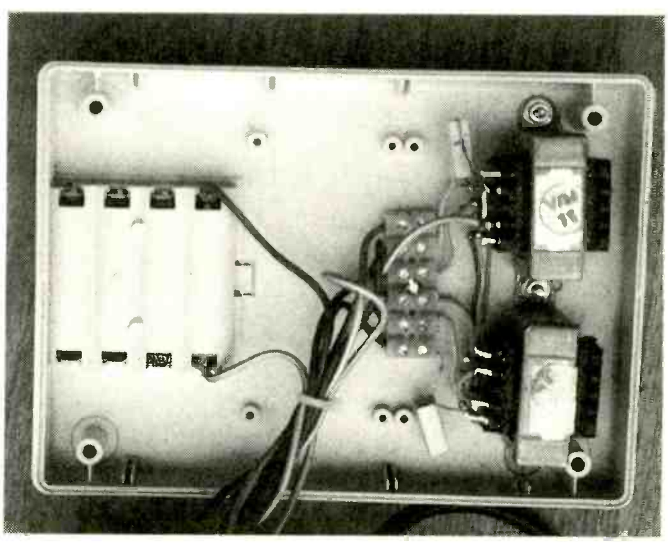


Fig. 10: Details of the Tandy switch suggested for use in positions SW1-4.



Inside view of the bottom section of the tester.

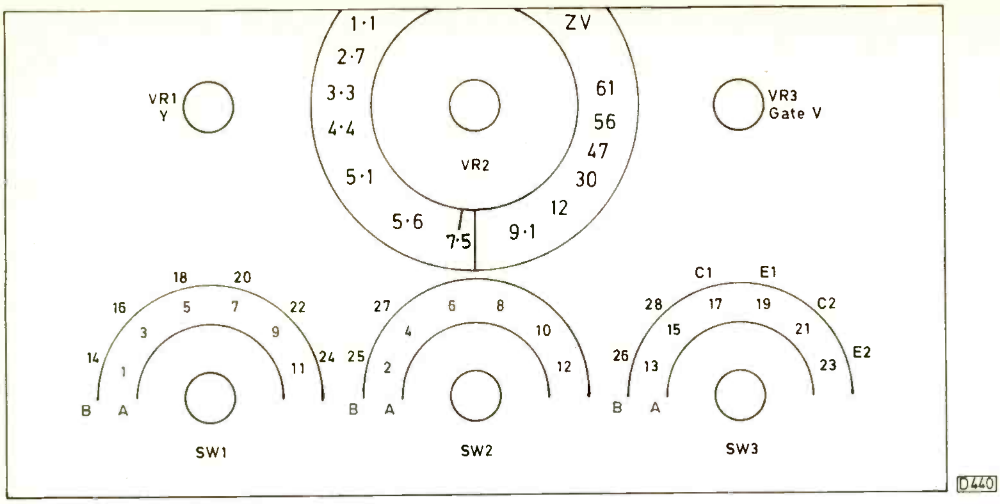


Fig. 11: Component tester scale, shown full size. Letters A and B indicate the toggle switch (T1-3) positions that select the marked scales of SW1-3.

brush, to prevent the letters being rubbed off. You can get the letters and varnish from a local art shop. Don't use cellulose varnish – this will remove the letters and the surface of the case.

Testing and Calibration

Check that the four toggle switches T1-4 are set to their centre positions. Connect the tester to the mains supply. The green neon should light. With SW4 in position 2 the amber neon should light.

Disconnect from the mains supply and turn VR1 and VR2 to their centre positions. Plug the screened leads, fitted with BNC connectors, to the scope's X and Y inputs. If these connectors won't fit your scope fit ones that will. Select external X drive – with some older scopes this may be labelled external horizontal drive. If in any doubt consult the instruction book. Set the scope's Y input to its least sensitive d.c. range. If the scope is an older model with just an a.c. input the tester will work but you may get a double image.

Reconnect to the mains supply and set the tester's volts knob (SW4) to position 2. Adjust the scope's X (horizontal) gain control until you obtain a centred horizontal line that slightly overscans the screen. Move

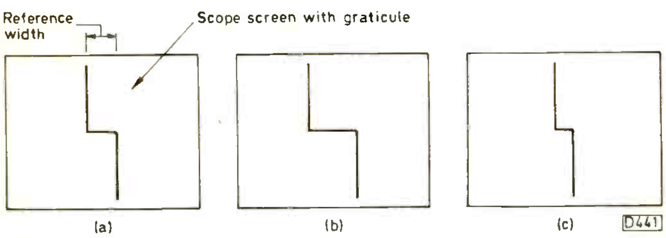


Fig. 12: Zener scale calibration: (a) 7·5V, (b) 12V and (c) 5·1V zener diodes.

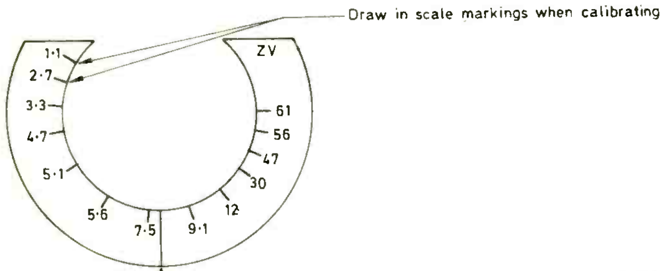


Fig. 13: How the ZV scale calibration is checked: for accuracy the lines connecting the figures to the scale edge should be drawn in on Fig. 11, using a range of zener diodes.

T4 to the set position. This should produce a vertical line. Turn VR1 to half-way and adjust the scope's Y (vertical) gain control until the line almost scans the screen. Centre the line then switch T4 to its N (normal) position.

Connect a diode across sockets T and Ch, anode to the Ch socket. If all is well you'll obtain a sharp, clear waveform of the type shown in Fig. 2(c).

To calibrate the ZV (zener voltage) scale, first make sure that the volt selection switch SW4 is still in position 2 and that the centre position of VR2 coincides with the centre scale line, then connect a 7·5V zener diode via the test leads between sockets Ch and T, with its anode to socket Ch. You should see the waveform shown in Fig. 2(e). Move the pointer line of VR2 to the 7·5V scale marking on the ZV scale. Adjust the scope's X gain (width) control until the horizontal section of the waveform covers just a small section of the screen – see Fig. 12(a). Replace the 7·5V zener diode with a 12V one. The horizontal section of the trace should widen as shown in Fig. 12(b). Turn VR2 to reduce the width until the horizontal section of the trace again covers exactly the same small section of the screen as in Fig. 12(a). The pointer line should now be opposite the 12V marking on the ZD scale. Connect a 5·1V zener diode across the test terminals and the horizontal section of the trace should narrow as in Fig. 12(c). Turn VR2 until the horizontal section of the trace is again as in Fig. 12(a). VR2's white line should read off 5·1V on the scale.

Provided you've used the specified Tandy control the ZV scale should be fairly accurate as drawn. Just the 7·5V calibration line is shown in Fig. 11. Fig. 13 illustrates the calibration procedure just outlined. Although the scale shown in Fig. 11 has been found to be accurate with several different scopes, to allow for component tolerances it's best to calibrate the scale using a range of known good zener diodes, drawing in the rest of the calibration lines yourself.

In addition to checking zener diode voltages the ZV scale enables you to identify the voltage of a zener diode whose markings have rubbed off.

After the instrument has been tested and the zener scale has been correctly calibrated, cover the scale with a thin sheet of clear stiff plastic to keep it clean. The panel control nuts will hold the scale and plastic cover without the need for glue that could damage the case.

Finally, using a small brush, apply a thin coat of circuit varnish to all soldered joints.

Next month we'll describe a broad range of tests that can be made with the unit.

The Ferguson FV30's Chopper PSU

J. LeJeune

The FV30 was the first of a new generation of Ferguson VCRs that show a trend away from Japanese design ideas towards a more European approach. Notable amongst these design trends is the use of a switch-mode power supply which is energised as long as the mains supply is connected to the machine. Although servicing the FV30 is not as simple as its predecesors, the power supply need not be a daunting prospect in a fault condition.

You'll find the power supply on the right-hand side of the machine. Take care over physical handling as the live mains and other high voltages are present on the PCB. Use of a mains isolating transformer is strongly recommended. With transistors that are directly connected you can get multiple failures under a fault condition. This is particularly so when the chopper transistor TP37 fails.

The power supply is capable of operating with a mains input over the range 110-240V a.c., either 50 or 60Hz. Consumption is 42VA maximum. There are three operating modes: (1) standby, (2) tuner (E-E) and (3) full operation. In the standby mode the power supply provides outputs for the microcomputer chip, the panel display, the r.f. mixer-booster and for tuning. In the tuner operation or E-E mode (tuner switch at "on") the power supply energises all the signal processing and control unit circuitry: this enables the machine to be used as a receiver with an output on ch. 36 or a video output via the scart connector. With full operation all the circuits are energised.

As there's no master switch the power supply is constantly on (when the mains supply is connected), providing a standby voltage. The microcomputer chip controls the application of power to the various parts of the machine. Fig. 1. shows the basic power supply circuit.

Circuit Operation

Three voltages are established when the machine is connected to the mains supply. These are: (1) a 300V supply which is provided by the mains bridge rectifier DP01-4 in conjunction with the reservoir capacitor CP07. (2) A 2-2·5V supply which is produced in under two seconds by DP11, RP12 and CP14. (3) A 3·5V supply which is produced in under two seconds by DP11 with RP11 and CP38.

When the second of these supplies has reached 1·5V the start-up oscillator TP16/17 will run at about 20kHz, driving the chopper transistor TP37 via TP28 and the

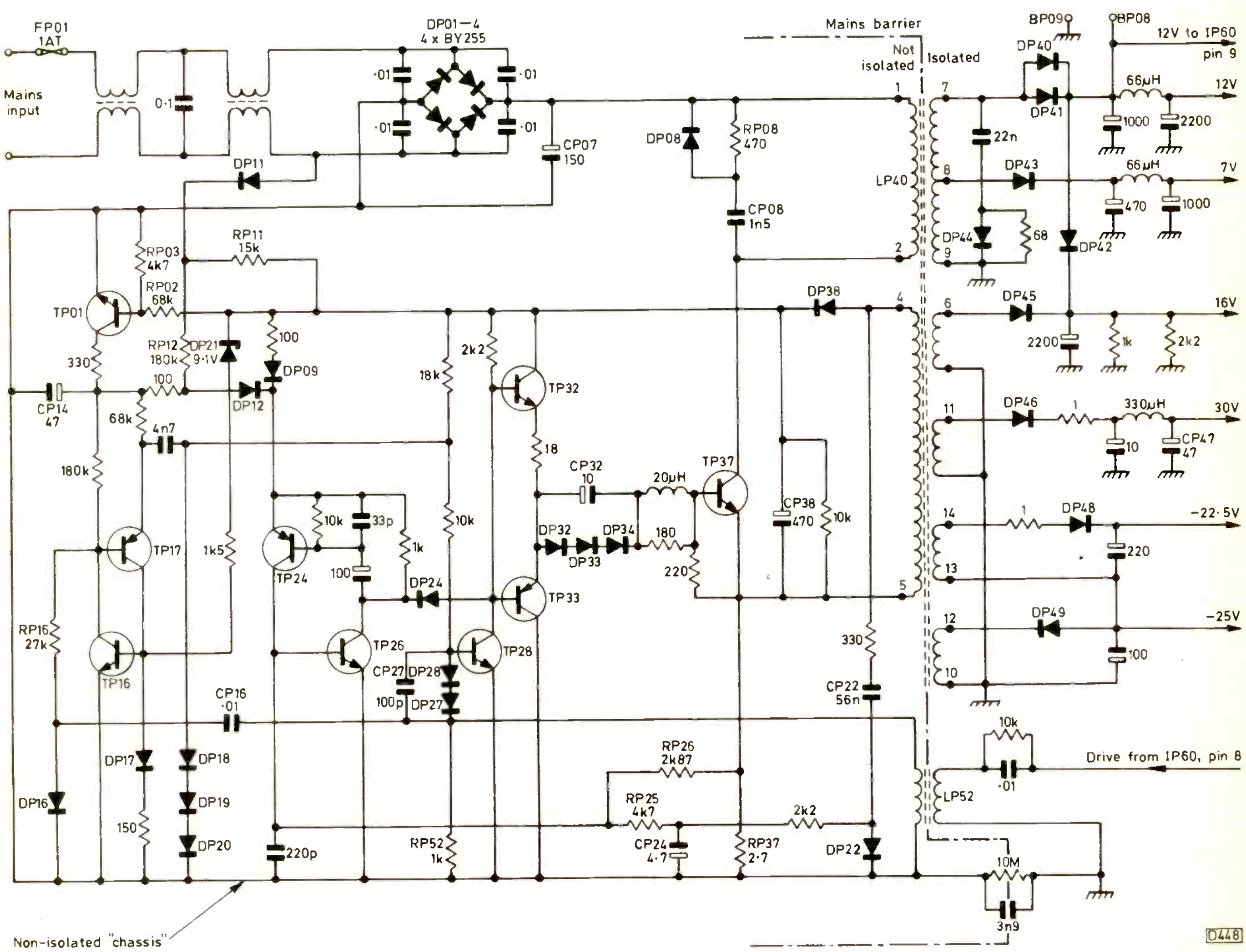


Fig. 1: The Ferguson FV30's chopper power supply circuit.

driver transistors TP32/3. At this time supply (3) powers these latter transistors (TP28/32/33). When the chopper transistor TP37 is switched on, the lower end of the chopper transformer's primary winding (pin 2 of LP40), which is supplied by the mains bridge rectifier, is grounded via RP37. As a result, a rising ramp current flows through the winding. When TP37 is switched off by the drive waveform the flux established by the ramp current collapses, energising the transformer's secondary windings.

Once the circuit has got going the drive for TP28/32/33/37 is provided by the regulator chip IP60 (see Fig. 2) via the isolating transformer LP52. DP40/41 supply 12V to pin 9 of this chip to power the emitter-follower output transistor within IP60. DP46 provides a 30V supply which is fed via RP59 to the 24V zener diode DP59. This is the main supply to the chip, which generates a reference voltage that appears at pin 12 and is then fed to pins 2 and 13. Within the chip the voltage at pin 2 is compared with that at pin 1, tapped from the set 12V control PP57. The error voltage thus produced is added to a sawtooth signal generated within the i.c. This is the classic pulse-width modulator arrangement. Over the whole feedback loop, the on time of the drive pulse applied to the chopper transistor is determined by the sample voltage at pin 1 of IP60.

The pulse-width modulated drive at pin 8 of IP60 is coupled to the base of TP28 via LP52 and DP27/28/CP27. During the start-up period it also synchronises the start-up oscillator via CP16/DP16/RP16.

As the circuit starts up DP38 develops about 13V across CP38. This supply powers TP28/32/33 and also, via the potential divider RP02/3, switches on TP01. As a result the supply to the start-up oscillator is effectively removed and it stops, leaving the chopper transistor under the control of IP60 which, via the PWM feedback, compensates for variations in the mains supply voltage and the VCR's current consumption, keeping the various voltages derived from the chopper transformer's secondary windings constant.

Transistors TP24/26 provide drive limiting in the event of excessive current demand from any of the circuits within the machine. CP22 and DP22 develop about −6V across CP24. This voltage is linked to the base of TP26 via RP25. When the chopper transistor TP37 switches on a positive voltage is developed across RP37. This appears at the base of TP26 via RP26. As a result TP26's base is normally at around −2V. Should the current demand be excessive TP37 will remain on for a longer period during each cycle of the switch-mode power supply's operation and the voltage developed across RP37 will rise. Should the voltage at the junction of RP25/6 swing positively TP24/26 will switch on, interrupting the drive to TP37. TP24/26 form a monostable oscillator which will remain on long enough to allow the circuit to stabilise and resume normal operation.

As voltages (2) and (3) rise slowly due to the time-contants RP12/CP14 and RP11/CP38, the chopper transistor is switched on for only very short periods initially, then for progressively longer periods until IP60 takes over. This constitutes a soft-start system, to ensure that the power is brought up slowly.

We'll next take a closer look at the operation of IP60. The inputs to the voltage comparator stage are at pins 1 (feedback from PP57) and 2 (reference voltage from pin 12). The second comparator (input pins 13 and 14) is so biased that it does not affect the regulation. Pin 3 provides a feedback path to stabilise the comparator,

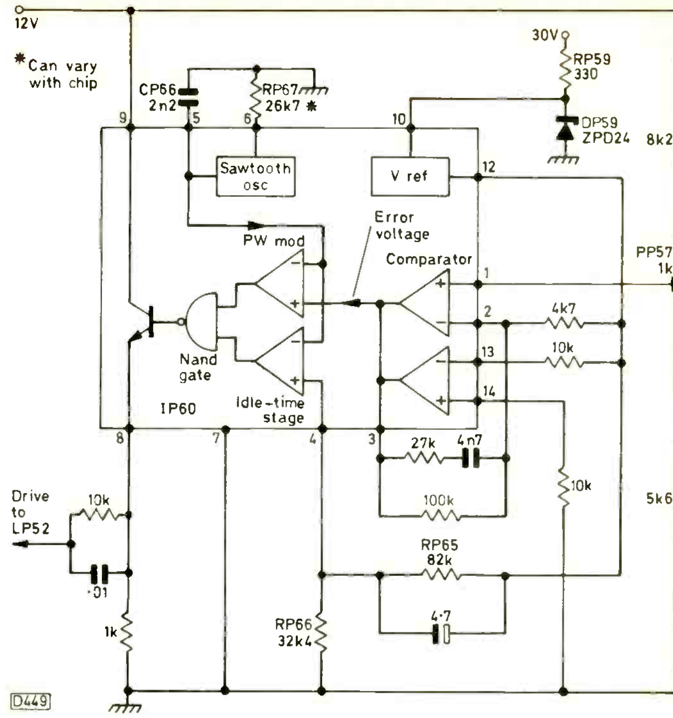


Fig. 2: The MC34060 regulator chip.

whose output at this point is applied to the non-inverting input of the following pulse-width modulator. The other (inverting) input to this stage (pin 5) comes from the internal sawtooth oscillator whose timing components CP66 and RP67 are connected to pins 5 and 6 respectively. The point during the sawtooth when the pulse-width modulator's output changes state depends on the error voltage. In this way a variable pulse-width drive waveform is produced to control the on/off times of the chopper transistor. The oscillator runs at approximately 20kHz.

The pulse-width modulator's output is one input to a NAND gate whose other input comes from the "idle-time" stage. This stage receives the sawtooth waveform at its inverting input and the reference voltage from pin 12 at its non-inverting input (pin 4) via a potential divider (RP65/6). It produces at its output a constant pulse-width 20kHz signal. When both its inputs are positive the NAND gate provides a negative-going output. The maximum pulse-width output from the NAND gate is therefore determined by the output from the idle-time stage. This provides stable limiting of the maximum output pulse width provided by the chip.

The chopper transistor TP37 is driven by a complementary-symmetry driver stage (TP32/33). When T28 is turned off by the output from IP60 TP32 conducts and TP33 is cut off. CP32 charges until there is sufficient forward bias for diodes DP32/3/4 to turn on. This arrangement provides the correct drive conditions for TP37 which switches on. When TP28 is switched on again by the PWM drive TP32 is turned off and TP33 conducts, discharging CP32 via TP37's base current. As a result TP37 is rapidly switched off. The flow of current in LP40's primary winding is thus interrupted and the magnetic flux it created in the transformer's core collapses rapidly. This produces a high back-e.m.f. in the primary winding and the other windings coupled to the core. These secondary outputs are rectified to produce the various rails required by the VCR.

IP60 monitors the 12V supply and as a result of the tight coupling of the other windings to LP40's core all the supplies derived from the transformer are stabilised.

The snubber network RP08, DP08, CP08 is included to protect TP37 from the fast-rising transient that would otherwise be present when it switches off.

Many of the supplies derived from the chopper transformer are fed to a switching circuit which consists of a simple transistor logic arrangement controlled by two switching signals – see Fig. 3.

In the standby mode the on/off monitor line is low because of the connection via RP93 to the −25V line. When the machine is set to the tuner (E-E) mode the on/off monitor line goes high, switching on TP77. As a result TP75 switches on and the 12V supply is applied to the signal circuits. TP73 also switches on, allowing 7V to be fed to the low-level servo stages and to the 5V regulator IP73. The latter supplies 5V to the signal circuits and to the collector of TP88. When play is pressed the servo on/off line ges high, switching on transistors TP71 and TP70. Thus 16V is passed to the servo system. In addition TP83 and TP88 are switched on to supply 12V and 5V to the servos. As a result of this arrangement power is applied to the servos in correct sequence.

Servicing

Switch-mode power supplies are about to become a way of life in the video sector. Though many engineers may hanker after the traditional mains transformer and static regulator designs, the switch-mode power supply operates at higher efficiency and does this at lower cost and less weight. Now to the servicing aspects.

The FV30's power supply, also the similar arrangements used in the FV31 and FV32, have a characteristic which, in human beings, would be described as volatile. Care is therefore required when servicing these power supplies as mistakes like forgetting to change the testmeter to volts from amps when checking a voltage, or

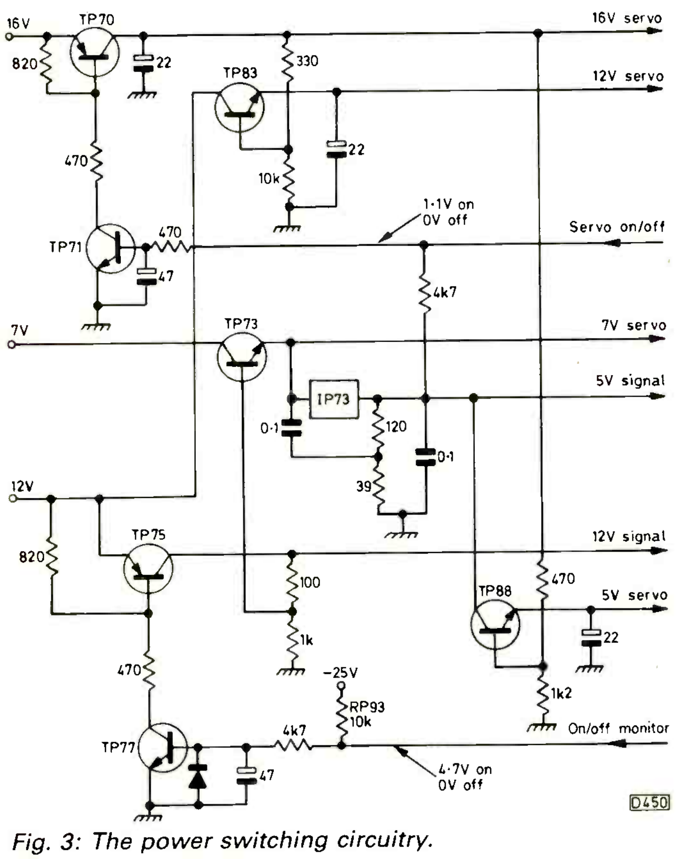


Fig. 3: The power switching circuitry.

a slight slip of a meter probe, will cause mayhem amongst the directly-connected transistors. Great caution is also necessary because of the high voltages present.

We should point out from the start that the circuit is sensitive to mains-borne transients. This can be the cause of repeated failure in the field. Make sure that the connections to the mains plug are sound and that the wall socket is satisfactory. If a domestic appliance is suspected of creating mains-borne voltage spikes, try fitting a suitably rated VDR to the offending item's mains input – or to the mains input in the VDR. These VDRs provide effective transient limiting.

The most common failure is a dead machine with fuse FP01 blown. In this event the chopper transistor TP37 is suspect number one. If you find that it's short-circuit RP37 will almost certainly have suffered as well. It should be investigated and if necessary replaced. If RP37 has been damaged it's certain that other items will have been affected because the 300V supply from the mains bridge rectifier will have passed via the shorted TP37 to the driver and preceding stages. It's therefore advisable to check TP24/26/28/32/33 plus diodes DP22/24/27/28/32/33/34. The start-up oscillator normally survives, but DP11, DP08 and DP38 could also have been damaged and may need replacement. It's often more economical to replace all the semiconductor devices en masse rather than risk another catastrophy when you switch on.

Say you've replaced all the dead silicon but you're reluctant to switch on before making certain that the same event won't instantly occur. Check the copper tracks around RP08 and the soldering to this resistor. These steps could save further mass destruction. Look for cracks in the print and bridge any you find with hook-up wire between the nearest solder pads.

A stage by stage check can now be made to ensure that all is well. First, if you've fitted a new TP37 take it out again! Remove TP01 and DP21. The start-up oscillator should now run continuously. Look for a sawtooth signal at the emitter of TP17 and check for 3V across CP14. There should also be about 12V across CP38. If there isn't, check that RP37 is o.k. The drive signal is applied to the base of TP28, but under these conditions it may be insufficient to turn TP28 on.

With no drive TP28 is on and TP32 is off. Check this part of the circuit by turning off TP28, using a shorting link between TP28's base and "chassis" – remember that it's live on this side of the chopper transformer. TP28 should switch off, TP32 on and TP33 off.

Checking the trip circuit under these conditions is not easy. A suggestion is to connect a 1·5V dry cell between the base of TP26 and "chassis", positive side to TP26's base, with a 470Ω resistor in series with the cell to limit the base current. This should turn TP26 on and indicate whether the trip circuit is likely to work in the restored power unit.

The regulator chip IP60 can be checked with the aid of a 12V supply. You need to apply this to test point BP08 and the positive side of CP47 as IP60 requires supplies at pins 9 and 10 to get going (the latter supply is normally derived from the 30V line). Connect an oscillope to pin 8 of IP60. If the chip is working you should see a pulse output.

You will find that you can work on the power supply more easily if it's removed from the cabinet. Desolder the mains lead and use another one for testing if you've no desire to struggle with the one fitted to the cabinet. Bare live terminals will be all too readily accessible, so great care must be taken.

When you are sure that your checks confirm that the unit will run, replace TP01 and DP21, fit TP37 and switch on. If you have a variac you can be more prudent, using it to set the mains input at 110V before you try the unit. If the power supply works under these conditions, set the 12V rail correctly (monitor at test point BP08) by adjusting PP57 *slowly*. Then raise the mains input to 240V and check that the 12V setting is maintained. If you've been thorough the power supply should work normally and the machine can be returned to its owner. If you haven't – go back to square one and try again!

The House Husband

Les Lawry-Johns

Well here I am, still trying to get used to retirement: confined to the bungalow and wondering what to do after I've done some of the jobs a housewife does. I never realised how hard they work and the different things they have to do. H.B. goes out most mornings to earn a few bob and I'm left to my own devices.I suppose I'll get used to it but I don't know when. The shop hasn't sold yet and I don't suppose it will for a while. If things don't change I might even rent it out to someone. At least that would help me pay the bank a little of what I owe it. I still get a few jobs, some of which might interest you.

For example the Philips G11 set I had to pick up the other day. There was only a vertical white line in the centre of the screen. This told me that the line timebase was working but the line scan coils weren't being driven. On inspection I found that the scan coupling capacitor C3135 ($0{\cdot}91\mu F$) had bulged out. When it was removed and checked it proved to be open-circuit. I found a replacement of the same value and rating but of more rectangular shape and fitted it, ensuring that it didn't touch any nearby components. When the set was switched on again there was a full raster but no vision or sound. I had to tune in all the stations as the owner had probably tried retuning in an effort at clearing the white line. It was then soak tested for a while before being returned to the owner who was pleased that it had been done so quickly – and cheaply (I can't bring myself to charge the current rates).

The next set I had to visit was a Bush one fitted with the Rank T20 chassis. This had no visible picture. The e.h.t. was o.k. so I took the coward's way out and increased the first anode voltages. This produced a picture but I'd forgotten the brightness network, so I couldn't do the job properly. The customer seemed to be quite happy however so I left him with it. I know a resistor had gone high in value but I didn't have the circuit with me. I may go back and do the job properly one day: when he calls me again for something else.

Then there was the Philips K30 with a scrambled picture and poor sound. I'd repaired the set some time ago – removing the aerial socket and repairing it. I thought that the present trouble would be a repeat performance but when a screwdriver was placed in the socket a much better picture was resolved. So I checked the cable from the VCR and then connected the main aerial cable to the set directly. The picture was till scrambled and as the plug and cable were o.k. I had to refer the owner to an aerial rigger. I used to put up aerial cable to the set directly. The picture was still

The jobs are not all that many, which is why I'm not writing so much. It's mainly a question of doing things like peeling the potatoes, which I'm doing while H.B. is out teaching her daughter to drive. Nobody did that for me. I had to teach myself on an airfield in Egypt. The second time I drove the lorry a Chief Petty Officer hailed me down and asked for a lift. As I was driving he commented "you blokes amaze me the way you can handle these vehicles". I didn't like to tell him I couldn't drive and wasn't licenced. A few nights later I was in charge of the night guard and had to post several men around the airfield. It was coming up for midnight so I popped over to the marine section and borrowed one of their lorries. While I was driving it around the hangers the port side wheels slipped into a hollow and the whole thing turned over. Luckily no one was hurt but we were unable to turn it back up. I waited till the next morning before reporting it and was subsequently charged and brought up before the C.O. As the officers from my squadron appeared on my behalf I got off lightly. A month's stoppage of leave I think, which didn't mean much being stuck out there. It's funny that I can remember such things that occurred fifty years ago but can't remember what happened yesterday.

But I can remember popping down to the shop when who should turn up but Beardy and Nonbeardy. This surprised me after the dust up we'd had on the previous occasion. They carted in a Philips K30 and said that it went off a few moments after it was switched on. When I switched it on I could hear the sparking. After removing the back cover I saw the arcing around the e.h.t. cap. I switched off and to my surprise the cap wasn't even clipped on. So I cleaned the area around the top of the tube and sprayed it with antistatic solution, then looked at the cap which was in a sorry state. I had to clip it off and look for another one, then peel the insulation back to prevent further discharge. Having done this it was just a matter of soldering the leads and pulling back the covering. When I clipped on the cap and switched the set on it came to life and stayed that way. After refitting the rear cover it was time to face the intrigued two.

"That's that" I said.

"Is that all it was?" said Beardy. "We don't have to pay for a little thing like that, do we?"

"Oh yes you do, and the next time you can try to do it yourself" I commented, wondering whether they would remember to discharge the e.h.t. cap to earth as I had done if they did try. After a struggle I manged to get £15 out of them before they left, vowing never to return to such a pricey establishment.

When I got back to the bungalow Stan from SEME called, not to take an order but to see if I was still alive and to see H.B. He left me the latest SEME catalogue which is full of interesting things. After he'd gone H.B. started on me.

"That cassette in the car is mucking about all over the place."

I'd fitted it only the week before and it was brand new. So that's another job I've got to do. I suppose I may get around to doing it one of these years . . .

CD Player Casebook

Reports from Mike Leach and Keith H. C. Parker

Sony Laser Problems

I've had a few problems recently with Sony laser assemblies. The type concerned is the KSS-150, which is used in various machines from different manufacturers. Various symptoms have been present. The first time I had trouble was with a Sony CDM20S that suffered from focus problems (jumping and skipping, etc.). Next there was a Denon DCD920 which spun the disc backwards at TOC readout. A Yamaha CDX630XE came in with the focus offset control at one end, while a Samsung CD ghetto blaster had no light emission at all. All these machines were fitted with variants of the KSS-150. Replacements cured the various faults. **M.L.**

Technics 5LP-420

Amongst the domestic machines available, Technics, Sony and Philips players are my favourites. When working correctly they knock spots off many other makes, especially the cheaper ones. This particular Technics player however produced all the signs of having a nasty fault: the laser assembly wouldn't return to the centre of the disc for TOC readout. I tried the plugs and sockets, to no avail, then took the main board out to check circuit protectors IC4 and IC5. As everything seemed to be all right I replaced the panel and ordered a service manual. Thought I'd just check again – and the machine worked! When I took the board out a second time I saw the cause of the problem. There were bad dry-joints around the regulators. A good old solder up and the machine worked very well. So there you are madam: your CD player is repaired but now weighs 3lb more than when you brought it in! **M.L.**

Pioneer Laser Problems

I've had problems getting the right laser unit for recent Pioneer models. Pioneer now supply revised versions of their lasers and until I discovered the code we were putting the wrong laser in certain machines. Most of these assemblies look exactly alike and all use the same method of fitting. They also have the same pin connections to the flexi PCB. The original part numbers were:

PWY1003, used in Model PDM-50 for example
PWY1007, used in Model PDX-940 for example

The correct replacements are type PWY1010 for the PWY1003 and type PWY1009 for the PWY1007. The two different types of laser are not interchangeable. If you fit a PWY1010 in place of a PWY1009 or vice versa it will not work and you could end up with the same fault symptom you had before. It's easy to do, I've done it and believe me you can be chasing your tail for hours. So check the part number with the manual first, then when the new one arrives check it against the replacement part numbers above. **M.L.**

Pioneer Multiplay PDM-610

This machine wouldn't eject the CD magazine fully. Instead of ejecting it by a couple of inches there would be partial ejection with the magazine jammed inside the player. I watched the operation of the mechanism for some while before I realised what was going on. Basically, the machine didn't return the disc into the magazine fully when eject was pressed. Thus the machine couldn't carry out the full eject operation.

The mechanism is rather complicated and difficult to explain. What was happening was that the lever that returns the disc into the magazine moved too slowly. It's driven by two sliding plastic plates beneath the top half of the mechanism. These two drive plates are separated by two ball bearings, presumably to reduce friction, and the problem was that one of the ball bearings was missing.

Stripping the mechanism is easy. Putting it back together isn't! But I was pleased that when everything had been reassembled after replacing the ball bearing the machine played and ejected perfectly. **M.L.**

Yamaha CDX2

We've had many of these machines with the complaint that the drawer will not open, close, does so intermittently or produces an occasional smell of burning. In all cases we've found that transistors TR220/1/2/3 have failed. Yamaha recommended that in addition to these motor-control transistors the 7V regulator TR232 and the mechacon control chip IC401 (MSM6404A-42RS) should be replaced. It seems that the chip can on occasions produce open and close control signals at the same time. Following this advice has cured the problem on all the machines I've had until recently when a player that had previously suffered from the problem was returned. There was a bit of additional information however – the player hadn't been used for some time.

After much thought I recalled that an almost identical circuit is used in the Yamaha CD2. My records showed that we'd not had failures of this type with the CD2. The difference is that with the CD2 the mechacon chip is on the main PCB while in the CDX2 it's on a small subpanel (operation 2). The problem turned out to be due to dirty contacts on the three- and four-pin plugs associated with the drawer limit switch and the logic drive betwen IC401 and TR220/1/2/3. **K.H.C.P.**

Denon DCD1300/1500/1700

On examination you may find that when the complaint with one of these machines is skipping and jumping the motor drive to the laser sled is very erratic in direction and seems to move with large jumps. In almost every case we've found that the cause of the fault is not the sled motor or its control but a laser with very low output. So check this first before ordering a very expensive motor. If the laser is poor I suggest you give the customer a quote as the laser assembly is even more expensive at approximately £150. **K.H.C.P.**

Interference from CD Players

Since the introduction of low-power Band II Community radio stations I've started to receive f.m. tuners for checking with the complaint that the local stations are sometimes "noisy" or "slightly unstable". No fault has been found with the tuners but on house calls to several customers I've discovered that they sometimes switch from playing a CD to the tuner in their hi-fi separates system without stopping the disc, allowing it to play to the end. The "unstable" interference is caused by the harmonics of the player's PLL, as it tracks the data from the disc, getting out of the player and into the tuner. If the player is on but stopped the interference is not apparent or at worst there's a slight hiss. The best cure is physical separation of the tuner/aerial lead and the CD player. I've found that Philips machines in particular give rise to this complaint. **K.H.C.P.**

Long-distance Television

Roger Bunney

April was a relatively quiet month, though there are indications that sporadic E conditions are already building up: a minor SpE spell occurred during the month, which is always a good pointer for a reasonable season to follow. The log below is varied and includes a flurry of excitement. Reception is SpE unless otherwise indicated.

5/4/90	TVE (Spain) ch. E2.
6/4/90	During a minor F2 opening Simon Hamer logged Australia ch. 0 at 1215 GMT, also TSS (USSR) ch. R1 and an unidentified ch. E2 signal, probably from the Arabian Gulf.
7/4/90	ARD (West Germany) E2.
9/4/90	+PTT (Switzerland) E2; TVE E2; TVP (Poland) R2.
10/4/90	TSS Eeste R2.
11/4/90	RAI (Italy) IA, B; Telemarket E2, TVA IA and a third Italian E2 signal – these are all "Private" stations.
12/4/90	RTP (Portugal) E3.
14/4/90	TVE E2; unidentified E2 programmes.
18/4/90	TVE E2; TSS R1, 2; YLE (Finland) E3; TDF (France) L3; RAI IC.
19/4/90	+PTT E2, 3.
20/4/90	TVE E2, 3.
21/4/90	TVA IA.
22/4/90	TVE E2.
23/4/90	TVE E2, 3, 4; RTP E2.
28/4/90	JRT (Yugoslavia) E3, 4; CST (Czechoslovakia) R2.
30/4/90	DR (Denmark) E3; +PTT E3; TVE E3.

A massive auroral event was seen on the evening of the 10th, giving signals throughout Band I and into Band III. RTE (Ireland) was seen on chs. B, D, F, G, H, I and J, all with distortion and the characteristic humming effects.

There was a minor tropospheric opening from the 23rd to the 26th, with signals mainly from West Germany, Denmark and the Benelux countries. High pressure at the end of the month, continuing into early May, produced an established lift and at the time of writing reports of reception from West/East Germany and Denmark are coming in from DXers in Scotland and down to the southern UK. The weather maps suggest that this could be a "big" one.

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

The French La Sept service is to transmit to Czechoslovakia and Poland via the TDF satellite. The service will include a compilation of East European offerings, CNN, MTV and sports from current satellite fare. Poland hopes to transmit the La Sept service for three hours daily on each TVP network.

Superchannel, currently at 13°E, is to move to a new higher-powered satellite in the Eutelsat-2 series due for launch later this year. There are to be six Eutelsat-2 series satellites in all, one held as an in-orbit spare. Eutelsat has also confirmed that it's seeking tenders for the Europsat DBS craft which it hopes to launch in the mid 90s.

News Items

Rumania: There is now regional programming at several locations, usually between the morning and afternoon network programmes and after the main network close-down at night. The networks now call themselves TRL – Televiziunea Romana Libera. TRL-2 is back on air. During 1300-1330 local time weekdays TRL-1 relays the satellite distributed French-language programme Canal France Internationale.

East Germany: The GDR TV network is now known as DFF (Deutscher Fernsefunk), as it was in the early 70s. Test cards show either DFF-1 or DFF-2. Regional programming is spreading, with "Nord Report" going out from the Rostok studios over the Schwerin, Marlow and Helpterberg transmitters at 1600 local time. The Dresden studios will provide the next regional opt out, from the Dresden, Lobau, Leipzig and Karl-M-Stadt transmitters. Following German reunification DFF-1 will transmit ARD-1 and DFF-2 ZDF-2, with private stations such as RTL+, Sat 1 etc. also being transmitted in the GDR area. Neighbouring countries have agreed in principle to permit DFF programming in their schedules. RTL+ is to start transmissions on ch. E44 at 100kW e.r.p. soon.

Czechoslovakia: CT-1 (Russian service relay) is now carrying a mix of satellite distributed programming including the French TV5 service.

Lithuania: Ch. R38 (600kW e.r.p.) now carries the Polish TVP-1 service, Leningrad TV having been dropped.

Iceland: All Stod-2 programmes (Reykjavik ch. E12) are now scrambled. There are plans for a second commercial service to start this autumn, using the logo SYN-TV – with scrambling.

Greece: More private stations are due to open – to date the government has received over a hundred applications from programmers seeking channels. Several private stations are at present on air illegally.

Poland: It looks as though advertising will be included with TVP-2. The country's first private station, TV Echo, is now transmitting from Wrocklaw on ch. R28 for four-five hours daily. Satellite programming is included. Lublin is to have its own station soon. TVP-3 Warsaw is now on ch. R44.

Spain: The Channel 9 regional station in Valencia is now in operation, transmitting from 1900-2400 weekdays and longer at the weekends. Approval has been given for the start of a fourth nationwide service.

Cyprus: Coverage is being increased in the Turkish

Times past. On the left the 1938/9 BBC tuning signal from Alexandra Palace. Arrows A and B had been added in the magazine (see text) to indicate particular points. The centre photo shows BBC announcer Elizabeth Cowell while that on the right shows Jasmine Bligh, another BBC duty announcer, both received in 1938 at the New York RCA research station via F2 layer propagation. Alexandra Palace operated on ch. 1 (vision carrier 45MHz).

controlled area. A new transmitter in the far eastern part of the island will broadcast to Israel, Syria and the Lebanon.

Africa: TVZ (Zanzibar) is seeking funds to upgrade its system. A microwave link is being set up between Libya and Egypt. A new station and studio are to be set up in Rwanda within five years.

New Zealand: Private stations are being set up, using the u.h.f. channels. It's thought that with careful planning twelve main and sixty relay transmitters could be accommodated.

Amateur radio: Over 120 permits have been issued in Italy allowing 50MHz operation with 6W input to the aerial. Limited 50MHz operation is now allowed in Egypt, and in West Germany amateurs can in most areas operate at up to 25W e.r.p. with horizontal polarisation.

From our Correspondents . . .

George Gaskin, our correspondent in Gibraltar, has installed a WB4 Band I wideband array atop the block of flats in which he lives. His first reception turned out to be not exactly exotic! Noting a weak ch. E3 TVE signal he assumed that good tropospheric conditions were providing him with reception from the Canaries. It later transpired that reception was from a communal distribution system over the border at a distance of 1km. Identification was established when computer-generated advertisements were inserted.

Wenlock Burton writes from Victoria, Australia reporting that a teletext service, Austext, is now carried on his local ch. 7. It includes promotions for "Data Broadcasting", a firm specialising in point-to-point links similar to page 777 on Oracle.

W. Drake in Lowestoft is currently using XG21W and Fernseh aerials for DXing and has experienced considerable success with tropospheric reception, including DFF ch. E34 and signals from Denmark and West Germany.

David Tilley has received several satellites as well as Astra using his 60cm Amstrad dish. He wants to swap his JVC C-210KM FST receiver, in new condition with PAL/SECAM/NTSC (3·58/4·43) and baseband inputs/outputs, for a JVC FST set incorporating teletext. Write to him at 6 West Down, Ashthomas, Tiverton, Devon EX16 4NR or telephone 0884 820 765.

EBU Listings

Belgium: Two American Forces stations have been listed this month, clearing up a mystery. They are Everbert ch. 33 with 2kW e.r.p. and Florennes ch. 34 at 10W e.r.p., both with horizontal polarisation. Note that AFRTS Shape continues to use ch. 34 with 4·5kW e.r.p. vertical. These transmitters all use 525 lines.

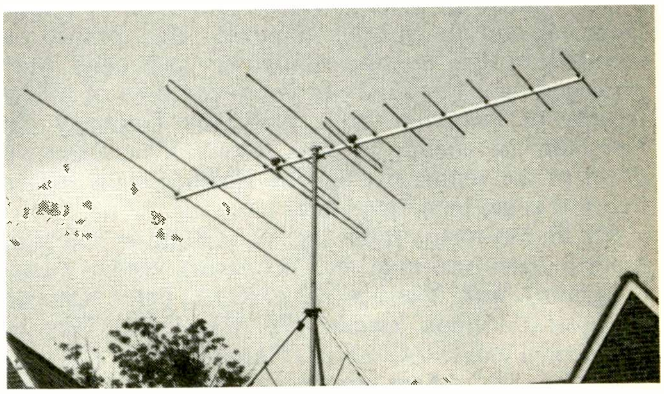
Holland: Smilde ch. E6 and Markelo ch. E7 (NOS-1) now have two-carrier sound.

France: Many new La Cinq and M6 transmitters are listed. Those with over 1kW e.r.p. are as follows: Valenciennes ch. E34 M6, ch. E49 La5, 5kW horizontal; Chalon-Sur-Sadne ch. E41 M6, ch. E44 La5, 2kW vertical; Parthenay ch. E60 La5 30kW horizontal.

New DX-TV Array

Bearing in mind environmental considerations, there's long been a need for an efficient, compact v.h.f. array for DX use covering Bands I, II and III. I was asked to produce such a design by Aerial Techniques, and the result is shown in the accompanying photograph. At the rear of the array there's a three-element wideband system covering chs. E2-4 (48-70MHz) with a gain of typically 2-4·5dBd over the range 50-65MHz. For Band II a three-element proximity coupled system covers 75-100MHz (chs. R3-5 and IC) with a gain of around 2·5dBd: it's coupled to the Band I dipole by the closely spaced discrete Band II elements at each side of the main folded dipole. At the front there's an eight-element wideband system covering 175-230MHz (chs. E5-12) with a gain of 7-9dBd.

A single one-inch sided square boom is used with half-inch diameter hard-drawn seamless elements throughout, giving a really strong system. Connections can be made to each dipole (low v.h.f. and high v.h.f.) using 75Ω feeders. Alternatively a phasing harness with single feeder or a diplexer can be used. For DX use separate feeders are best. The photograph shows the



The new TV-DXing/export wideband v.h.f. aerial available from Aerial Techniques.

aerial prior to being erected on a conventional mast and less feeder(s). Aerial Techniques is distributing the aerial – see nearby advertisement or phone 0202 738 232 for further details.

DTI News

The Radiocommunications Division of the DTI is to operate as an "Executive Agency" in future. Its aims are laid down as providing an effective, quality service to radio users by managing the radio spectrum, allocating and assigning radio frequencies and ensuring interference-free use of the spectrum. This should mean obtaining licences more quickly for fixed, mobile and marine applications.

The Agency has listed frequencies allocated for "independent programme making" for contracted work to IBA franchise holders and the BBC and for radio/TV links. The frequency bands to be used impinge on the conventional TV broadcasting bands used for TV-DXing. For radiomicrophones, at 10mW or less, the frequencies are 191·9, 208·3, 216·1, 583·455, 584·435, 585·570 and 588·4MHz – the latter four frequencies will be subject to geographical limitations after mid-1992. The bands for talkback and sound links are: 48·4-48·5MHz (8 12·5kHz channels); 52·85-52·95MHz (8 12·5kHz channels); 199·6-199·8MHz (20kHz channels); 457·25-457·35MHz (8 12·5kHz channels); 460·5-460·75MHz* (20 12·5kHz channels); 462·75-462·85MHz (8 12·5kHz channels); 467-467·25MHz* (20 12·5kHz channels); 854·75-855·25MHz (20 25kHz channels); 860·25-860·75MHz (20 25kHz channels). Allocations asterisked are temporary.

Times Past

A reader has sent me several copies of vintage TV magazines, all pre-war, that make very interesting reading. *Television and Short Wave World*, dated April 1939, claimed to be the "first television journal in the world", though No. 1, Vol. 1 of *Television*, the "world's first television journal", appeared as the monthly official organ of the Television Society back in March 1928 (it continues to be published by the Royal Television Society). The content of this latter issue was mainly concerned with mechanical scanning, selenium cells and televisors. The 1939 magazine informed readers of progress with French TV from an experimental station at Montrouge, using 405 lines. Details of the studio and transmitter are given – the latter fed 6-8kW to the aerial, providing signals over a 20km radius.

TV activity was on the increase in 1939. NBC and RCA were conducting experimental services in Washington, USA. JOAK-TV intended to transmit a 25-frame signal from a 100m mast at the Kamatacho Laboratory, Tokyo. In London an OB relay point had been established at Swains Lane, Highgate, with onward connection to Alexander Palace via coaxial cable. The BBC was planning to build a transmitter in the Manchester area, and setmakers were operating at full capacity – one large company had a 30 per day quota and was 350 receivers behind schedule.

A 1939 article on receiver problems and transient distortion used the BBC tuning signal to illustrate various points. Of DX interest are two photographs of F2 reception taken in October 1938 at RCA's Riverhead, Long Island establishment. They show 405-line signals from Alexandra Palace!

ECONOMIC DEVICES PO BOX 15, WOLVERHAMPTON, WV2 4AZ

15/80H	2.72
15/85R	3.28
17052	4.58
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	0.10
1N5408	0.15
1N914	0.04
1S1555	0.18
1S44	0.10
1S921	0.10
2N2219A	0.37
2N3053	0.35
2N3054	0.99
2N3055	0.66
2N3442	1.16
2N3702	0.14
2N3703	0.18
2N3705	0.15
2N3706	0.14
2N3707	0.16
2N3711	0.11
2N3771	1.56
2N3772	1.55
2N3773	1.61
2N3819	0.40
2N3823	1.17
2N3904	0.50
2N3906	0.62
2N4101	1.33
2N4240	2.68
2N4444	1.66
2N5293	0.50
2N5294	0.50
2N5296	0.50
2N5297	0.50
2N5298	0.61
2N6109	1.58
2N6130	0.85
2N6133	1.25
2N6180	0.73
2N6292	1.60
2SA1006	1.50
2SA1011	1.65
2SA1015	0.20
2SA1012	0.80
2SA1020Y	0.99
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
2SA483	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	0.41
2SC1413A	2.10
2SC1446	1.25
2SC1447	2.07
2SC1475	0.60
2SC1505	1.00
2SC1514	1.37
2SC1573Q	1.91
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	0.20
2SC1957	0.95
2SC1953	1.93
2SC1962	1.93
2SC1969	1.83
2SC1983	0.51
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	1.69
2SC2278	1.14
2SC2314	0.87
2SC2335 + Kit	7.00
2SC2551	1.26
2SC2565	4.10
2SC2570	1.85
2SC2577	1.34
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	0.06
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	1.48
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	2.92
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	1.75
2SD856	0.89
2SD857D	1.84
2SD882	1.15
2SD894	1.75
2SD898	2.19
2SK105H	2.15
7805-T022	0.63
7808	0.46
7812-T022	0.35
7815	0.64
7905	0.80
AD140	1.06
AD143	1.93
AD145	1.60
AD161	0.65
AD162	0.65
AF114	2.47
AF115	0.90
AF118	1.20
AF127	1.00
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
AN214D	2.40
AN234	5.09
AN236	3.33
AN240P	0.99
AN241	1.71
AN245	5.04
AN253	1.80
AN260	3.85
AN272	7.92
AN295	7.63
AN301	2.45
AN302	3.09
AN305	8.88
AN315	2.46
AN316	4.95
AN318	7.16
AN320	5.47
AN321	2.25
AN322	6.78
AN337	5.37
AN340P	1.53
AN355	1.65
AN362	1.50
AN370	3.95
AN5111	3.43
AN5120N	4.50
AN5132	4.42
AN5250	4.40
AN5610	7.43
AN5612	2.20
AN5613	4.20
AN5630	3.95
AN5701N	1.68
AN6250	1.75
AN6300	4.40
AN6310	4.54
AN6340	5.62
AN6341	2.22
AN6363	16.00
AN6531	1.95
AN6551	0.50
AN6552	0.68
AN6610	1.86
AN7111	1.25
AN7115	2.52
AN7145	2.80
AN7146	9.90
AN7151	2.37
AN7156	3.37
AN7158	2.10
AN7218	0.80
AN7223	4.55
AU107	7.72
AU110	5.69
AU113	14.63
AY106	2.80
BA524	8.94
BA310	0.14
BA1310	1.50
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	2.22
BA333	1.37
BA335	6.27
BA5102A	2.15
BA511	1.95
BA514	1.00
BA521	1.20
BA524	8.94
BA526	7.98
BA527	2.98
BA532	1.20
BA536	0.99
BA609	1.06
BA656	1.51
BA7100	11.35
BA841A	28.98
BA843	3.96
BA854	5.76
BAV18	0.06
BAV19	0.24
BAV20	0.36
BAV21	0.12
BAW62	0.11
BAX12	0.49
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	0.30
BC141	0.31
BC142	0.26
BC143	0.34
BC147	0.14
BC148B	0.14
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	0.11
BC173	0.17
BC174B	0.27
BC177	0.35
BC178	0.26
BC179	0.26
BC182	0.09
BC182LB	0.14
BC183LB	0.09
BC184	0.10
BC184LB	0.13
BC186	0.25
BC187	0.28
BC204	0.35
BC207	0.19
BC212B	0.26
BC213L	0.10
BC214	0.10
BC225	0.40
BC237	0.10
BC238	0.10
BC238B	0.08
BC239B	0.25
BC251A	0.31
BC294	0.50
BC300	0.38
BC301	0.34
BC302	0.53
BC303	0.48
BC307A	0.06
BC308A	0.11
BC309	0.17
BC317A	0.13
BC327	0.09
BC328	0.11
BC337	0.09
BC338	0.12
BC368	0.19
BC440	0.69
BC441	0.46
BC454	0.36
BC460	0.42
BC461	0.47
BC462	0.51
BC463	0.30
BC478	0.32
BC479	0.41
BC532	0.28
BC546	0.08
BC547	0.10
BC548	0.28
BC549	0.10
BC550	0.10
BC556	0.11
BC557	0.08
BC558	0.10
BC559	0.10
BC560C	0.14
BC635	0.34
BC636	0.20
BC637	0.24
BC639	0.15
BC640	0.24
BCX34	0.55
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	0.41
BD138	0.28
BD139	0.24
BD140	0.35
BD144	1.43
BD150	0.75
BD157	0.67
BD160	1.60
BD163	0.71
BD166	0.69
BD175	0.28
BD179	0.30
BD181	0.99
BD182	0.99
BD183	0.99
BD184	1.21
BD187	0.80
BD189	0.43
BD190	0.55
BD201	0.49
BD202	0.60
BD203	0.46
BD204	0.41
BD207	1.73
BD208	1.23
BD222	0.45
BD225	0.46
BD228	0.63
BD229	1.05
BD232	0.49
BD234	0.42
BD237	0.36
BD238	0.28
BD239	0.45
BD240	0.57
BD241	0.39
BD242	0.37
BD243A	0.62
BD243C	0.50
BD244	0.42
BD244C	0.72
BD245C	0.83
BD246C	0.85
BD253	1.05
BD278A	0.70
BD317	1.20
BD318	2.72
BD375	0.42
BD380	0.66
BD410	0.49
BD433	0.44
BD434	0.45
BD435	0.49
BD436	0.74
BD437	0.45
BD438	0.52
BD441	0.59
BD442	0.50
BD509	1.64
BD510	0.75
BD519	0.78
BD529	0.75
BD530	0.69
BD533	0.67
BD534	0.52
BD535	0.38
BD536	0.50
BD537	0.50
BD538	0.67
BD544B	0.75
BD677	0.33
BD679	0.43
BD680	0.66
BD681	1.48
BD696	2.47
BD699	1.85
BD700	3.70
BD707	0.60
BD709	0.80
BD710	0.60
BD809	0.45
BD810	0.57
BD879	0.74
BD895	2.18
BD901	0.55
BD902	0.56
BDW83C	0.99
BDW84C	0.99
BDX32	1.65
BDX53A	4.93
BDX53B	3.35
BDX54B	0.31
BDX62A	2.09
BDX63A	1.96
BDY20	1.21
BDY81	1.18
BF115	0.29
BF117	0.66
BF118	0.67
BF121	0.25
BF123	0.13
BF127	0.13
BF137	0.29
BF153	0.58
BF154	0.26
BF157	0.33
BF158	0.18
BF159	0.18
BF160	0.31
BF167	0.38
BF173	0.34
BF177	0.55
BF178	0.40
BF179	0.36
BF180	0.36
BF181	0.32
BF182	0.34
BF183	0.39
BF184	0.43
BF185	0.39
BF194	0.14
BF195	0.14
BF196	0.17
BF197	0.24
BF198	0.17
BF199	0.17
BF200	0.37
BF218	0.36
BF224	0.17
BF237	0.65
BF240	0.19
BF241	0.17
BF245	0.50
BF245B	0.49
BF246A	2.52
BF255	0.20
BF256	0.15
BF257	0.34
BF258	0.33
BF259	0.34
BF262	0.57
BF263	0.57
BF271	0.34
BF273	0.20
BF274	0.20
BF324	0.23
BF336	0.33
BF337	0.31
BF338	0.34
BF355	0.48
BF362	0.60
BF363	0.50
BF371	0.50
BF391	0.25
BF417	0.84
BF418	1.87
BF422	0.15
BF423	0.33
BF450	0.35
BF451	0.29
BF457	0.41
BF458	0.49
BF459	0.26
BF460	1.63
BF469	0.33
BF470	0.26
BF471	0.25
BF472	0.33
BF479	0.61
BF480	0.89
BF491	0.50
BF506	0.43
BF532	0.24
BF596	0.18
BF597	0.27
BF694	0.22
BF757	0.59
BF759	0.47
BF761	1.05
BF762	0.34
BF869	0.49
BF870	0.30
BF959	0.42
BF960	0.59
BF970	0.39
BFR39	0.44
BFR61	0.92
BFR62	0.50
BFR79	0.29
BFR81	0.29
BFR86	1.08
BFR89	1.63
BFR90A	0.67
BFX29	0.34
BFX84	0.37
BFX85	0.31
BFX86	0.36
BFX87	0.55
BFX88	0.34
BFX89	0.44
BFY50	0.30
BFY51	0.33
BFY52	0.27
BFY79	0.49
BFY90	0.89
BLY49	2.20
BR100	0.23
BR101	0.78
BR103	0.87
BR303	1.15
BRC84	2.08
BRX44	0.60
BRX49	0.46
BRY39	0.65
BSS38	0.70
BSTB0140G	4.93
BSTC0246	5.99
BSTC0233	6.12
BSTCC0143	3.07
BSTD1043	2.85
BSV57B	3.91
BSW68	0.60
BSX19	0.34
BSX20	0.19
BSY52	0.50
BSY79	0.51
BT108	1.45
BT119	1.76
BT120	2.17
BT121	2.48
BT123	1.98
BT151-800R	0.85
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	2.35
BU208A	1.12
BU208D	1.43
BU209	1.75
BU226	2.55
BU326A	0.99
BU406	1.24
BU406D	1.24
BU407	0.54
BU412	5.29
BU426A	1.67
BU500	1.53
BU508A	1.50
BU536	1.55
BU608	1.65
BU705	2.50
BU806	0.98
BU807	1.40
BU826A	1.95
BUW84	0.66
BUX84	0.50
BUX85	0.69
BY126	0.13
BY127	0.13
BY133	0.10
BY164	0.44
BY176	0.93
BY179	1.42
BY182	1.05
BY187	0.77
BY189	1.76
BY198	1.62
BY207	0.22
BY208	1.15
BY210-400	0.18
BY210-600	0.31
BY210-800	0.19
BY223	1.25
BY224-600	2.60
BY226	0.15
BY227	0.20
BY228	0.60
BY229-1000	1.12
BY229-600	1.20
BY255	0.13
BY295-600	1.23
BY298	0.20
BY299	0.60
BY407	0.90
BY409	1.49
BY448	1.40
BY713	1.12
BYW56	0.29
BYX55-600	0.23
BYX71-600	0.85
BYX71-350	0.88
BYY56	1.48
BZY93C30	1.86
C106D	0.37
C106M	0.76
CA3046	1.55
CA3089	0.83
CA3090AQ	3.25
CA3094	1.72
CA3131EM	2.95
CD4001	0.24
CD4002	0.27
CD4008	1.35
CD4011	0.20
CD4012	0.24
CD4013	0.33
CD4016	0.25
CD4017	0.30
CD4020	0.75
CD4021	0.39
CD4023	0.28
CD4025	0.64
CD4028	0.84
CD4040B	0.45
CD4047	1.06
CD4049	0.24
CD4052	0.33
CD4066	0.23
CD4069	0.29
CD4070	0.25
CD4081	0.14
CD4093	0.40
CD4511	0.44
CD4528	0.52
CD4556	1.47
CR02AM 8	1.70
CV12E	4.19
CX095D	3.14
CX104	8.77
CX108	12.48
CX109	7.20
CX130	8.76
CX134	4.50
CX136	11.49
CX139	11.83
CX157	5.52
CX158	10.45
CX177	8.80
CX187	5.26
CX755	12.95
CX885A	6.85
E1222	0.40
E5024	0.28
E5386	0.25
GD243	1.95
GF758	0.84
HA11215	1.75
HA11211	2.53
HA11225	4.29
HA11229	3.46
HA11235	1.95
HA11124	5.25
HA1125	4.29
HA1137W	1.38
HA1138	3.75
HA11414	4.20
HA1156	1.16
HA1160	5.79
HA1166X	6.60
HA1167	6.60
HA11706	3.61
HA11705	8.80
HA11703	3.45
HA11701	3.57
HA11710	3.45
HA11713	2.90
HA11711	9.40
HA11715	9.99
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	7.06
HA13342	2.65
HA13365	4.02
HA1366WR	2.88
HA1367	2.75
HA1368R	1.95
HA1368	2.65
HA1370	3.71
HA1374	1.80
AA117	9
HA1377	1.95
HA1388R	2.05
HA1389	2.39
HA1392	2.22
HA1394	2.65
HA1397	2.75
HA1398	2.75
HA1406	2.07
HA1452	0.85
HD14538	2.07
HD38702-A2	7.95
HD38750A53	5.77
HD38750A-7	7.25
HD38800A50	14.09
HD44801A05	14.07
HISH1010	14.60
HISH1004	6.00
HISH1002	9.50
HM6231	12.24
HM6232	7.20
HM6251	5.69
HM7103	4.85
HM9032	4.00
HM9012	3.22
HM9015	3.24
HT4207	13.25
HT4208	20.65
KA2101	1.00
KC581C	7.75
KC582C	4.85
L200CV	1.69
LA1201	0.75
LA1210	1.56
LA1230	1.18
LA1320	2.87
LA1357N	9.00
LA1363	1.05
LA1364	3.02
LA1365J	1.45
LA1385	1.53
LA1387	4.75
LA3350	1.43
LA3361	1.60
LA3390	5.52
LA4032P	2.95
LA4100	1.25
LA4101	0.88
LA4102	0.75
LA4112	1.35
LA4125	2.25
LA4138	4.98
LA4140	0.70
LA4192	1.50
LA4220	1.25
LA4420	1.72
LA4422	1.00
LA4430	2.88
LA4440	2.55
LA4445	1.80
LA4460	1.50
LA4461	1.60
LA5112N	1.18
LA7020	13.86
LA7025	11.97
LA7027	10.92
LA7040	9.20
LA7042	3.90
LA7800	1.30
LA7801	3.21
LB1274	1.90
LC7800	9.20
LD3120	1.13
LD3150	2.75
LM1017N	1.81
LM1877	2.95
LM2808	5.94
LM2877	7.45
LM317CKC	1.08
LM324N	0.98
LM339N	0.43
LM340K	11.85
LM348N	2.15
LM380N	1.50
LM567CN	1.71
LM6402/011	10.23
LM6402A093	10.15
LM748	0.69
LM8360	3.87
LM8361	2.95
LR3419	9.37
LR3471	9.37
LU1141	7.27
LU52012	20.62
LU52011	14.95
LU03112	12.37
M193	6.83
M21C	1.10
M23C	1.98
M293	6.71
M51102L	2.77
M5115P	5.24
M51203L	3.15
M51231P	0.95
M5134-9341	4.13
M51353P	5.25
M51381P	5.98
M51393AP	4.50
M51394P	14.50
M5142P	6.85
M5144P	4.27
M51513L	2.55
M51515BL	2.75
M51517L	2.90
M5192	3.13
M5194AP	5.74
M5231L	1.58
M53274P	1.93
M54532P	1.45
M54544L	2.97
M58478P	6.75
M58485P	14.05
MA06	1.07
MA8001	0.82
MA8003	1.16
MB3705	1.85
MB3712	1.85
MB3713	1.69
MB3730	1.75
MC13002	2.99
MC1310P	1.95
MC1327P	1.33
MC1330P	1.98
MC1350P	0.45
MC1351P	1.25
MC1352P	1.40
MC1357P	2.15
MC1358P	1.48
MC14493P	5.50
MC14494P	2.15
MC14497	7.10
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	1.25
ME0411	0.75
ME6002	0.26
ME6102	0.28
ME8001	0.34
ME0411	0.75
MJ2501	3.30
MJ3001	1.43
MJ481	1.53
MJE2955	3.30
MJE3055	1.25
MJE340	0.49
MJE520	0.49
ML231	0.99
ML232B	3.01
ML237B	1.95
ML238	5.65
ML923	3.10
ML926	3.58
MM5314N	8.99
MM5316N	3.50
MM5318N	3.11
MM5369N	2.01
MM5387AA/N	6.20
MM5841N	6.93
MN1400VL	1.58
MN1405	7.92
MN1435VX	8.81
MP1192	5.07
MP2794	4.00
MP2812	5.07
MP8812	1.57
MPC596	2.13
MPF256C	0.60
MPS6570	0.48
MPSA42	0.15
MPSA56	0.08
MPSA92	0.15
MPSU05	0.86
MPSU10	1.70
MPSU56	0.65
MPSU60	1.33
MR818	0.33
MR854	0.50
MR914	1.20
MSM5816RS	17.35
MSM5840H	12.26
MVS460-02	0.34
NE542	2.75
NE555	0.35
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	1.95
OC45	0.18
OC72	0.44
OC75	0.44
ON236	1.06
ON782	1.65
OT121	1.45
PT6042	3.25
PT8504	5.13
R1038	2.19
R1039	2.19
R2008B	1.98
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	1.65
R2540X	3.30
R2615	0.67
RCA2060	0.60
RGP01-15	0.70
RGP10	0.23
RGP30M	0.28
RT402	1.58
RT905A	3.28
S1299	5.34
S2800D	1.50
S2802	2.90
S2818	4.05
S3702S	5.21
S40W	13.10
S6080B	9.98
SAA1001	5.17
SAA1006	4.75
SAA1020	4.05
SAA1024	2.50
SAA1025	4.25
SAA1121	7.44
SAA1124	2.60
SAA1130	6.69
SAA1174	7.77
SAA1250	3.95
SAA1251	3.20
SAA1351	8.11
SAA3027P	2.71
SAA5000	3.25
SAA5010	3.50
SAA5012	5.50
SAA5020	5.78
SAA5030	6.33
SAA5050	4.90
SAB1009B	5.98
SAB3011	7.34
SAB3013	4.69
SAB3021	3.95
SAB3209	5.82
SAB3210	3.21
SAF1032P	2.95
SAF1039	1.95
SAS5010	8.39
SAS560S	1.91
SAS560T	5.42
SAS570T	5.42
SAS570S	1.95
SAS580	2.85
SAS6600	1.33
SAS660	1.33
SAS6700	1.33
SAS670	1.33
SAS6710	2.21
SBA750	1.61
SC84203	19.35
SC9504P	1.95
SDA2006	17.10
SDA2112/2	9.20
SG264A	5.26
SG613	10.70
SG629	8.27
SG6533	9.00
SI1125H	7.50
SI1630HD	20.62
SKE2F1/04	1.25
SKE2G3/04	0.73
SKE4F1/06	0.30
SKE4F2/08	1.07
SKE4F2/06	0.80
SKE4F2/10	1.36
SKE4G2/02	0.96
SKE5F3/10	1.36
SKS1/10	2.15
SL1310	3.14
SL1430T	2.31
SL414	3.69
SL432A	3.44
SL439	2.48
SL471	2.13
SL480	7.24
SL490	2.37
SL901B	8.32
SL918A	9.07
SN16861AN0	0.82
SN16862AN	2.98
SN16966N	10.25
SN29717N	7.19
SN29716N	3.66
SN29715N	6.04
SN29722	11.95
SN29723AN	8.77
SN29764AN	2.60
SN29767	3.90
SN29770BN	3.69
SN29772BN	5.75
SN29771BN	5.59
SN29791	1.67
SN29798N	5.56
SN2709	0.44
SN7400N	0.61
SN7401N	0.36
SN7402N	0.65
SN7404N	0.52
SN7408N	0.27
SN7410N	0.27
SN74121	1.60
SN7413N	0.37
SN74141N	2.65
SN74151AN	1.51
SN74154N	1.27
SN74190	1.35
SN7420N	0.34
SN7430	0.49
SN7440N	0.27
SN7472	1.54
SN7474N	0.44
SN7490AN	0.75
SN74LS26N	1.45
SN76001N	1.65
SN76013ND	7.49
SN76023N	2.97
SN76023ND	3.91
SN76033N	5.54
SN76110N	0.90
SN76115AN	1.61
SN76131	0.82
SN76227N	2.45
SN76226DN	2.98
SN76228N	3.27
SN76242	5.23
SN76243	5.23
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
SN76666N	1.20
SN76708	4.86
SN76709N	9.63
SN76707N	1.23
SN76705N	2.97
SN76730	5.54
SN76810N	0.60
SN76832N	1.33
SN94041	5.54
SN94042	4.35
SPS5384	1.98
ST1702L	0.99
STA401	2.49
STA441C	2.70
STA471C	8.70
STK0029	9.55
STK0050	7.85
STK016	11.23
STK022	8.95
STK031	12.95
STK040	13.34
STK054	9.35
STK058	27.50
STK077	9.28
STK1039	5.75
STK2110	7.33
STK2145	16.95
STK2240	16.65
STK2250	18.95
STK3042	6.08
STK3044	5.75
STK4019	9.29
STK433	6.18
STK4332	4.75
STK4352	7.12
STK436	1.95
STK437	6.91
STK4372	13.13
STK460	9.36
STK466	10.10
STK4833	9.52
STK501	6.32
STK502	7.25
STK5314	9.48
STK5730	3.20
STK7216	14.90
STK772	3.71
STR1096	11.20
STR4090	6.43
STR440	6.18
STR451	6.18
STR453	8.16
STR454	5.52
STR6020	6.96
T6029V	7.98
T6035V	0.73
T6036	0.67
T6037	2.11
T6044V	0.97
T6045	1.20
T6049	1.45
T6052V	0.87
T6058	3.08
T6059	4.22
T9003V	1.25
T9005V	2.38
T9011V	1.40
T9013V	4.95
T9014V	2.42
T9016	1.02
T9019W	1.98
T9034V	1.34
T9035V	6.65
T9051	7.70
T9054V	5.98
T9057V	3.44
T9062V	0.49
T9064	4.20
TA7027	4.80
TA7050	1.74
TA7051	1.74
TA7054	2.55
TA7060AP	0.71
TA7061AP	1.27
TA7069	3.13
TA7070P	1.83
TA7072P	2.57
TA7074P	1.98
TA7076P	7.50
TA7089P	3.10
TA7092P	9.94
TA7093P	3.99
TA7102P	5.88
TA7108P	1.61
TA7109	3.71
TA7122B/P	0.87
TA7124P	2.34
TA7129P	1.90
TA7130P	1.27
TA7136AP	1.89
TA7137P	0.98
TA7141AP	3.87
TA7146P	4.85
TA7148P	1.67
TA7149P	3.26
TA7152P	3.16
TA7161P	4.50
TA7162P	3.61
TA7172P	1.41
TA7176P	1.75
TA7193P	4.80
TA7204P	1.95
TA7206P	12.49
TA7207P	1.48
TA7208P	2.15
TA7210P	1.45
TA7214P	3.63
TA7215P	2.58
TA7217AP	1.45
TA7222	1.95
TA7226	3.57
TA7229P	4.66
TA7230P	1.35
TA7233P	3.61
TA7240AP	2.55
TA7245P	1.95
TA7310P	2.15
TA7313AP	0.65
TA7314	3.50
TA7323P	3.15
TA7325P	1.15
TA7339P	1.85
TA7340P	5.95
TA7607AP	1.30
TA7609	2.35
TA7611AP	2.32
TA7616P	5.25
TA7622AP	8.94
TA7628P	1.40
TA7629P	7.50
TA7630P	0.95
TA7640AP	2.40
TA7672P	2.75
TA7676P	2.81
TA7726P	10.25
TAA320A	1.27
TAA350A	6.59
TAA570	1.85
TAA621AX1	4.85
TAA661B	0.95
TAA691	8.58
TAA700	2.37
TAA930	4.36
TAA970	2.83
TAG626-600	1.20
TBA120AS	1.45
TBA120SB	0.40
TBA120T	0.57
TBA120U	2.50
TBA120A	1.05
TBA1440	1.94
TBA1441	1.95
TBA395	1.10
TBA396	1.20
TBA400	2.39
TBA440C	2.34
TBA480Q	1.30
TBA510	1.37
TBA520	1.20
TBA530	1.30
TBA540	1.72
TBA560C	1.40
TBA570Q	1.60
TBA570A	1.71
TBA673	2.60
TBA700	1.85
TBA720	4.32
TBA730	3.55
TBA750Q	2.50
TBA760	1.71
TBA800	1.08
TBA810S	1.61
TBA810T	1.75
TBA820	0.66
TBA820M	0.82
TBA890	3.50
TBA920	1.65
TBA940	1.87
TBA950	1.55
TBA970	3.60
TBA990	1.98
TCA270S	2.15
TCA270SQ	1.05
TCA290A	2.39
TCA420A	2.16
TCA440	2.25
TCA530	2.24
TCA640	2.25
TCA650	3.05
TCA660B	2.60
TCA730	2.75
TCA750	2.25
TCA800Q	5.95
TCA830S	2.38
TCA890	2.04
TCA900	1.65
TCA910	1.65
TCA940	0.82
TCA940E	2.93
TD3F800R	4.78
TD3F900H	5.50
TDA1001B	2.31
TDA1003A	1.47
TDA1005A	2.22
TDA1006A	7.00
TDA1010AF	4.25
TDA1011	1.14
TDA1010	1.05
TDA1011A	1.51
TDA1028	2.45
TDA1034B	2.42
TDA1035S	2.95
TDA1035T	1.70
TDA1037	1.79
TDA1037D	2.05
TDA1044	2.10
TDA1047	3.25
TDA1059B	0.80
TDA1054M	1.21
TDA1060	2.60
TDA1082	3.25
TDA1151	0.95
TDA1190	1.27
TDA1190Z	2.48
TDA1200	1.51
TDA1235	3.88
TDA1236	4.30
TDA1270	3.74
TDA1327A	6.93
TDA1412	1.08
TDA1420	1.52
TDA1440	3.45
TDA1470	2.90
TDA1470P	4.25
TDA1506	5.74
TDA1510	4.60
TDA1512	2.57
TDA1515	2.55
TDA1559	3.15
TDA1670	2.73
TDA1770	2.88
TDA1905	1.27
TDA1908	2.55
TDA1940	3.86
TDA1950	2.50
TDA2005	1.76
TDA2006	1.35
TDA2004	0.99
TDA2002	0.90
TDA2003	1.00
TDA2030	1.05
TDA2140	4.77
TDA2150	4.48
TDA2151	2.47
TDA2160	4.01
TDA2161	5.11
TDA2170	4.75
TDA2270	2.50
TDA2520	2.25
TDA2522	11.20
TDA2524	4.50
TDA2525	5.58
TDA2532	2.50
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TDA2541	1.00
TDA2540	0.99
TDA2545D	5.94
TDA2560	2.50
TDA2575A	0.50
TDA2578A	2.95
TDA2576A + Kit	12.35
TDA2581	1.60
TDA2582	1.35
TDA2591	2.15
TDA2594	2.45
TDA2593	1.99
TDA2595	2.46
TDA2600	7.00
TDA2611AQ	2.80
TDA2612D	4.68
TDA2611A	1.25
TDA2610	2.79
TDA2620	1.96
TDA2630	2.50
TDA2631	2.73
TDA2640	3.80
TDA2652	8.62
TDA2653	5.16
TDA2654	4.73
TDA2670	2.48
TDA2680	3.20
TDA2740	10.14
TDA2780AQ	9.12
TDA2795	2.78
TDA2791	1.81
TDA2910	13.25
TDA3300B	7.24
TDA3330	3.16
TDA3506	4.40
TDA3501	5.50
TDA3500	7.58
TDA3510	5.95
TDA3520	9.71
TDA3540	2.20
TDA3541	2.20
TDA3560	5.83
TDA3571Q	3.63
TDA3576	7.48
TDA3590	6.79
TDA3591	6.45
TDA3650	5.90
TDA3652	5.74
TDA3651AQ	3.95
TDA3651	2.45
TDA3651A	2.50
TDA3950	4.50
TDA4050B	3.40
TDA4280	7.20
TDA4290	1.95
TDA4400	4.90
TDA4420	2.30
TDA4422	8.32
TDA4427S	3.00
TDA4431	2.27
TDA4440	1.95
TDA4442	4.15
TDA4500	4.75
TDA4600-2	1.75
TDA4610	3.40
TDA4620	7.75
TDA5500	14.20
TDA5700	2.75
TDA7270S	2.25
TDA8190	4.30
TDA9403	3.70
TDA9503	2.92
TDA9513	3.15
TDB1033	2.68
TDE1081	7.24
TEA1002	4.93
TEA1009	0.80
TEA1014	3.00
TEA1020SP	4.33
TIC106C	0.61
TIC106M	0.65
TIC44	0.72
TIC45	0.55
TIC47	0.77
TIP120	1.55
TIP110	0.35
TIP112	0.45
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	0.82
TIP33A	1.02
TIP33C	0.95
TIP34	0.75
TIP41A	0.36
TIP41B	0.31
TIP41C	0.51
TIP42A	0.29
TIP42B	0.79
TIP42C	0.50
TIP47	0.65
TIS43	1.43
TIS90	0.21
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TY6010B	2.97
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UPC1025H	2.90
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UPC1161C	4.98
UPC1182H	1.38
UPC1186H	1.05
UPC1181H	1.35
UPC1185H	2.10
UPC1188	8.77
UPC1212C	0.80
UPC1225H	2.82
UPC1230	1.88
UPC1238	2.10
UPC1278H	5.95
UPC1351C	1.81
UPC1350C	1.40
UPC1353	1.63
UPC1355C	2.13
UPC1363	4.20
UPC1362	1.80
UPC1365C	2.50
UPC1366	1.65
UPC1360C	2.30
UPC1378H	1.95
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	2.99
UPC4558C	1.24
UPC474	5.11
UPC554C	1.85
UPC575C2	1.55
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	15.29
X0077GE	14.60
X0079CE	4.95
X0092CE	4.95
X0096CE	6.20
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VID4	01X0-018-729	Take up idler T3V00/PU49280	7.96
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VID8	01X0-040-017	Reel motor assembly 3V29/30/PU51381V	27.95
VID9	01X0-065-009	Capston motor 3V35/36/38/39/PU55371V	20.92
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VID23	VXP0401	Idler wheel NV333	0.85
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VID25	1430662T01201	Reel drive pulley VTC 5000	5.49
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VID28	1430420400300	Heart idler Fisher FVH-P615	2.95
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VID29	RMOTP1029	Capston motor 73/9300	29.95
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VID31	NIDL0006	Idler VC387H etc	1.60
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VID33	NIDL0004	Idler wheel VC2300	3.50
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VID35	LA9210S	Universal lamp with socket 310mm	0.50
VID36	NAT/PAN.	P.C. MTG. leadless lamp	0.20
VID37	SHARP 9300	Etc. lamp plus plastic shroud.	1.27

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VT 9300	DBK129	£1.10
VT 9500	DBK129	£1.10
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Test Report: Electronic Visuals Vectorscopes

Nick Beer

The number of cameras and camcorders in use is steadily increasing. This has implications for the service department. Many smaller dealers have adopted the policy of returning all such units to the manufacturer when repair is necessary unless the fault is particularly straightforward. The result is complaints from manufacturers that they are getting far too much equipment back with faults that are in no way special. One complaint is that they don't like being used as dealers' service departments. A knock-on consequence is that when a dealer has a real problem and desperately needs assistance he's likely to encounter considerable delays.

The suggestion for this test gear review came from a Panasonic engineer. Panasonic has always been amongst the best when it comes to dealer support. The company has very good terms for the test gear it feels dealers should have. With the increase in camera/camcorder work, Panasonic considers that more dealers should invest in a vectorscope, particularly where an appreciable number of cameras with tube type pickup devices are handled.

That same Panasonic engineer seems to have got the wrong idea about my article on camera workshop accessories back in January 1989. My comment about the alignment charts in Panasonic service manuals was not intended to be derogatory. The purpose of that article was simply to suggest ways in which the smaller workshop could make a start with camera/camcorder servicing without having to invest large sums of money, the aim being to provide a better back-up service by carrying out the simpler repairs required. If the amount and complexity of work increases, the situation must naturally be reviewed. In this case more money should be invested so that the job can be done as well as possible. There are various things on which the money can be spent, the largest single investment being a vectorscope – hence this review. But you should certainly consider getting the manufacturers' approved alignment charts, particularly the colour chart for use in conjunction with a vectorscope.

The EV4061

The Electronic Visuals Model EV4061 reviewed here is a combined vectorscope and waveform monitor. Electronic Visuals also has available a similar unit without the waveform monitor, Model EV4021. The prices are around £1,700 and £1,000 respectively, but for overseas customers these prices are subject to alteration to take exchange rate variations into account. The EV4021 is understood to be the lowest priced vectorscope available in Europe.

The unit came well packed in a sturdy box. Also included were a detachable mains lead (of the same type as used in the old Sony SLC7 VCR), an instruction/service manual and a plug for the remote socket. This appeared to be of the B9A valve base pattern. My first impression was of the unit's small size, measuring 132 × 216 × 432·5mm. When I put it on the bench it was dwarfed by the trusty Gould oscilloscope.

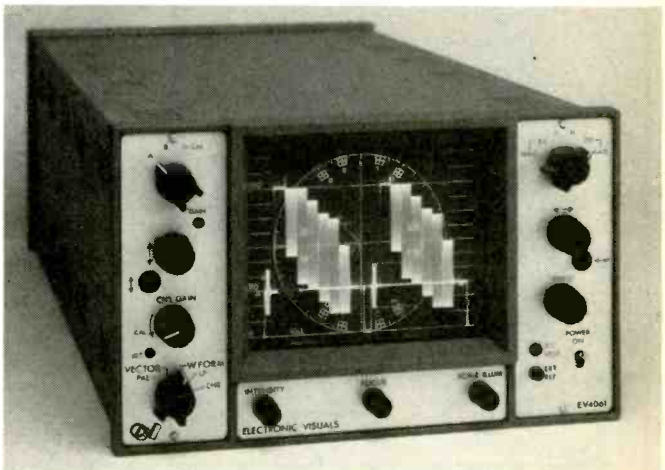
The front panel is uncluttered, with the controls bordering the 10 × 8cm display. Beneath the display there are the familiar scope controls for trace intensity, focus and backlight brightness. The latter has a fantastic range, allowing excellent viewing in any conditions. Switching between the vectorscope and waveform monitor displays is by means of a very sound switch at the bottom left-hand corner. A "six vector" presentation is given in the PAL vectorscope mode. In the waveform mode there's a choice between displays at field rate, twice field rate, line rate and twice line rate, with optional magnification in the two times ranges.

The inputs are arranged at the back of the unit, using BNC sockets. Each of the three inputs A, B and reference has a pair of sockets, allowing loopthrough. There's also a buffered monitor output socket. With the unit unpowered there's no output here – if you require an output for a monitor when the unit is switched off you use the loopthrough provided by the two sockets for each input.

Some adjustments require the vectorscope to be terminated at 75Ω, so a plug made up with suitable resistors will be useful. Input switching is carried out by means of the switch at the top left. This also has a 1V, 60kHz calibration setting.

The horizontal and vertical position potentiometers are on opposite sides of the front panel. The two remaining major controls are for vector gain and phase control. Vector gain increases the vector by up to five times. A calibrate position is included. The phase control provides a continuous 360° rotation. Finally at the bottom right corner of the control panel there are a small toggle switch and push-switches for d.c. restoration and external reference.

The instructions provided summarise these controls, the rest of the manual containing circuits and service information. This is understandable since to explain the possible uses of the unit would be a very lengthy business. The manufacturer has therefore decided to leave things to the individual. As most service manuals for video equipment explain exactly what's needed for a particular adjustment this should cause no problems.



The Electronic Visuals' EV4061 combined vectorscope and waveform monitor which was received for review. The EV4021 vectorscope only is housed in the same case and is of similar appearance – it would be more suitable for the average workshop contemplating camera and camcorder servicing.

In the past the unit has been used mainly in TV studio and field applications. It's only now beginning to appear in service workshops – Panasonic's amongst them. I found the unit magnificent to use. The display is superb, easy to see and to use. To be able to flick over and see the signal at field or line rate is very helpful. The unit's compact size makes it easy to add to an already busy bench area. Camera adjustments are very much quicker and more accurate than with an oscilloscope – if indeed you can do it with just the latter.

I would not expect the average workshop to invest in the EV4061 version since the price differential is quite large and you would seldom need the waveform monitor facility. The EV4021 represents excellent value for money: at around £1,000 it should end further argument – the price is little more than that of a new high-specification scope.

Availability

For further details contact Electronic Visuals Ltd. at Goldsworth Road, Woking, Surrey GU21 1RU (telephone 4083 771 663). My thanks to Brian Elliott of Electronic Visuals for his help.

TEST CASE

331

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.

Philbert had the usual motley selection of deliveries and service calls to make this Friday morning. The symptom in one case was given as "jumbled teletext". Mr. Hayes, the customer concerned, wanted to go on holiday. Twe w;ekz in Ten$rife or ton deys in Maj½rwa? He had a good guess at G&tw½c$ airport but wanted to be sure.

Philbert knew that he lived in an area that was not of the best for TV reception, and by luck he had in the van a teletext receiver for delivery after repair. Into Mr. Hayes' living room it went to provide a check. On this set the pages were displayed clearly, with virtually no incorrect symbols or misspellings. Not the aerial then, so Philbert turned his attention to the teletext decoder in the ailing TV receiver. It was a middle-aged model using the Mullard/Philips SAA series four-chip teletext decoder set of i.c.s. First he checked the 5V and 12V supplies. The voltages were correct and the ripple levels were low.

Next he carefully examined the text display on each channel in turn. Some of the four were better than the others. Channel Four was the worst, though the TV picture on this channel was acceptable. Each channel was then tuned for best results, at the front control panel, but this didn't improve the text situation at all. Indeed things were so bad with the Ch. 4 text display that even the clock and header row sometimes flickered over to nonsensical figures and symbols. Our man finally had a judicious twiddle of the clock tuning coil at pin 21 of the SAA5030 VIP chip while watching the clock display in the header row of the Ch. 4 index page. If the slug was moved far from its original setting in either direction the display went from bad to worse. He restored the setting to the original position and went off to consult the workshop worthies on the matter.

Back at the base the story was recounted in detail to a sympathetic colleague. The upshot of this was that Philbert returned to Mr. Hayes later that afternoon armed with an anti-static outfit and some electronic bits and pieces. Following his instructions, he first decoupled the decoder's supply lines with capacitors large and small. Then he checked the earthing of the teletext decoder panel. There was no change to the symptoms with the extra decoupling capacitors temporarily hooked in, and the earthing leads and joints proved to be o.k. Next then for Philbert's hour of glory, with the impressed Mr. Hayes as an onlooker. Philbert spread out his anti-static mat, earthed his wrist and his little soldering iron with a flourish, and produced a foil-wrapped SAA5030 chip fresh from the stores.

Fifteen minutes later the new chip had been fitted. The teletext panel was replaced in the set and Ch. 4 text was selected via the remote control keypad. How their faces fell! The text display was as mixed up and confused as before, with sprinklings of £ symbols, odd blocks of graphics and misspellings. Philbert, crestfallen, twiddled the bit-clock coil again. There was no improvement. He wished he was in Ten$rife or Maj½rwa.

Bright and early next day Dave appeared on the scene – it was Philbert's day off – with a replacement decoder panel that had proved to be o.k. in the workshop. Into the set it went, but the symptoms remained as before with very little improvement. Dave was convinced that there was something wrong with the signal from the aerial. So he tried a complete replacement TV set. Good teletext! Where lay the problem then? See next month for the answer.

ANSWER TO TEST CASE 330
– page 617 last month –

Picture foldover, and in fact linearity problems generally, are much rarer now than they were in the old days. The Ferguson TX10 set featured in last month's puzzle had foldover at the top of the picture, indicative of a slow or constricted field flyback. The lads in the workshop were on the right trail in checking out the flyback generator circuit associated with pins 6 and 8 of the TDA3652 field output chip, and the low-amplitude pulse at pin 6 should have led to further investigation in this area.

The normal action of this circuit is that C776 (100μF) charges to the supply line potential (26V) via D771 and R774 during the scan period. At the end of the scan the flyback generator within the chip whips pin 8 up to 26V, thus raising the positive plate of C776 to 48V and reverse biasing D771. In this way the supply to the deflection yoke is boosted, ensuring a fast reversal of the current flowing in the field scan coils. This wasn't happening, because R774 had increased in value form its normal 620Ω to about 1·7kΩ. Maybe a little more thought about the low-amplitude pulse at pin 6 would have got our fault-finders there a bit more quickly. Maybe that was what Sage was muttering as he settled down at his own bench, while RT dismantled the Christmas tree of components under the TX10's main PCB.

VCR Clinic

Reports from Philip Blundell, AMIEIE, Eugene Trundle, Ian Bowden, Alfred Damp, Stephen Leatherbarrow and Nick Beer

Philips DMP Series Decks

When taking the top plate from the mechanism be careful as you remove the erase plug: if you don't release the clips first you can easily break off part of the erase head mounting. This happens to be where the 180° roller adjusting screw operates, the result being that the tape path goes way off adjustment. Usually the engineer glues the erase head back on but leaves the L-shaped lug off, thinking that it has no effect – it comes into use only when threaded up. . . To do the job properly a new scanner ring is required. **P.B.**

Pye DV464/Philips VR6462

"Goes beserk" said the fault note, which wasn't far wrong. At switch on the deck would initialise then the clock would go off, the deck would go into wind and wouldn't stop. All this was accompanied by clouds of smoke from the i.f. module. The smoke was coming from R3426 as C2422 was short-circuit. It's part of the tuning voltage generator. . . **P.B.**

Philips VR6468

On occasions the cassette would eject when play or rewind was selected. If the service mode was selected the error was −2 (capstan not rotating). This time it wasn't loss of the tacho signal: the capstan motor had a dud spot. **P.B.**

Blaupunkt RTV310

The problem was tuning drift, with a hum bar superimposed on the snow. C1103 (47μF, 100V) on the power supply PCB was open-circuit. **P.B.**

Philips VR6362

The clock display would either go off or only one digit would appear – it was an intermittent fault. When it occurred the machine didn't answer the keyboard. Crystal 1001 on the clock module was dry-jointed. **P.B.**

JVC HRD320

The problem was very intermittent loss of the playback picture. Days would pass without the fault showing. Sometimes it would tease us for a few minutes at first switch-on from cold. We tried replacing the luminance chip IC101 but this didn't cure the problem. The symptom finally stayed for long enough to enable us to do some scope tests. These proved that low-pass filter LPF102 was the culprit. These filters have many internal joints, which probably explains why they are so often the cause of exasperating intermittent signal problems. **E.T.**

Samsung VI910

The reported fault was of cutting out intermittently on playback. No cause could at first be found: the most likely suspect, the reel drive idler, appeared to be fine. After the machine had worked correctly for several days it came to a stop – when we noticed it the tape had unlaced and the machine was in the off mode. We restarted it and it ran for only a few seconds before stopping again. This time we noticed that the power LED went out momentarily just as the machine cut out. We restarted it again, with a meter handy. This time when the fault occurred the machine just stopped dead with the tape still fully laced. We quickly found that the 13V supply, from which all the other supplies are derived, was missing. The cause was the 3132V regulator chip IC1. It could be turned on again by applying just a few drops of freezer to its case. **I.B.**

Panasonic NV-G21

When we switched the machine on a squealing noise came from it. After removing the top cover we noticed that the capstan rotor was vibrating. A check at the torque control input pin of the BA6430S motor driver chip IC2001 revealed some bursts of 1·8V spikes that sat on a d.c. level of 1·5V. The timing of these bursts seemed to coincide with changes in pitch in the noise coming from the motor. After checking with another machine however we found that these bursts are quite normal. We also discovered that the noise would fade away when the machine had been on for a few moments. A quick spray of freezer on the motor driver chip brought the fault back again, proving that the i.c. itself was the cause of the problem. **I.B.**

Panasonic NV-L25

This seemed to be a very strange fault at first. The customer said that the two words "write" and "release" would intermittently appear in the display and that when this happened nothing could be done with the machine. Unusually for an intermittent fault it showed up straight away for us, and we found that by lifting the front right corner of the machine slightly it cleared. As soon as the top cover screws had been removed however the fault wouldn't occur, no matter how the machine was flexed. With the top cover removed the cause of the fault was spotted straight away. A flat 14-way connecting cable goes from P7401 on the main PCB to P7501 on the display PCB. It hadn't been bent down far enough and the insulation had been cut through at connection five (serial data line) by the front of the metal top cover. This connection was thus earthed when the cover screws were fitted. **I.B.**

Panasonic NV-G21

This machine showed very little sign of life. There was no display and no LED indications. In fact all that worked was the r.f. amplifier. The cause was quickly traced to the power supply – there was no 6V and hence no switched 5V output from the STK5338 multi-voltage regulator chip IC1001. It was the second machine we'd had in a single week with the same fault. **I.B.**

Mitsubishi HS-B30

The owner complained that the counter didn't work correctly. In fact the digital readout didn't change at all. At the same time a noise bar moved through the picture, indicating absence of the CTL pulses. Replacement of the audio/control head cured both faults. This is rather intriguing: why complain about something as trivial as the counter when the playback picture quality is so poor?

As a footnote I received another VCR with the same complaint/symptoms later the same day. This one was a brand new Akai, but this time all that was necessary was to clean the control head. **A.D.**

Ferguson 3V57

This machine would intermittently stop due to either reduced amplitude or missing take-up reel pulses. The usual causes of this problem with these machines are dry-joints or a defective reel optocoupler. This time however I found that the switched 12V supply to the reel sensor board was low and varying. When the supply and the reel pulse waveform were monitored you could see that the latter disappeared when the supply dropped to 9·5V. The cause of the problem was on the power supply board: D3 was leaky with a reading of approximately 600Ω. **A.D.**

Ferguson FV13H

The job card said "dirty heads". When the machine was tested there was no picture but sound could be heard. So I switched off and set about cleaning the heads. When the test tape was tried again the symptoms were the same. I stopped the tape, ejected it and was about to attempt to clean the heads a second time when I noticed that the drum, which was slowing and about to stop, was actually running backwards! Not really believing my eyes I tried the test tape again and sure enough the drum was rotating backwards. So attention was turned to the servo board. After finding an incorrect voltage I replaced the VC2023B2 servo chip. This restored normal drum rotation. **A.D.**

Tashiko VVE922

Failure to record colour was the complaint with this particular Japanese nightmare. The more I looked for the cause of the fault the more intermittent it became. I tried creeping up on it but this didn't help. How do they know? Anyway, after a long foray into the machine with a hairdryer in one hand and freezer in the other VR303 (627kHz set potentiometer) proved to be the cause. Don't twiddle – the setting is critical. **S.L.**

Amstrad VCR4500/9000

On several occasions we've had no tuning or poor band coverage due to the 43V zener diode D517 on the power supply module. It's type GZA43Y but I always make do with a 33V and 9·1V zener diode together as 43V zeners don't exactly grow on spares cabinets. **S.L.**

Panasonic NV370/Philips VR6520

There was severe hum on both picture and sound in the E-E mode. It also showed very clearly with the test signal displayed. C1102 (2,200μF, 25V) on the power supply panel was bulging out its innards for all to see and was virtually open-circuit. **S.L.**

Amstrad VCR7000

Due to no take up, poor fast wind etc. we had to replace the reel idler in this machine. No surprise here of course, but we were surprised to find that the symptoms were still present after the replacement. The drive circuitry is very simple and the fault was quickly traced to Q15 (2SD1348) which was short-circuit base-to-collector. For those who may not know this, the idler is the same as the one used in the Sharp VC9300/VC381 range of VCRs. **S.L.**

Panasonic NV333

A case of no tuning voltage was traced to R7019 on the panel mounted vertically at the rear of the deck. Its value is 10Ω and there appeared to be no contributory cause to its failure. **S.L.**

B and O VHS80

Chewing tapes it said. Easy I thought – the idler is faulty for sure. More fool me! I found that the capstan motor didn't move in fast forward and rewind, nor did it move to give take-up in play or record. But it did thread. There was also a loud scratching noise during threading. A check on the circuit revealed that I'd had this problem before, but the resistor was o.k. this time. So time for some proper fault-finding.

There was no output from the capstan drive switching chip IC1151 though it was being switched correctly. This was because there was no motor supply input. There should be a regulated 4·2V input which is obtained from the 16V rail via Q1158. This transistor's collector voltage was high as it had no base bias because R1153, a tiny 1kΩ resistor, was open-circuit. Replacing this resistor restored motor drive. In the fast modes the reel drive was sluggish. A new idler upped the torque, but the deck didn't lace completely and because of this there was no take-up in the play and record modes. The cause was much simpler this time: the loading belts were very worn – as were the pinch roller and the other belts.

The mechanism is very similar to that in the Hitachi VT11. **N.B.**

Sony CCD-F340E

The card listed two faults, a loud screeching sound when rewinding and poor life from the battery – there was no indication as to whether it was the sole battery that had been used. I decided to deal with the noise first as I'd a fair idea of the likely cause, a faulty supply reel table. This had to be ordered and was fitted a couple of days later. I then looked into the battery problem.

The battery sent with the machine wasn't of Sony manufacture. It was a high-capacity (1,400mAh) Maxell one. As it was flat we charged it then tried it out. On continuous play it lasted for just a quarter of an hour. The camcorder was drawing the correct 6·5W in the camera record mode, and when flat the battery voltage had dropped to just over 5V.

We've found that the most common cause of loss of battery capacity is incorrect use/charging. The problem arises when people charge the battery, use it for a short time without "flattening" it, then charge it again. This is commonplace in the shop of course, where camcorders are constantly being demonstrated and the batteries left on charge. We've had some success with continually flattening and recharging batteries for a period to reactivate them. Customer education is the best cure. The fault seems to affect mainly batteries used with Sony camcorders and their clones – not just Sony batteries either. **N.B.**

Letters

MEDIUM-WAVE INTERFERENCE

I can sympathise with Ivor Nathan (Letters, March) over his problem with interference. Fortunately there's a well established solution, at least for medium-wave reception. The subject was very well covered in "The Loop Aerial Revived", *Wireless World* July 1979. The main point is that a long-wire aerial is unsuitable for a.m. reception in an urban environment because it's very sensitive to local electrical interference. Due to the short distance between the interference source and the aerial capacitive coupling is significant. Since most of the radiation is produced by high r.f. voltages (sparks, TV video output, TV line pulses) this capacitive coupling results in a high interference level. Electromagnetic interference radiation is relatively small.

What's required is a magnetic pickup device. One can be made for next to nothing. Make a frame about 1m × 1m × 50mm. This is easy to do with two lengths of 50 × 20mm timber joined in an X formation. Wind seven turns of fairly heavy wire round the frame, keeping a few mm between the turns. Connect the ends to a 500pF tuning capacitor. Place a radio with a ferrite-rod aerial inside the loop, with the coils on the rod in the same orientation as the loop. Tune the loop and the signal strength will rise dramatically. An alternative method of coupling is to wind a one-turn loop on the frame and connect it via twin cable to the receiver's external aerial socket.

Not only does this produce lots of signals with hardly any interference, it's also directional. Thus interference can often be nulled out by turning the loop. In addition, being tuned it helps to suppress image reception. Here in Nottingham I've received local stations as far away as Bradford and Southend using this loop aerial.

David Robinson,
Radcliffe-on-Trent, Nottingham.

INTERLACED SCANNING

I was interested to read David T. Looser's letter in the May 1990 issue and feel prompted to make the following comments. Interlacing provides 25 complete pictures per second at an overall flicker rate of 50Hz. The technique is to transmit 50 half pictures by scanning odd lines during the first fiftieth of a second and even lines during the second fiftieth. The price paid for doing this is an adjacent line-to-line flicker at 25Hz. If interlacing is not used and the other system parameters remain substantially unchanged only half the screen area is scanned, in other words half the elements that make up the picture have gone. This of course affects the camera as well – half the photosensitive area wouldn't be scanned either. So, even if David Looser prefers to watch such a picture, half the information has disappeared. I don't understand how his claim that "the vertical resolution is virtually the same" can be compatible with his later statement that "the line structure is quite noticeable". I recall the importance of interlacing with the 405-line system. Failure produced a 202-line picture which even the uninitiated thought was pretty awful! The idea for interlaced scanning came from the EMI team that developed the 405-line system fifty years ago. I think it unlikely that any great revelation is going to contradict their theory.

The argument that since VDUs don't employ interlacing TV sets needn't either is specious since we're not comparing like with like. At normal TV viewing distances the angle subtended to the eye by the screen is typically ten degrees in the vertical plane and the 25Hz line-to-line flicker is not very obvious. VDU users sit much closer to the screen and the ten-degree angle just mentioned can be thirty degrees. As a result the line structure is far more obvious. With interlacing there's a further problem that's far more relevant to VDUs than TV sets. If you get close to an interlaced picture and run your eye up and down the screen the raster breaks into a pattern of half the number of lines, moving up or down. When you stop the eye movement the number of lines appears to double, back to normal, and the 25Hz flicker can be seen.

So there are good reasons for not using interlacing with VDU displays. First, any 25Hz flicker is more obvious, because the operator is close to the screen. Secondly when reading down the screen, or having the display scroll through, the eye's tracking movement causes the break-up effect described above. Enduring this for a day can cause headache and eye fatigue. The definition of small 312-line VDUs is quite adequate for the characters used in word processing etc.

Truly high-definition computer displays employ both sequential scanning and a large number of lines – typically 1,250 – so that even with a magnifying eyepiece it's impossible to see the line structure. All you see are the phosphor dots of the delta-gun tube which, incidentally, is perfectly converged. This level of performance is essential for the computer-aided design of modern densely-packed PCBs for example. Such definition calls for a video bandwidth in excess of 25Hz, which brings us back full-circle to the use of interlacing as a means of reducing the bandwidth requirement with a TV transmission.

Keith Cummins,
Holbury, Hants.

THE FISHER FVHP615

With reference to the problems Dave Mackrill mentions at the end of his article on the fishy Fisher FVHP615, we service hundreds of these machines and can say that the final problem of tight supply and take-up reels is normally caused by the reel assemblies beginning to fall apart. All that's required is a push down on the centres of the reels and the problem is solved. Fred will most likely be calling back with tight reels!

C. Green, Budget Video Warehouses Ltd.,
Dartford, Kent.

PIONEER LASER UNITS

In the CD Player Casebook column for May Mike Leach quotes the price of the laser pick-up for the Pioneer PDZ-72T as £27 plus VAT. I wish we could sell them for that! As it is, our target retail price is £43·87 plus VAT, though trade customers will of course pay less. Mike's point about laser pick-up prices is well understood by ourselves and probably by most manufacturers. At our trade price Pioneer actually make a loss on each one we sell, but frankly we want to make a profit selling CD units, not laser pick-ups!

Of more concern to us is the fact that many if not most laser pick-ups are changed "on spec". All too often it's a question of "problem with a CD player – change the laser pick-up"!

Our training officer Ken Clements has been running two-day courses on CD for a few years now, all over the country. We think, and many engineers write to tell us, that it's an excellent course, with a very high practical content. Any of your trade readers who repair Pioneer CD players are welcome to contact us to find out when they can join one of them.

Roger J. Wood, National Service Manager,
Pioneer High Fidelity (GB) Ltd., Service Division,
Field Way, Greenford. Middx UB6 8UZ.

QUALITY OF 625-LINE TRANSMISSIONS

I'm writing to support Ray Truner's views (Letters, May) on the present quality of 625-line transmissions. I remember being astounded at the quality provided by early colour TV programmes transmitted during the BBC's sixtieth anniversary celebrations a year or so ago, particularly the edition of "Going for a Song". By adjusting my TV set just to underscan the tube face I can see that much broadcasting equipment is out of alignment, whether on BBC where the start of the active line is delayed or Channel Four where the active line finishes too early – with ITV this varies from company to company. I can also see the lining up of shots from mixer desks. Further, why does London Weekend Television use so much clipping and correction that the pictures produce a "cardboard cutout" effect? Is there no such thing as true black level? I'm beginning to think that it's all a plot to show how good HD-TV is. Would any TV company care to comment?

S.J. Cowie,
Shrewsbury, Shropshire.

SOUND QUALITY ETC

I read with interest John C. Priest's letter on cabinet design and TV sound quality in the April issue. Like John Priest I think that the sound quality of TV sets has got progressively worse over the years, due in part to the flimsy cabinets used and the tiny speakers often fitted in large-screen TV sets these days, but I feel that the type of audio amplifier also plays a large part in the sound quality obtained.

Nowadays the vast majority of sets tend to use amplifier chips, reducing labour costs. To my ears these chips often sound harsh and are fatiguing to listen to for any length of time. They tend to suffer from crossover distortion at low volume levels, and many are inherently unstable, the TBA820 for example – if you don't believe me, try disconnecting the Zobel network (usually 1Ω plus 0.22μF) connected across the output and hear it scream!

Many older designs used a transformer-coupled class A audio amplifier which provided a more pleasant sound despite greater distortion (on paper anyway!). Most of the distortion produced by this type of circuit is in fact second harmonic distortion, to which the human ear is very insensitive. Transformer-coupled amplifiers do tend to sound a bit on the warm side, but I don't find this colouration unpleasant – though my Decca 30 does sound as if it has a cold at times!

Many of the discrete push-pull designs used in TV sets over the years are capable of providing good sound, notably the class A designs once used by Philips. Class B designs can also sound good, though the rather under-biased effort in the Philips TX portable chassis sounds awful, with crossover distortion clearly in evidence.

In TV Fault Finding, February, Stephen Leatherbarrow comments on the unreliability of many STK type thick-film modules. This may be because too much heatsink compound has been used during assembly. My Onkyo tuner-amplifier uses an STK463 in its output stage and gives excellent sound but the STK463 blew after the first few months. On removing it I found a thick dollop of heatsink compound on the underside. This had prevented good contact between the module and its heatsink, the result being an excessive local temperature rise and early failure. The replacement was installed with a small amount of compound carefully smeared over the whole surface. It has given trouble-free service now for seven years.

Incidentally my Sony KV2000 suffered from decoder trouble recently. The colour was weak, with considerable noise on saturated primary colours. Voltage checks in the decoder showed that Q302 was conducting excessively. This was caused by the a.c.c. preset VR303 being dirty. A squirt of switch cleaner cured the fault. Dirty potentiometers seem to mar this set's otherwise excellent reliability now that it's getting on a bit.

S. Pearson,
Chipping Norton, Oxon.

CHARLES HYDE

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Freddie Whipp, Sales Manager,
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WELL DONE SES

There have been many letters in recent times about the poor service given to the small Independent Retailer/ Service Department by manufacturers and their agents. Occasionally however one obtains exceptional service, so I'd like to commend Sony agents SES (Staines) Ltd.

(Unit 1, Causeway Industrial Estate, Lovett Road, Staines TW18 3AN). During a recent visit the reception area simply oozed efficiency and all staff were quite exceptionally polite and helpful. Despite the fact that we are not Sony dealers we obtained immediate replacement of a failed on/off switch in a couple of KV2092 receivers free of charge while we waited – and a three-month guarantee covering the complete sets! Well done.
Barrie Hay TV,
Lancing, Sussex.

MANOR SUPPLIES TELETEXT ADAPTOR

I wonder whether anyone can provide details of the i.c. and transistor working voltages for the Manor Supplies Mk II Mullard teletext adaptor as this information is no longer held by Manor? Any expenses would of course be reimbursed.
E.G. Kempshall, 109 Portland Road,
Hove, East Sussex BN3 5DP.

HOW GREEN IS SATELLITE TV?

I wonder whether satellite technology is as green as David Tilley suggests. The satellites themselves are green so long as they don't re-enter the atmosphere. But putting a satellite into orbit requires a huge expenditure of highly volatile energy in relation to the size of the payload, and as the launch vehicle punches its way through the atmosphere, including the ozone layer, its propellant gases hurtle back into the atmosphere. Three decades of satellites and space probes have greatly increased our knowledge, but can anyone place his hand on his heart and declare that rockets are environmentally friendly?
D.F. Bishop,
Ripley, Derby.

CABINET DESIGN

May I echo John C. Priest's views (Letters, April) on the awful design of CTV cabinets in particular? It's clear that manufacturers are either so arrogant about the reliability of their products that they think they'll never need to be fixed, or they just don't give a damn for the poor beleagured service engineer. Many field engineers must at some time have had no choice but to balance a large, unwieldly PCB on one knee while squatting in a corner of a dingy room and work on it while it's live. Sometimes we have to handle metalwork that we know is at half mains potential due to the use of the ubiquious bridge rectifier.

Until quite recently TV sets had a servicing position that gave access to both sides of the main PCB without having to undo numerous cable clips. The service manuals blandly instruct you to ensure that all cables are fastened back in their original positions – which is impossible unless a Polaroid camera is part of your toolkit. We are also told always to use an isolating transformer when servicing. I'd like to ask those who write this sort of thing to carry one up to a top flat after having parked a couple of streets away.

Refitting the backs of some modern receivers is more difficult than repairing them. Numerous screws, PCB support slots moulded into the back, AV/audio/scart/aerial socket bits and pieces etc. all cause hassles. One top name Japanese set flaps alarmingly when the back is off: the paper-thin plastic can't support the weight of the c.r.t. properly.
Dave Henniker,
Edinburgh.

TRANSFERRING FILM TO VIDEOTAPE

A correction is required to my article on transferring film to videotape (May 1990). The audio/video output from the JVC GRA-30E camcorder is available at an 8-pin mini DIN plug. If connection is to be made to a JVC VCR with a 10-pin camera socket the JVC VC-V810U conversion cable will be required. While writing I would like to thank Ernie Kendall (Letters, page 525) for his interesting and helpful comments on the interference problems I described in an earlier letter.
Ivor Nathan,
Southgate, London N14.

SATELLITE RECEPTION ON OLD SETS

There has been mention in the daily press of Sky TV reception on old TV sets. I have for some time owned a Pye Model 99 (T14 chassis) monochrome portable which has a v.h.f./u.h.f. tuner of Italian manufacture. It had a small power supply fault and after putting this right I tuned through the v.h.f. band. Skysport came through with a little snow on the screen but quite a stable picture. The aerial used is outside my premises and has only five elements, of Z design, with two vertical bars as reflectors.

I'm puzzled as to how on earth microwave signals can be picked up by this 1972-vintage receiver and demodulated. Perhaps other readers would care to comment?
D.H. Davies,
Ebbw Vale, Gwent.

RGB DRIVE TO THE TX10

Now that the BSB satellite with its D-MAC transmissions is in operation I'm wondering whether the analogue RGB output from a BSB receiver could be fed to the RGB data inputs in a Ferguson TX10 chassis? These inputs go to pins 13, 15 and 17 of the TDA3560 colour decoder chip. The appropriate write voltage would be required at pin 9, and sync would have to be fed to the timebases. Or can these inputs handle digital data only?
Brian Webb,
Havant, Hants.

J. LeJeune comments: The data inputs at plug 18 on the signals processing board in the TX10 chassis can be used for analogue inputs. They should be a.c. coupled into the

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colour decoder chip, which has black-level restoration in it. The brightness can be controlled but not the contrast as this is carried out before demodulation of the chroma signal. Contrast control at RGB level is very difficult – one has to maintain accurate tracking in order to preserve the grey scale. The inputs can be switched by feeding 1·5V to pin 5 of plug 18, which goes to pin 9 of the TDA3560. Sync can be fed to the pin marked "video" adjacent to C748 on the main chassis or to pin 2 of plug 19 on the signals board.

The very last version of the TX10, the 22B5 professional series, was equipped with a scart socket for analogue/ TTL signals. Unfortunately parts are no longer available for this model. The contrast problem remains.

FOR DISPOSAL

I have for disposal two new 19in. twin-panel c.r.t.s of the type used in the Pye 11U and KB 801. An excellent A66-120X must also go. These are free for collection but a phone call first would be appreciated.
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Can anyone supply an i.f. panel for the Thorn 2000 chassis? The set has been in working order for 21 years but the panel met with an accident recently. Also does anyone know of a cure for teletext lines at the top of the screen with this chassis? All costs will be met in full.
J. M. Williams, Ardro, Pendyffryn,
Valley, Anglesey, N. Wales.
Telephone 0407 740 710.

Can anyone supply a seven push-button selector (assembly 959P00501) for the Mitsubishi Model CT180B, new or secondhand? All expenses paid.
J. Aldrich, 38 Parsonage Lane,
Burwell, Cambs CB5 0EN.

Can anyone lend or sell me a circuit diagram for the Sharp multi-standard Model CP1491SP?
Leon Electronics, 11 Woodland Close, Three Bridges,
Crawley, West Sussex.
Telephone 0293 20 536.

I urgently require two E421 dual n-fet input amplifier transistors for my Scopex 4D-10A oscilloscope. All expenses paid.
Ben Hosseinally, 3 Villa Chambly,
Curepipe Road, Mauritius.

Does anyone know where we can obtain the moving-coil meter used in the Ferrograph RTS-1 test set?
R. Sherwin, Bristol Sony Centre,
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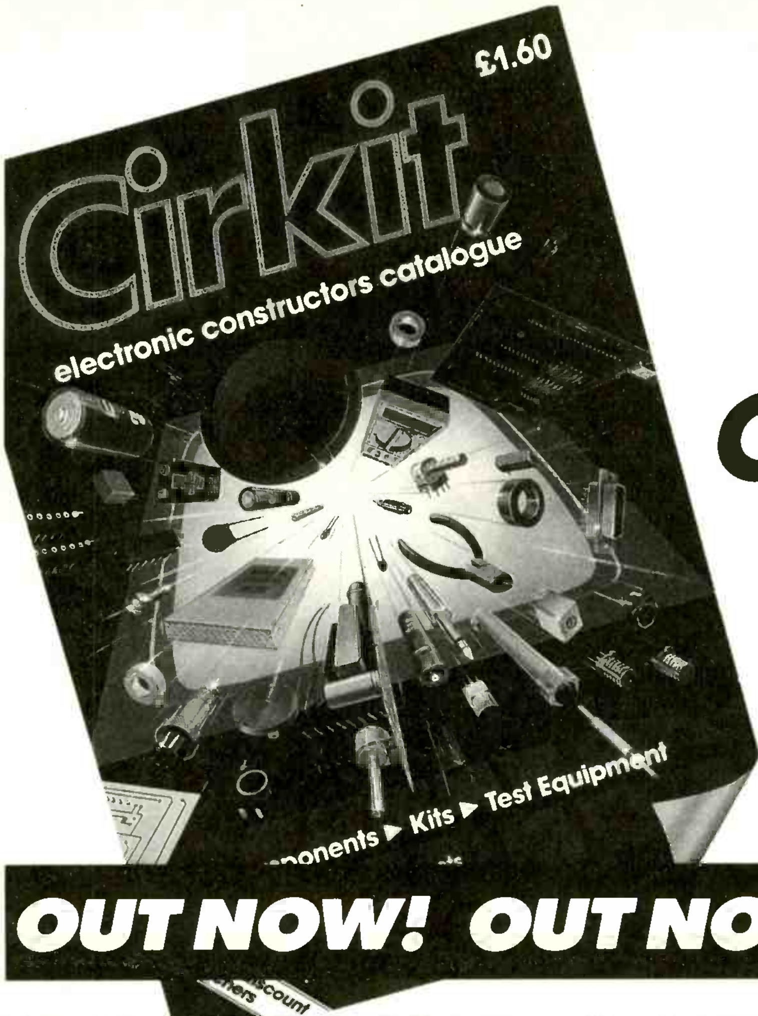

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3HSSU2N-NV230,470,480,G9,10, G11,G15PX	£30.60
3HSSU3N-NV430, 460	£21.50
3HSS3N-NV777,330	£21.50
3HSS4NB-NV730	£30.80
3HSS4NA-NV366	£30.80
NVG30,33,40,45,46,130 & most others Panasonics	POA

SANYO

3HSSSY-VHR1100,1110,1300	£26.50
3HSS3SY-VHR1500	£30.80

SHARP

3HSSSP-VC9300,9500,9700,381,481 482,483,486 etc	£21.00
3HSSSPB-VC581,583,651,750 etc	£21.00
VC7000,8000 series (Brass)	£42.00

OTHER MAKES

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Fisher FVHP510,520,530,615,710 etc	£21.00
Fisher VBS7000,9000 etc	£33.75
Goldstar 8000	£23.00
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Hinari VXL2,4,35	£23.00
Hinari VXL5,20H	£20.00
Hinari VXL20H	£23.00
Mitsubishi HS303,304,320,700,310	£35.00
Saisho VR100,605,705,805,905	£23.00
Samsung Universal 2 Head	£24.25
Toshiba V71,81, etc	£25.50
Toshiba V93	£25.50

ASK FOR VIDEO HEADS NOT LISTED

The above heads are replacements.
For originals please ask for quotations.

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BC214B	£0.07	BU536	£1.75
BC237	£0.07	BU806	£0.75
BC238	£0.07	BU807	£0.75
BC308B	£0.07	BUT11	£0.75
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BC328	£0.07	TIP29	£0.30
BC337	£0.07	TIP31	£0.30
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Ferguson FV26D	£14.50
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Sanyo VTC5000,5150,5400,5300,6500	£7.50
Sharp VC9300,9500 etc, Original	£15.90
Panasonic NV333,366 Original	£13.20
All other Panasonics	POA

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Ferguson/JVC (Mechanical models)	£23.00
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All Panasonic Original	POA

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VT8000,8500 etc. FF/Rew Pulley	£0.70
VT11,33 etc. Clutch Assembly	£8.00

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2SC-2581	200p
2SC-2582	40p
2SC-2603	20p
2SC-2611	40p
2SC-2631	40p
2SC-2634	40p
2SC-2660	85p
2SC-2688	50p
2SC-2753	50p
2SC-2781	50p
2SC-2785	50p
2SC-2791	325p
2SC-2792	275p
2SC-2944	175p
2SC-3078	40p
2SC-3156	325p
2SC-3179	200p
2SC-3182	250p
2SC-3284	175p
2SC-3298	120p
2SC-3506	250p
2SC-3519	150p
2SD-198	180p
2SD-200	210p
2SD-234	40p
2SD-235	40p
2SD-288	80p
2SD-299	160p
2SD-313	40p
2SD-315	75p
2SD-325	45p
2SD-331	80p
2SD-400	20p
2SD-401	50p
2SD-414	40p
2SD-421	60p
2SD-424	250p
2SD-426	150p
2SD-427	150p
2SD-428	150p
2SD-438	45p
2SD-461	100p
2SD-468	25p
2SD-471	30p
2SD-476	60p
2SD-478	100p

2SD-523	150p
2SD-525	70p
2SD-526	70p
2SD-560	50p
2SD-570	40p
2SD-571	30p
2SD-592	20p
2SD-600	80p
2SD-612	40p
2SD-613	70p
2SD-621L	450p
2SD-636	25p
2SD-637	20p
2SD-639	25p
2SD-641	310p
2SD-666	25p
2SD-667	25p
2SD-669	40p
2SD-687	60p
2SD-716	115p
2SD-718	100p
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2SD-985	80p
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2SD-1134	80p
2SD-1135	90p
2SD-1138	60p
2SD-1153	50p
2SD-1207	50p
2SD-1265	100p
2SD-1267	140p
2SD-1273	100p
2SD-1275	125p
2SD-1276	125p
2SD-1397	200p
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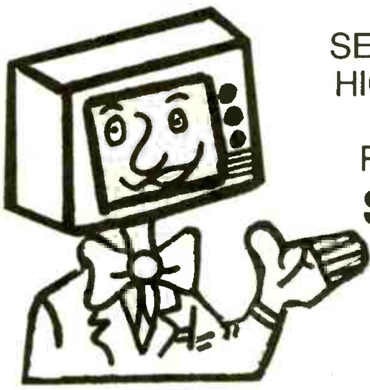

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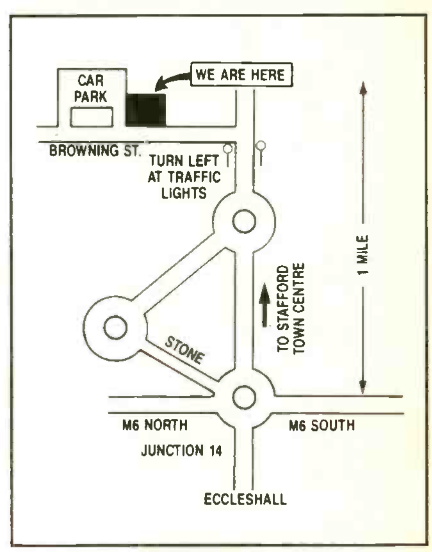

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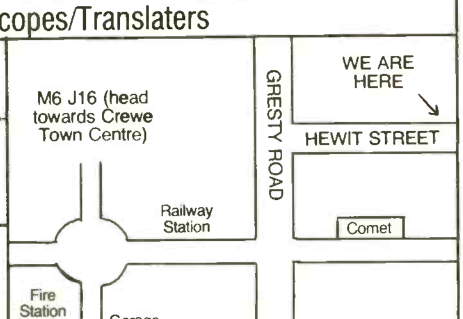

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47 10p each

1A/1600V 10p
DG3P EQV-BY228 10 for £1
2 amp bridge rec. wire end 15p
SKE4G2/02 15p
Eqv. BYX71/600 500ns.

Thorn Spares

New 9000 Decoder £8.50
9000 Frame panel £8
9000 Cyclops panel £1.50
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

Test-Dep Ex-Philips V.6100/05 T/V and Tel/Text unit and hand set £50.00
Send for data.

TT14 GEC TEX-DECODER

13 IC Panel with cable form £9.50

PHILIPS

Decoder SAA IC 5020-5030 5040B-5050
K40 Text Panel £8.00

KT3-K30

OE-425
OE-550 E.W. 10p
OE-513 correction 10p
OE-557 50p

DIODES

Bridge KBF-08 40p
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 500/200 — 5 amp 8p
BY 527 10p
BY 602 10p
BYV 26C 10p
F 247 10p
GP20G 5p
GRIP80G (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 C.H. K30 Tex Rec Front Panel with I.C. £5
K35 IF £5.00

Plug In

K4 Focus Pot £1.00

Fidelity Tube Base with transitor & 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 T.X. 12"-14" Philips G8
27482 £10
4822 £10
10273 £10
Thorn 1690 LOPT £7.50
2 J/Pots 3.500 1 off 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 AT 2036 £1.50
Pye 169 Line Trans £3.00
Pye mono £3.00
Rank mono 1704A £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. & ITT Trans each £2.00
LOPT Rank Z763 £5.00

Universal Tripler

with small focus pot. Green type £7.00

Black Triplers

KT3 Triplers £6.00
S.T.C. Universal Tripler £6.00
11 TJT £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
11TBY £4.00
D22 for Pye 18" colour portable £4.00
LP 1193/63 £4.00
BG 1004/1 £3.25
ERO Tripler print type with focus PO7 BG2087 £5
T/text ultrasonic rec'r panel £14.00
12-14V. 20 for £5.00 200 for £25.00
GEC 8 touch unit assy complete with all I.C.'s + pots £4.00
G11 E.W. Transformer 50p
G11 E.W. coils £1.00
G11 Transient Suppressors 245V 20p
G11 Scan Coils £5.00
G11 100K tuner pots 12 for £1
KT3 IF panel £6.00
KT3 line OSC transformer £1
KT3/K30 infra-red receiver head £4
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 560/1/570T £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

Voltage Regulators

+5V/UA78PO5SC 30p
−8V/79M08c 30p
+6V/78M06c 30p
+10/78LA10 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
BYX 49/600R 75p
BYX 55/350 10p
BYX 55/600 (Bead) 10p
BYX 71/350 20p
BYX 71/600 50p
BYX 72/300 20p
BYX 36/600 50p
BYV 95B 10p
BYV 95C 12p
BYV 96D 10p
BYZ 106 10p
BPW 41 15p
BYW 56 2A/1000v G11 8p
BYW 29/50 15p
BYW 95C 10p
BZU 15/24 54p
BZY 93c75 50p
BZW 15/18 30p
BZW 15/30 30p
BZW 70cw2 10p
BZX 79.3v 10p

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

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

G11 drawer ASS 3 pots Mains switch and lead £2.00

K30 Drawer Ass with pots cable forme £1.00

TX10 Drawer with 8 way pots. ass. £2.50

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

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

Hills 9 piece tool kit in case £5.00

Abbey Security Smoke Alarm Model 101 £4.00

Self adjusting cutter stripper £5.00

10 mixed tube bars £4.00

5000 Diodes-Resistors £3 pack

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 Silicon Grease £1.50

Freeze Philips £1.15

Foam Cleaner Philips £1.15

Contact Cleaner Philips £1.15

100 Coax Plugs £12.00

De-solder pump + 2 nozzles Philips £4.00

Flat Red LED and Green 5p

500gm 60/40 solder reel £6

Dual v/u meter -20 — +10db £1

K30 thermistor 232266298009 75p

De-solder Pump £2.50

Portasol Flameless Gas Soldering Iron £16.00

Green & Red. LED pack mixed 100 for £1.00

Hill Meter Leads. S/Rubber and Probes £4.00

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

Hitachi sets etc.

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

Philips Handset IC £3.00
SAA3010P £3
MAB8461/WO63 £3

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

M58484P £2.00

Hand Sets — Fidelity £15.00 to £35.00

Philip New A/V Hand Set £10

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

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

CMC 302 Panel with TC mains switch etc £5.00

CMD 800 Decoder £8.00

C7 Hand Set £6.00

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

Meters Hills 520 £17.00
Meters Hills 420 £10.00
Hills HD5000 Digital Meter 1000V DC 750AC 10 Amp 20 MRG Rangers £28

HT100 Multimeter £6.75
HT300 Multimeter £7.75
HT500 Multimeter £9.00
HT700 £15.00
HD1000 Digital £20.00
HD1200 Low Cost Digital £13.00
HD2500 £18.00
HD3000 Digital £25.00
HD5500 Digital £29.00
HD6000 Digital £32.00
HD8000 Digital £35.00
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

CT9185 £4.00
CT9176 £4.00
CT9133 £4.00

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 V.C.R. Handset £15.00

GEC Ultrasonic 8CH Full Remote £10.00

G11 Full Remote Ultrasonic £32.00
G11 Ultrasonic Teletext Handset £20.00
8 C.H. Ultrasonic GEC Full Remote C2014H/C2219H £15.00
New Replacement for G11 Ultrasonic Full Remote £12.00
Thorn 4000 insert with 7 buttons £5.00
Decca RC 11 £14.00
Decca RC 12 £14.00
G11 Infra-red full teletext £20.00
Dynatron-Full remote CTV 62, 63, 64 £19.00
Hitachi infra red handset £18.00
Philips full remote KT3, 16C928/20C934; 7228/7324: K12 26C 797/1ST 66K 1826 £12.00
G11. Full remote top button assy. £12.00
G11. Full remote repair service (exchange unit) £18.00
GEC infra red full remote 8 channel (I.C.SAA1250) £14.00
Philips infra red full remote 9 channel for 60 CP2605 £6.00
Philips infra red full remote 12 channel for 60 CP2605 £12.00
K35
KT3/K30 T/Text £12.50
KT3/K30 Full remote £15.00
KT3 Power supply £4.00
GEC infra-red 2236-2026 £4.00
GEC 8 button full remote £14.00
GEC push pad handset button blobs 10p each
Pye & Philips handset KT3-K30 chassis. No RC5150-RC5176-RC5171-RC5177.
Special Price £13.00
RC4001 KT3 and Teletex £14.00
IT CVC 32 handset repaired £15.00
CVC 32 Hand Set £15.00
CVC 45 3 and 2 Pin
TX10 Hand Set Text £12.50
TX9 with Text £12.50
TX9 & TX10 button print £2.00
TX10 Focus Pots £5.50

ITT

T/V & Video Processor. 1200 Type £10.00

PHILIPS
UNIVERSAL HAND SET £12.00 RC5
KT3 – K45

We have all parts for Philips Handsets

RC5353 £15.00
RC5300 £12.00
Philips RC5 £15.00

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

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

PHILIPS
RC5171 £12.00

K35-K4 HAND SET
Repaired for £5.00