JANUARY 1988 alia $2.50, New Zealand $3.50 (inc. GST), Malaysia $6.10
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TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

Extra inside –

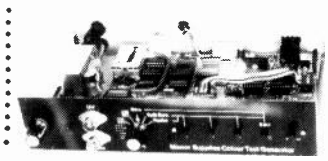
The Celtel Year Planner

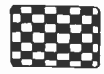
TV and VCR Standards Conversions
Dual-channel Television Sound
Servicing VHS Cassettes • DX-TV
Meter Repair • Test Report
VCR Clinic • TV Fault Finding

MANOR SUPPLIES

MKV PAL COLOUR TEST GENERATOR FOR DOMESTIC TV & VCR.

TEST DEMONSTRATIONS AT 172 WEST END LANE





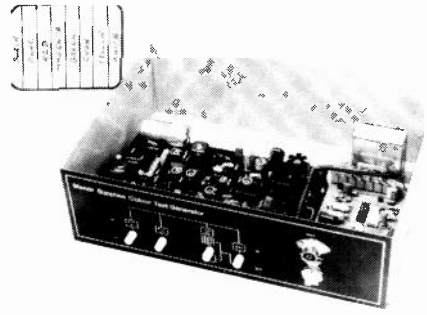
- ★ 40 different patterns and variations.
- ★ Broadcast transmission accuracy (fully interlaced sync pulses with correct picture blanking).
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ Chequerboard.
- ★ Mono outputs with border castellations, cross hatch, grey scale, vertical lines, horizontal lines and dots. UHF modulator output plugs straight into receiver aerial socket.
- ★ Additional video output for CCTV & VCR.
- ★ Facilities for sound output.
- ★ Easy to build kit, standard parts. Only 2 adjustments. No special test equipment required.
- ★ Mains operated with stabilised power supply.
- ★ All kits fully guaranteed with back-up service.
- ★ Also available with VHF Modulator.

Price of Kit	**£70.00**
Case (10"×6"×2¼") app.	**£8.60**
Optional Sound Module (6MHz or 5.5MHz)	**£3.90**
Built & Tested in Case including Sound Module	**£108.00**

SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

Post/Packing £2.80
Add VAT 15% TO ALL PRICES

PAL COLOUR BAR GENERATOR (Mk4)



- ★ Output at UHF, applied to receiver aerial socket.
- ★ In addition to colour bars R-Y, B-Y etc.
- ★ Cross-hatch, grey scale, peak white and black level.
- ★ Push button controls, battery or mains operated.
- ★ Simple design, only five i.c.s on colour bar P.C.B.

PRICE OF MK 4 COLOUR BAR GENERATOR KIT £30.00. CASE £8.60. BATT HOLDERS £4.20. MAINS SUPPLY KIT £4.20 (Combined P&P £2.80).

MK 4 (BATTERY) BUILT & TESTED £58.00 + £2.80 P & P.
MK 4 (MAINS) BUILT & TESTED £68.00 + £2.80 P & P.
VHF MODULATOR (CH 1 to 4) FOR OVERSEAS £5.75.
EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.

ADD VAT 15%

TELETEXT DECODER PANELS (TESTED)
Mullard VM6101 **£30.00**, Philips KT3, K30 **£30.00**, Texas XMII (TIFAX) **£28.00** p.p. £1.80

THORN TX9 MK2/3, TX10, teletext
Mullard Decorder panel + Interface **£35.00** p.p. £1.80
THORN TX10, PHILIPS G11 PRESTEL, TELETEXT
Mullard Units VM 6230, 6330 plus Line Coupler & Interface **£38.00** p.p. £2.50

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LOPTs, TRIPLERS, PANELS, TUNERS, SELECTORS ETC.

SPECIAL OFFER Front End Unit incl. Tuner, Saw IF and Channel Selector **£20.00** p.p. £2.00
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Frame, IF, decoder **£12.50** each p.p. £2.00. Scan **£20.00** p.p. £2.80.
PHILIPS G11 PANELS ex rental (untested).
Scan **£10.00**, Frame, Decoder **£5.00** p.p. £2.00.
PHILIPS G11 IF PANEL (New) Less Tuner **£2.50** p.p. £1.30
SPECIAL OFFER Mullard/Philips quality UHF modulator (audio & video input) ex new equipment **£5.00** p.p. £1.00.
PHILIPS G11 6 position touch tune channel selector units **£16.00** p.p. £1.80 (can replace earlier mechanical selector unit).
PHILIPS HANDSETS (New Replacements) p.p. £1.50.
G11 Ultrasonic Nontext **£22.50**, Infra red Text **£22.50**. Others available.
KT3 Non text (RC4001) **£21.50, KT3, K30 etc.** Text **£25.00.**
PHILIPS HANDSETS Ex rental, text, Untested. KT Text/Video Type, **£3.50** p.p. £1.00.
COLOUR MANUALS p.p. 50p.
PHILIPS G11 **£3.50**, KT3 **£3.50**, CTX-E **£1.50**, CTX-S **£1.50.**
THORN REMOTE CONTROL HANDSETS
TX9 ULTRASONIC (3-button) **£15.00; TX9, TX10** Infra red (Non-Text) **£18.00; TX9, TX10** Infra red Teletext **£21.50**, p.p. £1.20. Others available.
TX9 Ultrasonic remote handset transducer **£2.00**, switches 3 for **£1.50** p.p. 50p.
TX9/TX10 Teletext interface panel (1524) **£5.00** p.p. 80p.
TX Remote panel 1509G (incl. SAA5012) **£5.00** p.p. £1.80.
TX Remote panel 1564 (incl. UAA1008A & Battery) **£5.00** p.p. £1.80.
THORN TX9, TX10 Saw Filter IF Panel. **£5.00** p.p. 80p.
TX9, TX10 Remote & tuning control panel (1515) **£10.50** p.p. £1.80.
SAW FILTER IF AMPLIFIER PLUS TUNER complete and tested for T.V. Sound & Vision. **£28.50** p.p. £1.20.
PAL DECODER KIT (Video to RGB) for Monitors **£27.00** p.p. £1.00.
PAL ENCODER KIT (RGB to Video) **£18.50** p.p. £1.30.
CROSS HATCH UNIT KIT, Aerial Input type, incl. T.V. sync. and UHF Modulator, Battery Operated, also gives Peak White & Black Levels, can be used for any set. **£12.00** p.p. 80p. (Alum. Case **£2.90** p.p. £1.40.) **ADDITIONAL GREY SCALE** Kit **£2.90** p.p. 45p.
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ITT CVC30 SERIES PANELS SURPLUS (untested) **£2.50 each.** CMP31, CMF31, CMA30, CM532, p.p. 80p; CMD33, p.p. £1.80.
THORN TX9 Panels ex factory for small spares. Includes I.Cs & Semiconductors etc. **£3.00** p.p. £1.80.
THORN TX9 Panels salvaged ex factory for spares incl. Electrolytic & Mains Transformers. **£8.50** p.p. £3.00.
THORN 8000/8500 IF/Decoder Panels salvaged **£3.20** p.p. £1.80.
THORN 9000 SERIES IF/Decoder **£10.00** p.p. £2.30. Line T.B., Power Panels **£12.50** p.p. £3.00.
THORN 9000 IF/Decoder Panels Salvaged. For spares **£2.50** p.p. £1.80.
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PHILIPS G8 Line Driver Panel incl. Equalizing Coil. **£1.00** p.p. 60p.
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VARICAP TUNERS U321, U322/204, ELC1043/05 **£7.80** p.p. £1.00.
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THORN 8000, 8500, 8800	**£12.80**	**GEC** 2110 series	**£10.60**
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TRIPLERS Full range available. Mono & Colour.
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From February's issue the price of *Television* will be £1·40. We regret the need for this increase to cover our increased costs.

TELEVISION

January 1988

Vol. 38, No. 3 Issue 447

On sale December 17th

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.

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An annual subscription costs £16 in the UK, £19 overseas (by surface mail). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

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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. Requests for advice on dealing with servicing problems should be directed to our Queries Service. For details see our regular feature "Service Bureau". Send to the address given above (see "correspondence").

this month

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TDA3500	6.90
TDA3560	6.00
TDA3561A	6.66
TDA3562	8.60
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TDA3650	3.85
TDA3651A	4.50
TDA3652	6.00
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UPC1245V	1.35
UPC1277	4.81
UPC1350C	4.15
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UPC1358H	1.88
UPC1360C	2.20
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UPC1370C2	2.58
UPC1382C	1.08
UPC1384	3.78
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UPC577H	2.46
UPC585C	1.28
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UPD7538C020	11.06
UPD546C107	22.28
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U05G	1.27
V11N	1.27
10E2	43
10VT05	8.74

COMPUTER ICs

74LS260	55
2732	3.30
2764	3.20
27128	4.95
27256	5.90
4116	1.10
4164	1.60
6264	2.75
6522	4.00
Z80A CPU	1.70
8271	60.00
ZTX213	17
ZTX313	27
ZTX650/1	35
LM1889	2.00
TMS1000	8.95

COMMODORE ICs

6510 CPU	5.66
6526 CIA	Keyboard
Int.	5.11
6561	7.74
6569 Col.	Vid.
Cont.	20.77
6581	Sound
Gen.	7.79
901225	Char.
ROM	3.37
901226	Basic
ROM	6.45
901227	Kernel
ROM	3.52
906114 PLA	4.51
4164 RAM	1.60
Timer 555	46
8501	3.50
8701 Clock Chip	5.46

THYRISTORS

DEC1	2.20
DEC2	2.20
THY15/80	2.40
THY15/85	2.40
Transistor mounting kit TO66, TO3, TO220AB	30

LARGE RANGE OF ICs/SEMIS FOR SINCLAIR/AMSTRAD PRODUCTS AVAILABLE

SEMICONDUCTORS

AC107	35
AC126	34
AC127	34
AC128	34
AC128K	40
AC141	62
AC141K	39
AC176	35
AC176K	35
AC186	41
AC187	38
AC187K	46
AC188	35
AC188K	46
AD143=OC28	82
AD145	85
AD161	54
AD162	54
AD161/62 MP	1.15
AF106	49
AF114	89
AF121	75
AF124	48
AF125	53
AF126	53
AF127	53
AF139	63
AF178	1.54
AF239	60
AF279	1.56
AL102	4.90
AU110	3.01
BC107	20
BC108	20
BC109	20
BC114	12
BC115	17
BC116A	35
BC117	30
BC118	24
BC119	36
BC139	32
BC140	32
BC141	30
BC142	30
BC143	31
BC147	13
BC148	13
BC149	12
BC157	16
BC158=BC558	16
BC159	15
BC160	52
BC161	32
BC170B	15
BC171	15
BC172	15
BC173	16
BC174	10
BC177	27
BC178	26
BC182L	15
BC183L	15
BC184L	15
BC186	35
BC187	25
BC204	10
BC208	13
BC209	10
BC212	15
BC212L	15
BC213	15
BC214	15
BC237	14
BC238	14
BC251A	18
BC252	12
BC261	33
BC262	30
BC300	50
BC301	51
BC303	33
BC307	20
BC308	25
BC323	99
BC327	22
BC328	18
BC337	18
BC338	18
BC461	42
BC527	35
BC547	13
BC548	13
BCX32 = BC637	39
BC549	10
BC550	10
BC557	10
BD677	40
BC558	16
BC635	19
BC637	39
BC638	33
BC639	30
BC640	32
BCY72	13
BC372S	85
BD115	45
BD116A	90
BD124P	84
BD131	50
BD132	49
BD133	60
BD135	38
BD136	38
BD137	38
BD138	35
BD139	35
BD140	44
BD144	1.70
BD150	60
BD159	65
BD160	1.60
BD166	52
BD179	70
BD182	1.20
BD183	1.18
BD201	85
BD202	91
BD203	80
BD204	99
BD222	46
BD223	56
BD225	47
BD232	82
BD233	66
BD234	63
BD235	60
BD236	65
BD237	57
BD238	65
BD243	85
BD244	85
BD410	79
BD434	74
BD437	86
BD438	94
BD507	69
BD508	80
BD509	86
BD510	86
BD278A	81
BD517	60
BD519	1.08
BD520	75
BD535	82
BD536	91
BD696A	1.49
BD697=701	1.63
BD698=702	1.50
BD701	1.63
BD707	1.50
BDX32	2.10
BF115	38
BF117	36
BF125	26
BF154	15
BF158	18
BF160	27
BF167	24
BF173	37
BF177	52
BF178	46
BF179	42
BF180	39
BF181	39
BF182	36
BF183	29
BF184	42
BF185	36
BF194/394	16
BF195	16
BF196	16
BF197	16
BF198	18
BF199	21
BF200	35
BF224	40
BF241	38
BF256	60
BF257	34
BF258	34
BF259	34
BF262	84
BF263	81
BF271	24
BF273	24
BF274	24
BF336	40
BF337	41
BF338	41
BF355	56
BF362	68
BF363	72
BF371	30
BF392	35
BF422	34
BF423	46
BF457	35
BF458	43
BF459	58
BF460 = BF462	86
BF469	63
BF470	66
BF597	16
BF757	54
BF758	54
BFR39	27
BFR40	30
BFR79	85
BFR90	1.74
BFT42	42
BFT43	42
BFW10	60
BFX29	40
BFX84	42
BFX85	30
BFX86	30
BFX88	46
BFY50	32
BFY51	32
BFY52	32
BFY90	95
BR100	34
BR101	95
BR103	83
BR303	1.46
BRC4443	1.94
BRC4444	1.98
BRY39	56
BRY55	45
BRY56	57
BSV57B	89
BT100	1.65
BT101	1.20
BT106	1.60
BT108	1.69
BT109	1.31
BT116	1.87
BT119	3.66
BT120	3.66
BT151/800	2.07
BU104	2.00
BU126	1.75
BU204	1.50
BU205	1.87
BU206	1.80
BU208	1.60
BU208A	0.95
BU208D =BU800	2.20
BUW81A	3.84
BU208/02	2.10
BU326A	2.00
BU407	1.70
BU426	3.07
BU500	2.50
BU526	2.46
BU508	3.20
BU58D	2.77
BU806	1.40
BU807	2.94
BU826	4.95
BUT1L	2.58
BUW84	1.45
BUX84	1.50
E1222	40
BX342	5.12
CX104A	6.57
CX136A	9.23
CX143A	9.23
CX186	6.57
BUT11	2.58
GL4850	14
ME0411	20
MJE340	68
MJE520	50
MJ3000	1.98
MPSA92	35
MR814	45
MR854	55
MR475	4.85
MR479	4.85
MR477	4.90
OT121	1.91
R2008B	1.90
R2010B	1.92
R2265	1.50
R2322	84
R2323	67
R2461	1.60
R2540	3.20
RC4558	2.20
RCA16334	90
RCA16029	1.18
RCA16039	1.18
RCA16092	1.18
RCA16040	96
RCA16041	84
RCA16334 =ON447	90
RCA16335 =DN448	90
RCA16957	2.88
TIC45	1.18
TIC46	60
TIC47	72
TIL32	65
TIL78	48
TIP29C	43
TIP30A	47
TIP30C	43
TIP31C	55
TIP32C	42
TIP33B	75
TIP34B	1.06
TIP41C	47
TIP42C	50
TIP47	93
TIP11211	69
TIP120	65
TIP161	2.15
TIP2955	90
TIP3055	63
TIS91	32
TU106/02	1.80
15051V	3.43
T6069V	38
T6071	5.95
T9063V	4.70
T9064V	1.14
T9022W	43
T9053/4	4.50
2N696	21
2N918	82
2N2904	51
2N2905	28
2N3055	79
2N3702	16
2N3703	16
2N3705	10
2N3706	10
2N3708	17
2N5294	48
2N5296	48
2N5298	69
2N5496	53
2N6107	75
2N6109	81
2SA715	1.98
2SA771	3.04
2SA835	1.82
2SA1027R	1.27
2SA1175	89
2SB337	1.86
2SB733	1.18
2SB740C	1.24
2SB856	1.84
2SC403C	32
2SC867A	3.07
2SC1034	6.57
2SC1061 = 2SC1986	3.07
2SC1114	6.57
2SC1124	1.27
2SC1316	8.05
2SC1362-7	43
2SC1364	43
2SC1413A	9.23
2SC1475	43
2SC1962	1.84
2SC2009	32
2SC2278	1.24
2SC2335 Kit	11.18
2SC2369	4.14
2SC2551	1.27
2SC2785	43
2SC3153	5.12
2SC495	1.10
2SC496	1.31
2SC643A	1.82
2SC1096	1.72
2SC1172Y	5.50
2SC1173Y	1.69
2SC1306	2.73
2SC1307	3.00
2SC1449	1.67
2SC1520	68
2SC1678	2.67
2SC1909	2.90
2SC1953	1.44
2SC1986 =2SC1061	2.94
2SC2028	1.82
2SC2029	2.60
2SC2078	2.90
2SC2091	1.34
2SC2166	2.73
2SD870 (Sony)	8.05
2SD257	3.04
2SD725	11.08
2SD773	32
2SD774	1.24
2SD1164	1.27
2SD1497-02	5.12
2SD1497-06	5.12
2SD1453	2.20
1CPS10	98
1CPN25	98

VALVES

30FL2	1.70
DY802	98
DY86/7	66
ECC81	1.08
ECC82	98
ECC83	1.07
ECC84	80
ECC85	98
ECC88	1.35
ECF80	1.30
ECF82	88
ECH81	1.60
ECH84	1.66
ECL80	84
ECL82	1.30
ECL86	1.99
EF80	95
EF86	2.20
EF183	99
EF184	1.09
EL90	1.75
EL34	3.50
EL84	1.05
EY86/7	68
EY500A	2.25
EZ80/81	56
GY501	1.45
GZ34	3.50
KT66	9.75
KT77	8.50
KT88 (alt type)	12.00
PC92	4.50
PC97	1.65
PCC85	85
PCC805	1.40
PCF80	1.00
PCF200	1.35
PCF800	1.38
PCF801	1.13
PCF802	1.12
PCF805	1.80
PCF808	1.63
PCH200	1.45
PCL82	1.20
PCL84	1.20
PCL805	1.09
PCL86	92
PFL200	1.86
PL36	1.87
PL81	94
PL95	2.25
6L6GT	2.30
12HG7	3.20
12BH7A	2.75
PL504	1.65
PL508	2.90
PL509/19	5.30
PY88	81
PY500A	2.30
PY800/1	69
UCH81	2.25
UCL83	1.82
UY85	1.35
PL802T	4.00
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3AT2B	5.00
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FD09820	IS500	12 butt	13.81
FD09156	F14R	12 butt	13.81
FD09111	AVS	14 butt	13.75
FD09141	CTV14S	4 butt.	13.75
	20R/22R/140R		

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T725	TX9	NON TXT IR	16.50
T731	TX9/10/100	TXT/STEREO IR	16.50
T732	TX10	TXT IR	16.50
T736	TX9/10/100	TXT IR	16.50
T739	TX100		16.50

JVC

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GCA512220	C1653	22.00
GCA512230	C2086H, C2087H	28.50
GCA510710	C2067H	28.50
GCA514620	C2089H, C2090H C2889H, C2290H	21.00
GCA510870	C2069, C2269H	27.50

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RTP05/VRC138	TP8-120-120E	IR	13.50
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	TCE	8903/3V00/16/22	
VKIT 2	PANASONIC	NV7000/7200	3.00
VKIT 3	SONY	SLC5/7	3.75
VKIT 4	SONY	SL8000/8500/8600	4.50
VKIT 5	SONY	SL3000UB	4.00
VKIT 6	PANASONIC	NV3000B	3.00
VKIT 7	SANYO	9300P	4.25
VKIT 8	PANASONIC	NV2000B	3.75
VKIT 9	PANASONIC	NV8600/8610/V011	4.42
VKIT 10	TOSHIBA	V8600	3.00
VKIT 11	SHARP	VC7300	3.50
VKIT 12	SHARP	VC6300/6600	4.00
VKIT 13	SANYO	VTC5000	1.95
VKIT 14	SANYO	VTC5300	2.50
VKIT 15	JVC	HR7650-3V31	2.50
VKIT 16	HITACHI	5000	2.25
VKIT 17	SHARP	8300	1.76
VKIT 18	SHARP	9300	1.47
VKIT 19	HITACHI	VT8000	1.12
VKIT 20	HITACHI	VT11/33	2.15
VKIT 21	HITACHI	9500	1.12
VKIT 22	SONY	SLC6	3.75
VKIT 23	SANYO	5500	1.95
VKIT 24	PANASONIC	NV300/333	1.75
VKIT 25	TOSHIBA	V7540	1.90
VKIT 26	JVC	HR7000	96p
VKIT 27	THORN	3V29/HR7200	1.95
VKIT 28	AMSTRAD	7000	2.25
VKIT 29	PANASONIC	NV777	1.80
VKIT 30	SONY	T9	2.20
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0006/GEZZ	
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PS3B2S SONY C20/24/30 SL8000	25.00
PS3B3S SONY DSR 21/38/59R	39.95
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SONY (GENUINE) SLC9	49.39
SONY (GENUINE) SLC5,6,7	49.39
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SHARP (GENUINE) 3300/9700 (While stocks last)	56.00
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TOSHIBA 9600 UPPER ASSY. ONLY	14.50
3HSSH HITACHI 4000/5000/5500	25.50
3HSSHA HITACHI 9300/4001	25.50
HITACHI H1V1/VT800E/9300/9500	35.62
HITACHI VT33E/GEC4004	35.62
HITACHI VT11/GEC4100	35.62
SANYO 9300/9455/9500	53.00
SANYO 5000/5300/5400	58.00
PHILIPS V2000 and V2023	64.00
PHILIPS 1700	71.00

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Equivalents Chart in Catalogue

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	O.Dia	I.Dia	Width	
SONY	23.7	17.4	4.9	50p
SONY	24.2	18	5.1	50p
HITACHI	31.8	25	4.9	50p
PANASONIC	37	29	3.9	52p
AKAI	26	20	3.9	50p
JVC	39.3	32.8	3.9	56p
JVC	33	23.9	4	56p
NATPAN	31.2	25	3.1	56p

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SANYO	VTC9300/VBS7000	4.35
SONY	C7/J7/SL17	4.35
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JVC	HR2200/3320/3330/3660/1100/7700	4.35
AKAI	VS9700	4.35
HITACHI	VT5000	4.35
SHARP	VC6300/6500	4.35
SONY	TC6 GEN	4.35

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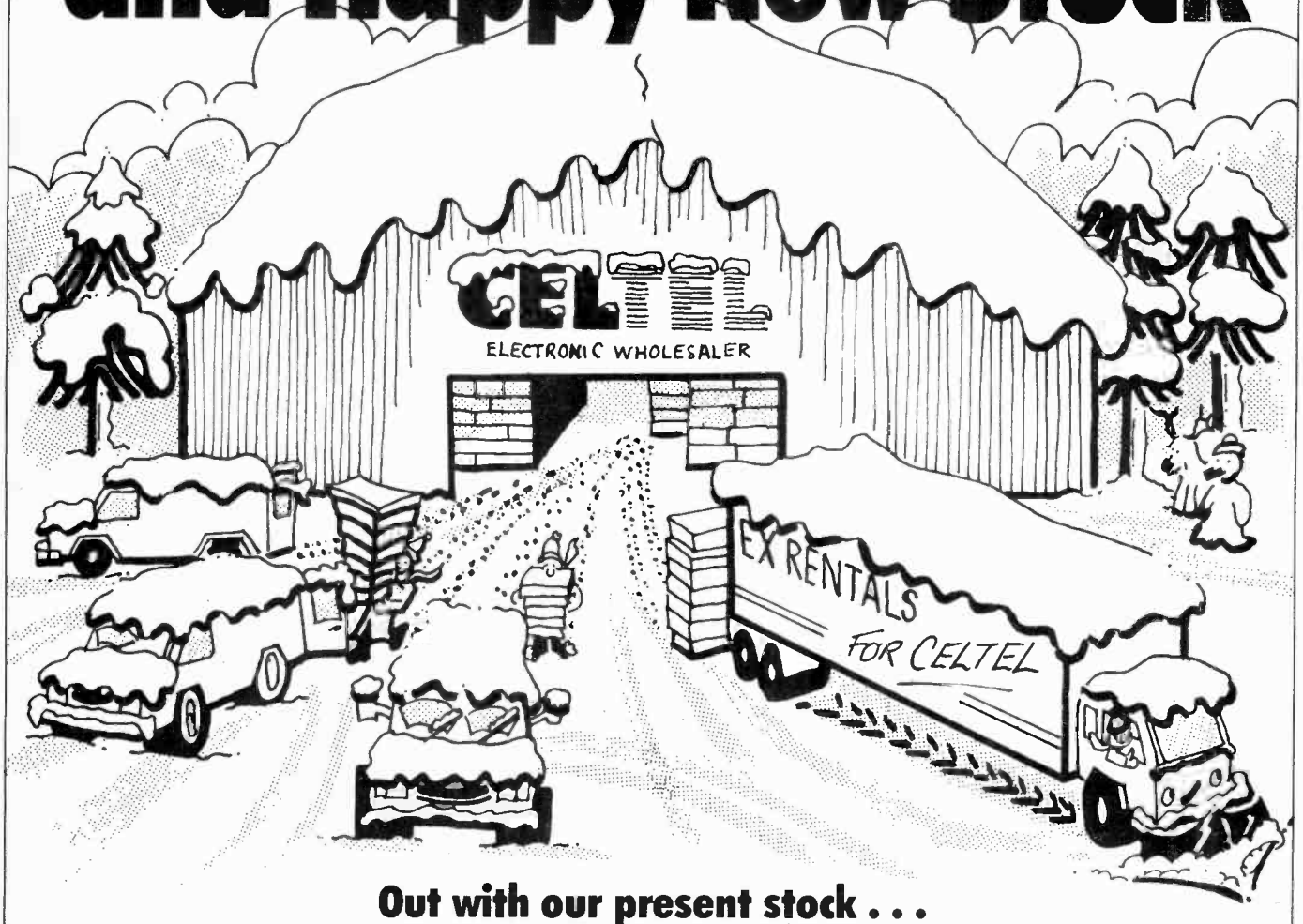

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HR-7200	(3)	£1.40
HR-7700	(3)	£1.40
NATIONAL		
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NV-2000	(5)	£1.55
NV-3000	(6)	£1.80
NV-7000	(5)	£1.50
NV-8600	(7)	£2.00
SONY		
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VTC-5300	(5)	£1.90
VTC-5500	(3)	£1.10
VTC-9300	(4)	£2.40
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VT-11	(5)	£2.20
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V-5475	(6)	£1.90
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V-8600	(6)	£1.50
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VIDEO MOTORS

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REEL MOTOR (RM11) P/N 4-529V-10800	£8.00
CAPSTAN MOTOR 4-527V-51000	£24.00
SONY	
CAPSTAN MOTOR BHF-1100D	£23.00
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REEL MOTOR RMOTV 1007 GEZZ	£17.50
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LOADING MOTOR RMOTM 1017	£10.00
JVC	
CAPSTAN MOTOR PU-55371V	£22.00
CAPSTAN MOTOR PU-45979	£22.50
DRUM MOTOR PU-46414	£22.50
TOSHIBA	
CAPSTAN MOTOR 70125101	£28.00

IDLERS & PULLEYS REPLACEMENTS

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SHARP	
IDLER SHARP NIDL0005 GEZZ	£2.25
HITACHI	
IDLER ASSEMBLY 6886971	£3.00
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IDLER ASSEMBLY PU-47752	£5.00

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NATIONAL	
NV-300	£4.75
NV-7000	£4.75
SANYO	
VTC-9300	£4.75
VTC-5500	£4.75
SONY	
SL-T7	£4.75
SL-C7	£4.75
JVC	
HR-3300	£5.00
HR-3330	£5.00
HR-3360/3660	£5.00
HR-7200	£5.00
AKAI	
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33. 2 – aerosol cans of ICI Dry Lubricant
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56. 1 – Miniature Uniselector with circuit for electric jigsaw puzzle
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60. 5 – ferrite rods 4" × 5/16" diameter aerials
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62. 4 – 200 ohm earpiece
63. 1 – Mullard Thysistor trigger module
64. 10 – assorted knobs ¼ spindles
65. 5 – different thermostats, mainly bi-metal
66. 1 – Magnetic brake – stops rotation instantly
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69. 2 – 25 watt pots 8 ohm
70. 2 – 25 watt pots 1000 ohm
71. 4 – wire wound pots – 18, 33, 50 and 100 ohm your choice
73. 4 – 3 watt wire would pots 50 ohm
77. 1 – time reminder adjustable 1-60 mins clockwork
78. – 5.5 amp stud rectifiers 400v
85. 1 – mains shaped pole motor ¾" stack – ¼ shaft
86. 2 – 5" ali fan blades fit ¼" shaft
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88. 1 – mains motor with gear box 1 rev per 24 hours
89. 1 – mains motor with gear box 1 rev per 24 hours
91. 2 – mains motors with gear box 16 rpm
93. 4 – 11 pin moulded bases for relays
94. 5 – B7G valve bases
95. 4 – skirted B9A valve bases
96. 1 – thermostat for fridge
98. 1 – motorised stud switch (s.h.)
101. 1 – 2½ hours delay switch
103. 1 – 6v mains power supply unit
104. 1 – 4½ mains power supply unit
105. 1 – 5 pin flex plug and panel socket
107. 1 – 5" speaker size radio cabinet with handle
109. 10 – ¼" spindle type volume controls
110. 10 – slider type volume controls
112. 1 – heating pad 200 watts mains
114. 1 – 1W amplifier Mullard 1172
115. 1 – wall mounting thermostat 24V
118. 1 – teak effect extension 5" speaker cabinet
120. 2 – p.c. boards with 2 amp full wave and 17 other recs
122. 10 – mtrs twin screened flex white p.v.c. outer
132. 2 – plastic boxes with windows, ideal for interrupted beam switch
188. 1 – plastic box sloping metal front, 16 × 95mm average depth 45mm
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266. 2 – mains transformers 9V ½A secondary split primary so ok also for 115V
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330. 2 – 6v 0.6v mains transformer 3A p.c.b. mounting
350. 40 – double pole leaf switches
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454. 2 – 2¼in. 8ohm loudspeakers
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464. 2 – packets resin filler/sealer with cures
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466. 4 – 7 segment l.e.d. displays
470. 4 – pc boards for stripping, lots of valuable parts
473. 1 – 5" 4ohm speaker with built in tweeter Radio mobil
480. 1 – 3A double pole magnetic tip, saves repairing fuses
498. 4 – 1000uf 25V axial electrolytic cpacitors

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The EME-101 drives a 3" disc of the new standard which despite its small size provides a capacity of 500k per disc, which is equivalent to the 5¼" disc. We supply the Operators Manual and other information showing how to use this with popular computers, BBC, Spectrum, Amstrad etc. All a a special snip price of **£27.50** including post and VAT. Data available separately £2, refundable if you purchase the drive.

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We again have very good stocks of these quiet running instant heat units. They require only a simple case, or could easily be fitted into the bottom of a kitchen unit or book case etc. At present we have stocks of 1.2kw, 2kw, 2.5kw and 3kw. Prices are £5 each for the first 3, and £6.95 for the 3k. Add post £1.50 per heater if not collecting.
CONTROL SWITCH enabling full heat, half heat or cold blow, with connection diagram, **50p for 2kw, 75p for 3kw.**

AXIAL FANS mains operated, famous West German PAPST company, all metal construction for reliability even running hot. Size approx 4½×4½×1½ especially recommended for sun beds, but they are quiet running so suitable for office, kitchen, bathroom etc. Brand new offered at about half proper price namley **£8**. Our ref 8P8. Good stocks, discount for quantities over 12.

SPEAKER EXTENSION CABLE Twin .7mm conductors so you can have long runs with min sound loss and for telephone extensions or burglar alarms, bells, intercoms etc, etc. 250m coil **only £3** + £1 post. Ref 3P28.

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Mains operated with 20 amp switch. One on and one off per 24 hrs, repeats daily automatically correcting for the lengthening or shortening day. An expensive time switch but you can have it for only **£2.95** without case, metal case – **£2.95**. adaptor kit to convert this into a normal 24hr. time switch but with the added advantage of up to 12 on/offs per 24hrs. This makes an ideal controller for the immersion heater. Price of adaptor kit is **£2.30.**
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Made for use in cars, etc, these are very powerful and easily reversible. Size 3½" long by 3" dia. They have a good length of ¼" spindle –
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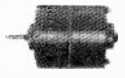
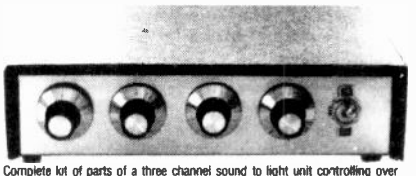


SOUND TO LIGHT UNIT



Complete kit of parts of a three channel sound to light unit controlling over 2000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two tone metal case and has controls for each channel, and a master on/off. The audio input and output are by ¼" sockets and three panel mounting fuse holders provide thyristor protection. A four pin plug and socket facilitate ease of connecting lamps. Special price is **£14.95** in kit form.

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POLARISED RELAY depending upon its direction dc current as low 4 Ma makes this open circuit, so it could be used to protect delicate instruments or as an earth leakage, or reverse voltage trip etc. **2 for £1** ref BD549.

24Hr TIME SWITCH. Beautifully made with West German precision. Just under 4" square with 15 amp c/o contacts can be set anywhere around 24 hr dial to the nearest 15 mins also with an overide switch. **Price £8 each.** Ref 8P6 but hurry we have only 300.

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4K ohms per volt – 11 ranges AC/DC Volts to 1000 – DC current and ohms – nicely packaged – offered 33⅓ discount **only £7.** Our ref 7P2.

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3 mtrs long terminating one end with new BT, flat plug and the other end with 4 correctly coloured coded wires to fit to phone or appliance. Replaces the lead on old phone making it suitable for new BT socket. Price £1 ref BD552 or **3 for £2** ref 2P164.

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Generates approx. 10 times more IONS than the ETI and similar circuits. Will refresh your home, office, shop, work room, etc. Makes you feel better and work harder – a complete mains operated kit, case included. **£11.50 + £2.00 P&P.**

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2P120 – 1 combined clockwork switch and thermostat for boiler control.
2P122 – 1 30a rotary switch, surface mounting with pointer knob.
2P123 – 1 25a rotary switch, surface mounting, cover engraved, high, medium, low and off
2P124 – 1 28kv .001mfd block condensor.
2P127 – 1 30a bridge rectifier assembly on heat sinks
2P129 – 1 10rpm motor 115v so supplied with adaptor for 230v.
2P131 – 1 Crouzet motor 230v fits the Crouzet gearbox.
2P132 – 1 ceilling heat-stat for fire warning or protection.
2P133 – 1 Circuit breaker 20a, Crabtree ref C50.
2P134 – 1 9v 500mA psu, plugs into 13a socket.
2P135 – 10m 10 conductor intercom cable.
2P136 – 1 2½kw element made for tangential blowers.
2P137 – 1 Thermo couple, stainless steel tipped for measuring internal heat.
2P138 – 1 Mains transformer 20v-0-20v 1a upright mounting.
2P141 – 1 rechargeable battery D size (4 AH) solder tag ended
2P142 – 10m 4 par intercom cable white PVC outer.
2P144 – 1 mains operated relay with 4× 8a c/o contacts.
2P145 – 1 18,000 uf 70v dc smoothing capacitor.
2P146 – 1 7,800 uf 150v dc smoothing capacitor.
2P147 – 1 16w 100 ohm line matching transformer.
2P148 – 1 Technical information on 3" FDD refundable if you buy fdd.
2P149 – 5 diff battery operated model motors.
2P150 – 1 PSU chassis with all components for 24v 2A dc unwired.
2P151 – 1 Metal box 14½ × 14 × 4 with lid add £2.00 post.
2P152 – 1 Motor start capacitor 80uf 250v.
2P153 – 1 Two station intercom unused but line reject.
2P154a – 1 Nicad charger – plug into 13a socket 5.2v .7UA output
2P154b – 1 Nicad charger – plug into 13a socket 6v .9VA output
2P155 – 1 Mains transformer giving 16, 17, 18 & 20v 60w
2P158 – 1 Oven thermostat with temp. calibrated knob.
2P159 – 1 9v 500ma cased with mains lead and output lead.
2P160 – 1 13a plug adaptor fused takes 3 × 13a plugs.
2P161 – 1 6" diagonal side cutters.
2P162 – 1 Stereo Matrix PCB mounting de-emphasis K35
2P163 – 1 AC Working capacitor 12uf 660v AC or 1500v dc.
2P163a – 1 AC Working capacitor 14uf 350v AC or 800v dc.
2P164 – 3 Phone leads 3 mtrs long tags one end BT plug other end.

£3 POUNDERS

3P7 – 1 DC voltage, doubler or halver for 12v to 24v, 12 to 6v, 24 to 12v.
3P8 – 1 24hr time switch Sangamo, new condition, guaranteed 1 year.
3P9 – 1 12v 500mA psu plugs in 13a socket.
3P10 – 1 Mains transformer 50v 2A with 6.3 pilot light winding, upright mounting, fully shrouded.
3P13 – 1 Noise filter to fit in mains lead of applicance up to 25a
3P15 – 1 waterproof case will take 200 watt transformer.
3P16 – 1 signal box, 3 lamps on face plate of metal box size 5½ × 3½.
3P17 – 1 choke and starter to work 8" fluorescent tube at 125w.
3P18 – 1 22v 3a mains transformer with bridge rect fitted on top panel.
3P20 – 1 0-5a ammeter 3½ ac/dc ex equipment.
3P21 – 1 power factor correction condenser 35uf 350ac
3P22 – 1 200va – auto transformer 230 to 115v torroidal encapsulated £1.50 post
3P23 – 1 35v-0-36v tapped 20v-0-20v 100va.
3P24 – 1 3" floppy disc for Amstrad etc.
3P25 – 1 7" Electricians pliers.

£4 POUNDERS

4P11 – 1 Car Radio aerial.
4P12 – 50m low loss co-ax 75 ohm + £1 post.
4P13 – 3 Hortsman time and set switches 15 amp.
4P14 – 1 150w mains transformer "C" core 43v 3.5A secondary.
4P15 – 1 powerful motor 2" stack fitted with gearbox final speed 60 rpm. mains operated, could operate door opener etc
4P17 – 1 Uniselector 3 pole 25w, 50v coil standard size.
4P18 – 1 Volt meter with digital display (DIGIVISOR).
4P19 – 1 12v dc motor will fit to gearbox 4P20.
4P20 – 1 Gear train giving speed reduction.

£5 POUNDERS

5P86 – 1 Transformer upright mounting 230/240v primary 2 × 100 1a secondary.
5P88 – 1 transformer in waterproof metal box 24v 5a add £2 post.
5P89 – 1 4 bank heating element each 2kw ideal convector heater.
5P90 – 1 18" long tangential blower with motor at one end.
5P91 – 1 14" blower, motor in middle.
5P92 – 10m Audio co-ax double screened 750hm super low loss for TV.
5P93 – 1 6" alarm bell 24v dc or ac.
5P94 – 1 Current transformer 14v out with 1a dc input.
5P95 – 1 Vintage photo cell.
5P97 – 1 Impedence matching transformer 0-4-5-8-160 ohm 100 add £1.50 post.
5P98a – 1 0-90a ammeter for mounting outside control panel.
5P98b – 1 0-180a ammeter for mounting outside control panel.
5P99 – 1 Mains operated blower centrafugal output size app 5" × 1½".
5P100 – 1 Mains splitter 45a switch 3 × 15a fused circuits.
5P101 – 1 Model motor 1 rpm from 6v reversible.

£7 POUNDERS

7P1 – 1 Instant heat solder gun – mains with renewable tip and job light.

£8 POUNDERS

8P1 – 1 Charger transformer 10a upright mounting 230/240 primary 16v 10a secondary.
8P2 – 1 6" underdome alarmbell suitable for a fire alarm or burglar alarm mains operated.
8P3 – 1 heat sink big powerful so ideal for power transmitter.
8P5 – 1 ⅓ hp motor 900 rpm capacitor run.
8P6 – 1 24hr time switch – 2 on offs 16a c/o contacts 3" × 3" × 1½".
8P7 – 1 Silent sentinel invisible ray kit.
8P8 – 1 Papst fan 3½ × 3½ × 1½ 230v metal bodied

£10 POUNDERS

10P13 – 1 reversible motor with gearbox 104rpm Parvalux.
10P14 – 1 100a time switch 1 on/off per 24hr extra triggers £1 pair.
10P15 – 1 Max demand meter 230 AC mains.
10P16 – 1 powerful air mover 2 snail type blowers with motor in middle.
10P18 – 1 mains operated klaxon.
10P19 – 1 12v alarm bell really loud, mains operated, in iron case + £5 post.
10P22 – 1 sensitive volt meter relay.
10P23 – 1 fruit machine heart 3 fruit wheels each stepper motor operated.
10P24 – 1 big panel meter face size 4¾ × 2½ 200ua movement scaled 1-10.
10P26 – 1 'Secretary' phone auto-dialler complete untested sold as such.
10P29 – 1 12v engine cooling fan.
10P30 – 1 instrument psu on pcb has 4 outputs .12v/ .5v 6a/ 12v .5a/ 5v .5a.
10P31 – 1 7 day time switch 16a c/o contacts sep switches for each day.
10P32 – 1 58 rpm 1/6th hp motor reversible.

£15 POUNDERS

15P1 – 1 kit for 115w hi fi amp.
15P2 – 1 kit for psu to supply one or two 15P1 amps.
15P3 – 1 time switch battery or mains operated – 16a c/o contacts,7 day programmable has 36hr reserve.

LIGHT CHASER KIT Motor driven switch bank with connection diagram, used in connection with 4 sets of X-mas lights makes a very eye catching display for home, shop or disco, **only £5** ref 5P56.

BARCLAYCARD VISA

EAST CORNWALL COMPONENTS

Access

1987 CATALOGUE available – range of components greatly increased – over 136 pages fully illustrated. Price £1.00 per copy (free upon request with orders over £15). Credit Tickets (3), Special Offer Sheets, Order Form and Pre-Paid Envelope. Order your copy now.

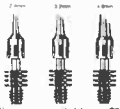
JANUARY SPECIAL OFFER

LIGHTWEIGHT NON-ELECTRIC SOLDERING IRON

Specification:

- ★ Power 10-60 Watts
- ★ Uses ordinary butane gas lighter fuel – refills in approx. 15 seconds
- ★ Adjustable temperature up to 400°C
- ★ Heating time approx. 20 seconds
- ★ Continuous operating time 1 hour
- ★ Various easy-to-change soldering tips available: 2.4mm, 3.2mm or 4.8mm
- ★ Lightweight and compact, excellent for out-of-the-way applications.

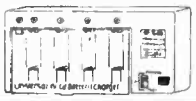
SPECIAL OFFER PRICE	£9.98
P&P & VAT	£1.76
TOTAL PRICE	£11.74



Spare Tips are available at £3.50 each (inc. VAT & P&P)

LIMITED SUPPLY

BATTERY CHARGER (Universal Nickel Cadmium)
An attractive nickel cadmium battery charger ideal for charging the rechargeable batteries detailed below. The charger will charge all the sizes listed: AAA, AA, C, D and PP3 and up to four AAA, AA, C and D types and one PP3 can be charged at the same time. The charger has a hinged plastic dust cover for easy viewing. The five battery positions have L.E.D. 'charge' indicators. The unit also has a switch allowing batteries to be checked for current state of charge.
Power: 240V A.C.
Dimensions: 210 × 100 × 50mm
ORDER CODE
BAT CHARGE
1+ **£4.50**
10+ **£4.25**
100+ **£3.75**



Ni-CAD BATTERIES		
AAA	£1.25	£1.20 ea/10
AA	.90	.85 ea/10
C	2.10	1.90 ea/10
D	2.50	2.20 ea/10
PP3	4.10	3.90 ea/10

DESOLDER PUMP

£2.99 each £2.50 ea/10 off

NOZZLE FOR ABOVE

60p each 50p ea/10 off

RESISTORS – CARBON FILM 5%

¼W 1RO to 10M (E12 Range)	2p each. 15p/10. 75p/100
½W 2R2 to 10M (E24 Range)	2p each. 15p/10. 75p/100
1W 10R to 2M2 (E12 Range)	5p each. 40p/10. 3.00/100
2W 10R to 2M2 (E6 Range)	8p each. 60p/10. 5.00/100

RESISTOR KITS – each value individually packed

¼W pack 10 each value E12 – 10R to 1M 610 pieces	4.50
¼W pack 5 each value E12 – 10R to 1M 305 pieces	2.95
¼W pack Popular – 10R to 10M 1000 pieces	6.50
½W pack 10 each value E12 – 2R2 to 2M2 730 pieces	7.75
½W pack 5 each value E12 – 2R2 to 2M2 365 pieces	4.70
½W pack Popular – 2R2 to 10M 1000 pieces	9.50
1W pack 5 each value E12 – 2R2 to 1M 353 pieces	13.75
2W pack 5 each value E6 – 10R to 2M2 317 pieces	21.75

ADDITIONAL KITS

DISC CERAMIC 50V	125 pieces	£3.50
ZENER DIODES 5ea	55 pieces	£3.50
ELECTROLYTICS R.	100 pieces	£7.25
FUSES Q/BLOW 20mm	80 pieces	£3.75
FUSES T/DELAY 20mm	80 pieces	£7.50
PRE-SET POTS-H	120 pieces	£6.75
PRE-SET POTS-V	120 pieces	£6.74
NUT & BOLT	800 pieces	£3.00

EXTENSION MULTI-SOCKETS
ALL 13A, FUSED WITH NEON INDICATOR

2-WAY	£2.75 each £2.50ea/5
3-WAY	£3.80 each £3.50ea/5
4-WAY	£3.99 each £3.75ea/5
4-WAY + 3m lead & plug	£5.75 each £5.25ea/5
PLUGS 13A 3-pin fused, white	£0.46 each £0.42ea/10

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 90p/10

1 DOMESTIC MAINS FUSES
ALL 13A, FUSED WITH NEON INDICATOR 50p/10
2A, 3A, 5A, 13A £1.00/10

1¼ QUICK BLOW FUSES
500mA, 1A 1.25A, 2A, 12A 50p/10

FUSE HOLDERS

20mm	P/M	25p	22p/10
	DCB/M	26p	23p/10
	Ch/M	10p	8p/10
	CLIP	5p	4p/10
1¼"	INLINE	12p	10p/10

SAFEBLOC
FOR QUICKLY AND SAFELY TESTING EQUIPMENT ON MAINS VOLTAGE. SIMPLY CONNECT WIRE TO CLIPS AND CLOSE LID £6.75

SOLDER: 60% TIN 40% ALLOY
22g. Non-corrosive Multi-core Solder.
500gm Reel £4.99 each — 10 Reels £3.75 each

SOLDERING SECTION

Soldering Station complete with 30W		CS 18W, as above	10.90
or 40W Iron (state which)	72.50	Antex 15W iron	5.40
XS25 W Iron kit/complete with stand,		Antex 18W iron	5.60
1m lead & plug attached	8.20	Antex 25W iron	5.80
CS17 Iron Kit	7.99	Antex elements	3.20
C15 Iron Kit	8.30	Antex bits	1.15
XS25 W Iron kit/complete with steel		Antex stands	2.20
& plug attached	11.00	Sodersucker	4.50
		Spare nozzles for Sodersucker	0.65

SERVICE AIDS

Goldklene Degreasing		Aero Duster	1.49
Solvent	1.75	Super 40	1.88
Switch Cleaner Lubri	1.15	Rapid Fire Extinguisher	3.30
Supa Freeze-it	1.38	Silicone Grease Tube	1.80
Foam Cleanser	1.18	Silicone Grease Spray	1.38
Video/Tape Head Cleaner	1.10	Heat Sink Compound	1.18
Plastic-Seal	1.35	**Solda-Mop**	
Aero-Klene	1.10	Light guage 0.08mm	0.78
Anti-Static Spray e/list	1.20	Standatd gauge1.2mm	0.76
Excel Polish	1.19	Industrial reel 1.2mm	2.96

MAINS PLUGS 13A FUSED
46p EACH
42p EACH/10

MAINS SOCKETS

13A Single Unswitched	1.50
13A Single Switched	2.18
13A Twin Unswitched	2.50
13A Twin Switched	3.98

PATTRESSES PACK BOXES

Single 16mm	45p
Single 25mm	52p
Double 25mm	69p
Double 35mm	89p

MAINS SWITCHES

Single 1 Way (1 Gang 1 Way)	0.85
Single 2 Way (1 Gang 2 Way)	1.20
Twin (2 Gang 2 Way)	2.00
Triple (3 Gang 2 Way)	2.85

INTEGRATED CIRCUIT SOCKETS
DUAL IN-LINE
A range of high quality low profile dual in-line sockets.

	ORDER CODE	1+	10+
8-pin	CON/IC/8	8p	7p
14-pin	CON/IC/14	10p	9p
16-pin	CON/IC/16	11p	10p
18-pin	CON/IC/18	14p	13p
20-pin	CON/IC/20	16p	14p
22-pin	CON/IC/22	20p	18p
24-pin	CON/IC/24	21p	19p
28-pin	CON/IC/28	22p	20p
40-pin	CON/IC/40	28p	26p

TEST PRODS (FUSED)
Manufactured by Bulgin.
High strength plastic inc. 1A 1¼" fuse. Length of prods – red & black – 144mm.
£1.50
per pair

TELEPHONE EQUIPMENT

BT App Telephone Plug + 3m Lead	£1.25
BT App Master Socket inc Wiring instrns	£2.75
BT App Secondary Socket	£1.85
4-way plug	25p each
BT 4-Core Cable per metre	15p/m £12.00/100m
Cable clips for above	10/15p 100/98p

VALVES
Enquiries are welcomed for any other valve not listed here.

Type	Price (£)
AZ31	4.55
AZ41	2.05
DAF96	1.05
DF96	0.80
DK96	2.70
DM71	3.00
DY86/87	0.70
DY802	1.00
CV850	2.55
CV4015	2.85
E180F	6.55
EABC80	1.05
EAF42	1.55
EB91	1.35
EBC41	3.50
EBF80	0.80
ECC81	1.05
ECC82	0.95
ECC83	1.05
ECC84	0.85
ECC85	1.00
ECC88	1.45
ECC189	0.90
ECF80	1.25
ECF82	0.90
ECF83	1.95
ECH35	3.80
ECH81	1.45
ECH84	1.55
ECL85	0.80
ECL86	1.80
EF80	0.80
EF86	1.85
EF91	2.05
EF95	1.70
EF183	0.95
EF184	1.05
EH90	1.00
EL34	3.45
EL36	2.30
EL81	7.00
EL84	2.40
EL85	5.00
EL86	6.95
EL509	7.90
EL519	8.00
EM80	0.90
EM84	1.80
EM87	2.60
EY51	0.95
EY86/87	0.70
EY88	0.80
EY500A	2.55
EZ41	2.85
EZ81	0.85
GY501	1.45
GZ32	1.25
KT66(G.E.C.)	18.00
KT77	11.50
KT88(G.E.C.)	19.00
PC88	1.45
PC92	3.05
PC900	1.45
PCC88	0.85
PCC89	0.80
PCC189	0.90
PCF80	1.00
PCF82	1.00
PCF84	0.80
PCF86	1.30
PCF87	0.60
PCF200	2.00
PCF201	2.00
PCF800	1.25
PCF801	1.10
PCF802	1.10
PCF805	2.05
PCF806	1.25
PCF808	1.65
PCL82	1.05
PCL83	2.55
PCL84	1.05
PCL86	0.95
PCL88	2.55
PCL805	1.10
PD500	2.95
PFL200	1.90
PL33	1.55
PL36	1.80
PL82	0.80
PL95	2.05
PL504	1.55
PL508	2.75
PL519/509	5.30
PL802	5.55
PY81/800	1.15
PY82	1.80
PY88	0.85
PY500A	2.25
PY801	0.75
UABC80	0.90
UAF42	1.30
UBC41	3.05
UBC81	1.75
UCC85	0.80
UCF80	1.25
UCH42	2.55
UCH81	2.05
UCL82	1.85
UCL83	3.30
UF41	1.30
UF89	2.55
UL84	1.30
UY85	1.20
2D21	1.65
6AT6	1.30
6AU6	1.05
6C4	1.05
6GH8A	1.25
6J5GT	2.55
6K7G	2.05
6K8G	2.80
6KD6	6.55
6X4	1.55
30FL2	1.75
30FL12	1.65

IDLER KITS/(REWIND KITS)

SHARP NIDL-0005 GE ZZ		SHARP-0012	3.15
0006		SHARP-0013	3.50
SONY SLC5/7UB		IK-01	5.85
SONY SLC6UB		IK-02	4.70

VIDEO HEADS

AKAI	ALL		39.50
FERGUSON	3V00/22/16/23/24/31/29/30		39.50
HITACHI	VT5000E		38.00
JVC	ALL		39.50
NAT/PANASONIC	VE and NV	FROM	39.50
SANYO		46.30 and	50.60
SONY	SLC 9UB/6/7/9/20/30/40/8000		49.95
TOSHIBA	ALL		48.75

SERVICE MANUALS

FIDELITY CTV 145/CTV140/R/CTV 2022	ALL	2.75
SONY KV1810UB Mk.1/KV1400UB	ALL	8.15
SONY KV2212/KV2705/KV2252	ALL	5.85
SONY SLC5UB/SLC6UB/SLC7UB/SLC9UB	ALL	10.50

VIDEO BELT KITS

NAT/PANASONIC	VDB01	2.05
JVC HR 7700	VDB02	.40
JVC HR 3360/HR3660	VDB04	4.15
SONY SLC7	VDB05	2.40
JVC HR3300/HR3320/HR3330/HR3600	VDBo6	4.65
SONY SL8000	VDB07	6.75
NAT/PANASONIC NV8600	VDB08	1.55
SONY SLT-7ME	VDB10	.98
SONY SLT-9ME	VDB11	.98
TOSHIBA V5470	VDB12	1.45
TOSHIBA V5475	VDB13	1.56
TOSHIBA V8600	VDB14	4.50
NAT/PANASONIC NV300	VDB15	2.05
SANYO 5500	SANYO-012	2.05
SANYO 9300	SANYO-013	4.05
SHARP VC381	SHARP-020	3.15
SHARP C6300	SHARP-021	5.33
SHARP VC7300	SHARP-023	5.65
SHARP VC9300	SHARP-024	3.30
SHARP VC9700	SHARP-025	2.65

BOOKS

DATA VOLUME 1 – Trans. data & drawings	
A-BUY	£9.99
DATA VOLUME 2 – as above C-Z	£10.75
DATA VOLUME 3 – 2N-2N6735	£10.20
DATA VOLUME 4 – 2SA & on	£13.50
DIODES VOLUME 1	£10.75
DIODES VOLUME 2	£10.65
Both Volumes	£20.60
I.C. CMOS	£8.95
I.C. TTL	£19.50
I.C. LIN VOLUME 1	£6.95
I.C. LIN VOLUME 2	£6.99
Both volumes	£13.00
THYRISTORS A to Z	£10.45
TRANSISTORS A to Z	£5.40
TRANSISTORS 2N-3N	£5.50
Both volumes	£10.00

VOLTAGE REGULATORS

78L05	0.28
78L08	0.28
78L12	0.28
78L15	0.28
7805	0.36
7808	0.36
7812	0.36
7815	0.36
7818	0.36
7824	0.36
7905	0.38
7912	0.38
7915	0.38
7918	0.38
7924	0.38
LM305H	1.48
LM317T	0.95
LM723	0.65

INTEGRATED CIRCUITS (£) EACH

741	0.16
CA810QM	1.20
CA3020	2.10
CA3065	1.60
HA1366WR	1.59
LA4422	3.20
LC7131	4.90
LM324N	0.40
LM380N8-P	0.80
LM380N14-P	1.80
LM1011N	3.20
LM1458N	1.35
LM3900N	0.50
M51513L	2.30
M51515L	3.15
MC1307P	1.99
MC1327P	1.50
ML237B	2.30
NE555	0.20
SAS560S	1.85
SAS570S	1.85
SAS580	2.85
SAS590	2.85
SN76226DN	1.30
SN76227N	1.10
SN76533N	1.75
STK015	6.20
TA7203P	2.50
TA7204P	2.50
TA7205AP	1.80
TAA550	0.50
TAA611A12	3.50
TAA621AX1	3.50
TA120B	1.30
SAJSQ	1.30
TBA1520	1.50
TBA530	1.20
TBA540	1.64
TBA560C	1.50
TBA810S	1.20
TBA950/2A	3.05
TCA270SQ	4.02
TDA1006A	2.45
TDA1035S	4.50
TDA1170S	1.99
TDA1352A	1.80
TDA2030	1.80
TDA2530	2.20
TDA2532	2.80
TDA2560	3.20
UPC575C2	1.45
UPC1350C	4.05
UPC1182H	2.75
UPC1208C	1.25
UPC1356C2	3.00

TRANSISTORS – DIODES

Type	Price (£)
AC126	0.30
AC128K	0.38
AC141	0.58
AC141K	0.38
AC142	0.40
AC142K	0.38
AC152	0.48
AC153K	0.46
AC176K	0.32
AC187	0.40
AC187K	0.42
AC188	0.24
AC188K	0.38
ACY22	1.50
AD142	0.88
AD149	0.95
AD161/162	1.20
AF114	0.88
AF115	2.10
AF116	2.10
AF121	0.66
AF124	0.70
AF125	0.50
AF126	0.50
AF127	0.50
AF139	0.56
AF178	1.50
AF239	0.65
AF279S	1.40
ASY80	5.20
ASZ17	2.00
AU110	2.90
AY102	4.32
B40C200	1.03
BA115	0.12
BA121	0.40
BA148	0.16
BA155	0.12
BA157	0.20
BB105B	0.32
BB105G	0.30
BB110B	0.42
BC108	0.10
A,B or C	0.14
BC109	0.10
A,B or C	0.14
BC115	0.15
BC117	0.28
BC118	0.20
BC119	0.43
BC125	0.14
BC140	0.48
BC141	0.36
BC142	0.26
BC143	0.36
BC147B	0.16
BC148	0.10
BC148B	0.12
BC149	0.12
BC149C	0.14
BC159	0.14
B/C	0.16
BC160	0.38
BC161	0.30
BC168B	0.25
BC170/A/B/C	0.12
BC171/A/B	0.10
BC172/B/C	0.12
BC177/B/C	0.24
BC182/A/B/C	0.10
BC182L	0.10
LA LB LC	0.12
BC183/A/B/C	0.10
BC183L	0.10
LA LB LC	0.12
BC184	0.08
A B CL LC LB	0.10
BC212/A/B/C	0.10
BC212L	0.10
LA LB	0.10
BC213/A/B/C	0.10
BC213L	0.10
LA LB LC	0.10
BC237	0.12
BC238	0.12
BC251/A/B	0.14
BC262	0.26
A B	0.29
BC301	0.36
BC302	0.38
BC303	0.36
BC307A	0.15
BC317B	0.15
BC323	0.90
BC327	0.10
BC328	0.10
BC337	0.08
BC338	0.10
BC350A	0.24
BC351	0.16
BC516	0.35
BC547	0.08
BC440	0.36
BC548	0.08
A B or C	0.10
BC549	0.08
A or B	0.10
BC550	0.10
A or B	0.10
BC557A	0.10
BC558A	0.10
BCY70	0.36
BCZ10	3.21
BCZ11	2.60
BD124P	1.20
BD129	0.90
BD130Y	0.68
BD131	0.46
BD132	0.50
BD135	0.26
BD136	0.26
BD137	0.28
BD138	0.30
BD139	0.30
BD140	0.29
BD142	1.60
BD145	1.82
BD150B	0.50
BD160	1.58
BD165	0.45
BD183	0.70
BD201	0.52
BD202	0.57
BD222	0.80
BD225	0.40
BD232	0.52
BD234	0.30
BD235	0.30
BD236	0.36
BD237	0.38
BD410	0.76
BD438	0.64
BD439	0.85
BD441	0.85
BD507	1.05
BD520	1.20
BD587	0.88
BD707	0.80
BDX18	1.00
BDX32	1.75
BF115	0.32
BF117	0.50
BF119	0.82
BF125	0.42
BF127	0.44
BF154	0.14
BF157	0.46
BF160	0.23
BF167	0.32
BF177	0.42
BF178	0.36
BF180	0.27
BF181	0.27
BF182	0.32
BF183	0.32
BF184	0.47
BF185	0.28
BF194A	0.15
BF195	0.12
BF224J	0.20
BF240	0.15
BF241	0.18
BF257	0.22
BF258	0.26
BF259	0.30
BF262	0.34
BF263	0.38
BF270	0.30
BF271	0.28
BF273	0.22
BF274	0.34
BF294	0.46
BF336	0.40
BF337	0.38
BF338	0.28
BF355	0.42
BF371	0.27
BF450	0.30
BF457	0.36
BFR51	0.36
BFR61	0.32
BFR90	0.86
BFT41	0.68
BFT43	0.38
BFY50	0.32
BFY51	0.32
BFY52	0.32
BFY90	0.80
BFY90S	1.34
BR100	0.20
BR101	0.76
BR103	0.60
BR303	2.75
BRY39	0.80
BRY56	0.42
BSX20	0.20
BSY52	0.35
BSY95A	0.25
BT100A/02	0.90
BT101/300	2.75
BT101/500	3.25
BT102/300	3.60
BT106	1.15
BT116	1.20
BT119	3.30
BT138/600	0.98
BT151/560R	0.90
BTY79/400R	2.80
BU104	1.80
BU105	1.40
BU108	1.90
BU126	1.60
BU133	1.90
BU204	1.60
BU205	1.40
BU208A	1.50
BU326S	1.75
BU407	1.40
BUX80	2.90
BUY20	2.75
BUY69A	2.90
BUY69B	1.98
BY100	0.80
BY103	0.50
BY122	0.60
BY126	0.10
BY127	0.08
BY133	0.10
BY135	0.35
BY164	0.45
BY179	0.60
BY182	0.80
BY184	0.38
BY187	0.65
BY189	6.75
BY198	0.64
BY199	0.72
BY206	0.14
BY207	0.16
BY210/400	0.21
BY210/800	0.22
BY227	0.28
BY228	0.50
BY238	0.65
BYX10	0.28
BYX36/150	0.40
BYX36/600	0.48
BYX48/300	0.70
BYX55/600	0.30
BYX71/600	1.50
E1222	0.30
E5024	0.30
MCR106/5	1.20
ME0413	0.70
ME6002	0.20
MEU21	0.62
MJ400	1.45
MJ2955	1.10
MJ3000	1.80
MJE340	0.50
MJE520	0.60
MJE2955	1.60
MJE3055	1.40
MPSA05	0.30
MPSA12	0.30
MPSLO1	0.34
MPSUO5	1.05
MPSUO6	1.20
MR502	0.40
MR854	0.86
OA91	0.14
ORP12	0.95
R2008B	1.40
R2010B	1.20
R2540	2.71
TIP30A	0.35
TIP31C	0.30
TIP32	0.36
TIP33A	0.75
TIP34A	0.90
TIP41C	0.36
TIP42	0.38
TIP47	0.60
TIP121	0.63
TIP2955	0.68
TIP3055	0.85
TIS88	0.50
TIS90	0.27
Y723	0.92
Y969	2.80
IN4001	0.04
IN4003	0.05
IN4004	0.05
IN4006/7	0.07
IN4148	0.04
IN5400	0.08
IN5402	0.12
IN5405	0.12
IN5406	0.14
IN5408	0.18
2N2122A	0.34
2N2222	0.30
2N2904A	0.48
2N2926G	0.14
2N3053	0.30
2N3054	0.80
2N3055	0.60
2N3703	0.14
2N3773	1.90
2SB337	1.90
2SC1098	0.94
2SC1172Y	1.70
2SC1173Y	0.88
2SC1413A	2.70
2AC1449	0.80
2SC1507	0.60
2SC1678	1.80
2SC1758	0.68
2SC1953	0.70
2SC1957	0.95
2SC2029	2.70
2SC2122A	3.20
2SC2335	1.50

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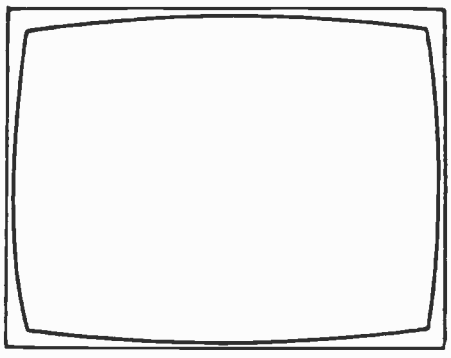

TELEVISION

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COVER PHOTO
This month's cover photograph shows a typical candidate for standards conversion and some of the components involved – an r.f. converter and two ceramic filters.

CORRECTIONS
During our editing an error was introduced in the article on the TDA3562A colour decoder chip (October issue, page 834). Joseph Cieszynski asks us to make clear that auto grey-scale sampling is carried out once per frame (not field), the correction voltages stored by the capacitors being used throughout the duration of two fields.

There seems to be a jinx on our efforts to get those Sony fault-finding guide part numbers right. The audio book is S-79510001 (one of the zeros was omitted in last month's correction).

Cloudy Prospects

One shouldn't be too surprised by the announcement that Sony is to buy the CBS Records Group. As long ago as 1968 Sony and CBS set up CBS/Sony Group Inc. as a fifty-fifty joint venture to supply the Japanese market. It's now the largest record company in Japan, with annual sales of around $600m. Nevertheless the move does raise some interesting questions.

The CBS Records Group did not come cheap. Sony is to pay $2b, a multiple of around twenty times current earnings. But the CBS Records Group is the world's largest record operation, with diversified activities including production, manufacture and sales of records, tapes, compact discs and video software through its own operations and subsidiaries, joint ventures and licensees in over fifty countries. It has manufacturing plants in fourteen countries around the world and runs the world's largest mail-order record operation. In 1986 worldwide sales were almost $1·5b, with an operating profit of over $160m – expected to peak at around $200m in 1987.

Sony's first offer for the CBS Records Group, of $1·25b, was made in December 1986. So it's taken some while to reach agreement – this is the usual Japanese way of doing things of course. The interesting aspect however is the contrast between CBS and Sony's business plans. While Sony has decided on a major diversification, CBS has decided to concentrate on its core business, broadcasting. One might have thought that records could be considered as part of CBS's core business – CBS has been in the recording industry since the twenties. After all, broadcasting and records have a natural affinity. CBS's problem in the past has been what to do with its income from broadcasting. It can't build market share beyond a certain point because there's a US regulatory limit of 25 per cent on the ownership of TV stations (CBS at present has 19 per cent). As a result, CBS has had a long history of diversifying into other fields, including magazine and book publishing, music publishing, toys and Steinway pianos. CBS's profitability has been on the wane however in recent years, which led to a management change in September 1986. Since then the policy of diversification has been put into reverse, leaving CBS with a group of TV and radio stations and a joint videocassette venture. This still leaves the question of what CBS intends to do in the future. Broadcasting in the USA is highly competitive and none too profitable. Perhaps, like GEC in the UK, CBS will sit on its cash mountain and draw interest.

As to why CBS decided to sell out at this time, the general view is that the offer was just too good to refuse, reflecting as it did a peak in the record group's volatile earnings. How will Columbia records fare under Sony management? Well for a start some continuity is assured by the fact that the division's president Walter R. Yetnikoff is to remain in office. This leaves the interesting question of Sony's intentions.

Sony has always been the odd man out in the Japanese consumer electronics goods industry. For a start it was founded shortly after the war – most of Sony's Japanese competitors have much longer histories. Then there is the fact that Sony has in the past concentrated on consumer electronics – the only diversification has been into broadcast and professional audio/video equipment – whereas competitors such as Hitachi, Toshiba and Mitsubishi have a much wider business base. There are two points about Sony's move on which one can speculate. The first, rather obvious one is the DAT (digital audio tape) dimension. The second is as to whether Sony has doubts about the future growth of the consumer electronics industry.

Sony's history has been one of remarkable innovation. The Trinitron colour tube, the Walkman personal stereo system, Betamax and 8mm video are examples. But innovation alone doesn't guarantee profitability – one wonders what the cost of Sony's adherence to the Betamax VCR system has been. More recently Sony has been concentrating on 8mm video and on DAT. Its 8mm video equipment is remarkable technically, but as with Beta it has to compete with the entrenched VHS system. DAT would seem to offer good prospects, providing the quality of the compact disc with added flexibility, but has not to date been the success that was expected. In fact you could almost call it a flop, though the longer term prospects should be better. DAT was launched in Japan in February 1987. During that year sales of DAT players amounted to little over 15,000, about half the industry's initial estimates. The European launch of the system has been postponed. Two factors have contributed to this poor initial response to the system – the high price of the players and the lack of software. The first will be resolved as production builds up – the Japanese consumer electronics goods industry has a remarkable ability to bring down the price of goods while maintaining profitability. The second could be resolved by just such a move as Sony's take-over of the CBS recording business.

But to pay $2b to get DAT moving would be a rather high price. One has to conclude that Sony's move could be telling us that Sony has doubts about the prospects for the consumer electronics market. The market has been remarkably buoyant for some years, but such conditions do not continue indefinitely. There are signs that saturation is being reached in many product areas. Even Dixons has reported sluggish sales recently, and a poor pre-Christmas trade build up. There are plenty of developments which will ensure the health of the market in the long term, but for the present it seems that buyers are beginning to hesitate. Maybe then it's just that Sony sees its diversification as an insurance policy for the medium term future.

Teletopics

FIRST EURO DBS IN ORBIT

An Ariane-2 rocket placed Europe's first TV broadcasting satellite, the West German TV-SAT 1, into orbit on November 21st. The launch has not, so far, been a complete success as one of the two solar panels failed to open fully. Ground control hopes to be able to correct the stuck panel but this will become technically impossible if it cannot be achieved within about two weeks. Failure would mean that the satellite will be able to provide only two TV DBS channels instead of the planned four (the commercial Sat-1 and RTL Plus services and the public Drei-Sat (ZDF) and Eins-Plus (ARD) services). Regular transmissions are due to start in about three months' time. About 100 million people live in the satellite's service area. Receiving equipment is unlikely to be available in quantity until the summer – at present decoders for the D2-MAC transmissions are being produced only in prototype form.

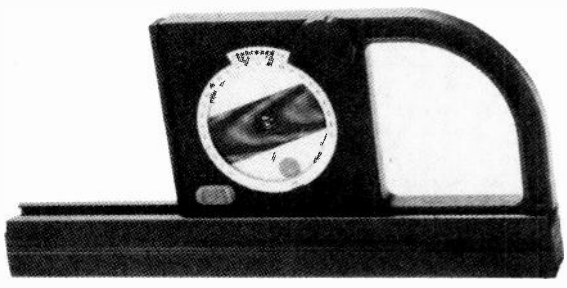
The French TDF-1 satellite is due to be launched in April, followed by the medium-power Astra satellite, with sixteen channels, in July and the UK BSB satellite in late 1989. Astra will feature English-language programming. The low-power ECS-4 satellite, launched on September 16th, was brought into service on November 1st. It's now officially known as Eutelstat I-F4 – the orbital position is 10°E. Some of the satellite's eight transponders will be used for television.

SATELLITE TV RECEIVING EQUIPMENT

Megasat has introduced a new 90cm aerial which it calls the Compact Dish (trade mark). The dish is produced by Comtronics and provides a gain of 40·66dB. It features a unique, patented double-skin construction. The dish is sold as part of Megasat's XX4 range of satellite receiver packages. For further details contact Megasat Ltd., 5 St. Pancras Commercial Centre, Pratt Street, London NW1 0BY (01 267 5222).

Borg Warner Chemicals, PA Technology and PA Design have jointly developed a 60cm dish which uses Borg Warner's Cycolac engineering thermoplastics. It consists of five precision mouldings, with metallised dish surface and a one-piece feed arm. The design was undertaken to develop a unit which can be put into high-volume production.

Moagon AB of Gothenburg (Box 53232, S-400 16 Gothenburg, Sweden) has introduced a new generation of optical goniometers for measuring the angles of parabolic TV aerials. The goniometers are fitted with moiré grids: light beams passing through the grid converge to form an arrow pattern when the aerial's setting is not correctly adjusted but appear as parallel lines when the angle is correct. Accuracy is to within 0·2°. For vertical adjustment the goniometer can be secured to the aerial stand with magnets. The aim is to enable riggers to complete jobs quickly and efficiently. Improvements incorporated in the new range include a locking device, an adjusting knob with high gear ratio and separate grids for coarse and fine adjustment.



The latest Moagon optical goniometer.

TAKE-OVER BID FOR VISIONHIRE

Granada has made a take-over bid for the Electronic Rentals Group which trades as Visionhire. When the original offer of £222m was raised to £250m the offer was accepted by the directors and by Philips which owns 21·8 per cent of the shares. The terms now have to be approved by the shareholders. As the combined group will have some 35 per cent of the UK TV/video rental business however the take-over could be referred to the Monopolies and Mergers Commission. Visionhire has 450 outlets and Granada 620 (including the Laskys retail chain). Some rationalisation would be inevitable and it's thought that about a fifth of the outlets might be combined. The group would provide strong competition for Thorn-EMI which has about 40 per cent of the UK TV/video business through its Radio Rentals, DER, Multibroadcast and Focus TV chains.

OTHER BUSINESS NEWS

Woolworth Holdings has bought from Harris Queensway for £8m the Ultimate electrical retailing operation. Ultimate at present has 127 outlets: Woolworth will integrate 94 of these with its Comet Radio chain and the others will be closed down. Woolworth's aim is to consolidate Comet as the main competitor to the Dixons/Currys group.

Thorn-EMI is to sell its one-third interest in the J2T joint VCR production venture to its partners JVC and Thomson GP. Production of VCRs by J2T has risen from about 75,000 machines a year to 850,000 a year during its five years in operation, but profitability has been very low – an estimated one per cent on sales. J2T supplies about 13 per cent of the European VCR market which, in 1987, amounted to some 6·7m machines.

NEC is spending £36m on a new factory at Telford, Shropshire. The plant, which is due to come on-stream in the middle of the year, will be used primarily for assembling VCRs. Some computers and other products are also expected to be produced at Telford.

Bang and Olufsen, which produces mainly up-market audio/video equipment, claims that it has been badly hit by the worldwide stock market collapses. 250 workers, about ten per cent of the staff, have been dismissed.

Sony has bought the CBS Records Division for $2b. The price, a multiple of twenty times current earnings, is considered to be on the high side.

TV USES

An interactive cable TV system called Jukebox, developed by Praxis Systems of Bath, has gone into operation on the Coventry cable TV network. Subscribers can select from up to 1,000 pop video items held by the cable company on disc. Within seconds a message appears on the screen to indicate when the selection will be played.

The National Westminster Bank has installed a system known as Window Shopper at selected branches. The point-of-information unit employs interactive video disc technology and enables customers to obtain information

on 21 services offered by the Bank via a touch-screen monitor. A built-in printer can provide loan quotations etc. for individual customers. The equipment has been designed and built by Philips Electronics and consists of a video disc drive, personal computer with Videologic MIC system, Cameron touch-screen monitor, printer and motorised card reader and interface. The software was produced by Convergent Communications.

Reuters has launched a teletext news and prices service called Citywatch. It's believed to be the first large-scale subscription teletext operation – the signals are carried on IBA channels.

A TV retailing system called Telaction, owned by US retailer J.C. Penney, has come into operation in Chicago. Referred to as an "electronic shopping mall", the system operates via a cable TV channel. Customers make purchases by pressing different numbers on a touch-tone telephone.

RECORD ONCE COMPACT DISC

Philips and Sony have developed and agreed the basic specification for a compact disc system that can be used to make recordings – the disc cannot be erased and re-used however. Up to 600Mbytes of data can be stored on the blank 12cm discs. While the system can be used for audio recording and playback, giving an hour's playing time, it's assumed that data storage will be the main use. The term WORM has been coined – write once, read many times.

STEREO TV DELAY

Though the BBC has been carrying out successful stereo TV sound test transmissions for many months the Corporation has announced that regular stereo TV broadcasting will not start until at least 1991. The announcement has upset manufacturers who have already developed decoders to receive the transmissions – in fact some Nicam ready equipment has already been put on the market.

GOLDSTAR COMES TO THE UK

Korean manufacturer Goldstar has launched a range of TV and video equipment in the UK. The initial range includes five monitor-style TV sets in screen sizes 14-20in., at prices ranging from £160-£270, three HQ VHS VCRs with remote control and a playback only machine. Goldstar's UK subsidiary is Goldstar UK Sales Ltd., Goldstar House, 264 Bath Road, Slough SL1 4EW (0753 691 888).

VIDEO NOTES

Minolta is to introduce in the UK a Video 8 camcorder which it claims is the world's smallest and lightest – the weight is 1·1kg without battery and cassette. Model 8100E is a full-feature machine with 1/1,000th sec shutter, three-head drum, zoom lens and an auto calendar programmed to the year 2099. Toshiba has introduced at only £400 a digital VHS VCR with full-HQ specification circuitry. Model DV90B supersedes the DV80B and adds to the specification digital slow-motion, 27-function remote control and a direct-drive tape-head system to reduce noise bars in the search mode.

USP Design of 20 Talbot Lane, Leicester LE1 4LR (0533 537 575) is marketing a video cassette lock which slots into one of the cassette's spools. The key is then removed until the cassette is next required.

George Cole writes: Sony has just released in Japan a Video 8 camcorder which can be used with either alkaline batteries or a conventional Nicad battery. The camcorder, Model CCD-M7, is aimed at the lower end of the market.

Hitachi's S-VHS camcorder, Model VCM-6000A, features a "tape tracker". This is in effect a 50 micron bulge on the surface of the head drum. It reduces tape rolling, which can affect picture quality. Other benefits claimed include suppressed vertical line distortion and reduced mechanical noise during tape transport. No UK release details have as yet been announced.

Sharp is about to release a new digital VCR, Model VC-D801H. Digital playback features include a channel search function which allows nine different channel pictures to be displayed on screen simultaneously. Other effects include picture-in-picture display, strobe and still frame. There are three high-speed index systems, an on-screen display function and a child lock button which disables all function buttons. A new "blue mute" feature mutes hiss and turns the screen blue when an unrecorded section of tape is being played back or a blank channel is tuned in. Also included are a 45-function remote control system, HQ circuitry and a 14-day/four-event timer. The price is around £650.

Grundig has released in the UK the teletext VCR first mentioned in this column last November. The VS540 has a built-in teletext tuner to enable non-teletext TV sets to receive teletext pages. The timer can also be set from a displayed teletext page. Other features include the ATTS system which calculates the amount of time remaining on tape, an electronic locking facility and a numeric keypad. The price is around £650.

TV RECEIVERS

Several small-screen portable radio/TV receivers have been released recently. The Samsung BT121J sells at around £70 and has an MW/v.h.f. radio and a 5in. monochrome TV section; the Steepletone STVR45 at £75 has an MW/v.h.f. radio plus 4½in. TV section; the Nikkai TLG18s at £100 includes a three-band stereo radio/recorder and a 4½in. TV section. At the other end of the scale £1,700 brings you ITT's multi-standard (PAL, SECAM, NTSC) Digivision Model 3988MS, which has a 76cm FS tube, stereo sound circuitry, a teletext decoder with eight-page memory and a digital CTI system for improved colour definition.

REMOTE CONTROL UNITS

Vision Spares Ltd. of 29 Bridgefoot Street, Dublin 8, Ireland, has introduced a 16-channel remote control system which will fit into any TV set that uses a varicap tuner. The kit comes complete with remote control handset, infra-red receiver, a small button unit and a special fitting escutcheon – fitting instructions are available for most types of TV set. Thus almost any TV reeceiver can be turned into a 16-channel set with remote control of volume and channel change facilities. The unit sells in Ireland for IR£37·50 plus VAT – quantity discounts are available.

The company has also developed a self-contained 99-channel remote control set-top unit which provides for composite video and audio outputs and covers the complete v.h.f. and u.h.f. spectrum including the S channels. In addition to its use for upgrading older sets it can be used as a tuner unit for computer monitors. The retail price is IR£70 plus VAT.

Vision Spares Ltd. is interested in appointing distribution agents for these products in the UK and Europe.

Features of the Panasonic NV-D80

Harold Peters

By now we've come to expect from a top-of-the-range VCR two-speed recording, hi-fi helically recorded sound and a timer that's programmable from the remote control handset. The recently introduced Panasonic Model NV-D80 not only has these features but several more, due to three innovative extras: a digital field store, a bar-code scanner, and a deck mechanism that includes a "half-loaded" position. We'll take a brief look at these.

Digital Field Store

As shown in Fig. 1, the NV-D80 has a digital field store in parallel with the analogue video signal path. The digital store can be brought into use not only during playback but also in the E-E mode. Amongst the new possibilities that this makes possible are:

(1) Still frame – a jitter-free picture that doesn't stop the sound output, or the tape.

(2) Digital strobe – a succession of still frames, controllable from one to six per second, can be flashed up on the screen, again without disrupting the sound.

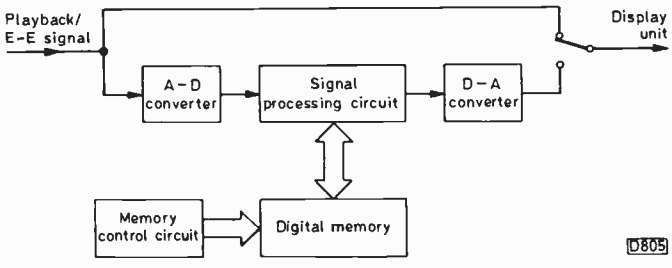


Fig. 1: Block diagram of the digital system.

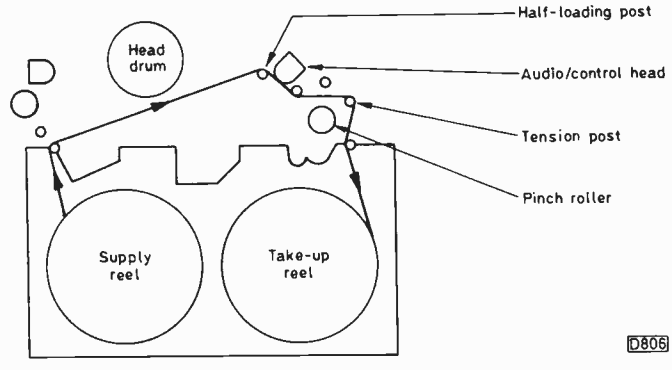


Fig. 2: The deck mechanism in the half-loaded position.

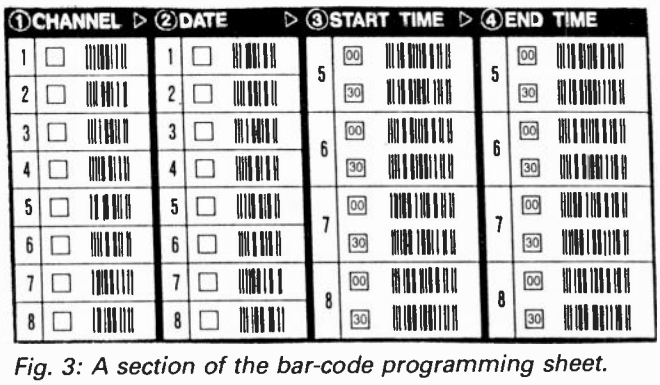


Fig. 3: A section of the bar-code programming sheet.

(3) Graphic effects – similar to those found on pop music video programmes.

(4) Noise reduction by adding the stored field to the analogue picture signal: the pictures add while the noise subtracts – the principle is similar to the operation of the familiar PAL delay line arrangement.

Search Indexing

Whenever the record button is pressed at the start of a recording an index signal is recorded on the control track. Extra signals to indicate parts of a recording of particular interest can be added at places of your choosing by pressing the record button at the appropriate times. These indexed points – up to twenty per cassette – can be found rapidly during rewind or fast forward by calling up the index number of the part you want to see.

Alternatively you can use "intro scan". In this mode the tape, in fast forward, stops and plays ten seconds of picture at every index mark. When the part you want is reached you press play and the intro search ends. This feature is made possible by the half-loaded tape position shown in Fig. 2. Between each ten seconds of picture playback the tape is run in the half-loaded position, clear of the head drum and pinch roller but in close contact with the audio/control head. The tape stays in this half-loaded position during the rewind, fast forward and stop modes. This is an improvement on previous search indexing arrangements which work only in the "cue and review" mode.

Bar Code Timer Control

In common with two other models in the current Panasonic range, the NV-D80's timer can be set at the front panel, by means of the remote control handset, or by using a bar-code scanner that comes with the machine.

The intention is that bar codes printed with the programme listings will eventually be used, as in Japan, but until copyright and printing problems have been resolved you have to do this by using the programming sheet (see Fig. 3) that comes with the machine. You simply switch the scanner on, point the sharp (LED) end of the scanner at the sheet and read off the channel, date, on and off times of the programme you want to record. Then turn the scanner round, point the blunt end at the VCR and press the transmit button. The VCR displays your information for ten seconds, gives a bleep of recognition, and switches to timer.

You have to scan the programming sheet fairly rapidly and straight. Every read-in produces a bleep, and a completed programme is given a train of bleeps. On and off times are given to the nearest half hour, with a fifth column on the programming sheet for extra minutes if needed. Since the scanner retains the last programme information, the cancel bar must be read before booking a further programme. To save on batteries the scanner switches itself off after twenty seconds of idleness.

Panasonic enthusiasts will be delighted to know that despite all the extra features the good old one-piece diecast chassis is retained.

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TV and VCR Standards Conversions

Eugene Trundle

We are often asked to convert imported TV sets and VCRs so that they can be used in the UK. In some cases such action is not viable economically. Even where the project is viable, it's important for the technician and his customer that the practicality, cost and subsequent performance of converted equipment are assessed at the outset, and that it's made clear to the customer that the process may not be easily reversible.

Many factors need to be considered. For example, if the make and model is an obscure one any spares that might subsequently be needed are unlikely to be available. Conversion is not recommended where the equipment is old or in poor condition since its reliability prospects will not be good. With recent models produced by well-known companies that have representation in the UK the outlook is much brighter, especially where there's an equivalent or similar UK version – this will often be indicated by the model number having a suffix that differs from the UK type. In this case such crucial spares as video heads, line output transistors and special semiconductor devices should be available – as will be the bits and pieces required for conversion. It's notable that many camcorders and semi-portable VCRs have a u.h.f. modulator with a preset system I/G sound switch, obviating any need for conversion.

Alternative Approaches

Where applicable, other possibilities worth considering are the use of AV connections between equipment to bypass an incompatible modulation system, or fitting an up-converter such as the Labgear CM7122 to interface a v.h.f. modulator and a u.h.f. receiver, though in this case the sound conversion to be described below would generally still be required. These approaches lead to a loss of versatility, but in some cases may be the best solution. I've yet to find at a viable price any sort of down-converter to adapt a v.h.f. receiver for use with u.h.f. transmissions – it would be a complex and ungainly device.

What's Viable?

In these days of high labour costs (relative to the purchase price of new equipment, that is!) there's a definite limit to what can be done: a good rule of thumb is that the modification will probably be worthwhile if the equipment, be it a TV set or a VCR, is already capable of producing colour pictures from UK TV transmissions – the lack of sound can usually be dealt with at a reasonable cost. There are one or two exceptions to this rule – primarily concerning v.h.f.–only sets from Australia, New Zealand and parts of the Middle East whose conversion prospects will be dealt with below.

The type of equipment that's most commonly brought to us for possible conversion consists of the multi-standard (PAL/NTSC/SECAM) VCRs and TV sets that are produced for use in the Middle East and are brought home by Brits returning from tours of duty. Cost of conversion seems not to be a matter of great concern, perhaps because of the high earnings obtained in that part of the world. It's perhaps surprising that despite all the front-panel trumpetings of "multi-standard", "seven-system" and so on few or none of them are able to receive system I sound – it seems that the UK, Ireland, Hong Kong and South Africa are left out of the equation. This opens the way to a reasonably profitable line in conversions for those prepared to have a go – often the TV set and the VCR both come in together.

In addition to these expatriates from the Gulf, we've successfully converted sets from West Germany. The method adopted would apply to sets from Scandinavia and most West European countries except for France, whose SECAM colour system and a.m. sound make conversion virtually impossible.

System G-I TV Conversion

TV receiver conversion is the simplest. The main difference between the Continental CCIR system G and the UK system I is the frequency spacing between the sound and vision carriers – 5·5 and 6MHz respectively. The fact that two different vision i.f.s (38·9 and 39·5MHz) are in common use is of no consequence, since the intercarrier sound frequency (sound i.f.) is fixed by the transmitter's carrier spacing. A very basic block diagram of the receiver section of a typical modern TV set or VCR is shown in Fig.1.

Thus the job is primarily one of retuning the intercarrier sound channel to 6MHz. In most cases selectivity is achieved by the use of one or two ceramic filters in the path between the vision demodulator and the intercarrier sound channel – point B in Fig. 1. Replace the filter(s) with a standard 6MHz type. These are commonly available as spares from wholesalers and manufacturers. The usual prefix for the type used in the UK is SFE, though I've found SFC and CFE types: the key letter seems to be F, and the SFE6·0 type works happily as a replacement.

The i.c.-based sound demodulator is generally a quadrature or PLL type using a resonant circuit (C in Fig. 1) which must also be changed to 6MHz. The tuned circuit usually consists of a parallel *LC* combination whose coil core can generally be unscrewed to bring in good sound.

Fine tune it for minimum buzz with a "busy" off-air picture like racing captions or the text-in-vision broadcasts that are available most weekday mornings. The "tank" circuit may on the other hand consist of another ceramic resonator, which in Continental sets is generally prefixed CDA. Changing it to a CDA6·0 type will bring in UK sound. Note that the resonator used in this position is quite different from the selectivity type used at the input to the intercarrier sound strip. Where, as is often the case, there's an "equivalent" UK TV or VCR model it's safest to order the system I filters as standard spares from the UK manufacturer or agent. Most Japanese manufacturers have their own type codes for these filters: it's essential to swop like for like.

Once its sound channel has been retuned the set will probably work quite well off air. Various snags may crop up however – substandard sound, coarse beat patterns on strong colours and, in areas where adjacent channels are received, an overall patterning effect. These effects occur because the filters and traps in the vision i.f. circuits are still tuned to the system G sound frequencies. To overcome these effects it's necessary to retune the co-sound and adjacent-channel sound traps – the frequencies involved are shown in Table 1. In the now rare case of discrete component i.f. circuitry the best course is to refer to the manufacturer's alignment data: add 0·5MHz to the frequencies specified for the i.f. traps. If equivalent data is available for a UK model, tune to the frequencies given, which will be 6MHz below and 2MHz above the vision i.f. for the co-sound and adjacent-channel sound traps respectively. In most modern sets a SAW filter is used to define the vision i.f. bandpass response – see A in Fig. 1. In this case retuning is not possible and a replacement system I filter will have to be fitted. Hopefully this will be available in the UK as a standard spare part.

Finally, in most sets there's a sound carrier trap in the post-detector video signal path – see D in Fig. 1. This may be a ceramic or a discrete component *LC* filter and must be replaced or retuned to operate at 6MHz to avoid the risk of tonal distortion of the highlights and, with monochrome and high-definition tubes, a fine dot pattern. To tune an *LC* filter to 6MHz, hook a scope downstream of the filter and adjust the latter for minimum "grass" on the sync pulse tip – see Fig. 2. Where a ceramic filter is used in this position it's usually recognisable because of the inductor strapped across it, as shown in Fig. 1. This filter has the opposite characteristic to the SFE type used for sound selectivity and often carries the prefix TPS, though I've seen STP and T prefixes in this position. T appears to be the critical letter, which is important when you're fitting a 6MHz type as a replacement.

Where no UK source of these special ceramic filters (CDA and T types) is apparent, a browse through the service manuals for Amstrad, Finlux, Luxor, Network or Samsung TV sets may turn up some suitable part numbers – no doubt there are many more, but be sure to order types that provide the same functions as those being replaced.

Bands and Channels

In the case of a TV set the job has now been finished and the sound and vision performance should be comparable to that of a home-market set. Where the receiver is designed solely for system B operation (Australia, New Zealand, etc., with transmissions confined to the v.h.f. bands) it's also necessary to replace the v.h.f. tuner with a u.h.f. one. Often you'll find that the PCB is punched to take a u.h.f. tuner, or alternatively that one may be available as a pin-compatible replacement (as used in an equivalent UK set). In such cases the required type should be available for fitting. Otherwise a u.h.f. tuner of the ELC1043, U321 or U322 variety will have to be plumbed in. With these it will sometimes be necessary to provide extra i.f. gain and/or to arrange for a fixed a.g.c. voltage to be provided by a preset potentiometer. Where conversion is being undertaken as a commercial venture this may not be viable economically, but it's worth checking with manufacturers represented in the UK. For example, Ferguson published detailed information on the TX9 and TX10 range of receivers in issue 9 (December 1983) of *Ferguson Feedback:* the technical departments of other setmakers may well be able to offer practical modification advice for particular models.

VCRs

The comments made so far all apply to the receiver sections of VCRs, whose circuits are basically the same as those in a TV set. One further modification is required to a VCR however – to ensure that it provides a signal to the system I specification. As shown at the bottom of Fig. 1, the r.f. modulator (sometimes called an r.f. converter) in a VCR incorporates a sound carrier generator that uses an *LC* tuned circuit – this is not always shown in the circuit diagram. Usually it's the only slug-tuned coil with its own screening can in the modulator. The core must be unscrewed a few turns to bring the sound carrier frequency up to 6MHz – it's best to tune by ear for minimum intercarrier buzz from a good TV set acting as a monitor. While this can be done in the tape playback mode, it's preferable finally to trim the coil for minimum buzz from an off-air transmission – the transmission will have higher vision frequencies than an off-tape signal, providing a more critical test to achieve a spot-on carrier frequency. You'll need a non-metallic trimming tool for this one. Sometimes access is impossible with the modulator in its normal working position, so the modulator must be temporarily stood off the board on soldered legs of tinned copper wire.

Mains Supply Voltage

In general, equipment for use in system B/G countries is designed to be run from a 220V a.c. mains supply. In all the cases I've come across the equipment will operate happily and reliably from a 240V supply provided any selector (which may take the form of an internal link) is correctly set. Where a 50Hz mains transformer is fitted there's usually a mains-tap adjustment. You won't find, or need, an input voltage adjustment with a chopper power supply. Equipment intended for operation from 100-120V supplies is generally of the NTSC/525-line type, and is thus not a practical proposition for conversion.

SECAM

The SECAM colour system was developed in France which now stands alone in Western Europe so far as its colour encoding system is concerned. While the use of a.m. sound precludes easy conversion of French sets, for SECAM equipment from other countries where a sound (and, if applicable, a tuner) conversion is feasible, particularly with high-quality monitors and other baseband video equipment, it's possible that the Mullard

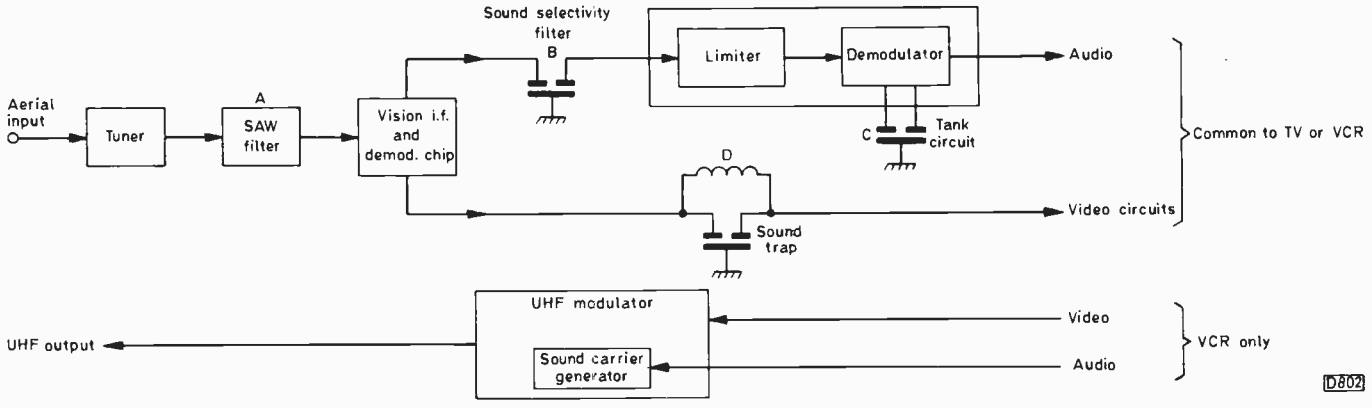


Fig. 1: Positions of tuned circuits relevant to systems conversion. Some of those shown here as ceramic filters may in practice be in discrete LC form. The letters are referred to in the text.

TDA3952A PAL-to-SECAM transcoder chip could be used. This chip requires several peripheral components in the way of filters and delay lines: these items would have to be assembled, mounted and powered, so a conversion of this type would not be a five-minute job. I understand however that ready-built PAL-to-SECAM, SECAM-to-PAL and other transcoder modules are available from Universal Electronics, 29 Rue Stephenson, 75018 Paris, France (telephone 42 64 8117 or 42 62 3272).

Some PAL VCRs can record and playback SECAM signals, though tape interchange with a genuine SECAM machine is unlikely to work. Much depends on circuit design. Some VCRs, such as the Hitachi VT6500, have a switch to change to quasi-SECAM operation. For a truly compatible conversion it would be necessary to inhibit the colour killer, circumvent the comb filter in the crosstalk-cancelling circuit, and inhibit the colour subcarrier phase switching.

Outward Bound Conversions

Less often we're asked to convert UK equipment for system B or G operation – usually by a customer who's heading for permanent residence in Spain. As previously mentioned, the r.f. modulators of many camcorders and portable VCRs are switchable between systems I and G, so there's no problem here. With other equipment the processes previously described need to be reversed, using Table 1 as applicable.

The main problem with this is to ensure that the 5·5MHz sections are properly on tune. For this you need a multi-system v.h.f./u.h.f. pattern generator such as the Orion model we reviewed in the February 1987 issue. Without this you're likely to get an angry international phone call within a few weeks! Since export conversion is less commonly required the various filters, tuners and modulators saved from previous conversion jobs can be recycled – system B/G components are not so easy to obtain in the UK. I've got a complete kit of filters for any Grundig TV set headed for its Fatherland, and a nice channel 3/4 v.h.f. modulator just waiting for Barry Humphries, suitcase in hand, to ring me – available at knock-down price, fitting extra . . .

Table 1: Standard i.f. channel frequencies.

Vision i.f.	38·9MHz	39·5MHz
System I co-sound	32·9MHz	33·5MHz
System I adj. sound	40·9MHz	41·5MHz
System B/G co-sound	33·4MHz	34MHz
System G adj. sound	41·4MHz	42MHz
System B adj. sound	40·4MHz	41MHz

Commercial Conversions

Portatel Conversions of 25 Staines Road West, Sunbury-on-Thames, Middx (0932 788 972) will carry out conversions in both directions. They will do work for the trade and the public and are recommended by many setmakers. They are happy to discuss and quote for various conversions, including PAL/SECAM VCR jobs where this is practical.

Software

Video cassettes are not nearly so system conscious as the hardware you feed them into. Provided the scanning standards (i.e. 625/50 or 525/60) and encoding system are the same, the tape will play in any VCR of the correct format – usually VHS these days. Thus tapes can be freely interchanged between Australia, the UK, Spain, the Middle East, Denmark, West Germany, etc. French and East European block tapes will play back in monochrome via PAL equipment: the exception here is Video 8 tapes which have complete interchangeability in all 625/50 countries.

Tapes from the USA, Canada and other 525/60/NTSC countries will not play back at all on European VCRs. It's simplest, provided there are no copyright problems, to have them transcoded by a facilities house. Two of the leaders in this field are Flintdown Channel Five of 339 Clifton Drive South, Lytham St. Annes, Lancs FY8 1LP (0253 725 499) and Video Action Services of 130 Brookwood Road, London SW18 5DD (01 870 5558).

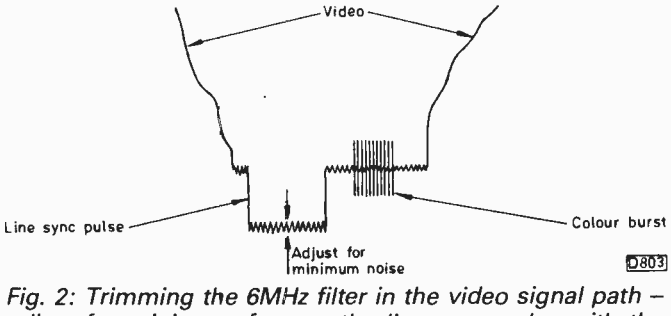


Fig. 2: Trimming the 6MHz filter in the video signal path – adjust for minimum fuzz on the line sync pulse with the scope's Y gain turned up high to magnify this section of the video waveform.

Practical Computer Programming

Part 2

Mike Phelan

Last month we saw that the microprocessor can carry out only a limited number of fairly simple tasks, though it does this very rapidly. To recap briefly, there are within it various places where one, or sometimes more, bytes of information can be stored. This information is held in the form of logic levels one or zero, each representing one of the digits of a binary number.

The microprocessor chip can also manipulate the values of the binary numbers held in the registers, also in external memory after being fetched, by using decoded "opcodes". These are instruction bytes fetched from an external memory location identified by an address. The address in a small computer using a Z80 or 6502 microprocessor is usually a two-byte number - because these chips have sixteen pins connected to the computer's address bus. Each pin can be only high or low, representing one bit. With sixteen bits we can represent numbers up to 65,535, or in binary code 1111 1111 1111 1111 (two bytes).

Instructing the Microprocessor

O.K. So how does the microprocessor know where to fetch its instructions from? The microprocessor contains a sixteen-bit register called the program counter. When the computer is switched on one of the microprocessor's pins is fed with a reset pulse which, amongst other things, loads the program counter register with a set value – zero or 65,535 is usual. The first opcode will be fetched from this address in the external memory. Then, as each instruction is executed, the value in the program counter register is automatically incremented. The only exception to this rule are when the instruction changes the value in the program counter register (more on this later).

It can be seen that we are still a long way from making much use of the computer. What we have outlined so far will enable the microprocessor to carry out only a fixed program stored somewhere in memory. This would be adequate for a microprocessor used in a remote control system or a VCR's system control arrangement, or in other applications where a set program is used to control hardware. In such applications the ROM is usually part of a single microcomputer chip. But for computer use in the normal sense we require some interaction with the world outside the computing system, and the facility to chose the programs we want to run. This brings us to peripherals and operating systems.

Computer Peripherals

Our apologies for yet more jargon! A peripheral is something that's attached to the computer for the purpose of converting data as the computer knows it into some other form, or vice versa – or both! Put simply, things like the keyboard, monitor, disk drive, tape deck and printer are peripherals. Some of these can clearly pass data only one way, i.e. the keyboard and monitor. Items like the tape deck pass data both ways.

So how do we use a chip that can refer only to an address in memory to, for example, send information to a display screen? The simplest way is to use what's called "memory maping". This means that, in this particular example, the screen appears to the microprocessor to be a particular block of memory. By depositing a byte at one of the addresses in this block, something will appear at the corresponding screen location. This exercise requires another chip which is known as a CRT controller, or CRTC for short. The CRTC sorts out what is to be displayed, in what colour, and where on the screen. It also generates the sync and blanking signals required by the monitor.

Other peripherals also use various memory areas, but we need some means of controlling all this, which brings us to the operating system. First we must digress into the subject of computer languages.

Operating Systems and Computer Languages

It will be best to look at these two things – operating systems and computer languages – first in the context of a simple home computer, then to expand the ideas to cover business machines.

It would be extremely laborious to have to program our computer by entering long strings of numbers. The computer's opcodes are known collectively as "machine code", and it may take something like fifty or so instructions just to get a single character printed on the screen. So imagine what the instructions for a complicated application such as a stock control system would be like! Not to mention the fact that finding any errors would be extremely difficult. To get round this things called "high-level languages" have been developed. "High-level" means as much like ordinary English language as possible. Most home computers employ a version of the high-level language known as BASIC (Beginners' All-purpose Symbolic Instruction Code). This allows us to enter instructions at the keyboard, or to put them together as a program, using straightforward English-language type instructions. Something that looks like English is easy to understand and debug (fault-find). Each BASIC instruction corresponds to a number of machine opcodes. As an example, PRINT 'A' is a BASIC instruction whose meaning is obvious to anyone.

BASIC is actually a program itself, called the interpreter – it interprets our English-language type instructions into the machine code that the computer system uses. With a home computer the interpreter program is automatically loaded from ROM soon after switch on. As previously mentioned, the first thing that occurs at switch on is that an address of 0 or 65,535 is loaded into the microprocessor's program counter register. The instruction brought from this address starts a chain of events that culminates in starting the interpreter so that the machine is ready for the user to type something in.

The ROM program that loads the interpreter is called the operating system, and in this type of computer is fairly simple. Other jobs carried out by the operating system program include managing data sent to the printer, tape deck, disk system etc. It groups the data in "files", which can consist of data, a program or anything else held in a chunk of memory.

The greater part of the computer's memory consists of RAM, from which all data is lost when the computer is

switched off. The basic ROM, which retains its data, contains the operating system, BASIC interpreter and little else. The microprocessor distinguishes between the two by means of the addresses or an electronic switching arrangement – how it does this is irrelevant here.

Tapes and Disks

Clearly if we need to keep any data other than that held in ROM we must keep it on tape or disc. For serious use a tape deck is inconveniently slow and prone to trouble. Files are stored on tape by modulating a signal with two frequencies used to denote one and zero respectively. Some business applications require multiple files: it's difficult to swap tapes to get at the files and to find where a required file is on a tape.

Disk Drive

The answer to this is a disk drive. There are at least four disk standards in common use, and various operating systems for use with them. For smaller business machines the most common type of disk is the 5¼in. one, with an operating system known as DOS produced by Microsoft. This is designed to work with an 8088 or similar microprocessor. With home computers the situation is rather different. Many of these have no in-built disk drive, so this item must be purchased separately and may come with its own operating system. An exception to this is the Amstrad range that uses 3in. disks and an operating system known as CP/M – DOS was evolved from this and the two are similar in many respects.

With a disk-based machine the operating system looks after running the programs, the disk and other peripherals. The languages used are not usually contained in ROM but must be loaded from the disk, as indeed must the operating system itself. But hold it – how can we do this since we need an operating system to load a file from the disk?!

The answer is in ROM and is called a bootstrap program – the term "booting up" is derived from this. The bootstrap program starts a process which loads the operating system and prepares it to accept keyboard commands. How this works in detail will be explained after we've covered the way in which files are stored on disk.

Storing Data on Disks

Unlike a tape, which is a serial device, a disk is divided into concentric areas called "tracks". Each track is divided into "sectors", and each sector can be found by its sector and track number. It must be stressed that the pattern is purely a magnetic one: it's laid down when a new disk is "formatted", which must be done before it can be used. This is carried out by one of the operating system commands.

From here on for clarity we'll use DOS as the assumed operating system. The formatting process also reserves several sectors as a "directory" and some more as a "file allocation table" (FAT). The files on the disk have a directory entry which gives the file name, length and starting track/sector. The operating system puts the files on the disk contiguously. If a file increases or decreases in size, or is deleted altogether, DOS reallocates the space as necessary.

So how do we keep track of a file that may be spread all over the disk? The answer to this lies in the FAT. For convenience, the sectors are grouped in units called "clusters". Two sectors per cluster is typical. DOS recognises a cluster by a unique number, and a cluster is the smallest unit that can be allocated to a single file. The directory entry is actually the starting cluster number rather than a track and sector number. The FAT is divided into "cells", each entry corresponding to one cluster on the disk in a fixed order. There are three possibilities for an entry: (1) The number of the next cluster in the file. (2) A unique code that means the cluster is unusable. (3) A unique code that means it's the last cluster of a file. Thus the DOS can pick up the first cluster number from the directory and use the FAT to trace the rest of the file. So unlike a tape any file on a disk can be reached without having to read other files first. And of course a disk system is much faster – after all it was designed for the job, not for reproducing audio!

Incidentally, when a file is erased nothing of the sort actually happens. What does happen is that the directory entry is changed so that the file name doesn't appear, and the FAT clusters are put on an "unused" list. This explains the apparent magic of programs which can recover an "erased" file – as long as the space hasn't been reused.

Next month a closer look at computer languages and reasons for choice.

Still Hazy

Yes, I have to admit that I'm still hazy and finding it very difficult to type this note. There are one or two things I must say however.

First, my thanks to Les Austin (see Letters page) for his help with the Grundig set that gave me so much trouble. You remember the 2210 that blows the 1A fuse I fitted in series with the supply to the line output stage? No, Les, it doesn't make any popping noises before it goes. It just goes. You did say that a lot of people cross over the e.h.t. tripler's diode and earth leads. This had happened to the set and on wiring it correctly I found out why. When wired correctly there was no luminance, only chroma. This was due to the 680Ω resistor R528 in the e.h.t. current sensing circuit having gone almost open-circuit, producing permanent beam limiting. Having put all this right the set is now working and I'm waiting to see whether the fuse still fails. Thanks for putting me on the right track.

Thanks also to the other kind chap who called in at the shop to give me a replacement for the small choke (L508) which is wired in series with the line scan thyristor's gate. He told me that when faulty it causes trouble due to the thyristor firing early. I fitted the choke but the fuse still blew. Thanks anyway.

Whoops – the fuse has gone again. Sorry Les: one day I'll find out what's doing it. Fancy the tripler being incorrectly connected and making so little difference.

Now what's all this about and why am I so hazy? Well, you see, at present the heart hasn't the heart to pump sufficient blood to my brain while I'm standing up or sitting down, only when I'm lying down, and I can't do that all day, can I? So I have to take some tablets, but only two per day as they are rather powerful. They work for about an hour, then I sink back into partial oblivion – still able to repair sets, but unable to remember much about them. So, as you can imagine, I'm getting myself into some fine old scraps.

Les Lawry-Johns.

TV Fault Finding

Reports from Eugene Trundle, Dennis Apple, B.Sc., William G. Lockitt, Eng. Tech., Lenny Dinsdale, Alfred Damp, Philip Blundell, Eng. Tech. and D.H. Davies

Philips CTX-E Chassis

A portable fitted with this chassis made several visits to the workshop before we got to the bottom of the trouble. Each time the complaint was that the set would "tick", with momentary loss of picture and sound. Although we saw it once we weren't fast enough to make a diagnosis!

The problem finally got so bad that the fault was more on than off. The power supply was pumping, and on each pump cycle the h.t. came up to about 80V. In a darkened room we could see some sparking inside the stalk of the e.h.t. "flower" connector to the tube bowl. Fitting a new lead and connector solved the problem for good. **E.T.**

Toshiba C2225B1, C2625B1, C2226B1 etc.

These models use a mains-isolated chassis, with an optocoupler link for standby switching. The optocoupler bridges the live and safe areas of the RMT selector board. Where a no-go situation is encountered with one of these sets you'll very often find that the optocoupler is responsible. Prove it by withdrawing the flying socket from the live section of the RMT SEL panel, after which the set should come on by operating the on-off switch. If so, check that l.t. supplies are present at the RMT panel before condemning the optocoupler – the safety feed resistors sometimes go open-circuit for no apparent reason. We've not quoted circuit reference numbers because they vary from model to model. **E.T.**

Ferguson TX9 Chassis

We've had several puzzling cases of low or no colour in sets that use the TDA3560 decoder chip. Until we twigged it a lot of time was spent tracking down the trouble. What happens is that the carbon track of RV67 (470Ω, delay line circuit balance control) goes high-resistance or open-circuit. It's probably the emitter load resistor of a transistor within the chip and it's failure completely duffs out the colour. **E.T.**

Decca/Tatung 120/130/140 Chassis

In the 120 and 130 chassis beam current limiting is carried out by sampling a negative voltage developed at the earthy side of the line output transformer's e.h.t. overwinding. This negative voltage is offset by a positive feed via R425 and R426 (both 56kΩ or 68kΩ depending on tube type). Increasingly we find that these two resistors have gone high in value or open-circuit. This results in a weak and milky picture which is little improved by advancing the setting of the contrast control.

The equivalent resistor in the later 140 series chassis is R427 (150kΩ or 120kΩ) which should be worth checking where the weak picture symptom is present. **E.T.**

Philips 320 Chassis

This set produced a very noisy picture with both high and low-gain aerials, though the contrast was adequate. Without giving it much thought I changed the tuner. Naturally this had no effect. Still without thinking about it I changed the transistor in the first i.f. can, then the three transistors in the second can, all to no effect. Having wasted some time on all this, and feeling rather foolish, I did what I should have done to start with – think! If the set could produce a picture with reasonable contrast when operated with a very low-gain aerial the tuner and i.f. amplifier were unlikely to have been suspect in the first instance . . . With narrowed eyes, I worked the set-a.g.c. control while observing the i.f. a.g.c. voltage at pin 4 of the i.f. selectivity can. As there was no voltage change I checked back to where the a.g.c. voltage comes from – pin 4 of IC2225. This voltage varied nicely from 2V to 6V as quoted in the manual. So with sleuth-like precision I traced along the a.g.c. line and found that R2206a was not connected to pin 4 of the chip. Putting this right produced a beautifully noise-free picture with excellent contrast and brightness.

Channel changing was a bit erratic however. This responded to cleaning the sliders of the rotary channel-change switch and resetting the spring tensions (this was the 17in. transportable version of the chassis). Everything now seemed to be all right and the set was left on soak test. Suddenly there was a loud crack from inside the cabinet and both the sound and picture disappeared. Dear me I thought, how trying!

I peered inside the cabinet and switched on. Nothing. Then suddenly an arc about two inches long shot out from the rectifier base to chassis, making the interior light up like the proverbial Christmas tree. Wondering what bad deeds I must have done to deserve this, I attempted to measure the h.t. voltage before the arc struck again. The meter read about 200V which should have been 163V – the neon over-voltage protection circuit hadn't operated. Cold tests on the power supply panel seemed to be the appropriate course of action. The regulating thyristor read all right and much time was then wasted checking other innocent items. Eventually I decided to change the thyristor anyway, using the more robust 2N4444. The new h.t. reading was still too high, but could be brought down to 163V by means of the set-h.t. control.

At last, with the h.t. voltage as it should be, I could concentrate on the remaining fault – no sound and a blank screen, though e.h.t. was present at the tube. Since IC2225 (TBA550) provides the a.g.c. and outputs to the video and sound channels checks were made at its pins. The voltages were haywire – in particular the a.g.c. voltage was far too high and was biasing off both the tuner and the i.f. amplifier. A new TBA550 was fitted and, holding my breath as I switched on, there it was – a fine healthy picture. So far the excellent picture has remained stable and, I very much hope, this is the end of the story! **D.A.**

Ferguson TX9 Chassis (PC1044 Panel)

This set had no sound and no raster and a check on the h.t. line revealed that there was no h.t. voltage. Some checks in the power supply brought us to the TDA4600 chip's supply pin 9 where the voltage was only about 2V instead of 12·5V. We eventually found that one of the diodes in the mains bridge rectifier, D64, was open-

circuit. As a result there was no earth return through the bridge.

On another of these sets the picture was displaced two-three inches to the left. This can be caused by a faulty resistor in the feedback link to the TDA9503 line processor chip, i.e. R212 or R217 (both 220kΩ). In this case R212 was open-circuit. **W.G.L.**

Ferguson TX9 Chassis (PC1001 Panel)

This one really threw us. The original complaint was no picture, but when we tried it on the bench there was no sound either. A lot of time was wasted trying to find a common cause. The facts we established were that the supply lines were present, an e.h.t. rustle could be heard at switch on, and all the signals around the TDA9503 sync/line processor chip were correct. At this point the engineer who'd brought the set in told us that it was used as a computer monitor in a school's science laboratory. This was when the penny dropped that the two faults were not related – the loudspeaker had been disconnected and what we should have been looking for was the reason why the RGB output transistors were cut off. This was not difficult. The bases were all at about 2V while the emitters were at 12V. The emitters are returned to chassis via the beam-quenching transistor VT57 (BC337) whose base is fed from the 115V h.t. line via the 82V zener diode W57 (BZX61C82). The latter was found to be open-circuit. **A.D.**

Ferguson 16A3

This set wouldn't produce text. Checks around the SAA5030 video input processor chip revealed that although the video input and the timing pulses were present and correct there was no output. Replacing the chip cured the fault **A.D.**

ITT Digi 3 Chassis

The modification for intermittent loss of remote control operation – fit a 10kΩ resistor from pin 6 of the infra-red remote control receiver chip to chassis – also works in cases where the set changes channel by itself.

For a dead set check whether D795 is short-circuit.

For incorrect or patchy colours suspect the degaussing posistor R701.

For a shaking picture, as though the line phase is shifting, try a dash of freezer on IC1402 on the IFB286 module. **P.B.**

ITT CVC32 Chassis

Intermittent field foldover at the bottom of the screen can be an awkward fault with these sets. First check the chassis connections by the line oscillator module (though this usually causes height variations). If they are o.k., try pressing the Molex plug on the raster correction panel (by the scan coils). Poor connections in the socket can be responsible – I usually solder the wires directly to the PCB.

I've had a few cases of poor line sync lately due a faulty TBA920 socket – again removal of the socket is best. **P.B.**

Grundig CUC Series Chassis

Recently I had to send the tuner/i.f. can from one of these sets to MCES for repair. It came back with a sheet showing to which models it could be fitted. As I'm used to ITT sets which for years used just two versions, CMR800 for sets with manual tuning and CMR803 for synthesis tuning, it came as a surprise to see how many tuner/i.f. systems Grundig use. The trouble is that some require 12V, some 13·5V, others 15V. Looks like a good trap for the unwary. **P.B.**

ITT Digi 3 Chassis

This set had faulty colour – it looked as though the reference oscillator was just off frequency. Substitution proved that the fault was in the digi board, but changing the video codec and PAL processor chips made no difference. Replacing the clock generator chip IC610 put matters right.

For squegging on vertical lines, replace the video codec chip IC650. **P.B.**

Rediffusion Mk. 5 Chassis

This set would trip after two-three hours. When working normally all the voltages were correct. On checking we found dry-joints around the line output transformer. Resolding all the joints around the transformer put an end to the trouble. **D.H.D.**

Hitachi TU75A

The fault was loss of line hold after two hours' use. Resetting the line hold control would then give a steady picture for a further hour and a half or so. The 2SC458 line oscillator transistor was found to be the cause of the trouble though it checked all right out of circuit. **D.H.D.**

Fidelity CTV14R (ZX2000 Chassis)

One of these sets came into the workshop a few weeks ago with the dead set symptom. The line output transformer had been replaced a few months ago, so we discounted that. Checks revealed that h.t. was present at R828 and R901 but not at the collector of the line output transistor. A careful check along the print then revealed a hairline crack which couldn't be seen with the naked eye. Repairing this restored the set to normal working order. We've since had several cases of print breaks like this. **L.D.**

National TC48G

In a previous case we had to replace the electrolytic C505 to cure line drift – this 1μF capacitor couples the sample pulse from the line output transformer into the flywheel line sync discriminator circuit. We had the problem again recently and decided to try fitting a polyester replacement capacitor. Due to its size this had to be mounted on the reverse of the board. It gave good lock without drifting – presumably an electrolytic was used originally simply because of its physical size. **L.D.**

Decca 30 Series Chassis

Although these sets are getting decidedly old now many of them continue to give good service. One fault we get quite often is a short-circuit h.t. rectifier diode. In nine cases out of ten the customer will tell you that they were using a vacuum cleaner when the set went off! We usually fit a higher power rectifier in this position and increase the value of the parallel transient bypass capacitor C603 from 470pF to 1,000pF – the value found in most sets. **L.D.**

Meter Repair

Bob Walker

Recently an Eagle minimeter, Model HT120, arrived at my workbench for attention. Like so many of the wee jobs that come my way this one turned out to be (a) almost impossible, (b) uneconomic and (c) guaranteed to make one wish it had landed somewhere else. Having said that, I must add that the joy of beating the odds, of playing electronic detective, and of returning to its owner an item he thought was fit only for scrap is something to savour. For any reader who has a similar problem the procedure I followed might well prove instructive and helpful. The mathematics are pretty elementary, so don't be put off.

The neat little meter informed all who might be interested that it had sensitivities of 4,000Ω/V on the d.c. ranges and 2,000Ω/V on the a.c. ranges. The pamphlet and circuit diagram that came with it were found to relate to a different model (KEW7N) but seemed to offer some sort of guidance (misleading as it turned out).

On removing the meter's back the full extent of the catastrophy was revealed. Four print tracks had disintegrated, including part of the printed switch track, and several resistors were burnt or blackened to the extent that their values couldn't be read. Resisting the temptation to abandon the project, I connected the meter's movement in series with a 10kΩ variable resistor set to maximum and my own multimeter on the 0·5A range across a 1·5V cell. With a little adjustment I found that the movement was working and that it reached full scale at 0·223mA. As its mate on the pamphlet was rated at 0·2A and there are two diodes across the movement this seemed to be a reasonable figure to work on. Its resistance was measured using an electronic meter and was found to be 350Ω.

From the damage done it was evident that a hefty voltage had been applied to the unprotected ohms range, which had been hurriedly changed over to the adjacent 1kV a.c. range, blowing part of the switch track, D2 and the return track to the negative terminal. Fig. 1 shows the circuit diagram and identifies the affected tracks and components. The survival of the delicate movement was something to marvel at.

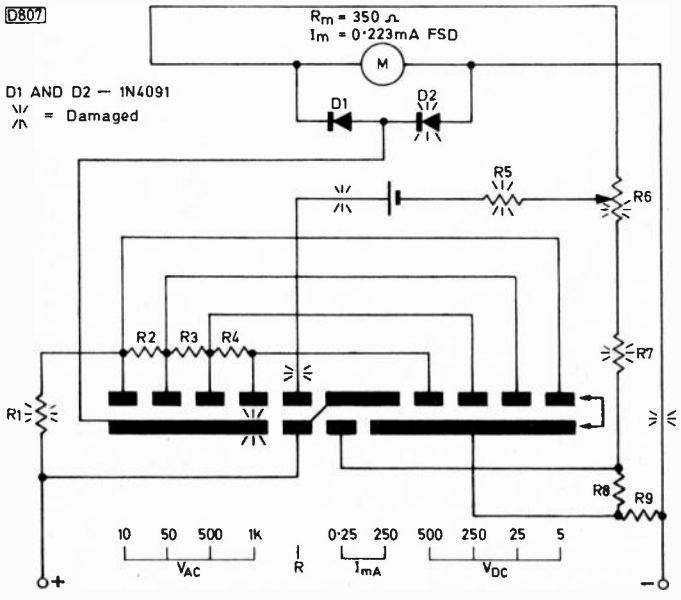


Fig. 1: Eagle minimeter Model HT120 circuit diagram.

Current Ranges

Fig. 2 shows the basic current meter circuit. R8 and R9 were o.k. but R6 and R7 had suffered. The good half of R6's track measured 500Ω, and as such potentiometers are normally linear the control was assumed to be 1kΩ and was replaced accordingly. A value for R7 was obtained as follows.

On the 0·25mA range 0·223mA flows through the meter circuit and 0·027mA is shunted through 12,012Ω (R8 + R9), giving a voltage of $(0{\cdot}027/10^3) \times 12{,}012 = 0{\cdot}324$V. For the same voltage at 0·223mA the resistance of the meter circuit has to be $(0{\cdot}324/0{\cdot}223) \times 10^3 = 1{,}452{\cdot}9\Omega$. R7 would therefore be $1{,}452{\cdot}9 - (1{,}000 + 350) = 102{\cdot}9\Omega$. A 100Ω resistor was fitted.

On the 250mA range the shunt tap is transferred to the junction of R8/9. In this case the meter circuit current is 0·223mA and 249·777mA flows through R9, giving a voltage of 2·997V. For the same voltage the resistance of the meter circuit has to be $(2{\cdot}997/0{\cdot}223) \times 10^3 = 13{,}441\Omega$. Actually it's 12,000 + 100 + 1,000 + 350 = 13,450Ω. Reasonably close! This checked out in practice using the previously mentioned test circuit.

Voltage Ranges

On d.c. the voltage ranges are based on the 0·25mA current circuit giving a sensitivity of 4,000Ω/V. The voltage across the meter circuit is, as calculated above, 0·324V at f.s.d. On the 5V range the series resistor required, R1, has a value $[(5 - 0{\cdot}324)/0{\cdot}25] \times 10^3 = 18{,}704\Omega$. For 25V R1 + R2 = 98,704Ω, so R2 is 80kΩ. For 250V R1 + R2 + R3 = 998,704Ω, R3 being 900kΩ. For 500V R1 + R2 + R3 + R4 = 1,998,704Ω, R4 being 1MΩ.

The resistors in circuit checked out o.k. with the exception of R2 which measured 100kΩ. This was replaced using two resistors of 56kΩ and 22kΩ in series, the tolerances being such that the total resistance was 80kΩ.

The same resistors are used in the a.c. voltage ranges, which checked out quite well in random tests after D2 and the burnt-out segment of the switch had been replaced. For the latter a small copper rivet was used, wired behind the panel to a suitable point.

Ohms Range

The ohms range circuit (see Fig. 3) had taken the brunt of the damage and needed most attention. The printed circuit was first reinstated, using fine tinned insulated copper wire between connection points where the print

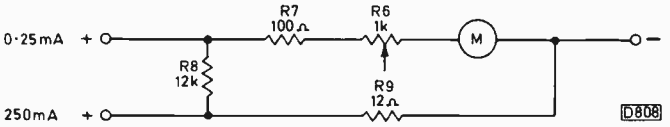


Fig. 2: The basic current meter circuit.

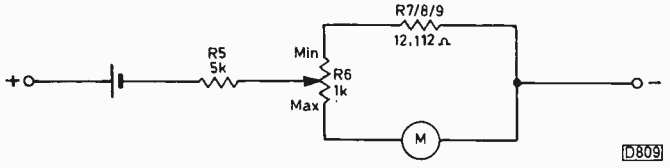


Fig. 3: The ohmmeter circuit.

had disappeared. A value for R5 then had to be found as it had been roasted. The calculations for this may seem to be a bit daunting because of transfer of the shunting effect of R6 from the meter circuit to the parallel circuit at various settings of the zero control, but can be kept quite simple. There are two limits to the range covered by R6. I've marked these minimum and maximum (in terms of the meter reading) in Fig. 3. The total resistance Rt for the meter and shunt together can be obtained as follows:

$$\text{Rt min} = \frac{(R7 + R8 + R9) \times (R6 + Rm)}{R7 + R8 + R9 + R6 + Rm} = \frac{12{,}112 \times 1{,}350}{13{,}462} = 1{,}214{\cdot}6\Omega.$$

$$\text{Rt max} = \frac{(R6 + R7 + R8 + R9) \times Rm}{R6 + R7 + R8 + R9 + Rm} = \frac{13{,}112 \times 350}{13{,}462} = 341\Omega.$$

The voltage Em required for f.s.d. differs in the two cases because at minimum R6 is in series with Rm and at maximum only Rm is involved. In both cases the f.s.d. current Im will of course be 0·223mA. Thus

Em min = IRm = $(0{\cdot}223/10^3) \times 1{,}350 = 0{\cdot}301$V

Em max = $(0{\cdot}223/10^3) \times 350 = 0{\cdot}078$V

At the minimum setting:

Shunt current Is min = $(0{\cdot}301/12{,}112) \times 10^3 = 0{\cdot}028$mA.

Total current It = Im + Is min = 0·223 + 0·028 = 0·251mA.

Total resistance Rt required for f.s.d. = $(1{\cdot}5/0{\cdot}251) \times 10^3$ = 5,976Ω.

Series resistance required Rs min = R − Rt min = 5,976·9 − 1,214·6 = 4,761·4Ω.

At the maximum setting:

Shunt current Is max = $(0{\cdot}078/13{,}112) \times 10^3 = 0{\cdot}006$mA.

Total current It = Im + Is max = 0·223 + 0·006 = 0·229mA.

Total resistance Rt required for f.s.d. = $(1{\cdot}5/0{\cdot}229) \times 10^3$ = 6,550·2Ω.

Series resistance required Rs max = R − Rt max = 6,550·2 − 341 = 6,209·2Ω

These calculations assume a constant 1·5V supply, but in practice of course the cell voltage drops over a period of use and time from a figure of over 1·5V when new to about 1·2V, at which stage readings would tend to vary downwards owing to the increasing internal resistance of the cell which should therefore be replaced.

Taking a round figure of 5kΩ for the series resistance and working backwards we get Rt min = 5,000 + 1,214·6 = 6,214·6Ω.

At the required f.s.d. current of 0·247mA the cell voltage required would be

E = I × Rt min = $(0{\cdot}247/10^3) \times 6{,}214{\cdot}6 = 1{\cdot}53$V.

Rt max = 5,000 + 341 = 5,341Ω.

At the required f.s.d. current of 0·229mA the cell voltage E = $(0{\cdot}229/10^3) \times 5{,}341 = 1{\cdot}22$V.

Thus with Rs = 5,000 R6 will be capable of adjustment for f.s.d. with cell voltages ranging from 1·53 − 1·22V, which will met the above requirements.

In Conclusion

It will be noticed that the above method necessarily differs from that employed in the design of a multimeter. This had to be done in order to restore the meter to its original state as closely as possible. Some components had known values, others were damaged and/or the markings were deleted. Some values had changed.

At the end of the exercise the meter performed as well as could be expected. The task was clearly a totally uneconomic one to undertake on a low-cost meter, but was nevertheless instructive and, to a meter lover like myself, worthwhile.

Servicing VHS Cassettes

Harold Peters

The cost of head drum replacement being what it is you think twice about using a dodgy cassette. As a result there are, lying idle, large numbers of cassettes that with a little care and attention could quite safely be reused.

It must be emphasised at the outset that the writer's experience relates only to VHS tapes. The VHS cassette is unique in having a transport system that relies on a transparent leader at each end of the tape to make it stop. These leaders are attached to the playing tape by patches of sticky foil which use an adhesive that doesn't migrate over the edge of the tape under winding pressure. The leaders are short enough to prevent the join from passing over the head drum in either direction: thus as long as the playing tape in between is unjointed, uncreased, untouched by hand and is not shedding oxide it can be used over and over again. This gives the clue to what follows, namely to discard the faulty part(s) of the tape, going back to the nearest leader joint and then carefully remaking this.

Our suggestions do not apply to V2000 or Beta tapes. The former have silver foil stops deposited on the ends of the playing tape itself, the latter have metallic strips. Before going into details of the repair method – which in truth is rather obvious – here's a list of the faults usually encountered.

Types of Fault

To examine a VHS cassette, release and hold back the protective flap – without touching the tape. A good tape will lie flat, be shiny and be neither creased nor marked.

Lines that run along the tape lengthwise are scratches caused by grit particles or other foreign bodies. If they turn up on more than one tape the cause is in the VCR: if only one tape is affected the cause is within the cassette itself – usually the particles are around the metal tension pillars. A longitudinal scratch produces sparklies across the picture, in one place on the screen.

Lines that run across the tape are winding creases. They are usually found at the beginning and end of the tape and are mostly caused by sudden stopping after rewinding. The screen displays lines of sparklies that run slowly down the screen. Incidentally, after rewinding the tape it's good practice to put the machine into the play mode for a few seconds before pressing the stop button. This not only puts the heads past most of the creases but also prevents the wind-rewind jockey pulley from spending long periods of idleness squeezed between the drive spindle and the take-up spool. The Philips VR6462 and its clones are most susceptible to this.

A chewed tape edge may be either a wavy line or a jagged sawtooth. The cause is the tape riding either too high or too low through the VCR's tape path. Sometimes the problem is due to the threading up process hesitating, as a result of which the tape drops below the guides. The sawtooth effect is produced by the braking teeth inside the cassette. Symptoms: no field sync if the lower edge of the tape is chewed, weak or woolly sound if the upper edge is chewed.

Blotchy tape – uneven deposition of the recording oxide – is a manufacturing defect. The cassette is eligible for replacement if new. The symptom is flashing white blobs in any part of the picture – they stay put in the freeze frame mode.

Oxide shedding is another possible manufacturing defect, but can also be caused by damp or very hot storage. Splinter-like flakes of black oxide appear inside the VCR deck and the affected cassette and the heads need cleaning every time the machine is used.

Jammed tape. Removing a jammed tape involves getting it out while the machine is still in the threaded mode, leaving about nine inches of tape to be wound back into the cassette. It's almost impossible not to touch the tape or crease it, but if you are lucky it may flatten if wound up tight. The symptoms consist of about seven seconds of interference rolling down the screen, possibly followed by a dirty head. The tape may stop due to light getting through where the pinch roller has worn off the oxide.

Turned tape. In the course of threading up, a damp or damaged tape may turn over so that the oxide side is inwards, away from the heads. Symptoms are snow and no sound or maybe a faint buzz from the inverted control signal. On many tapes both sides look alike, so go back to the leader: the sticky patch is always on the "dead" surface of the playing tape.

Cures

Scratched, creased, blotchy, chewed and jammed tapes can all be salvaged by winding on past the damaged area and discarding the damaged tape back to the nearest leader (invariably the start). Details follow.

Tapes that shed oxide must be totally discarded. They are handy in the garden for tying in, training beans and, if tightly stretched horizontally, make an effective bird scarer! This treatment usually confirms that the oxide coating is poor – after a while the tape becomes quite transparent (tape discarded for any other reason remains black). Save empty cases and spools for future repairs.

Repair

Unless the tape ends are lost inside, most repairs can be carried out without unboxing the tape. Use cotton gloves if you have them – body salts deposited on the tape eventually get to the heads. Open the cassette flap and, with something like a pencil rubber, wedge it open. Push a peg up the brake hole to release the brake and pull out all the damaged tape until the transparent leader appears. If the operation gets tight towards the end, press up on the spool with the fingernail. Cut off the damaged tape to within two inches of the leader and carefully pull out six inches of clean tape from the good spool.

Between the transparent leader and the two inches of damaged tape there's a square, sticky patch. You now have to peel the black video tape off this square, leaving the adhesive on the jointing tape. This is the only part of the procedure where skill and finesse are needed, and which defies detailed description. Lay the clean black video tape straight in line over the transparent leader and squeeze the two together at the sticky patch. Trim off the overhang, wind the joint tight, close the flap and test.

Should you fail to recover the sticky patch, don't whatever you do use ordinary Sellotape or parcel tape – its "goo" will eventually find its way on to the heads. Use only special video jointing tape.

Tip to Tail

The second half of an E180 cassette is on average used far less than the first half. You can double the life of a clean tape by turning it round from start to finish. For this you need a winding-on motor – the writer uses an old reel-to-reel audio recorder.

Wind the tape fully forward in the cassette, remove the end label across the join, turn the case over and remove five self-tapping screws. Carefully turn the cassette upright again and lift the top half vertically off the bottom half. You can now lift out both spools.

Spring out the leader retaining wedge on the empty spool, turn the spool over, and refit the leader. Put the empty spool on the anticlockwise (take-up) motor spindle and, holding the full spool upside down in your hand, carefully wind the tape back on to the empty spool. When you come to the other leader, spring out its retaining wedge, turn the spool over, and refit the leader as before.

Refit the spools in the cassette, reassemble and test. The start has now become the finish. I use this as a "last resort" operation: it's usually much quicker to take off the first five minutes of the original start and mark the cassette "short tape".

Test Report: Ondra Remote Control Handset

Eugene Trundle

All modern remote control handsets operate by emitting a pulse-position modulated beam of light in the infra-red region of the spectrum. The code carried by the light pulses depends on the equipment being controlled and the function requested. The subject of this report is a new, programmable remote control handset that can memorise up to 96 different remote commands and will work with a wide range of equipment.

The Ondra PRC6000 has been designed for those households with several different items of equipment that can be remote controlled – the idea is that this one unit can be used to operate them all. It's programmed by placing the Ondra unit and the existing handset head-to-head then pressing the corresponding buttons on each. The pulse pattern given out by the existing unit is picked up by a photodiode in the PRC6000 and fed into a programmable memory. In this way up to 96 commands can be stored and used as required: there are three modes, TV, VCR, and hi-fi, 32 commands being assigned to each. The Ondra unit's keys are marked with a typical range of TV and VCR functions, but since they are nearly all fully programmable each key can be assigned to any function. The handset comes with self-adhesive fascia panels and sticky labels to identify the function assigned to each key.

On Test

Programming the Ondra unit is very simple. A concealed switch on its underside is flipped – a ballpoint pen tip will do – to the "learn" position, after which guidance and information is given by an array of five LEDs on the face of the handset. It takes two stabs of the appropriate buttons to programme each memory position, one to read the data into the memory and a second to compare and confirm identical data. After this a "function learned" LED comes on and glows at each subsequent stab of the programmed key to indicate that valid data is being transmitted. When programming is complete, the concealed switch is returned to the "use" position.

I tried the Ondra handset with every remote controlled receiver in the workshop (except for an oldie that had an ultrasonic remote control system) and in every case had no trouble in using it – the range of equipment tried included sophisticated teletext TV sets, VCRs of all sorts and such audio and satellite TV equipment as I could lay hands on. The 32 programmable keys were adequate for all the equipment used in the trial. Some additional keys are available, such as prog+ and prog– which give sequential stepping through already programmed channel selections.

For the Engineer

Apart from the obvious potential of sales to customers, the device could find uses as a tool for the bench and field technician. Since it can store 96 random commands and repeat them all at will, it may be useful as a "master key" once it has been programmed with the codes used by sets out on rental, maintenance or whatever. Here the card overlays (three come packed with the device) could come in useful for identifying the sets and functions held in memory. Commands are retained in memory throughout the 9–12 months' life of the batteries, and for about an hour when these are being replaced.

The Ondra handset could also be used as a replacement for units that have been lost or damaged beyond repair, especially where replacements are no longer available. Our own Service Bureau recently had a plea of this sort – for a source of supply of a remote control handset for use with a middle-aged Continental teletext set. The problem, of course, is how to programme the Ondra unit in the absence of a suitable original handset to teach it the commands!

Showroom Demonstrations

This handset would also be a useful salesman's aid in the retail shop, enabling him to demonstrate various combinations of equipment – typically a satellite TV receiver hooked up to a TV set, a VCR and a hi-fi arrangement. Ordinarily this could involve the use of up to four separate controllers: a single handset would make for a slicker demonstration – and perhaps an additional small sale!

Availability

The Ondra remote control unit is available from HRS Ltd., Electron House, Great Barr Street, Birmingham B9 4BB at a net trade price of £49·95 plus VAT (those not in the trade should order through a trade outlet).

Room at the Back

J. LeJeune

Sid Bias, Topcut of Millthorpe's Service Manager, sat in his shirtsleeves in the heat of the Indian summer. The warm weather so late in the year discouraged activity in the Service Department and its three occupants felt languid and sleepy.

Norman Gates was soldering together another pair of dial bulbs prior to fitting them into the rear nearside lampholder on the van, wondering whether it would pass its third MOT like that. Gareth poked listlessly with a grub screwdriver in the area of a music centre's cassette mechanism. A 3V31 VCR, minus top cover and screening plate, played a recording of the German Grand Prix for no one in particular.

"Whew" said Sid, startling Gareth from his semi-coma as Norman appeared at the open door, having (he hoped) complied with the vehicle's legal lighting requirements. "Teatime" announced Sid, "do something useful Gareth."

Gareth got up from the bench, stowed the screwdriver in his shirt pocket and vanished into the outside kitchen to make his version of tea.

"Is he still fiddling with that music centre?" asked Norman.

"Perhaps he needs some guidance" replied Sid. "They aren't always the simplest of things to trouble-shoot."

Norman peered into the tape section and began to inspect it more thoroughly. The job-card note merely said that the tape speed was wrong. The 3922 was battered and stained and had clearly led a busy life.

"Where's it from?" asked Sid.

Norman looked at the job-card again. "It says the Goat and Bucket. Looks as though they use it in the bar."

"Wouldn't know" commented Sid. "Don't go there since they got that new landlord."

"New motor" said Norman decisively. "It's one of those with a built-in speed control circuit and something's gone phut in it."

"Gareth's been poking at some board or other in there" said Sid. "Probably didn't realise the speed control gear is built into the motor."

"As like as not" replied Norman. "It's all very confusing nowadays."

The TX10

Tea arrived and was taken slowly. Sid sat at his paper-strewn desk, writing out spares orders. Norman, having explained the music centre motor to Gareth, had gone on to a TX10 he'd collected earlier in the day. It had a vertical striation about half way in from the start of the scan. Gareth was looking on, hoping to learn something.

The fault proved to be an awkward one. Nothing Norman did cleared the striation. He'd checked all the usual things – dressing the video leads away from the chopper circuit and making sure that the focus and e.h.t. leads were properly seated in the sockets in the body of the chopper transformer.

"Have you changed the chopper transistor?" asked Gareth.

"No" replied Norman. "They either work or they don't. No in-betweens like with Sid's bottles!"

"I think Gareth could be right" said Sid. "50p it's the BU208B."

"You're on" replied Norman, delving into his pocket for a coin.

The BU208B and its insulating mica washer were changed. "We always replace the mica as well" Sid told Gareth, "it occasionally saves a call-back."

When the set was switched on the striation had gone. "Explain that" said Norman.

"Can't" replied Sid, "anyway, what about that 3V31?"

The 3V31

The VCR had been brought in by a notably fastidious customer who complained that the still-frame picture always had a noise bar at the very bottom of the screen. Various adjustments had been tried, and the machine's electrical set-up had been declared O.K. Remembering what he'd been told on his VHS course at Gosport, that 90 per cent of all VCR troubles are mechanical, Norman prepared to check the tape transport mechanism.

Here again all seemed to be in order, but Norman noticed that if he put pressure on the loading guide assembly roller, on the feed side of the drum, the noise bar went. Adjusting the roller didn't improve the picture, only applying pressure to it did. Norman went on to establish that any pressure in the area produced the same result.

"This one can go back to Ferguson" Norman finally said. "The desk's distorted and I'm not going to be the one to bend it straight."

Since the amount of movement produced by the pressure on the deck was barely if at all visible Gareth was fascinated by the fault and expressed his amazement.

"The width of the VHS track is only 49 microns" said Norman. "This means that there are just over twenty tracks to the millimetre. Few people seem to appreciate how precise the mechanics have to be for optimum performance."

"You'd rate the mechanics as being the more important then?" said Sid.

"Certainly would" replied Norman. "Get them right and you're well on your way to sorting out most of your problems."

"What about head cleaning?" asked Gareth. "I've an uncle who uses a head cleaning tape every time before he puts a cassette in the machine – and the picture is lousy and getting worse!"

Norman held his head in mock pain. "Don't use those tapes. They don't do a complete job and they do harm when used excessively. Your uncle's machine needs new heads by the sound of it."

"It's a 3V29 and we don't have any heads for that model" said Gareth. "Would a 3V31 head do?"

"It would work" said Norman, "but the 3V31 is designed for still and slow-speed performance while the 3V29 isn't. Use a 3V31 head in a 3V29 and you get a noise effect due to lower luminance sideband crosstalk which the 3V29 doesn't cancel all that well. The 3V31 cancels the crosstalk effectively – so use the right head for the job."

An Audio Recorder

Next on the bench was a small tape recorder. The complaint was of non-erasure of recordings and no record

bias. Gareth looked for the oscillator coil. Ten minutes later he said to Norman "can't find the oscillator coil in this cassette portable."

"It doesn't have a separate one" said Norman. "For smallness and cheapness it uses the erase head as the oscillator coil. I expect you'll find the head open-circuit if you check it with a meter."

Gareth fetched the Avo and checked the head's continuity. It read open-circuit. There weren't any in stock so Sid had to return to his desk to write out yet another spares order.

The 9000

A set with the 9000 chassis had an unusually poor picture with all the symptoms of a failing tube. But a new one had been fitted not long since.

"Do you reckon we fitted a duff tube?" Sid asked Norman.

"Don't think so" replied Norman. "The feel of it's wrong. I'll check the tube's operating voltages."

Just then the phone rang. Sid picked it up. "Service Department, can I help you?' After listening he said "we'll be around later in the day, about 4.30."

"That", announced Sid, "was the Home for Distressed Gentlefolk. They want us round promptly to get their new 3V35 working with their old 26in. TV."

"That old thing" said Norman. "It's almost as old as some of the residents. The flywheel time-constant's as long as your arm."

"Nevertheless" replied Sid, "our beloved leader has flogged them a 3V35 with the assurance that it will work with their receiver, which was presented to them by the Mayor's Comfort Fund. You'd better go and do your best. What did you make of the 9000?"

"Low first anode voltage" said Norman. "R720 should be 330kΩ but reads about 600kΩ."

"Would that give the effect of a dud tube?" asked Gareth.

"You saw for yourself" replied Norman. "Perhaps I'd better explain. Faults are a little easier to diagnose with PIL tubes because accurate convergence depends to some extent on the first anode and focus voltages being a fixed proportion of the e.h.t. If the first anode voltage alters the convergence gets worse and you should be able to see this when you wind down the brightness. This gives you a clue, but a quick check at the tube base will reveal all. Lowering the first anode voltage is like altering a pentode valve's screen grid voltage – the accelerating effect on the electron beam is reduced and the gun assembly's 'gain' is lowered. To get a picture you have to overdrive the tube and possibly the RGB output stages as well. This gives almost the same effect as a low-emission tube except that you don't get the grey-scale shift."

Norman, working as well as talking, had replaced R720 and was about to switch the set on.

"How do you set the first anode voltage then?" asked Gareth.

"You can use a meter or do as I do" Norman answered. "As the manuals usually quote a fairly wide voltage range I start by turning the brightness and contrast to minimum, then advance the first anode potentiometer until you see flyback lines on the screen. You then know that the first anode voltage is too high, so you back off the control until the lines just disappear."

After going through this procedure Norman restored the set's brightness and contrast controls to their normal setting and checked the picture. "That's O.K." he pronounced.

"Some manuals don't give the tube's operating voltages" said Gareth.

"You're right" commented Norman. "Makes life difficult, especially when you're on your knees at the back of a set in someone's house. Whenever we get a set with a new chassis in stock I try to get half an hour alone with it and the service sheet. I measure the voltages I think I ought to know with my own meter and jot them down. It's a wise precaution – and that's why Sid keeps borrowing the manuals from my van."

"Strewth" said Sid. "Hotter than ever. Think I'll go out and see that set-up at the Old Folk's Home."

"Mind they don't keep you in" called Norman.

Letters

ANGULAR AND LINEAR VELOCITY

In writing about CD player motor servos in the November issue J. LeJeune states that the servo system has to maintain "a constant angular velocity". This is obviously a slip, especially as later in the same paragraph he writes that "the angular velocity must decrease to maintain constant track speed".

To clarify the situation, the angular velocity is the angle turned through in a given time. It's usually measured in radians/sec^{-1} and is given the symbol ω. Linear velocity is the distance travelled in unit time and is usually measured in metres/sec^{-1}. For an object following a circular path, e.g. a point on the surface of a compact disc, the two velocities are related as follows: linear velocity = angular velocity × radius (of point from the centre) – provided we measure the angular velocity in radians/sec^{-1}.

For a compact disc the linear velocity (i.e. track reading velocity) is between 1·2 and 1·4 metres/sec^{-1}, giving a rotational speed of approximately 500 r.p.m. at the middle of the disc, dropping to 200 r.p.m. at the outside edge.

The use of radian measure in mathematics is very handy since it leads to simple relationships like the one above. The fact that $360° = 2\pi$ radians makes calculations involving circles much simpler by removing the 2π terms. This is useful in other related topics such as the impedance of capacitors and inductors and a.c. theory generally.

Peter Richards,
Criccieth, Gwynedd.

GRUNDIG'S NEW POLICY

How many readers are aware of Grundig's latest stunt? Would you believe it, you can no longer get technical help by telephone unless you are a Grundig dealer. Their action has been explained as follows:

(1) They are fed up with people who haven't even removed the back ringing up.

(2) Why should technical information be supplied to non-account holders when the company spends hundreds of thousands of pounds training dealers.

(3) The public should take their TV sets to a Grundig dealer because only appointed dealers have the necessary training.

(4) If people take equipment to a non-Grundig dealer

they must expect the repair to take longer.

Whilst I have every sympathy with the first point, the second one presupposes that there's a Grundig dealer in every town. Even if there is, many of them will repair only goods they have themselves sold. The local dealer may even be too busy etc. What does the poor customer do then? Grundig say take the set back to the dealer from whom it was purchased. What if they have gone out of business? What if the customer has moved from one part of the country to another?

I consider Grundig's view provocative and have ceased to take in their sets as a result. I had one customer plead with me to repair his TV set because not one repairer in a twenty mile radius would touch it – and that included a Grundig dealer. Maybe others have views on this subject.

Martin K. Blake,
Audio and Visual Services, Mold, Clwyd.

GETTING A GRIP ON IT

Here's a very simple idea I'd like to pass on to fellow engineers – it could well save much expense and embarrassment. I'm sure we've all at some time encountered the highly-polished set with rounded corners, such as the Panasonic TC2061 and some of the Philips KT3/4 range. The shape of the cabinet corners makes it difficult to grip the set at the best of times, and a regular application of furniture polish may make it impossible.

A visit to a supermarket or hardware shop can produce the solution however, in the form of a plastic sheet (usually circular) the size of a saucer. These are sold to make it easy to remove tight jam jar lids etc. but are also ideally suited to improving one's grip on the slippery customers mentioned above – and they cost only a few pence.

Lee Marchant,
Slough, Berks.

TROUBLE-SHOOTING GRUNDIGS

So Les has got a freebie Grundig with a fault (November). When they give intermittent trouble they are best given back! For most faults however they are easy to fault-find – honest, and I'll tell you why a bit later. He hopes to tell us when the set is o.k., and with his assault on the set with his soldering iron he may well have found the fault and cured it without knowing why, a common situation with many sets that suffer from dry-joints.

But what about the subsidiary fault he's not spotted? The clue to this lies with the 12Ω, 17W surge limiter resistors R604/5 (see Fig. 1). As a rule failure of one or both of these is caused by a short-circuit mains rectifier and very little else.

Now we know that Les's set has a line timebase fault because of his clever idea with the extra fuse, but really he should have been listening to the set going "bonk, bonk . . . bonk" for about 30 seconds until fusible resistor R608 springs open. The 29301.038.01 mains protection module contains a thyristor which under normal conditions is gated on. An overload in the line output stage, i.e. across the +A 280V line, will however increase the voltage developed across R608/611. This voltage change, via R619, will cause the 10V zener diode Di619 to conduct. Hence the thyristor will switch off, removing the 280V supply. The on gating then switches the thyristor back on again, the continuing overload switches it off again, and the sequence continues until R608 springs open.

There are problems with this however. The BSTC0233K thyristor Ty615 tends to become leaky. It then stays on instead of going off when instructed. Grundig have recently started to supply a PT5006 as a replacement and this seems to be up to the job. Unfortunately while R619 is trying to switch off the leaky, unwilling thyristor it takes a bit of a hammering. It will often be found overheated and open-circuit. Being a safety component it must be replaced with the correct item, part no. 8700.361.007. So, Les, check Ty615 and R619 and you'll probably find the subsidiary fault.

Whenever you have a set that uses this mains protection module, check it out by connecting a 10kΩ ½W resistor from the junction of R619/Di619 to chassis. You should be rewarded with a healthy "ping-ping-ping", indicating that the module works. Always repeat the test after the set has been running for about half an hour. If the thyristor becomes leaky at working temperature the set will fail to go "ping-ping-ping" when the module is tested, indicating the absolute necessity to repair or replace it.

Now about that easy fault-finding I promised. When working on the 2210 – and many other Grundig sets from the 1975-80 period – it's worth realising that a diagnostic socket is present to help with instant fault location. If you don't have a diagnostic unit (part no. 29301.039.01), the label over the diagnostic centre plug carries full information on what should be found. Go through the test points, in numerical sequence, using your multimeter and scope. Then refer to the helpful information on the circuit diagram. Incidentally, we still have a few of the diagnostic units available.

There was also a very helpful and comprehensive fault-finding article on Models 5010/5011/6010/6011 by Andy Denham in *Television*, November 1976. These four sets differ from the 2210 in having a thermal trip in the power supply instead of the thyristor module described above, and the e.h.t. control is on a small subpanel. The fault-finding principles laid down in that article apply to all the sets with the two-thyristor line output stage however.

Back to Les's 2210. I've never had the BYY56 diode Di528 go leaky, but quite often a faulty tripler will result in it going short-circuit. Whenever you replace a tripler in

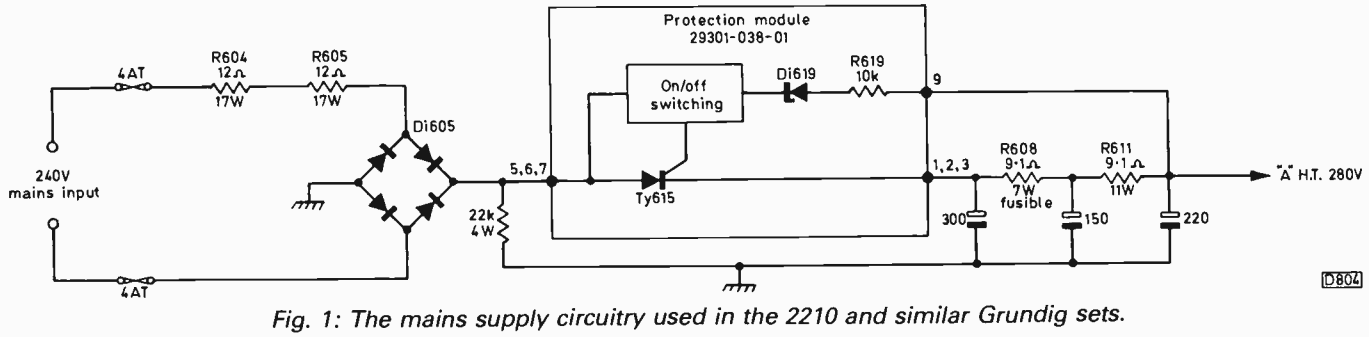


Fig. 1: The mains supply circuitry used in the 2210 and similar Grundig sets.

a thyristor line timebase Grundig set check that its "diode" connection goes to chassis (usually via a fuse) and that the "capacitor" connection goes to the BYY56 diode. Most of the triplers are marked with a chassis style symbol for the capacitor connection, so many engineers connect them up the wrong way. As a result there's no beam limiting action. So if that tripler has been changed by someone else in the past, check it carefully for correct connections.

Also with faulty triplers always check R383 (3·9kΩ), Di528 (BYY56), R628 (usually 680Ω but depends on make of tripler), the 50mA fuse Si528 (if included) and R546 (220kΩ safety resistor, part no. 8700.362.129).

Now who wants to help me? I have a 2252 (identical chassis to the 2210) with intermittent line tearing. It runs for hours then plays the goat. I think I've changed everything except the cabinet back but it still leers at me with a wicked, crinkled grin, and always when I'm doing something else. Fortunately the customer bought another set from us, so whether or not I also end up with a freebie Grundig remains to be seen. I think I would rather not, this time.

Les Austin, Ochre Mill Technical Services Ltd.,
Mill Cottage, Lower Moddershall,
Stone, Staffs ST15 8TF.

FILING AID

Have you ever felt that you could do with a filing cabinet? Some system of filing away circuits, pamphlets and other useful information which may be needed in a hurry at some future date? Well, for two or three pounds you can have one. Just nip out and buy a "Flip Photo" album and some postcards and you're set up.

You draw your circuits on a postcard, or any other information for that matter, then insert the card in the album. Hey presto, it's all done! With the title of the information at the bottom of the card, a quick scan down the sides of the album tells you what you've filed away. I usually put the component values on the circuit and the power and voltage ratings on the other side of the card. The cards can be kept clean in their transparent celloplastic sleeves and can be easily removed.

When I need to make frequent use of a particular card I varnish it to prevent finger marks getting all over it. Needless to say there are plenty of other uses for these albums, which hold up to eighty postcards.

Albert L. Hitchens,
Stockport, Cheshire.

VIEW FROM A BATTERED MARINA

Unless Harold Berkley repairs mainly old sets I can't believe that he does most of his repairs in customers' homes. My experience of making field calls nowadays is that most faults are of a very intermittent nature – so much so that those of us who work mainly at the bench seldom find it possible to carry out a quick repair. Gone are the days of easy faults such as open-circuit dropper sections, or budgie swings as they were known.

Today we tend to be faced with complex chopper power supplies which won't function unless the line output stage is working – and the latter won't work without the chopper doing its bit. If the line output stage is overloaded the power supply shuts down, and simple totally dead set faults seldom seem to arise. Could Harold Berkley deal with this sort of thing in the allocated time for a home call, with the bloody dog biting him and the baby screaming and the customer trying to pin him down to an estimate that won't deviate by more than a pound or two?!

Harold Berkley says he doesn't come across many 26in. CTVs nowadays. No, 27in. is more common. Has he tried to lift a 27in. Sony on his own? This brings me to my final point.

I'm stuck with a Y registered Marina van which has been repainted British Telecom yellow – the same colour as the local council and British Rail. The engine consumes more oil in a week than I manage beer. The gearbox jumps out of first and reverse gear. You have to hold the gear stick in place whilst reversing – the noise from the box in this mode is indescribable. The front wheel bearings rumble away, which helps to drown the noise from the gearbox. The heater fan doesn't work and the driver's side window fell down twelve months ago. It's held up by a piece of two by one timber that vibrates off the glass if I try to do more than 45 m.p.h. Very unnerving and dangerous if one is travelling on the motorway in the rain or snow. I try to park it out of the way when attending training courses, out of embarrassment. So if you pass a yellow van with a grey-haired driver looking harassed, please leave me alone to suffer in silence as I ponder the good old days.

Name and address supplied.

REDIFFUSION TIP

With the take-over of Rediffusion by Granada, a lot of Rediffusion sets are becoming available at discount warehouses etc. As an ex-Reddy engineer, I thought other readers might like to have a tip about one of the monochrome chassis – the Mk. 12 (also Mk. 13) aerial and cable sets which use the same timebase panel.

When looking for a fault in the field timebase, always check the driver transistor TR207 out of circuit. To see what I mean, take the transistor out and check the resistance across the now vacant connections as if checking a transistor. Odd though it may seem, the readings you'll obtain indicate that the transistor is still in circuit!

If you still have field collapse and can find no fault on the timebase panel check the RPX220 rectifier diode D301 on the line output panel, then if necessary the winding and resistor associated with it.

M. Wright,
Spennymore, Co. Durham.

DIY CAN HELP

How your magazine has changed! It seems to be read by the trade more than the DIY enthusiast nowadays. I'm sure that Mr. Camm would have been helping us all to do our own repairs with our spares boxes. But to the point. Why do traders castigate those who enjoy trying to get auntie's TV set to go? Such people will never get more than say one set in thirty to work, leaving plenty of sets for the dealers.

TV sets now last longer than ever, and many dealers employ boys with just enough knowledge to know which circuit board to change. I'm friendly with one who told me that when they have about twenty the boards are packed up and sent to a firm which specialises in repairing them. You don't need City and Guilds to be able to change boards!

One last point. Will a dealer come out at say 10.30 p.m.? The DIY enthusiast may well be tempted to have a go when things go wrong at an inconvenient hour.

Ex-valve set dabbler.

VCR Clinic

Reports from Steve Beeching, T.Eng., R.S. Narwan, Eugene Trundle, Philip Blundell, Eng. Tech., Les Grogan and Steven Leatherbarrow

Saisho VR1000

This machine produced a black-and-white picture in playback and wouldn't record. The playback whites were clipped and the syncs crushed – this explained the absence of colour, as the sync separator couldn't cope with the distorted signal. The record signal disappeared half way through an i.c., and the white clip test point TP4001 had no signal on it. Also the PB 9V line had just over half a volt on it in the record mode, suggesting a switching problem.

Three i.c.s were ordered from Mastercare, an LA7031 f.m. demodulator, LA7034 f.m. record processor and an OEC2003 power rail switcher. Fitting the LA7031 restored normal playback levels and colour, but there was still no signal at TP4001 despite healthy signals at pins 19 and 20 of the LA7034. After much mucking about we discovered what had happened. The white clip level control VR4008 had been turned right down and the dark clip level control VR4006 had been turned right up – full white clip and full dark clip leaves you with a straight line! Some further time was then spent setting the record a.g.c., carrier level and deviation (using a method described in my book!). A lot more time was spent arguing with the customer that £91 for some six hours work plus parts was justified, and that his complaint should be with the friend of a friend who had twiddled it in the first place . . . **S.B.**

JVC HRC3

The trouble here was spasmodic deck shut-down, with an alarm indication given by the stop light flashing. After a while we discovered that this was due to the drum motor running erratically – the drum would slow down dramatically just before shut-down.

Diagnosis was hampered by the intermittent nature of the fault, but we finally managed to tie the problem down to the drum motor power supply section of the switching regulator module, in which the drum speed control was becoming throttled in some way: when the motor slowed down massive correction was applied by the servo module to pin 9, but to no avail. Replacement of this expensive and oddly-shaped bunch of electronics cured the problem, as a long soak test proved. **E.T.**

Hitachi VT150

Our warehouseman Reg staggered into the workshop with this one. It had had to be replaced a few days after delivery. The customer said that when it got warm it squawked and the picture twitched laterally. After several hours running, sure enough it did just that. The squawk was in fact more of a "shush-shush" noise. It was coming from the head drum.

On switching the machine off and then rotating the drum by hand we could feel friction at one point in the turning circle, suggesting that there was a bearing or rotor clearance problem in the direct-drive motor. Accordingly a new lower drum assembly (incorporating the motor) was ordered under guarantee. We were apprehensive about fitting it, anticipating a long setting-up session – after all this is a dual-speed machine. In the event virtually no adjustment to the tape path or the electronics was required, though everything was checked. This is a tribute to the tolerances to which modern VCRs are built. **E.T.**

Hitachi VT8000

The businesslike zizz as the drum motor runs up to speed in this family of machines is characteristic and unmistakable. How we would have liked to hear it from this one! It wouldn't turn on in response to its operate switch, though had we known this it did work in the timer mode. This is starting to sound like one of those test cases! Anyway, the trouble was traced to a leaky 5·1V zener diode (ZD905) in the switch-on network between the key and pin 41 of the microcomputer chip IC901. **E.T.**

Akai VS5

This machine worked properly most of the time. Occasionally however it would thread the tape then go beep-beep-beep like a VCR possessed when asked to play or record. This would be followed by unthreading, with the breakdown caption lighting up. To escape from this impasse the owner had to switch off and on again, then once more key in play or record. The automatic shut-down was due to the loading switch not being triggered – tape threading wasn't always fully completed. The cause was the loading belt slipping. Fitting a new one cured the problem. **E.T.**

Sanyo VTC5300

We've had two of these machines in for service recently, both with the same fault – a shift in the u.h.f. tuning position and a messy picture of lines and bars when each station is retuned at a higher point on the scale. The giveaway was a high level of mains hum on the E-E sound. In both cases we found that there was more than 1V peak-to-peak of sawtooth mains ripple on the 33V tuning supply line from the power supply section of the machine. Reservoir capacitor C5002 (47μF, 100V) was in both cases responsible, having gone low in value.

After five years or so the video heads in these and contemporary Sanyo machines are finally beginning to wear out. They seem to have been the hardest wearing of all the types fitted to Betamax machines, having long outlived those used in Sony and Toshiba machines. Unusually, replacing the Sanyo heads involves dismantling the rotary transformer, though this operation is not difficult. **E.T.**

General VGX520B

This is quite a new model, and was a complete stranger to us. Its problem lay in the tuning department, which would not self-seek no matter how much the tuning-up button was pressed. The culprit was the tuner/clock/display microcomputer chip, type μPC7519, which lives near the fluorescent display panel. It's a surface-mounted chip which can be removed only by cutting off all its legs (use a very sharp scalpel to do this) and clearing up all the stumps afterwards.

When the chip had been replaced we found that we

could only seek as far as the top end of Band I, as indicated in the display panel on the "VL" bar-graph. To progress to Bands III (VH) and IV/V (U) we had to fit a switch across the vacant key connections marked "band" at the bottom of the keyswitch PCB. Once all available programme settings have been assigned to u.h.f. in this way the switch can, if required, be removed since the new chip is now programmed. **E.T.**

Hitachi VTTU65E

This tuner/timer partners the VT6500 VCR. One that came in for repair suffered from intermittent loss of the vision and sound signals. All the question marks vanished when we removed the top cover. The i.f. module is the same as that used in the 8000 series of "table" models, with its well known trouble of an internal dry-joint at the junction of the copper printed earth land and the tabs on the screening wall. Mystery solved! **E.T.**

Hitachi VT9500

This machine had intermittent sound on E-E and playback. On removing the covers I homed in on the relays, but this time they were blameless. The fault was due to a dry-joint on C429. **P.B.**

Akai VS9700

The pinch roller solenoid didn't always pull in when record was selected, though it always did when playback was selected. Tests on the mechacon board showed that the Rec/Play 12V voltage wasn't always present. It turned out that the record switch was dirty. **P.B.**

Sharp VC9700

This machine was intermittently dead with no clock display. Tests around the STK772B chopper regulator chip I9001 in the fault condition showed that there was 31V at pin 7 but no 13V output at pin 6. Pins 3 and 4 feed the internal pulse-width modulator and the voltages here were both negative – clearly wrong!

These pins are also associated with the over-current protection circuit (Q9001). As it was difficult to determine whether the chip was responsible or Q9001 was telling it to shut down we disconnected pins 3 and 4 – this seemed to be the best way of tackling things. The negative voltages remained and fitting a replacement chip put the machine back on the road. It was the second machine of this type in as many weeks that needed replacement of the STK772B chip. **S.L.**

JVC HRD725/Ferguson 3V43

No E-E sound and no playback sound either were the complaints here. A look at the circuit revealed an awful lot of things that could have gone wrong! A great deal of the circuitry in this machine is for audio processing.

The protection fuse CP3 was found to be open-circuit but replacing it produced no improvement. Many checks were made before we found (stumbled across?) the fact that there was no 9V supply at pin 8 of the switching chip IC5. There was voltage at pin 8 of IC17 however, which the circuit showed as being the same section of print (linked by a 220Ω resistor). As a quick check these points were cautiously linked across. This produced low, distorted sound and only 3V at pin 8 of IC5. Mmm! A regulator transistor, Q16, is associated with CP3. When this was checked it was found to be short-circuit base to collector. Replacing it restored normal voltages and sound and my link could also be removed. **S.L.**

Panasonic NVG7

This machine would accept a cassette then immediately eject it. Unless the end sensors are covered, immediate ejection of the carriage is normal with a Panasonic front loader when it's fooled into loading the carriage without a cassette in place. With this information in mind we suspected perhaps a leaky end sensor, and as another of these machines was available we swapped over the loading carriages. The fault persisted however. We next compared the voltages at pins 20 and 21 of the system control chip with those in the working machine – these are the end sensor inputs. The readings in the faulty machine were 5·5V against 3·2V in the other machine.

The supply voltages for the end sensor phototransistors, which are connected to pins 20 and 21, are obtained from a potential divider network (R6009/10/11/12) across the 6V rail. A check revealed that there was no voltage drop across R6009 (1kΩ) at the top of the network and an ohms check showed that there was a dead short across it. The resistor itself was blameless, as the short persisted when one leg was unsoldered. On closer inspection we noticed that R6009's other leg was very close to an adjacent print track. In fact the leg was touching the track, as a result of which R6009 was shorting itself out. When the resistor's leg was prised up the short disappeared and the machine accepted cassettes readily. **L.G.**

JVC HRD120/Ferguson 3V35

It was difficult to pinpoint whether the fault was in the r.f. amplifier or the converter – it was very intermittent. We decided to remove the aerial booster unit, solder all suspect joints and refit it, but the fault was still present. Taking the same course of action with the converter unit put matters right. Prior to doing this we'd checked the supply rails and found them to be correct.

When we'd done all this we found that playback was faulty, the symptoms looking like the effect of misadjusted tape guides. The cause turned out to be different however: the back-tension brake band was broken at one end. Replacement plus back tension resetting was required. **R.S.N.**

Ferguson 3V55

The job card read "dead – no functions – tape jammed". We extracted the customer's tape by rotating the tape loading motor manually. After switching on there were still no functions. A check on the power supply section revealed that there was no voltage at pin 3 of plug CN1, nor at pin 2 of CN3. The cause of the missing supply was the fact that CP1 (F10) was open-circuit. Replacing this restored normal operation. **R.S.N.**

Akai VS112

The symptoms with this machine were no channel changing and blank video in the E-E mode. We found that there were dry-joints inside the aerial booster unit. Removing this unit and carrying out careful resoldering cured the problems. **R.S.N.**

Long-distance Television

Roger Bunney

At the time of writing, on November 6th, tropospheric conditions are wide open, with really high-level signals from central Europe in Band III and at u.h.f. Much local UK TV is suffering from line pairing or complete obliteration of programmes due to the overseas interference. Denmark, East Germany, West Germany, France and the Low Countries have been received today at excellent levels, RTL+ (Luxembourg) being an extra bonus. The cause of the enhanced conditions is a slow-moving high-pressure system over the UK and northern France. It has produced the characteristic fog in addition to the excellent reception conditions and looks likely to continue for a fourth day. More on this opening will have to wait till next month.

Ionospheric DX-TV propagation (Sporadic E and transequatorial skip) has been remarkably active during the past month, considering the time of year. The log is as follows:

5/10/87 Suspected African/Middle East ch. E3 reception – see later.
11/10/87 RAI (Italy) chs. IA, B; TVE (Spain) chs. E2, 3.
12/10/87 TSS (USSR) R2; RAI IA, B; TVE E3.
13/10/87 TVE E2, 3; RTP (Portugal) E2; NRK (Norway) E2; an Aurora noted in Scotland during the evening, with Band I signals.
18/10/87 TVE E2, 3, 4; RTP E3; RAI IA; MTV (Hungary) R1; JRT (Yugoslavia) E3; TSS R1.
19/10/87 TVE E2, 3; RTP E3.
20/10/87 RAI IA; TSS R2; SR (Sweden) E2, 3, 4.
21/10/87 TSS R1, 2; SR E2, 3, 4; TVP (Poland) R1, 2; CST (Czechoslovakia) R1, 2; DR (Denmark) E3, 4; ORF (Austria) E2a; NRK E2, 3, 4.
22/10/87 JRT E3; RAI IA; TVE E4; +PTT (Switzerland) E2; TSS R2.
23/10/87 RAI IA.
24/10/87 RTP E3; TVE E3.
25/10/87 JRT E3; TVE E3; RAI IA, B.
26/10/87 TVE E2; RTP E2, 3; RAI IA, B.
27/10/87 NRK E2, 3, 4; RAI IA, B; TVE E3; Band I auroral reception in Scotland during the evening.
28/10/87 RAI IA.
29/10/87 NRK E2, 3.
30/10/87 TVE E2, 3; SR E2.
31/10/87 TVE E3.
1 /11/87 TVE E3; NRK E2.

My thanks to the following for sending in their reception reports to supplement my own meagre valley-bottom results here at Romsey: Gareth Foster (Middx), Ryn Muntjewerff (Holland), David Oliver (Birmingham), Tim Anderson (St. Leonards), Simon Hamer (Powys), Iain Menzies (Aberdeen), Bill Cotterill (Tipton), Roger Fussell (Torpoint) and Nick Baldwin (Northants).

The entry above for 5/10/87 relates to Ryn Muntjewerff's reception of ch. E3 signals from a south east/easterly direction between 1730-1750, with predominantly vertical polarisation. The picture consisted of an announcer followed by four people in a discussion group. Picture quality was smeary, a characteristic of TE/F2 propagation. Did anyone else see this signal?

A letter from Hugh Cocks in Portugal mentions his extensive Band I TE reception during October. Reception of ch. E2/3 signals – and occasionally ch. E4 – usually started at around 1630 GMT and ended by 2000. Signals frequently received included GBC (Ghana) chs. E2, 3 and NTA (Nigeria) ch. E3. The 22nd produced vision buzz on ch. A2 for several minutes from 2300. During August he received SpE signals from N. America, with WSB (Atlanta) on the 17th and WUND (Carolina) later in the month.

F2/TE propagation has been reported in the 50MHz amateur radio band. Botswana was received in the southern UK at 1720 on the 8th of October (thought to be TE plus a last SpE hop into the UK). On the 17th contact was made at 1040 between Namibia and a Mediterranean station. The Botswana station was in contact with several UK amateurs during the afternoon of the 22nd, from 1535-1722 GMT. Interesting that the Botswana amateur (A22Z2) comes from Ventnor, Isle of Wight.

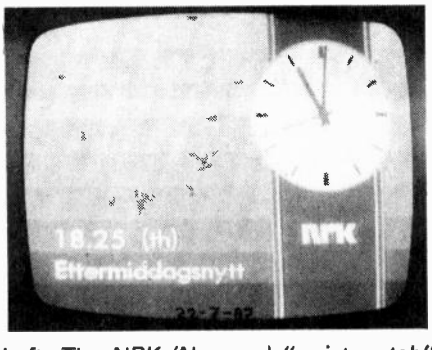
Several DXers along the south coast lost their complete aerial systems during the hurricane on the 16th. My own system remained intact though the plastic decoy falcon (see July column) lost its wings which were wrenched off, never to be seen again.

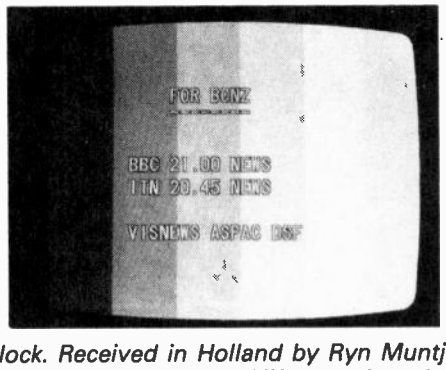
An eventful month!

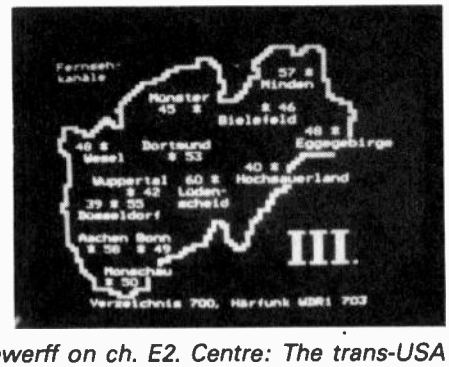
Interference

Much 49MHz equipment has recently come on to the UK market for use in the newly allocated low-power device band. Many kids walkie-talkie pairs are being marketed at under £10 a pair. Iain Menzies has even seen remote radio control joysticks.

One evening I noted locked VDU raster information (graphs and other historgrams) at a nominal 64·9MHz.







Left: The NRK (Norway) "wrist-watch" clock. Received in Holland by Ryn Muntjewerff on ch. E2. Centre: The trans-USA news feed via transponder 2 of the Westar 5 satellite, from the UK through to the New Zealand Broadcasting Corporation, received by Frank Lumen in Colorado. Right: The West German WDR videotext service provides a transmitter location map.

This was tracked down to an Amstrad computer some 70 yards away (a rival to the Spectrum for DX radiation?!). The radiation came from a data transmission development company which is producing equipment to provide distribution in office buildings without any need for connecting wires. Signals at 173 or 456MHz are sent either via radio or through the mains wiring.

Another domestic radiator on sale is known as a "video sender". It comes from Taiwan. The sender modulates baseband audio/video on to a ch. E21 carrier for low-level radiation or cable distribution. The equipment is currently on offer through Supercomm Digicall of Purley (01 660 9116).

EBU List

Subscriptions are now due for the 1988 "List of VHF/UHF Television Stations" in the European broadcasting area. This excellent, comprehensive listing is recommended to all TV-DXers. The cost is 1,000 Belgian francs from the European Broadcasting Union, 32 Avenue Albert Lancaster, B-1180, Bruxelles, Belgium. Bank charges for International money drafts seem to be very high nowadays: you might like to consider taking a chance at buying the currency from a large bank in note form and sending that.

News Items

UK: The BBC has announced a nightly, one-hour scrambled programme which will be transmitted over the BBC-2 network after normal programme close-down. The service is intended for doctors/GPs who would record it using special VCRs. Successful scrambling tests have already been carried out. The service is being developed by British Direct Television Ltd. and will be available on a subscription basis.

The DTI has announced that 173MHz is to be used for transportable and mobile radio alarms.

The DTI and the UK broadcasting authorities are to carry out a technical study into the possibility of starting a fifth TV service using chs. 35-38 inclusive, to reach some 55 per cent of the population. The proposal is subject to the present airport radar moving to other frequencies by 1994, and liaison with Jodrell Bank which uses certain frequencies in this band. A further possibility would be to re-engineer part of the former v.h.f. TV bands now being used for PMR etc. Use of MMDS is also under consideration.

Further information has been received about the projected ch. E28 Sealand-TV service from the Sealand Fort off Harwich. It's intended that the service, covering the London region, will start during December, using a 6-7MW e.r.p. transmitter – one of the highest powers for TV transmission in the world! A sea platform is being fitted out in a West German yard: when complete it will be towed to a position adjacent to the Sealand Fort, where a link will be established. An 800ft high transmission tower is to be used and costs are projected at around £5m. The DTI is treating the matter seriously and threatens to board the Fort complex should it come into use. The project is both ambitious and highly speculative in relation to its likely technical success considering the chosen environment. Developments are awaited with interest! In the early 60s TV Nordzee broadcast on ch. E12 for about three weeks from a man-made platform off the Dutch coast before being boarded and closed down by the Dutch Navy.

David Moller tells us that Radofin Electronics (UK) Ltd., Eastgate House, 28/34 Church Street, Dunstable, Beds LU5 4RU (0582 607 066) is marketing a decoder which enables teletext subtitles to be recorded on tape via a VCR – system I/PAL.

We understand that the London TV pirate Network 21 of Brixton, which has in the past operated on Friday nights from approximately 2400 on ch. E21, intends to be on air again "near Xmas".

France: Canal Plus is proving to be a success and is receiving some 3,000 applications a day for its subscription service. The total number of subscribers passed the two million mark in early October.

Sweden: The latest identification on the Swedish PM5534 test pattern is KANAL 1 at the top and SVERIGE at the bottom. There are plans to extend the YLE (Finnish) network to cover all the main areas of Sweden within two years. Stockholm is already on air (ch. E39). Other transmitters will open at Uppsala, Gavle, Borlange, Vasteras, Orebro, Norrkoping, Skovde, Goteborg and Boraas.

USSR: The UEIT test pattern that carries the identification TM 1987 is used by Moldavian TV.

Iran: The BDXC reports that there are five transmitters operating in Band I: Shiraz (20kW) and Boushehr on ch. E3; Hamedan (108kW), Ilam and Shah Nakhjer on ch. E4. Most powers are not known.

Rumania: The following stations may provide opportunities for SpE reception: Bucharesti 100kW ch. R2;

Bistrita 2kW, Oreadea 120kW and Semenic 15kW ch. R3; Suceava 100kW ch. R4; Birlad 50kW and Tirgu Mares 50kW ch. R5. These all transmit TVR-1. The TVR-2 service is at present suspended, the Bucharesti 75kW transmitter radiating TVR-1.

Holland: Details of the NOS-3 chain have now been received. The main stations will be: Arnhem ch. E43, Goes ch. E35, Lopik ch. E30*, Markelo ch. E51*, Roermond ch. E34*, Smilde ch. E44* and Wieringermeer ch. E42. Stations asterisked are now testing. There will be relays at Eijs ch. E48, Hulsberg ch. E43, Losser ch. E34, Maarstricht ch. E59, Noorbeek ch. E52; Piertersberg ch. E23, Slenaken ch. E32 and Wijk aan Zee ch. E21. No e.r.p.s have been announced.

Switzerland: The three national Swiss services SRG, SSR and TSI are at present transmitted from over 150 legal private TV transmitter sites. Some of these stations also transmit the Italian, German, Austrian and/or French TV services. Some could possibly be received here during good tropospheric conditions. Watch out for:

E.R.P.	*Station*	*ARD-1*	*ZDF*	*ORF-1*
1kW	Sedrun	E22	E25	E33
1kW	Ausserberg	E33	E35	E48
10kW	Gebidem	E58	E62	E65
3·2kW	Celerina	E57	E60	E62
3kW	Lopper	E53	E56	E59

Celerina also transmits RAI-1 on ch. E68. Note that Bantiger-1 transmits TSI (Italian service) on ch. E50 at 235kW in parallel with ch. E40.

West Germany: Private TV networks are to come into operation during 1988. The transmitter network for the Schleswig-Holstein region will be as follows:

Network-1: Kiel ch. E24 400W; Flensburg ch. E24 100W; Lubik/Berkenthin ch. E36 34kW (beamed to the S.W.): Eckenforde ch. E37; Schleswig ch. E42; Itzehoe/Hennstedt ch. E49 100kW; Lubek city ch. E57 3kW.

Network-2: Flensberg ch. E28 200W; Lubek/Berkenthin ch. E42 34kW (S.W.); Schleswig ch. E52; Kiel ch. E53 400W; Itzehoe/Hennstedt ch. E59 100kW; Lubek city ch. E60 3kW; Eckenforde ch. E60.

Some transmitter powers have not been announced.

Kiel, Flensburg and Lubek are due to start test transmissions early in the year. Regular programming will be from Sat-1 and RTL+ satellite downlinks from early summer. Hennstedt is likely to be on air next winter. One of the two Hamburg outlets is at present on test at 1·7kW to be increased to 15kW – ch. E46. The test pattern is the DBP (Deutches Bundespost) type with the identification HMB K46. The sound carries tone and transmission announcements.

Antiference Aerials

We've recently received details of the current range of Antiference v.h.f. aerials. The MH602 is a combined Band I/III system consisting of a two-element ch. B array horizontally mounted with a gain of 3dB and f/b ratio of 19dB and a six-element ch. H array vertically mounted with a gain of 7.6dB and f/b ratio of 8·6dB. It's intended for use with the Maghera transmitter. The HC2011 is a wideband array covering chs. E5-12 with a gain of 10dB and f/b ratio of 28dB. It has double driven dipoles, twin reflectors and nine directors. The LP7 with seven elements is a log-periodic design covering chs. E5-12 with a gain of 7·5dB and a f/b ratio of 29dB; there is also a four-element version covering the same channel group with a gain of 4dB and f/b ratio of 15dB. For further details contact Antiference Ltd., Bicester Road, Aylesbury, Bucks HP19 3BJ.

1988 Meteor Shower Dates

Our thanks to George Spalding, director of the Meteor Section of the British Astronomical Association, for providing the following list of 1988 Meteor Shower dates:
Quadrantids January 1-6th peaking at 0900 on the 4th.
Lyrids April 19-25th peaking on the 21-22nd.
May Aquarids April 24th-May 20th peaking on May 5-6th.
Delta Aquarids July 15th-August 20th peaking on July 28-29th.
Perseids July 23rd-August 20th peaking between 0000-1200 on August 12th.
Orionids October 16-27th peaking on the 21-22nd.
Taurids (will be weak this year) October 20th-November 30th peaking on November 1-10th.
Leonids November 15-20th peaking on the 17th.
Geminids December 7-16th peaking on the 13th.
Ursids December 17-25th peaking on the 22nd.

North American Low-band TV Transmitters

Last summer's SpE season produced dramatic reception of several transatlantic ch. A2 and A3 TV transmitters. Use of the 50MHz band by amateur radio operators also produced many reports of transatlantic reception. It would seem therefore that transatlantic signal propagation is perhaps more common than previously thought. Such SpE reception tends to be more common in July, from 1900 BST – a ch. A2 opening last year continued until past midnight in the UK.

The signals received will of course be 525-line, 60Hz ones (i.e. System M). Most receivers will easily lock to such signals. Reception of a System M signal is usually indicated by a rolling field: once the field timebase has been locked you'll generally find that the height is reduced. A2 is the channel generally received, though the m.u.f. may allow ch. A3 reception during intense SpE conditions (I once saw evidence of ch. A4). Although the next sunspot maximum is some years away, transatlantic reception is certainly worth trying in suitable conditions. The following list of relatively high power N. American transmitters on the eastern side of the continent should help with signal identification. It was compiled from the *World Radio/TV Handbook* and WTFDA North American TV listings (for further information on the World Wide TV-FM DX Association write to PO Box 514, Buffalo, NY 14205, USA – include sufficient return postage). Note the carrier frequencies: ch. A2 55·25MHz vision, 59·75MHz sound; ch. A3 61·25MHz vision, 65·75MHz sound.

Ch.	*Station*	*E.R.P.*	*Network*
A2	Moncton CKCW-TV	56kW	CTV
A2	Bancroft CIII-TV	100kW	Ind.
A2	Wiarton CKCO-TV	100kW	CTV
A2	Kirkland Lake CFCL-TV	38kW	CBC
A2	Carlton CBGAT-TV	32kW	CBC
A2	Montreal CBFT-TV	100kW	CBC

A2	Rimouski CJBR-TV	100kW	CBC	A3	Woodstock CKLT-TV	35kW	CTV
A2	Miami WPBT-TV	100kW	PBS	A3	Neguac CBAFT-3	53kW	CBC
A2	Daytona Beach WESH-TV	100kW	NBC	A3	Argentia CJAP-TV	36kW	CTV
A2	Atlanta WSB-TV	100kW	ABC	A3	Halifax CBHT-TV	56kW	CBC
A2	Charleston WCBD-TV	100kW	ABC	A3	Barrie CKVR-TV	100kW	CBC
A2	Columbia WUND-TV	100kW	PBS	A3	Timmins CITO-TV	55kW	CTV
A2	Greensboro WFMY-TV	100kW	CBS	A3	Bearn CKRN-TV	35kW	CBC
A2	Buffalo WGRZ-TV	100kW	NBC	A3	Tampa WEDU-TV	100kW	PBS
A2	New York WCBS	22kW	CBS	A3	Columbus WRBL	100kW	CBS
A2	Utica WK-TV	38kW	NBC	A3	Savannah WSAV-TV	100kW	NBC
A2	Pittsburg KDKA-TV	100kW	CBS	A3	Charlotte WB-TV	100kW	CBS
A2	Boston WGBH-TV	87kW	PBS	A3	Wilmington	100kW	ABC
A2	Baltimore WMAR-TV	100kW	NBC	A3	Norfolk WTKR-TV	100kW	CBS
A2	San Juan WKAQ-TV	54kW	—	A3	Philadelphia	95kW	NBC
A2	Santo Domingo HIJB-TV	30kW	—	A3	Clearfield WPSX-TV	100kW	PBS
A2	Havana	132kW	TR	A3	Syracuse WSTM-TV	100kW	NBC
A2	Ciego de Avila	56kW	TR	A3	Burlington WCAX-TV	37kW	CBS
A2	Puerto Boniata	33kW	TC	A3	Mayaquez WIPM-TV	73kW	PBS

Phased Array Computer Program

J.T. Beaumont, T.Eng., G3NGD

The following program, for use with the BBC microcomputer, can be used by aerial fitters when installing a phased aerial system to overcome the problems associated with co-channel interference and ghosting.

The use of phased arrays provides an effective solution to such problems, but the distance between the two arrays is critical. This is where the program helps.

When it's run, a prompt at line 200 requests the channel number to be fed in. This is converted to the vision carrier frequency at line 210. The angle of the unwanted signal to the required one is fed in at line 260. A calculation is then performed to give the required spacing. Fig. 1 shows the angle to feed in and Fig. 2 a typical example. The program is user friendly and the aerials are drawn on the screen.

It's important that the two aerials are connected together using a phasing harness matched into a phasing box – both lengths of coaxial cable between the aerials and the box must be of equal length.

Program

```
 10 REM  * * * * * * * * * * * * * * * * * *
 20 REM  *    CALCULATING THE SPACING      *
 30 REM  *        FOR TWO "PHASED"         *
 40 REM  *       TELEVISION AERIALS        *
 50 REM  *    TO ELIMINATE CO-CHANNEL      *
 60 REM  *          INTERFERENCE           *
 70 REM  *        J.T. Beaumont 1987       *
 80 REM  * * * * * * * * * * * * * * * * * *
 90 MODE 7
100 FOR H=5 TO 6:PRINT TAB(5,H);CHR$(141); CHR$(130);
    "Phased Television Aerials": NEXT H
110 FOR H=8 to 9:PRINT TAB(6,H);CHR$(141);CHR$(130);
    "To eliminate Co-channel":NEXT H
120 FOR H = 11 TO 12:PRINT TAB(11,H);CHR$(141);
    CHR$(130); "Interference": NEXT H
130 PRINT TAB (8,20);CHR$(129);"by J.T. Beaumont
    G3NGD"
140 FOR T=1 TO 5000:NEXT T
150 MODE 1
160 VDU23,224,25,38,70,74,82,36,88,128
170 VDU19,0,4,0,0,0
180 PROC_ Antenna_ 1
190 PRINT TAB(5,25); "Input the UHF T.V. channel
    number"
200 INPUT Chan
210 LET N=(8*Chan+303·25)
220 PRINT TAB(0,26);"      "
230 PRINT TAB(0,25);"Vision carrier of Channel";Chan;
    " = ";N;"MHz"
240 PROC_ Angle
250 PRINT TAB(2,27);"Input ANGLE";CHR$(224);"of the
    unwanted signal"
260 INPUT Deg
270 IF Deg<1 OR Deg>90 GOTO 260
280 REM Convert Frequency to Wavelength
290 LET W = 300/N
300 LET Dist=W/(2*SIN(RAD(Deg)))
310 LET Dist=INT(Dist*100+·05)/100
320 LET Dist=Dist*100:REM Answer in cm
330 CLS
340 PROC_ Antenna_ 1
350 PROC_ Antenna_ 2
360 PROC_ Result
370 COLOUR 2
380 PRINT TAB(5,30);"Press the space-bar to repeat"
390 A$=GET$
400 IF A$=" " GOTO 150 ELSE GOTO 390
410 END
420 DEF PROC_ Antenna_ 1
430 MOVE 500,400
440 DRAW 500,900
450 MOVE 400,400
460 DRAW 600,400
470 MOVE 400,500
480 DRAW 600,500
490 DRAW 600,520
500 DRAW 400,520
510 DRAW 400,500
520 MOVE 400,600
```

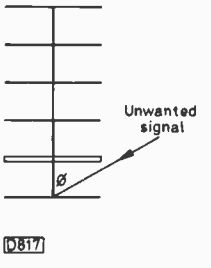


Fig. 1 (left): The unwanted interference signal angle.

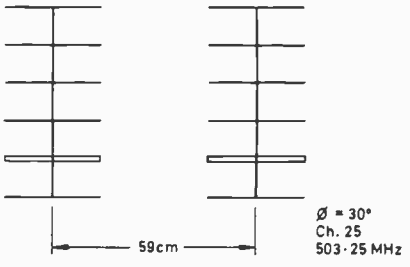


Fig. 2 (right): The completed array spacing calculation.

ECONOMIC DEVICES & QUICK SAVE T.V. SPARES

15/80H	3.30	2SA940	0.59	2SC535	0.79	AF180	0.55	BA656	1.00	BC560C	0.14	BDX63A	1.96	BFY52	0.27	BYX71-350	0.80
15/85R	3.30	2SA940-2	2.14	2SC536	0.33	AF181	0.53	BA7100	11.35	BC635	0.30	BDY20	1.21	BFY79	0.49	BYX94	0.16
16039	0.79	2SA950	0.72	2SC537	0.54	AF186	0.53	BA841A	28.98	BC636	0.28	BDY81	1.05	BFY90	0.61	BYY56	1.20
16181	1.04	2SA951	1.75	2SC605L	1.16	AF239	0.43	BA843	3.96	BC637	0.24	BF115	0.40	BLY49	2.20	BZY93C30	1.86
16182	1.04	2SA966-Y	1.16	2SC620	0.95	AF279	0.88	BA854	5.76	BC639	0.20	BF117	0.66	BR100	0.29	BZY88 RANGE	0.10
16334	0.98	2SA999	1.36	2SC643A	1.54	AL113	1.36	BAV18	0.21	BC640	0.24	BF118	0.67	BR101	0.65	BZX61 RANGE	0.18
16335	0.94	2SB774	1.15	2SC668	0.67	AN115	3.98	BAV19	0.11	BC879	0.49	BF121	0.25	BR103	0.55	BZX79 RANGE	0.10
16446	0.98	2SB185	1.13	2SC681	4.40	AN155	1.89	BAV20	0.35	BC880	0.31	BF123	0.21	BR303	1.15	C106D	0.46
16600	1.38	2SB375	3.87	2SC682	1.88	AN206	2.58	BAV21	0.12	BCX34	0.18	BF127	0.13	BRC116	0.67	C106M	0.76
16802	1.27	2SB400	0.40	2SC684	1.65	AN208	3.55	BAW62	0.11	BCY70	0.30	BF137	0.29	BRC300	2.01	C1129	0.58
17052	5.61	2SB405	1.03	2SC693	0.63	AN210	2.28	BAX12	0.48	BCY71	0.21	BF153	0.58	BRC5296	0.77	CA3046	1.55
17053	5.61	2SB449B	6.98	2SC710	0.69	AN211	3.25	BAX13	0.11	BCY72	0.20	BF154	0.26	BRC6109	0.83	CA3089	0.83
17074	9.30	2SB511	2.26	2SC711A	0.50	AN214Q	1.50	BAX16	0.11	BD115	0.34	BF157	0.33	BRC82	1.08	CA3090AQ	3.25
17089	3.45	2SB54	1.39	2SC717	1.28	AN234	5.92	BC107	0.13	BD116	0.70	BF158	0.18	BRC83	2.19	CA3094	2.20
17127	3.51	2SB546	0.56	2SC734	1.43	AN236	3.78	BC107A	0.11	BD124	1.31	BF159	0.18	BRC84	2.08	CA3131EM	2.95
17376	1.58	2SB56	2.80	2SC761-Y	0.95	AN239	4.68	BC107B	0.18	BD124P+KIT	0.69	BF160	0.31	BRX44	0.60	CBF16848N-071	1.56
1N4001	0.04	2SB618A	2.22	2SC783	3.98	AN240P	1.25	BC108	0.15	BD131	0.57	BF167	0.38	BRX49	0.67	CD4001	0.34
1N4002	0.06	2SB631	1.45	2SC790Y	1.85	AN241	1.71	BC108B	0.15	BD132	0.20	BF173	0.34	BRY39	0.69	CD4002	0.27
1N4003	0.06	2SB643	0.80	2SC828	0.28	AN245	4.49	BC109	0.12	BD133	0.53	BF177	0.35	BSS38	0.87	CD4008	1.35
1N4004	0.05	2SB669	3.67	2SC867A	3.84	AN253	1.10	BC109B	0.15	BD135	0.36	BF178	0.40	BSTB0140G	5.25	CD4011	0.29
1N4005	0.05	2SB681	3.96	2SC876	0.96	AN260	3.85	BC109C	0.12	BD136	0.26	BF179	0.36	BSTC0246	6.99	CD4012	0.24
1N4006	0.08	2SB695	1.98	2SC930	0.54	AN262	1.20	BC113	0.14	BD137	0.36	BF180	0.36	BSTC0233	7.25	CD4013	0.33
1N4007	0.07	2SB75	1.04	2SC935	4.13	AN272	8.25	BC119	0.36	BD138	0.46	BF181	0.32	BSTCC0143	3.07	CD4016	0.46
1N4148	0.03	2SB774	0.65	2SC936	8.66	AN295	5.52	BC126	0.23	BD139	0.28	BF182	0.34	BSTD1043	2.85	CD4017	0.82
1N4448	0.05	2SB819	1.13	2SC940	4.68	AN301	2.45	BC132	0.14	BD140	0.29	BF183	0.39	BSV57B	3.49	CD4020	1.23
1N5401	0.14	2SC1034	6.75	2SD1128	2.90	AN302	3.99	BC135	0.14	BD144	1.70	BF184	0.43	BSW68	0.60	CD4021	0.39
1N5402	0.15	2SC1050	5.06	2SD1138	1.00	AN303	4.39	BC137	0.18	BD150	1.25	BF185	0.39	BSX19	1.29	CD4023	0.28
1N5403	0.16	2SC1096	1.16	2SD1273	1.56	AN305	8.95	BC138	0.34	BD157	0.67	BF194	0.14	BSX20	0.30	CD4025	0.64
1N5404	0.15	2SC1104	3.98	2SD1453	1.40	AN315	2.46	BC139	0.28	BD160	1.60	BF195	0.14	BSY52	0.50	CD4028	0.84
1N5408	0.35	2SC1106	4.54	2SD152K	2.64	AN316	5.53	BC140	0.45	BD163	0.71	BF196	0.17	BSY79	0.51	CD4040B	0.85
1N914	0.04	2SC1114	3.25	2SD198	4.20	AN318	5.25	BC141	0.34	BD165	0.62	BF197	0.18	BT100A	1.61	CD4047	1.05
IR3403	5.00	2SC1116	4.95	2SD234	0.49	AN320	5.47	BC142	0.23	BD166	0.42	BF198	0.17	BT108	1.45	CD4049	0.46
1S1555	0.31	2SC1124	1.28	2SD235	0.60	AN321	2.25	BC143	0.19	BD168	0.73	BF199	0.17	BT119	1.76	CD4052	0.75
1S44	0.10	2SC1129	1.65	2SD24	2.29	AN322	5.85	BC147	0.08	BD175	0.20	BF200	0.37	BT120	2.17	CD4066	0.20
1S5012A	0.81	2SC1131	0.64	2SD257	1.98	AN331	4.59	BC148A	0.11	BD179	0.45	BF218	0.36	BT121	2.48	CD4069	0.29
1S921	0.10	2SC1158	3.33	2SD292	2.59	AN337	3.81	BC148B	0.13	BD181	0.99	BF224	0.17	BT123	1.98	CD4070	0.66
2N1303	0.38	2SC1162	0.55	2SD313	2.59	AN340P	1.17	BC148C	0.11	BD182	0.99	BF237	0.65	BT151-800R	0.89	CD4081	0.35
2N2219A	0.33	2SC1172	2.22	2SD325D	2.26	AN355	5.98	BC149	0.11	BD183	0.99	BF240	0.17	BTT6018	2.42	CD4093	0.72
2N2222	0.38	2SC1195	5.80	2SD348	16.13	AN362	1.50	BC149B	0.13	BD184	1.21	BF241	0.15	BTT8124	4.89	CD4511	1.10
2N2646	0.80	2SC1212A	1.97	2SD350	5.20	AN370	3.95	BC153	0.14	BD187	0.53	BF245	0.50	BU106	2.48	CD4528	2.04
2N2904	0.36	2SC1213	0.89	2SD350A	3.05	AN5010	5.70	BC154	0.14	BD189	0.69	BF245A	0.52	BU108	1.50	CD4556	1.47
2N2905	0.59	2SC1226	1.46	2SD353	8.94	AN5111	2.92	BC159	0.36	BD190	0.72	BF245B	0.49	BU109	2.65	CR02AM-8	1.70
2N2906	0.38	2SC1293	0.90	2SD389	2.41	AN5120N	4.50	BC160	0.40	BD201	0.40	BF246A	2.52	BU110	5.69	CV12E	4.09
2N2926	0.15	2SC1306	1.98	2SD401	1.40	AN5132	5.39	BC161	0.28	BD202	0.60	BF255	0.20	BU111Y	4.16	CX095D	3.14
2N3053	0.27	2SC1316	10.25	2SD414	1.98	AN5250	3.98	BC168	0.36	BD203	0.50	BF256	0.38	BU126	2.48	CX104	9.64
2N3054	0.99	2SC1317	0.50	2SD471	2.13	AN5435	2.25	BC169C	0.16	BD204	0.61	BF256LB	0.42	BU137	1.45	CX108	10.50
2N3055	0.61	2SC1364	0.49	2SD560	2.95	AN5610	5.50	BC170	0.16	BD207	1.79	BF256LC	0.82	BU205	6.53	CX109	7.86
2N3442	1.56	2SC1383	1.20	2SD588A	2.36	AN5612	4.68	BC171	0.11	BD208	0.34	BF257	0.34	BU207	1.35	CX130	8.76
2N3702	0.14	2SC1391	2.45	2SD600	3.25	AN5613	4.63	BC172	0.13	BD222	0.38	BF258	0.36	BU208	1.27	CX134	12.32
2N3703	0.18	2SC1398	0.79	2SD601R	0.65	AN5630	3.95	BC172B	0.27	BD225	0.49	BF259	0.34	BU208/02	1.65	CX136	11.49
2N3705	0.16	2SC1413A	3.05	2SD613	1.03	AN5701N	1.66	BC173	0.17	BD228	0.63	BF262	0.28	BU208A	1.20	CX139	11.83
2N3706	0.14	2SC1446	1.25	2SD621	12.85	AN6250	2.95	BC174B	0.27	BD229	1.05	BF263	0.57	BU208D	1.12	CX157	4.84
2N3707	0.16	2SC1447	2.07	2SD636	0.55	AN6300	4.40	BC177	0.35	BD232	0.50	BF271	0.34	BU209	1.97	CX158	5.52
2N3711	0.13	2SC1475	0.60	2SD639-R	0.72	AN6310	8.74	BC178	0.26	BD234	0.42	BF273	0.20	BU226	1.95	CX177	6.46
2N3771	0.70	2SC1505	1.00	2SD655	0.98	AN6320N	4.28	BC179	0.26	BD237	0.47	BF274	0.20	BU326	1.50	CX187	6.84
2N3772	1.71	2SC1514	1.69	2SD657	3.50	AN6340	10.14	BC182	0.05	BD238	0.39	BF324	0.35	BU326A	2.95	CX755	12.95
2N3773	1.65	2SC1573Q	1.25	2SD661A	0.80	AN6341	2.02	BC182L	0.10	BD239	0.45	BF336	0.33	BU326S	2.00	CX885A	6.85
2N3819	0.42	2SC1578	8.74	2SD731	1.05	AN6342	2.77	BC182LB	0.07	BD240	0.57	BF337	0.45	BU406	2.20	DEC1	2.20
2N3823	1.17	2SC1583	0.50	2SD773	0.60	AN6363	16.00	BC183L	0.11	BD241	0.39	BF338	0.33	BU406D	2.20	DEC2	2.20
2N3904	0.62	2SC1617	3.89	2SD811	3.30	AN6371	9.24	BC183LB	0.26	BD242	0.39	BF355	0.31	BU407	1.49	DS3486N	4.33
2N3908	0.62	2SC675	1.41	2SD823	1.98	AN6387	10.65	BC184	0.13	BD243A	0.35	BF362	0.62	BU407D	1.79	DS3487N	4.95
2N4101	1.73	2SC1678	1.98	2SD837	1.56	AN6531	1.95	BC184L	0.14	BD243C	0.29	BF363	0.60	BU408	0.82	E1222	0.40
2N4240	3.30	2SC1741	1.25	2SD841	2.60	AN6551	1.35	BC184LB	0.26	BD244	0.45	BF371	0.50	BU407D	0.99	E5024	0.28
2N4444	0.99	2SC1810	1.70	2SD856	1.55	AN6552	0.68	BC186	0.27	BD244C	0.79	BF391	0.25	E5386	0.25	E9003	0.46
2N5293	0.50	2SC1815	0.45	2SD857Q	1.84	AN6610	2.40	BC187	0.28	BD245C	0.99	BF417	0.84	E9005	0.50	ESM310BP	4.15
2N5294	0.50	2SC1826	0.67	2SD882	1.15	AN6677	10.45	BC204	0.16	BD246C	1.25	BF418	1.87	BU412	9.15	FND500	5.78
2N5296	0.49	2SC1829	3.34	2SD894	1.63	AN7111	1.25	BC207	0.14	BD253	1.05	BF422	0.29	BU426A	1.13	GC374	1.65
2N5297	0.50	2SC1875	5.85	2SD898	1.85	AN7114E	8.54	BC212	0.11	BD278A	0.60	BF423	0.52	BU500	1.45	GD243	4.95
2N5298	0.61	2SC1881K	2.98	2SK105H	2.15	AN7115	3.38	BC212B	0.26	BD317	2.60	BF450	0.35	BU508A	1.25	GF758	0.84
2N5771	1.18	2SC1893	3.02	2SK152	2.50	AN7120	4.65	BC213L	0.10	BD318	2.85	BF451	0.29	BU536	1.65	GH3F	1.82
2N6109	1.58	2SC1906	0.98	2SK34	0.76	AN7145	2.80	BC213LB	0.15	BD375	0.42	BF457	0.41	BU608	1.80	HA11215	1.75
2N6130	0.80	2SC1921	1.37	2SK41	1.07	AN7146	4.35	BC214	0.10	BD380	0.76	BF458	0.33	BU705	1.85	HA11211	2.53
2N6133	1.25	2SC1923	0.30	2SK79	2.98	AN7151	2.26	BC214LB	0.26	BD410	0.52	BF459	0.52	BU806	1.79	HA11225	1.50
2N6180	0.95	2SC1929	2.25	40408	0.50	AN7156	2.85	BC225	0.40	BD433	0.47	BF460	1.45	BU807	0.80	HA11226	10.44
2N6292	1.65	2SC1945	7.99	40594	1.53	AN7158	2.32	BC237	0.10	BD434	0.49	BF469	0.22	BU826A	2.15	HA11229	0.85
2N696	0.43	2SC1957	1.09	40636	1.43	AN7218	1.64	BC237BJ	0.12	BD435	0.49	BF470	0.55	BUW84	1.39	HA11235	1.75
2N698	0.43	2SC1959	1.18	4EX581	0.80	AN7223	4.25	BC238	0.10	BD436	0.60	BF471	0.33	BUX84	1.00	HA11124	5.25
2SA1006	1.50	2SC1962	1.93	741	0.30	AU107	3.50	BC238A	0.13	BD437	0.49	BF472	0.33	BUX85	1.10	HA11244	4.02
2SA1011	1.65	2SC1969	2.04	7805-T022	0.63	AU110	2.25	BC238B	0.08	BD438	0.40	BF479	0.35	BUY69A	2.04	HA11251	4.47
2SA1015	0.49	2SC1983	2.00	7806	0.73	AU113	5.25	BC239	0.12	BD441	1.42	BF480	1.38	BY126	0.13	HA1125	4.29
2SA1012	1.25	2SC1985	1.55	7808	0.85	AY105K	2.08	BC239B	0.25	BD442	1.41	BF491	1.99	BY127	0.08	HA1137W	2.87
2SA1020Y	0.89	2SC2009	0.34	7812-T022	0.35	AY106	1.09	BC251A	0.31	BD509	1.65	BF495	0.64	BY133	0.12	HA1138	5.03
2SA1027R	0.45	2SC2029	2.33	7815	0.64	BA524	8.21	BC294	0.50	BD510	0.62	BF506	0.43	BY164	0.44	HA11414	5.65
2SA473	0.75	2SC2028	2.11	7818	0.92	B250	2.25	BC300	0.35	BD519	1.50	BF509	0.41	BY176	0.52	HA1144	7.87
2SA766S	4.95	2SC2063	0.99	7824	0.64	B40	1.55	BC301	0.45	BD529	0.80	BF523	0.24	BY179	1.08	HA1156	1.16
2SC1173Y	1.25	2SC2078	3.11	7905	0.80	B80	1.55	BC302	0.53	BD530	1.18	BF532	0.45	BY182	0.95	HA1160	4.78
2SC1474	1.25	2SC2073	2.25	9368	10.70	BA130	0.14	BC303	1.04	BD533	0.67	BF596	0.18	BY184	0.40	HA1166	1.96
2SC1509	1.35	2SC2085-Q	1.65	AA133	0.12	BA1310	1.98	BC307	0.18	BD534	0.53	BF597	0.27	BY187	0.77	HA1166X	6.43
2SD1391RL	3.95	2SC2091	1.30	AC123K	0.43	BA1320	1.38	BC307A	0.08	BD535	0.79	BF694	0.22	BY189	1.79	HA1167	5.36
2SA1095	3.74	2SC2141	2.44	AC127	0.27	BA1322	3.95	BC308	0.18	BD536	0.61	BF757	0.64	BY198	1.62	HA11706	3.61
2SA1103	6.55	2SC2166	1.98	AC128	0.34	BA1330	2.75	BC308A	0.11	BD537	0.80	BF759	0.47	BY201/2	1.50	HA11705	8.00
2SA329	0.40	2SC2216	0.69	AC138	0.24	BA145	0.19	BC309	0.17	BD538	0.80	BF761	1.05	BY203/20	0.59	HA11703	4.22
2SA489	1.17	2SC2233	1.80	AC141	0.29	BA148	0.25	BC317A	0.13	BD544B	0.83	BF762	0.50	BY207	0.22	HA11701	4.56
2SA490	2.25	2SC2236	1.65	AC142K	0.35	BA154	0.40	BC327	0.15	BD598	1.25	BF869	0.47	BY208	0.46	HA11710	9.50
2SA493	2.25	2SC2278	1.69	AC151	0.28	BA155	0.12	BC328	0.10	BD677	0.69	BF870	0.30	BY210-400	0.19	HA11713	9.75
2SA562	0.57	2SC2314	2.17	AC176	0.30	BA156	0.05	BC337	0.09	BD679	0.57	BF959	0.42	BY210-600	0.27	HA11711	20.16
2SA564	0.75	2SC2335+KIT	13.44	AC179	0.28	BA159	0.08	BC338	0.10	BD680	0.76	BF960	0.49	BY210-800	0.34	HA11715	3.25
2SA614	4.88	2SC2551	1.26	AC183	0.72	BA182	0.24	BC368	0.24	BD681	1.48	BF970	0.50	BY218	1.64	HA11714	9.75
2SA628	1.14	2SC2565	3.92	AC187	0.39	BA222	1.66	BC440	0.69	BD696	2.47	BFR39	0.44	BY223	1.23	HA11716	13.10
2SA639S	1.75	2SC2570	2.88	AC187K	0.43	BA302	1.24	BC441	0.44	BD699	3.49	BFR61	0.92	BY224-600	1.88	HA11725	18.26
2SA659	0.49	2SC2577	1.60	AC188	0.47	BA311	1.32	BC454	0.36	BD700	3.70	BFR62	0.50	BY225-100	1.13	HA11725MP	16.00
2SA673	1.50	2SC2578	6.75	AC188-01	0.49	BA312	1.45	BC460	0.42	BD707	0.98	BFR79	0.29	BY226	0.25	HA117555P	6.23
2SA684	1.61	2SC2671	1.99	AC188K	0.43	BA313	0.76	BC461	0.35	BD709	1.05	BFR81	1.65	BY227	0.49	HA11781	19.90
2SA697	1.05	2SC2826	2.07	AC193K	0.65	BA317	0.08	BC462	1.15	BD710	0.80	BFR86	1.08	BY228	0.60	HA1180	5.15
2SA699	1.75	2SC288A	1.85	AC194K	0.65	BA318	0.02	BC463	0.64	BD809	0.85	BFR89	1.63	BY229-1000	1.12	HA1196	7.43
2SA715	0.95	2SC3153	6.84	AD140	1.06	BA328	1.65	BC477	0.37	BD810	0.69	BFR90A	0.70	BY229-600	0.92	HA13001	2.25
2SA747	10.74	2SC372	1.40	AD143	1.93	BA333	1.37	BC478	0.22	BD879	0.74	BFT42	0.43	BY255	0.69	HA1306	2.26
2SA748	1.36	2SC373	1.16	AD145	1.60	BA335	6.27	BC479	0.41	BD880	0.79	BFT43	0.43	BY295-600	1.03	HA1338	7.50
2SA817	0.65	2SC383	1.33	AD161	0.30	BA5102A	2.86	BC532	0.28	BD895	2.31	BFT84	0.40	BY298	0.36	HA1339	2.33
2SA818	1.82	2SC388	0.50	AD162	0.30	BA511	1.95	BC546	0.08	BD899	2.48	BFW10	0.60	BY299	0.45	HA13402	7.87
2SA835	2.50	2SC394V	0.81	AD262	1.25	BA514	2.20	BC547	0.10	BD901	0.79	BFX29	0.34	BY407	0.90	HA13342	2.65
2SA836	0.89	2SC403C	0.60	AF114	2.47	BA521	2.52	BC548	0.10	BD902	0.84	BFX84	0.37	BY409	1.49	HA13365	4.02
2SA844	0.65	2SC41	2.19	AF115	0.79	BA524	8.94	BC549	0.10	BDW83C	1.45	BFX85	0.41	BY448	1.35	HA1366WR	1.50
2SA872	0.80	2SC458	0.15	AF118	1.20	BA526	7.98	BC550	0.10	BDW84C	1.56	BFX86	0.36	BY713	0.65	HA1367	2.75
2SA884	2.15	2SC495	0.92	AF127	0.50	BA527	2.98	BC556	0.10	BDX32	1.75	BFX87	0.55	BYW19/1000	0.69	HA1368R	2.45
2SA937R	0.97	2SC515A	2.85	AF139	0.53	BA532	1.46	BC557	0.10	BDX53A	4.93	BFX88	0.34	BYW56	0.16	HA1368	2.07
				AF178	1.45	BA536	2.05	BC558	0.10	BDX53B	1.85	BFX89	0.44	BYX10	0.29	HA1370	3.30
				AF179	0.55	BA6209	4.55	BC559	0.10	BDX54B	2.16	BFY50	0.32	BYX55-600	0.23		
								BC559B	0.11	BDX62A	2.15	BFY51	0.25	BYX71-600	0.90		

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Micro Clinic

Reports from Christopher Holland, Ken Taylor and Roger Burchett

Amstrad CPC464/CPC6128

In my experience there are two chips that give trouble in these computers. The first is the pluggable ULA device which causes the unit to be inoperative with no welcome on the screen: substitution soon eliminates this problem.

The second and less obvious i.c. is the sound generator chip, an AY-3-8912. The sound section of the chip doesn't give problems. It's the section which forms part of the interface between the keyboard buttons and the rest of the circuit that causes trouble. There are two main fault symptoms: either a row of garbage is displayed on the monitor at switch on, after which the keys cease to have any effect; or depressing a key results in two letters appearing on the screen, e.g. depressing "Q" will result in "QW" registering. This problem can occur as the computer warms up.

If certain keys are inoperative however don't blame this chip. This fault will be down to the keyboard itself, particularly if the later type of keyboard is used – the one with the clear plastic membrane on to which conductive tracks are etched. Visual examination, bearing in mind the keys that are inoperative, will soon reveal the break in the track. A possible cure is to use the conductive paint sold for repairing car rear window heaters to bridge the break in the tracks. This isn't always successful, but is worth a try as the membranes aren't available on their own and complete keypads don't come cheap. **C.H.**

Amstrad CTM644 Colour Monitor

When confronted with a dead monitor, try the following fault-finding procedure. If the 5V and 12V lines are present check whether R521 or the circuit protector in series with it is open-circuit. If so check the 2SD1397 line output transistor Q405. If a cold check eliminates the transistor, try replacing the circuit protector which can go open for no reason. It will probably fail again at switch on however, in which case a new diode-split line output transformer will be required.

If there are no outputs at the secondary side of the switch-mode power supply check the following items: C515 and the crowbar circuit zener diode D510 in the 100V supply; the 12V regulator IC503 in the 12V supply; IC502 and transistor Q502 in the 5V supply. In all probability however the fault will lie in the primary side of the power supply.

In this case check for 300V d.c. across pins 1 and 14 of the STK7308 regulator chip. If this voltage is present, check the 3·6V zener diode D507 before changing the i.c. – also make sure that neither of the 180kΩ resistors R506/7 has gone open-circuit. If there's no voltage across the STK7308 this will be due to either the fuse, R501 (5·6Ω, 5W) or R502 (1Ω, 3W) being open-circuit. These items normally fail because the chip itself has gone, but after replacing the i.c. and any open-circuit items check D507 and R511 (10Ω) before switching on – otherwise your shiny new STK7308 may instantly expire. **C.H.**

Commodore 64

The chip marking in the Commodore 64 can be very misleading. This machine for example obviously had a supply line fault – even the indicator LED was flickering. The cause was a defective i.c. which was marked 8715 2984. "Never heard of it" was our first response, but as the PCB is well marked we checked the chip (U26) with the circuit diagram and found it to be a standard 74LS373.

The faulty i.c. was rapidly detected because of its temperature – it's always worth doing a quick "touch" check on all the i.c.s before starting to make more detailed tests. Service manuals for the Commodore 64 are available from HRS Electronics Ltd.: a circuit diagram for the 64 is available in the *Programmers' Reference Guide.* **K.T.**

Atari 1300

No machine is improved by being christened but the keyboard membrane on this one is particularly vulnerable to spillage. It consists of a flexible printed circuit which is contacted by a conductive plastic bridge at the end of each key stem. As there's no seal or liquid trap even a slight spillage drips on to the circuit tracks on the top surface of the membrane.

The machine brought in for repair had track erosion that affected a group of keys. I don't know whether Atari spares are available, but a perfectly satisfactory repair was carried out by using RS silver conductive paint applied carefully to bridge the gap. When using this paint remember that it has a very high resistance in the wet state: it should be allowed to dry for an hour or so before testing the machine. **K.T.**

Sinclair Spectrum Plus

This machine came in with a simple looking fault that proved to be one of the more elusive ones. At power up the screen area was completely black and the logo didn't appear. It had apparenty gone part way through the initialisation process, so there couldn't be much wrong.

Testing the signals at the CPU and ROM pins produced different results each time checks were made – this should have been a clue that an unusual fault was present. After removing both the CPU and the ROM I found slightly low resistances on the data lines. The cause was faults in the 32K extension memories – five of the TMS4532 memory chips were found to be faulty! These can be checked by measuring the resistance between the data lines and 0V. With the CPU and ROM removed a reading of 10kΩ is satisfactory: a normal working computer gives a reading of 5-6kΩ. In any case a quick comparison between all the data lines is a useful exercise. Connect the red (negative) lead to 0V if you're using a standard analogue meter.

Eliminating the extension memory by removing IC25/6 or cutting the control tracks to these i.c.s had no effect on this fault. Only removing the faulty chips or cutting the data tracks to them cleared it. **K.T.**

Commodore 64

Computer repairs have dwindled somewhat now that I no longer do trade work. But at least I no longer get horrible

little boys with battered Spectrums in which apparently every chip is damaged. So I get more profit for less work, due to better maintained machines that (usually) have only one fault at a time.

No sound on one of these machines was caused by the 6581 sound generator chip (cries of "surprise, surprise"!). Another one initialised, but without the message. The cause was a faulty BASIC ROM (901226-01). Simple stuff. It can't go on like this, there's obviously something horrible around the corner – watch this space! **R.B.**

Dual-channel TV Sound Systems

Part 1

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

THROUGHOUT the development of television the sound channel has tended to be the poor relation. Despite the fact that the broadcasters have always provided a high-quality signal, by and large the setmakers have failed to do justice to it. Major quality improvements in the audio field in recent years, for example developments in magnetic tape systems and the introduction of the compact disc system, seem however to be creating greater interest in better domestic TV sound quality — plus stereo — to add to the total viewing experience. The great problem about adding stereo to existing terrestrial TV transmissions is that any system used must be compatible with the existing mono ones. With DBS the situation will change, since the transmission standard proposed for European use allows for stereo from the start. Another new factor with DBS transmissions is that they will spill across national boundaries, creating a demand for multi-lingual sound channels.

Although the Zenith-GE (pilot tone) system used for terrestrial v.h.f./f.m. radio transmissions provides a very satisfactory service, no such single standard has evolved for television use. In the field of terrestrial TV broadcasting the following analogue stereo systems are in use in various countries: the US Multichannel Television Sound (MTS)/Broadcast Television Systems Committee (BTSC) system, the Japanese f.m.-f.m. system and the West German dual-carrier system.

Channel Separation

Whilst a channel separation of 25-30dB is satisfactory for a stereo sound transmission — it's debatable whether a listener in a live auditorium experiences a better level — for alternative language transmissions a rejection of the unwanted channel of better than 55dB is necessary. It is chiefly for this reason that the many other systems have been developed.

Zenith-GE System

To recap briefly, in the Zenith-GE pilot-tone system a compatible L+R signal is transmitted along with an L−R stereo difference signal and a 19kHz pilot tone which is used as a reference for decoding in the receiver. The L−R signal is amplitude modulated on to a 38kHz subcarrier using double-sideband, suppressed-carrier modulation. The problems that make it difficult to use this system for TV broadcasting were described by David Looser in an article on stereo TV sound in the August 1984 issue of *Television*. Put briefly, its noise performance is some 22dB worse than with a mono f.m. sound system, interference from the accompanying video signal giving rise to a characteristic buzz. We'll now consider later proposals/systems.

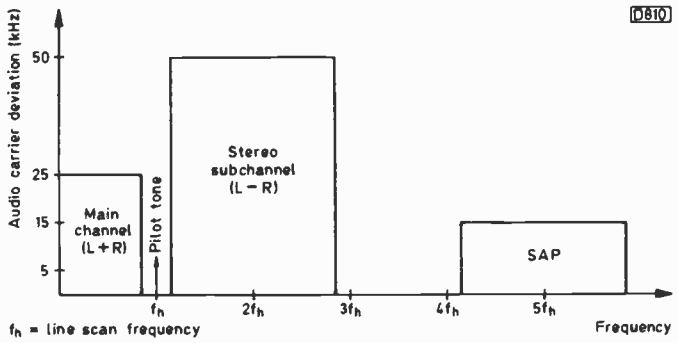

Fig. 1: BTSC/MTS multichannel sound system spectrum.

Leaming System

The Leaming system is a variant of the Zenith-GE pilot tone system devised to reduce the problems of the latter for TV use. The major change involves the use of companding for the L – R signal to improve the noise performance. A whistle filter is incorporated in the receiver's decoder to remove the beat note between the line scan harmonics and the subcarrier.

BTSC/MTS System

The BTSC/MTS system is a further derivative of the Zenith-GE system using a pilot tone and subcarrier that are locked to the line frequency to avoid the beat note problem. The baseband frequency spectrum is shown in Fig. 1, where it will be seen that there's a significant difference in the carrier deviation produced by the various signal components relative to the Zenith-GE system. It will also be noted that there's provision for a Separate Audio Programme (SAP) channel. This consists of a 12kHz wide audio channel on an f.m. subcarrier at five times the line frequency. Companding is used for both the L−R and the SAP channels. The SAP channel can be used to provide an alternative language version of the main programme or may be completely unrelated to it. In certain cases a "Professional Channel" may be provided at 6.5 times the line frequency. This is a 3.4kHz allocation that's used for talk-back during outside broadcasts. As with the Zenith-GE system, adequate separation of the channels depends on accurate setting of the decoder's subcarrier phase adjustment.

Japanese FM/FM System

With the Japanese f.m.-f.m. system the subcarrier is locked to the second harmonic of the line frequency. It can be frequency modulated with either the L−R stereo component or a second language signal. An a.m. subcarrier at 55kHz is included to provide the signals

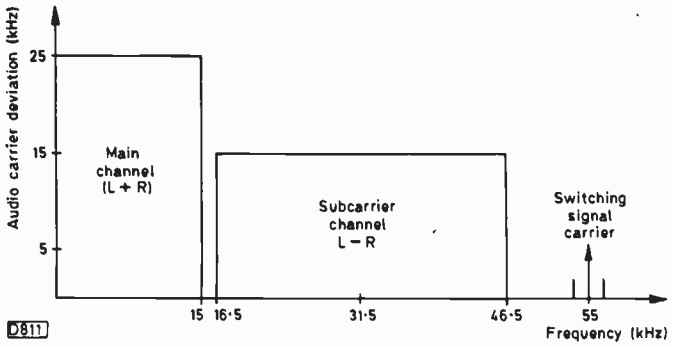

Fig. 2: Japanese f.m./f.m. system signal spectrum.

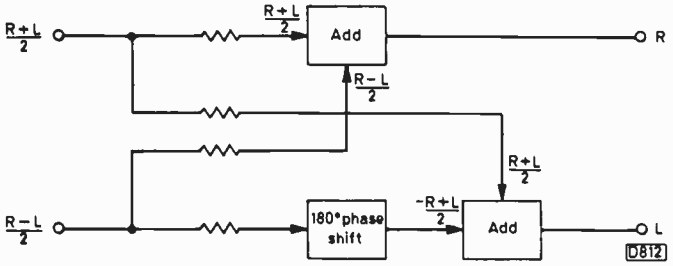

Fig. 3: Zenith-GE system decoder matrix.

needed to switch the receiver's decoder automatically between stereo and bilingual operation. Fig. 2 shows the baseband frequency spectrum. As with the other systems mentioned so far, this composite signal is used to frequency modulate the final r.f. carrier. The system offers good mono/stereo/bilingual compatibility, is easy to implement and uses fairly simple decoders. The wide bandwidth can however give rise to adjacent channel interference problems and a complex buzz that occurs with certain video signals.

Wegener Multichannel Systems

The US corporation Wegener Communications Inc. has devised a standardised band-plan to use up to ten f.m. subcarriers that are added to the normal video/sound spectrum. In extensive tests no significant ill effects were noticed in terms of either the video signal-to-noise ratio or the demodulator threshold. The plan allows for mono or stereo sound, dual language, unrelated audio signals and digital communications to be transmitted simultaneously. The main criteria are that the f.m. index (the ratio of the carrier frequency deviation to the audio frequency) for each subchannel should be between 0.14 and 0.18, with the subcarriers spaced by 180kHz. Provided the total deviation produced by all the subcarriers is small compared to that produced by the video signal the subchannels have little effect on the total transmission bandwidth.

Each 180kHz slot can be allocated to 15kHz of audio (or further subdivided for either 7.5 or 3.5kHz of audio) or used for data signals, using frequency shift keying (FSK) or quadrature phase shift keying (QPSK) etc. One Dolby ADM channel can be accommodated in two adjacent 180kHz slots. For NTSC applications the subcarriers are typically disposed between 5.2 and 8.5MHz — the equivalent distribution with PAL systems lies between 6.3 and 9.74MHz.

The Wegener 1600 stereo system is a subset of this band plan. The left and right audio channels use separate subcarriers spaced by 180kHz. The maximum deviation for each subcarrier is ±50kHz and both audio channels are companded to improve the overall signal-to-noise ratio. With the PAL system the two most common subcarrier frequencies are 7.02 and 7.2MHz.

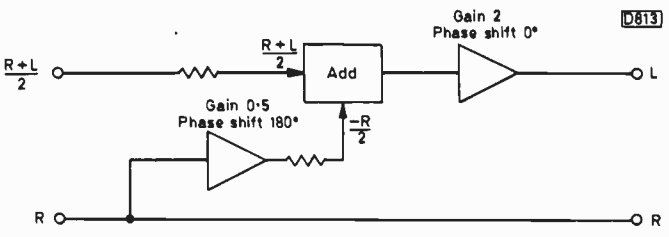

Fig. 4: West German dual-carrier system decoder matrix.

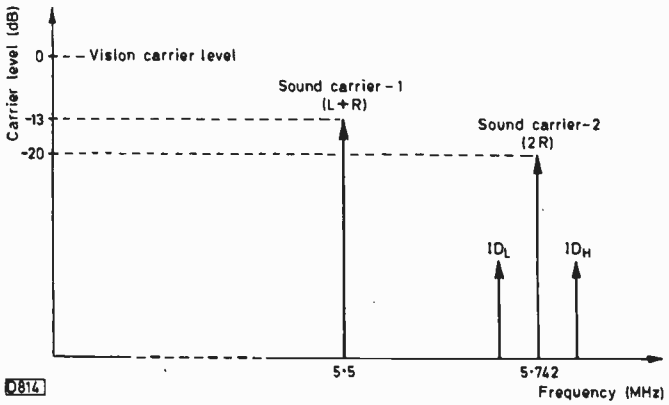

Fig. 5: West German dual-carrier system signal spectrum.

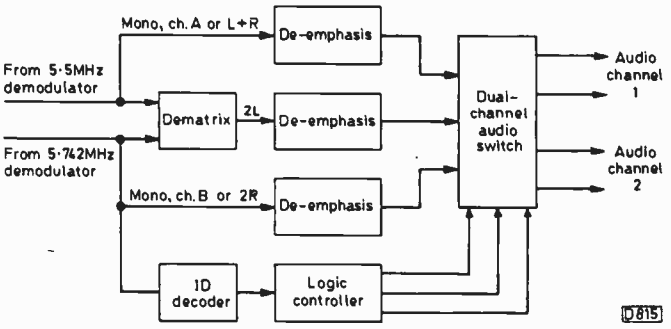

Fig. 6: Dual-channel decoder block diagram.

Warner Amex Stereo System

With the Warner Amex stereo system the sum (L+R) and difference (L−R) audio signals are generated in a

similar manner to that used in the Zenith-GE system: they are then used to frequency modulate separate subcarriers. These two modulation components finally frequency modulate the main sound carrier.

West German Dual-carrier System

The standard decoding matrix for the Zenith-GE system, shown in Fig. 3, suffers from two problems when used for dual-language transmissions: poor channel separation and, perhaps more important, the fact that any noise in the transmission and in the predecoding stages of the receiver tends to become concentrated in one channel. This can be shown as follows, assuming that the noise N affects each channel equally:

$$[\tfrac{1}{2}(R+L)+N] + [\tfrac{1}{2}(R-L)+N] = R+N$$
$$[\tfrac{1}{2}(R+L)+N] - [\tfrac{1}{2}(R-L)+N] = L.$$

The West German dual-carrier system maintains compatibility by transmitting the sum signal R+L on the main carrier and the additional information required for stereo as 2R on a second carrier. Fig. 4 shows the basic decoder matrix, which produces the following results under similar noise conditions:

$$2[\tfrac{1}{2}(R+L)+N] + [(-\tfrac{1}{2}R)+N] = L+N$$

for one channel and simply R+N for the other. Thus the noise is now equally distributed across both channels.

Fig. 5 shows the distribution of these signals within the channel spectrum. The L+R and 2R components frequency modulate two carriers which are held at levels of −13dB and −20dB respectively relative to the vision carrier. The three modes of transmission, mono, stereo or bilingual, are automatically selected at the receiver through the action of the identification (ID) signal which is modulated on to the second carrier, i.e. in addition to the 2R signal this carrier is modulated with an f.m. ID signal whose deviation is ±2.5kHz. The ID signal itself consists of a 54.6875kHz subcarrier which is unmodulated for mono transmissions and is 50 per cent amplitude modulated by 117.5Hz and 274.1Hz tones respectively for stereo or dual-language sound. The two sound carriers and the control signals are precise multiples and submultiples of the line frequency.

Fig. 6 shows the basic operation of the decoder. The signal components recovered from the demodulators are dematrixed and then de-emphasised. The ID decoder identifies the transmission mode and generates the appropriate logic switching signals. These enable the audio switch unit to provide the correct output. The majority of receivers designed for use with this system incorporate headphone listening facilities.

South Korean Dual-carrier System

A unique combination of the Zenith-GE and the West German techniques, adapted for use with the NTSC system, has been developed in South Korea — the idea seems to be to protect the country's domestic market from the products of other Far Eastern manufacturers. When used for stereo the two subcarriers employ f.m. for the L+R and L−R signals to a maximum deviation of ±25kHz. The two subcarriers are spaced at 4.5 and

4.742MHz above the vision carrier and are maintained at the same relative levels as in the West German system. Again the system provides for mono, stereo or bilingual transmissions. The second subcarrier supports a 55.07kHz ID signal which is amplitude modulated by 149.9 and 276Hz tones respectively for stereo and dual-language broadcasts.

Analogue Companding

In an analogue communications system the low-level signals are affected most by channel noise, the high-level signals masking the effect of noise. Companding is a technique devised to improve a system's overall signal-to-noise ratio. Before transmission (or storage in a noisy medium) the signal's dynamic range is compressed by using non-linear amplification. At the receiver end the signal is expanded in a complementary manner.

The overall effect is illustrated in Fig. 7. The input signal is assumed to have a dynamic range of 60dB which is compressed to 30dB for transmission. Suppose that the channel has a noise level of −30dBm (1μW). This would completely swamp the original low-level signal components. The signal's dynamic range is expanded at the receiver by relatively depressing the low-level signals. This also depresses the noise to a level of −60dBm. Thus the overall effect is to improve the signal-to-noise ratio by 30dB.

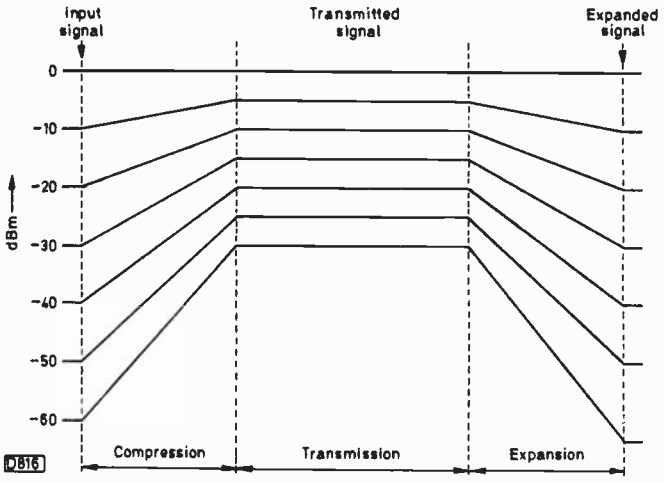

Fig. 7: Characteristics of a companding system for use with analogue signals.

More on Glue Guns

Harold B. Berkley

Since my original report on glue guns in the July 1987 issue a couple more have been sent to me to try out. The glue gun is undoubtedly a useful device, so here's my report on the latest two.

Camping Gaz Model P500

The first one to come along was the cordless Camping Gaz Model P500, which is a unique product. I must say that I'm very much in favour of cordless servicing equipment, especially for use in the field. Anything that makes the serviceman's life easier must be good news!

The P500 is powered by the new CV360 butane gas cartridge which will operate at any angle and was designed specifically for use with this glue gun. Ignition is battery-operated – there's no flame. A catalytic heating system is used, with the temperature thermostatically controlled. Warm-up time is about five minutes. The cartridge should give about four-eight hours' use.

Hot-melt adhesive is easily applied using the longer glue sticks and automatic squeeze action. The gun is heavier and more bulky than an electronic one, but in practice this was not found to be a problem. Close inspection showed that quite a lot of engineering went into the design of this gun, and I must conclude that at £35 it's good value. With its freedom from mains leads I glued just about everything in sight – even the heels on the receptionist's shoes. But I won't repeat the applications suggested in the previous article.

Summing up, I feel that this is a first class product that performed well. It's extremely useful both for TV servicing and home use.

Willow Vale Glue Gun

The second glue gun came from Willow Vale Electronics (11 Arkwright Road, Reading, Berks RG2 0LU). It's an imported, electronic, trigger glue gun, part number 04.186, that sells at £9·95. It has an integral stand and the trigger feed takes the longer glue sticks.

A mains plug was fitted and a glue stick was loaded ready for blast off. All this glueing is becoming a bit of a bore I yawned as I put the kettle on during the warm-up time. But wait – the thing is rapidly getting very hot, a fact confirmed by gingerly touching the metal nozzle. The blurb on the box states that the temperature rises to 380°F, which is pretty hot. It's interesting that the gun is marked for use with 100V-240V supplies: this could be the reason why it gets so hot – there's no voltage selector.

Anyway, switching off the kettle I put the gun through its paces, bonding various materials with the glue sticks supplied. The gun behaved very well. One disadvantage of the rapid warm up is the long cool down time – be careful not to burn your fingers, and to let the gun cool down.

The glue sticks that come for use with this gun are interesting – very hard and light brown in colour. The bond they produce is good and rigid. They are available from Willow Vale at £1·12 for a pack of twelve (part no. 10.187), which is very reasonable. A glue gun is only as good as its glue sticks of course. I assume that these sticks can be used with other glue guns.

Most of the other general-purpose glue sticks available are clear and rubbery – these are the kind you'll find at your local DIY supermarket. I tried out a Bostick stick in the gun, leaving it for a good warm up. When I was about to start using the gun – there are not many things left to glue in our house! – I realised that all was not well. The whole glue stick was melting, not just the tip: the trigger wouldn't feed the glue stick through because the stick had become too soft. The correct glue sticks from Willow Vale must have a higher melting point. So be warned. There may be other glue sticks that will work with this gun – it certainly works all right with the Willow Vale sticks.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·50 cheque or postal order (made out to IPC Magazines Ltd.), the query coupon and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

SHARP C1493GS

The problem with this set is field collapse. Unfortunately we don't have any service information but we were able to make comparative voltage checks with an identical working set. The main difference was no voltage at the field drive output from the sync/timebase generator chip. Finding no capacitor or semiconductor shorts we ordered a new chip, but fitting this has made no difference.

It's a characteristic of the IX0065CE chip that it shuts down in the absence of a feedback signal from the field output stage. Check both output transistors with an ohmmeter, also the peripheral components, especially the bias resistors R511 and R512 and feedback resistors R508/509.

SANYO VTC5000

There seems to be complete system control failure with this machine. When a cassette is inserted, no loading takes place. Press play and the tape loads, the drum motor turns and the tape moves, but after five seconds the tape and drum motor stop, the tape remaining loaded. Nothing will then operate, except that the tape unloads when the stop button is pressed. The only way to keep the tape moving is to press the pause/still button repeatedly. If either the fast forward or rewind button is pressed the tape moves fast, in the unloaded condition, then stops after about five seconds. At this instant the ring revolves to load the tape, the drum motor stops and everything ceases.

In our experience this behaviour of the syscon and mechanics can arise only as a result of a faulty cassette-down switch or lack of pulses from the reel rotation sensors. Check these items, bearing in mind that the reel sensors can produce an output only when the reels are turning and that the reel drive system in this model – the motor and idler assembly – is notoriously unreliable.

GRUNDIG CUC220 CHASSIS

Sometimes the set won't switch on. All that's heard is a fluttering noise for a few seconds. If the set is switched off and on again at the socket outlet a louder fluttering noise occurs, with the green LED display flashing on and off, then after a couple of minutes the set goes into the standby mode and the fault disappears. The fault does not occur at high room temperatures.

Confirm that 320V or so is developed across C626 when the fault is present. If so replace R646, R631 and C631 and check carefully for dry-joints around the chopper transformer TR651 and associated components. If these measures do not cure the fault suspect the TDA4600 chopper control chip which you may be able to prove faulty with a hairdryer and freezer aerosol. Be sure to replace R646 before fitting a new TDA4600 or chopper transistor.

SHARP VC381

Sometimes when play is selected there's a squeaking noise that seems to come from the head drum. The tape then stops. After a few further attempts the machine will play with no more problems. The fault always occurs when returning to play after forward or reverse picture search, but again can be overcome by making several attempts to select play. The fact that the drum doesn't slow down before switch off, and that the fault can be overcome with presistence, seems to discount a drum motor fault.

The problem is very common with this and related models. It can almost always be cured by replacing the reel idler. It's occasionally necessary to replace the reel motor.

FERGUSON TX10 CHASSIS

At switch on there's a clear picture, but after about half an hour the picture darkens with an emphasis on green. Eventually the screen goes blank. Sometimes it will return to either clear or a green predominance, but will again fade out to leave a blank screen.

This problem is not uncommon with the TX10 chassis. It is generally caused by intermittent failure of the LED (D657) that biases the RGB output stages. It's mounted on the c.r.t. base panel. Use only a Ferguson supplied replacement.

SONY KV1330

The picture is not very bright and is very green. A check on the voltages at the c.r.t. base panel reveals that these are all more or less as quoted in the manual. There's a glass encapsulated unit with a potentiometer that looks the worse for wear, with signs of overheating. Could this be the cause of the problem?

The glass encapsulated unit is the e.h.t./horizontal static convergence unit which often looks dark and stained but is seldom faulty. Check the HV and CV connections to the studs in the c.r.t.'s glass envelope. If these are o.k. it's almost certain that the tube itself is faulty or worn out. Reactivation may work, but it's unlikely in view of the age of the set.

FERGUSON 3V32

This machine records and plays back correctly in the long-play mode, but in the standard-play mode there's a patterning effect every two-three minutes. The patterning nearly wipes out the picture and looks like a tracking fault.

It seems that the capstan is running out of phase lock in the standard-play mode. First check that the control track

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TELEVISION JANUARY 1988

head is clean and that the alignment of the tape past the head is correct. If necessary, carry out the capstan free-run setting up procedure given in the manual.

DECCA 100 CHASSIS

This set blows the mains fuse after being on for three-four hours. I've changed the tripler, the line output transistor, the bridge rectifier diodes and the main h.t. electrolytic but the set still blows the fuse. I'm told that a split second before the fuse blows the set seems to come on with increased power i.e. the sound and brightness etc. increase.

The problem is not uncommon with this chassis, and can generally be cured by replacing the 6·8V zener diodes D614 and D616 and the 186V crowbar circuit zener diode D617. Since 186V zener diodes are no longer available, use three 400mW zener diodes in series to make up the correct breakdown voltage, e.g. two 68V plus a 56V zener diode or two 72V plus one of 47V.

TEST CASE

301

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.

As consumer electronics equipment becomes ever more complex and, in the case of portable equipment, more miniaturised the ability to diagnose faults by reasoning and the use of test equipment becomes more important. With surface-mounted components tightly packed on boards that are often difficult to get at the "suck it and see" approach of diagnosis-by-substitution becomes impractical, especially when virtually all the components are specials that have to be ordered from the manufacturer concerned. Thus more than ever the processes of fault diagnosis and repair must be kept separate.

Logical analysis of the symptoms present is essential, in order to narrow down the field of search during perusal of the manual and subsequent scope and meter tests. This is easy in cases like field collapse or no sound in a TV set: less so, perhaps, in more complex gear like VCRs and camcorders. To help with this some modern camcorders have a self-diagnostic system built into the syscon microcomputer, whereby the pattern of function LEDs, when flashing in the alarm mode, gives an indication as to where the cause of the problem lies. In general however the technician has to think for himself if he's going to avoid wasting expensive time in fault tracing.

Our example this month happens to be a sophisticated Sony camcorder, Model CCD-100E, but the principle, and above all the first step in the diagnosis, is the same as for most conventional VCRs. The machine, still under guarantee, was returned for urgent repair with the message "no go – light flashes." What we found was this. The switch-on and eject processes were fine, and the machine would happily accept a tape and thread it up. As soon as any moving mode was selected however – record, play, wind or fast forward – the deck would run for five or six seconds and then stop, with the eject light flashing (the alarm mode indication in this particular model). To get any further it was necessary to reset the microcomputer by switching off and on again, after which eject would once more operate.

A first vital clue was given by the fact that the playback picture and sound were present during the five seconds when the machine worked normally. Everything that should go round (and across, etc.!) did so at what was plainly the correct speed. There were no graunching noises and no bulging loops of tape. This observation of the deck's operation and the behaviour of the syscon had already – along with a reasonable knowledge of how VCR systems operate – suggested a very likely culprit area. The provisional diagnosis was virtually confirmed by the technician's next action, which consisted of pressing two buttons on the front panel in quick succession. What were they? Those of you knowledgeable in VCR matters might like to stop reading at this point. For others we'll provide more clues.

Play was keyed in, followed within a couple of seconds by pause. The result was that the machine happily remained in freeze-frame, with a stationary picture displayed by the monitor and in the viewfinder. As far as the technician was concerned this was the clincher. He then separated the camera and recorder sections preparatory to wading into the latter to unclip and hinge out several mini PCBs. Where was he heading? Why with such confidence? More in the February issue!

ANSWER TO TEST CASE 300
– page 127 last month –

Last month's fault was an unusual one – overheating and failure of the TDA2190 intercarrier sound/audio output chip in a set fitted with the Rank T22A chassis. Sage's second replacement didn't bite the dust like the first one because he kept the volume low while carrying out further investigation. In fact the relative comfort of the chip at zero and very low volume settings was the key to the diagnosis.

As with most TV receiver loudspeakers, the one in this set is coupled to the audio output stage by means of a large electrolytic capacitor. Thus the load presented by the speaker becomes significant only when a signal is present. In this particular chassis the loudspeaker has – or should have! – an impedance of 30Ω. Sage decided that the speaker was imposing a heavy load on the output stage. When the speaker was disconnected, by removing socket 3Z8, the chip ran cool at all settings of the volume control.

A d.c. ohmmeter check on the loudspeaker showed that its resistance was a little over 1·5Ω: its cone was jammed almost solid. Sage found and fitted a 30Ω speaker and after this all was well. The owner even said that the tone was better than before!

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A CHRISTMAS CAROL

In the centre of 'Hardup Village' was a shop called "Scrooge Electronics." It's proprietor, Eberneezer, was infamous for his money grabbing antics and everyone knew that he would buy his televisions and videos at the lowest price possible without any concern for quality. Consequently Bob Cratchett, his engineer, worked many long hours refurbishing and repairing sets, earning just enough money to survive.

"Scrooge Electronics" had a reputation for poor quality and Bob, who spent all his spare time on service calls, knew that because of this, potential new customers were wary of buying. But it wasn't Bob's fault — after all you can only work with the materials you're given.

One Christmas Eve, whilst all were asleep and the snow was falling silently on the rooftops, Eberneezer had a dream: First he saw the ghost of Christmas past — and he recognised all the customers to whom he had sold poor quality sets. They were now sitting at home looking very miserable, for their television's were beyond repair and out of guarantee. This scene started to affect his conscience.

Then he met the ghost of Christmas present — and he saw Bob Cratchett's family sat at home, without any food on the table, waiting for Bob who was working long hours still doing service calls. Eberneezer didn't realise the misery he had created and knew something must be done.

Whilst he worked on a solution, the ghost of Christmas future arrived and started to ask him questions:

"Would you like to buy televisions and videos in showroom condition?" "Yes!" said Eberneezer.

"Does it annoy you that all the profits you make are being spent on service calls and maintenance?"

"Yes!" said Eberneezer.

"Do you now realise that if you buy the right quality sets in the first place, your customers will be hassle free and happier, and that with the extra profit you save from service calls you can pay poor Bob a decent wage?"

"Yes! Yes! Yes!" said Eberneezer. "But what do I do! I have travelled the length and breadth of this country wasting time and money, calling at wholesalers; and I am fed up spending half the day there, sorting through stock, only to find that the handful of sets I come away with start causing me problems as soon as I get home. I am at the point of despair and there is no-one who can help!"

"Oh yes there is!" said the ghost "But only one!"

"Who is it?" said Eberneezer.

"Pro-Vision" said the ghost. "They're the Professionals. Give them a call."

Eberneezer did, and ever since that day he has realised that reputation and profits go hand in hand. So why not take Eberneezer's advice, contact ProVision and have yourself a very merry Christmas and a prosperous New Year.

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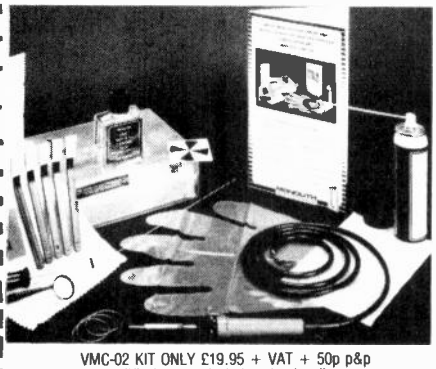

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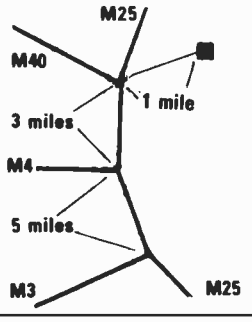

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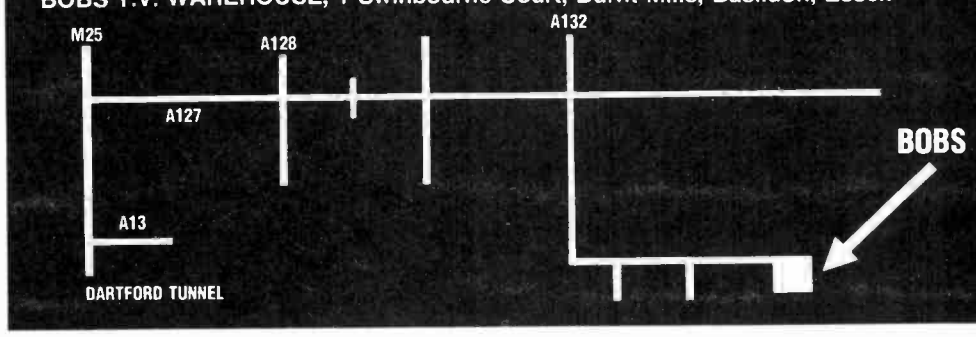

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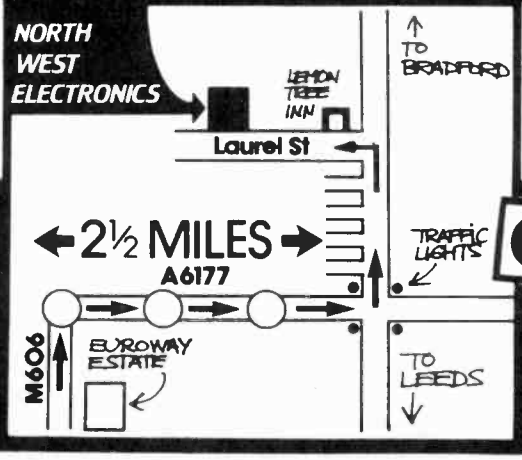

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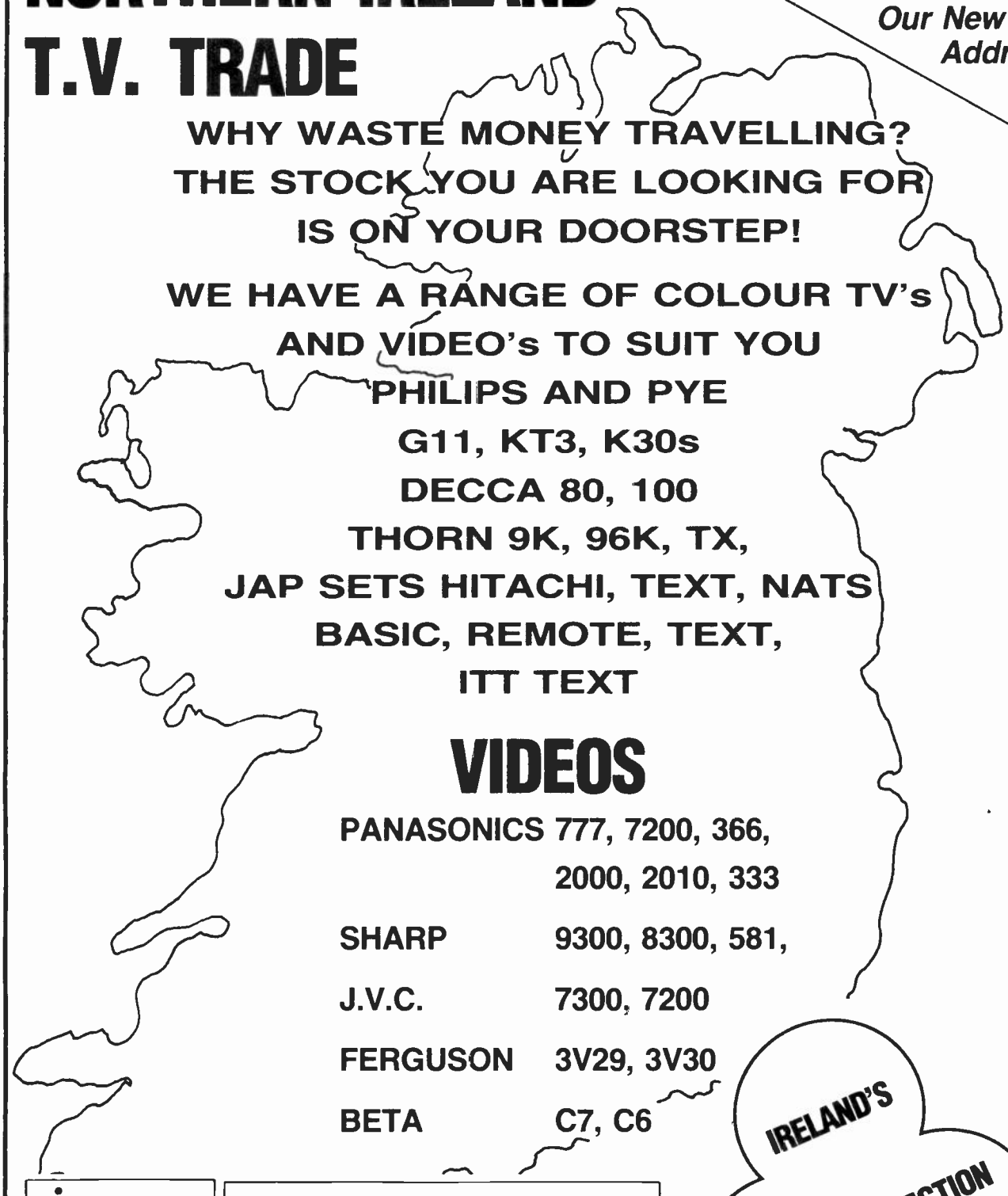

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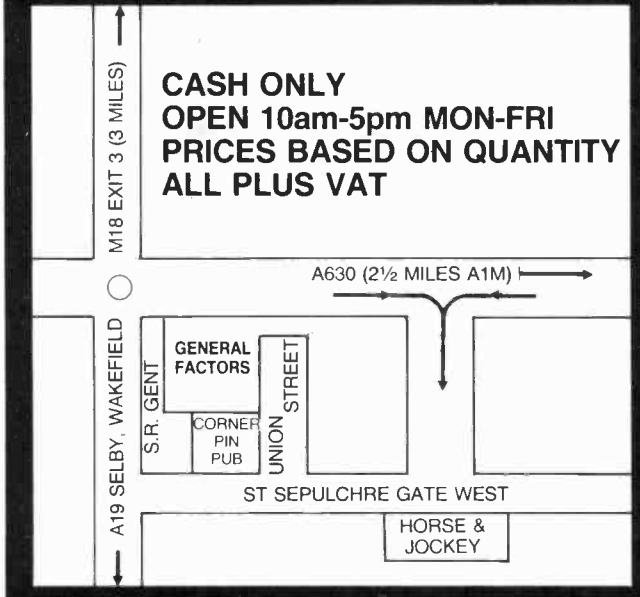

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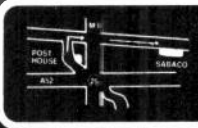

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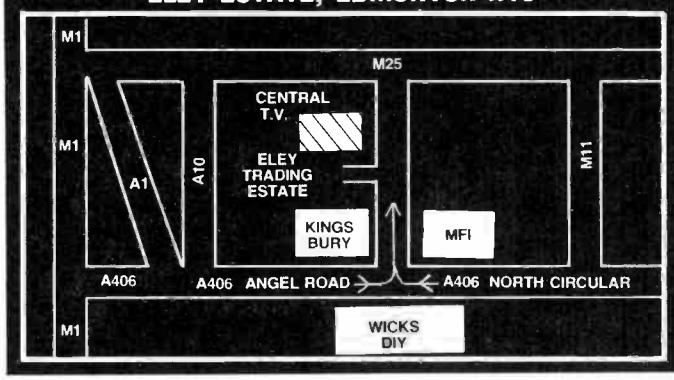

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15V, 015V, 1A Print Type Trans **£1**

Philip's Headphones Compact Disc Stereo Type **£10**

ITT Display Tube 58705 **50p**

8 Seg Display FND500 **20p**

Model 3000 Pocket Personal D.M.M. Volts range AC, DC 200M/V to 400V. Res. 2000Km **£20**

Export PYE731 6 Push Button unit with (UHF-VHF) band switch **£4**

ITT Micro Phone M5 **50p** with switch

1½ Volt Sub Min Relays **25p**

Philips Solar Scientific SBC1730 Calculator **£12**

15v-0-15v 1 Amp Transformers **£1**

RGP30K **10p**
RGP30G **8p**
RGP10B **5p**
RGP15G **6p**
T6024WGI **10p**

Multi Core **£4.50**
60–40 Soldar 500G 20 SWG **£5.00**
15 Watt Stereo Amp Sanyo Module with Data **50p**
PHILIPS
25 Watt Solder Iron **£4.00**

Various Tools and Accessories

T/V V/Aerial 300Ω or 75Ω **£1.50**
L.C.D. clock display with alarm **75p**
* D/P push mains switch **20p each**
Mains lead & two pin socket for radio cassette **35p**
T/V loop aerial **75p**
Radio Telescopic Aerial **£1.00**
Philips Neon Lamps for TV sets **5p**
Freeze Philips **£1.20**
Foam Cleaner Philips **£1.20**
Contact Cleaner Philips **£1.20**
Cans of Anti Static, Degrease Cleaner and Anti Corona **All at £1.40**
Lorlin Full Remote Relay Switch fit most T/V sets, mains 4 tag, 2 tag 12 volt **£1.00**
Mains timer. 13 amp — up to 2 hours: easy to use, plugs into socket **£3.00**
Screen locking agent, large can **£1.50**
Red E.H.T. LAED and Anode Cap **£1.00**
Weller solder iron 15 watt/25 watt **£5.00**
Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V **60p**
100 Coax Plugs **£12.00**
De-solder pump + 2 nozzels Philips **£4.00**
Flat Red LED and Green **5p**
500gm 60/40 solder reel **£6**
Solder 1 kilo reel **£5.50**
Dual v/u meter -20 – +10db **£1**
K30 thermistor 232266298009 **75p**
De-solder Pump **£2.50**
Portasol Flameless Gas Soldering Iron **£16.00**

KT3 PANELS

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

SONY 1400KV Chroma Panel **£6**
SONY 1400KV Touch button unit **£3.50**

GEC Decoder Panel PC772A3 PC446A5 **£6**

Tube Base 20AX GEC PC852B3 **£1**

Thorn Aerial Socket TX10 **£1**

12 Volt Mains Trans 500M/A **£1.00**

Quantity Reductions
BY204/4 **25 for £1.00**
BY206 **25 for £1.00**
KT3 touch button black **6 for £1**
G11 touch button red **6 for £1**
K30 full remote Dawer Ass with 3 I.C. **£7.00**
K30 VHF. UHF Dawer Ass **£6.00**
BY298 3 amp/fast/R **20 for £1.50**
BU126 **10 for £6.00**
BU205 **10 for £8.00**
BU105 **10 for £6.00**
BF458 **10 for £1.00**
BF224 **20 for £1.40**
OA90 **40 for £1.00**
50 Ceramic Condensers **£1.50**
Mixed Mounting Kit for Power Transistors **50p**
300 Condensers **£1.50**
300 Resistors **£1.50**
150 Electrolytics **£2.00**
15 Bulbs Philips **40p**
Antistatic Discloth **5 for £1**

SENDZ COMPONENTS
TO ORDER SEE BACK PAGE

Plastic Boxes 4¾ × 4 × 1 × ¾ **50p**
100 Fuses **£2.00**
100 W/W Res. **£1.50**
BF 199 **20 for £1**
10 × 20 Turn 100k pots. Rank BF 470 **£2 20 for £2**

6 Mixed UHF Aerial Isolating Sockets, some with long leads. Fit ITT, GEC, Philips, Pye **£1.00**

Mixed Packs
TO66 12 Power Trans RCA 16182 NPN Replacement for BD124 and Mounting Kits **£1.00**
50 Mixed AC series Transistor **£4.50**
25 Panel Mount Bulbs & Neons **£1.50**
10A **£1.50**
25 LED red/yellow/green **£1.50**
20I/C Holders **£1.20**
20 Large LED Red **£1.00**
20 Small LED Red **£1.00**
10×20 Turn 100K Pots **£1.00**

Red & Green LED on Panel **1p each**

Mixed 100 Transistor B.F. and B.C. and PET **£1.50** 1000 for **£10.00**

12 Volt 4 Amp Video Battery Pack 10 of Type D Cells **£8.50**

40 glass reed switch **£1**
10 press to make switch **70p**
40 Pots **£1.50**
5 Tube Bases **£1.00**
1,000 Diodes, Condensers, Resistors on Bandolier **£2.00**
20mm Fuse Holders
Chassis Mount **20 for £1**
EHT Diodes, small **20 for £1**

300 Mixed Diodes **£2**

100 500M/A Fuse **£1**
100 1.225 Amp Fuse **£1**
Mixed V/Cap Pots ITT-GEC-Hitachi-Philips etc, **20 for £1**
ITT Mains Switch with Remont CMC113 **£1**

SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

Matsushita PY34220 Tuner £7
C. Cam Decoder with TDA3591 £5
Toshiba VHF/UHF EG522F £6
Mitsumi MEC1-F51 £5

Thorn Spares

New 9000 Decoder £8.50
9000 Frame panel £8
9000 Cyclops panel £1.50
8000/8500 timebase panel £8
8800 convergence panel £6
8500 convergence panel £6
4000 Power supply £3
1600 Mains leac. switch
3500 6 push button + cable form £1.50
T605 1vNPN T066 80v/6A 10p
9000 Sound output panel £1
3500 Focus unit £1.50
3500 Mains Trans £4
3500 cut outs 10 for £4
3500 IF panel £2
3500 Frame panel £3
3500 Line panel £3
3500 A1 Diode 20p
Export 3500 IF panel £2
IC board with set of SN741S £1
4000 Tube base £4
3500 A1 pots 50p
Beam limiter panel £1.50
3500 Power panel with Y969 £1
3 Way regulated adaptor 240V 6V/
7.5/9V/300mA £3.50
Rank/Toshiba preh unit 0354 £9.50
4 Push button unit prch £1.00
6 Push button VHF/UHF for
w/cap. GEC-Decca type £7.00
7 Push button for CVC5 ITT £8.00
G8 Push Button Unit £10.00
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
Rank Z718 4 P/B/Unit MEC11 £4
7 Button Unit GEC with Lamps £7
697 Push Button Unit £6.00
Z916B panel £5.00
T513AP panel £5.00

Mains Droppers

Pye 731 3+56+27R 50p
Thorn 50/17/1K5 £1.00
120/220/20/48/1IT £1.00
270/10/6 for Thorn 4000 50p
18/320/70/39 £1.10
Thorn 50-40R-1K5 50p
Ae Socket & Lead
GEC, ITT, Philips, Pye 25p
7×3¾ Thorn £1
Thorn 1600-1700 £1.50
Rank Toshiba Tube Bases 30p

Speakers

6×4 G11 25 ohm £1.00
5½×2½ 3 ohm £1.00
5×3 80 ohm 70p
5×3 50 ohm 50p
5×3 35 ohm 70p
6×4 15 ohm £1.00
6×4 speaker 16 ohm
7×3 70 ohm £1.00
8×5 8 ohm 15 watt £2
8×5 8 ohm £1
5×3 8 ohm 70p
7×3 16 ohm £1.00
5" dia 16 ohm £1.00
5" dia 8 ohm £1.50
6½" dia 4 ohm £1.50
6½" dia 3 ohm £1.50
2¾" dia 8 ohm 75p
3" dia 8 ohm 75p
4½" sq. 15 ohm 75p
KT3 speaker K30 75p
3" dia 15 ohm 60p
1690 5×3 12 ohm £1
K45 Philip 15 ohm 75p
K30 15 watt £1

KT3-K30

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

DIODES

BY 126 10p
BY 127 10p
BY 133 10p
BY 134 10p
BY 164 50p
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 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 527 10p
BY 602 10p
F 247 10p
GP20G 5p
GRP80G (TX10) 60p
XK 3102 50p
BYV 28/200 20p
800v/2.75 amps 10p
International Rectifier EHT Diodes G770/HV34 6KV 3 for 8p
6A/600V Stud Diodes 20p
6A/1000V Stud Diodes 20p

K35 Decoder £8.00
K35 Sound OP £4.00
K35 Split Diode 3122-138-35930 £10.00
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

Line Transformers

Line O.P. Trans. Mono T.V. 12"-14"
Philips
27482 £10
4822 £10
10273 £10
Thorn 1690 LOPT £6.50
2.1/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 1700A £3.50
Split Diode Trans £7.00
GEC 20 AX Rank Z522 £3.00
Rank L.O.P.T. Z970 £3.00
CVC32 £6.00
AT2080/15 £5.00
CVC30 ITT £5.00
CVC32 Line Tran £7.00
CVC800 Line Trans £6.00
CVC40 Slip/Diode £12.00
CVC 45 £5.00
GEC Portable G1OT2041 £3.00
GEC Portable G1OT2046 £3.00
EHT Spht Diode Leads ITT £1.00
3500 L.O.P.T. & HT Trans each £2.00
LOPT Rank Z763 £5.00
K35 Split Diode 3122/13835930 £10.00

Black Triplers

KT3 Triplers £6.00
S.T.C. Universal Tripler £5.00
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 TFZ Rank £3.00
G9 Philips £4.00
GEC 2110 £4.00
3500 Thorn £3.00
8500 Thorn £4.00
9000 Thorn £6.00
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
11THY £4.00
D22 for Pye 18" colour portable £4.00
LP 1193/63 £4.00
BG 100/41 £3.25
ERO Tripler print type with foacs 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 F.W. coils £1.00
G11 Transient Suppressors 245V 20p
G11 Scan Coils £5.00
G11 100K tuner pots 12 for £1
KT3 IF panel £6.00
KT3 line OSC transformer £1
KT3/K30 infra-red receiver
head £1
K30 drawer unit with IC's
(home) £10
K30 drawer unit with IC's
(export) £10
KT3 AE Sockets 50p
KT3 receiver panel £8
KT3 line driver transformer 50p
Pye, K30, GEC, etc Pre-mains stand-by
switch £1
Decca 80/100 IF panel £5
NPN PNP 80V 6 Amp T066 O.P.
Trans pair 25p
5 button touch tuner BBC1/2 ITV1/2
video with ic SAS 560T/570T £7.00
Control panel 5 sliders + mains lead £1.50
G11 8 touch button unit replaces old 6
P.B.U. £24
G11 6 touch unit replacement with
dat £14.00
Tube base + base unit for 820 Euro
chassis £4.00
GEC Line O/P Trans. & Rec Stick for
Portable £3.00
CVC 20/25/30/35/40 decoder panel £10
CVC 20/25/30/35/40 decoder panel
(untested) £5
CVC 40/45 IF panel £5
40K Transducer 50p
PHILIPS NE511N £1.20
LM337M Reg. 30p
20 GEC Black Spark Gaps £1.00
KT3 Front Panel Control
Assy £2.50
BTW 30/50 50p
BTW 92/800R £3
25A473 PNP C/P 10p

Rank T20 Z136 Panel £6.00
NEW 1617 THORN Chassis with ICs & AU113 £5.00
NEW GEC 20AX Power Supply Switch Mode £12.00
Complete new GEC portable chassis M1201H/M1501H with P.B.U./
v.cap/LOPT £10.00
Field + Jungle panel for GEC 3133/3135 £1.50
GEC 2110 line panel with transformer £7.00
GEC 2110 tuner unit + IF Panel £12.00
Pye/Chelsea Line op panel £12.00
Pye 205 T/unit £3.90
Pye 205 Line op panel £7.50
Pye 713 IF panel and tuner £7.00
Pye 713 Chroma £10.00
Pye/Chelsea Timebase panel with LOPT £10.00
Pye 731 Frame Panel £5.00
Pye 731 Convergence Panel £5.00
Pye 731 Chroma £10.00
Pye 731 IF panel + tuner £10.00
Pye CDA/205 panel £6.00
GEC portable chassis + LOPT 2114 New £4.00
Thorn 1613/1713 chassis 9.75
G9 Power Panel £6.00
Mono RANK Chassis 127A NEW £10.00
NEW G9 Frame Panel £4.00
NEW G11 IF Panel £10.00

25% OFF ALL PANELS

G8 Tuner Unit + Panel £4.00
G8 6 Sloping PBU £8.00
G8 IF & Chroma £6.00
G8 Chroma £3.00

G11 IF Detector £3.00
G11 Selector gain module £3
Complete CVC 825 Chassis (both
panels) £40.00
AEC V/Cap Resistor Unit UHF with IC
SAS660 SAS670 £3.00
Z714 RANK IF Panels 6MHz 1 I.C.
SL437F £3.00
Z909B RANK IF Panels
Export 5.5MHz 2 I.C.'s
TBA120SB TCA270SQ £2.50
K35 IF £6.00
Z743 RANK IF Panel
Export 5.5MHz 3 I.C.'s
TBA750+SC9504P+
SC9503P £1.50
Pye G11 Front panel with transducer,
pots, tuner pots, 6 pb switch+lead £5.00
Pye 6 button switch portable £1.00
GEC V/cap VHF/UHF tuner and IF+
sound O/P PC 706B3 (Export) £12.00
GEC Line O/P PC 659B3 £6.00
2110 GEC Power Panel £8.00
CVC 20 Front panel with sliders +
mains input panel £4
CVC 40 PUSH BUTTON ASSY with
sliders: complete with lamp assy + pots
8 button units £9.00
CVC9 slider pots panel 50p
CVC 5 Mains on/off + 5 pots £2
Universal Focus. Fits Pye, Thorn and
Decca Units.
T147 Rank tube base on panel £1.00
Z718 Focus Unit £1.50
T20 Focus Unit £1.00
Large Type 75p
Decca Small 75p
KT3 Focus Unit 75p
K30 Focus Pot 75p
K30 Tube base on panel £1.00
TX10 Focus Units £7.00
CVC 32 Focus Unit 75p
Fedility Focus Unit 14R-14S 30p
3500 Thorn Focus Unit £1.00
ITT Small for use with Split
Z718 Bush Focus £2.00
Diode 50p
TV11 50p
Remo TV12SP 50p
1600 Thorn EHT Rec and Lead 50p
TV13 50p
TV14 50p
TV18 60p
TV20 £1.00
TV45 50p
Thorn 14/1500 rec stick 5p

TX10 8 Button Unit £10.00

TX10/TX100 16 Button £10.00

G11 drawer ASS 3 pots Mains switch
and lead £2.00

K30 Drawer Ass with pots cable
forme £1.00

TX10 Drawer with 8 way pots. ass. £2.50

TX10 Ex. port with band switch
(drawer) £2.50

Line O/P panel GEC 2217/2218/2213/
2214/2226/2227/2228 £10

PHILIPS BATTERIES
(Small Types) HAND SETS

SR41 40p
SR43 40p
SR44 40p
SR54 40p
LR43 40p
LR44 40p
LR54 40p
CR2032 40p

.22/1000 20p
.1/250AC 20p
.1/100 5p
1MFD-250AC 25p
1/100 × 10 30p
22/100 10p
4.7M/100 5p
470/100 20p
4700/100 75p
47/160 10p
300-300/300V 80p
800/160 50p
.1/250 Pulse 5p
2.2 250v 10p
7N5 1500V 15p
3n3/250 A.C. 10p
.33/250V 20p
.39/250V 15p
4n7/250 tested 5KV 25p
22/250 15p
47/250 10p
100/250 20p
G11 470/250V £1.75
GEC600/250 60p
700/250 £1
300+300 MFD 350v £1.00
800/250 40p
32/300 20p
4/350 5p
8/350 8p
4.7M/350v 10p
33/350 20p
220/350 30p
300/350 40p
400/350 50p
22/375 15p
220/385 (ITT) 75p
330/385 CVC 820 IT 60p
0.1/400 15p
KT3 E/W .39/400 15p
.56K/400v 20p
4700pf/400 10p
.22/400 10p
8/400 15p
33/400 20p
400/400 40p
394K/400V 20p
220/450 40p
.47/500 25p
0.1/600 15p
0.1/1200V wire end 20p
0.1/450 A/C wire end 20p
.22/1000 20p
.047/600 15p
0.047/1000 10p
0.01/1000 10p
0.1/1000 10p
.47/1000v 65p
.47/250V A.C. 10p
.001K/1250 10p
0.0047/1500 10p
.005/1500 10p
.0105/1500 15p
1n8/1500 15p
2n0/1500 15p
2n2/1500 15p
.01/1600 20p
G11.8200/2KV 15p
0.1/2KV 10p
3n9/2KV 15p
0.0015/2KV 10p
6n2/2KV 15p
2n0/2KV 15p
2n2/2KV 15p
470pf 4KV 10p
7500pf/2KV 10p
3000PF/3000V 10p
4n7/2KV 15p
6n2/2KV 10p
7n1/1500V 10p
8n2/1500V 10p
9n1/2000V 15p
8n2/2KV 15p
0.0082/2500 10p
150/3500 5p
1800/4KV 10p
4.7nf/5KV 10p
170/8KV 10p
180/8KV 10p
210/8KV 10p
1000/10KV 15p
47/100V 80p

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

Tube Thermpath 167 £1.00
Rank Secam Decoder Panel UHF & VHF
T115A £13.00
10 off .91 CAP G11 £2.00
Philips K4 CAP 150M/385V 50p

Multi-Caps

220 MFD Sprague 385V 50p
350V 300M + 300M £1.00
400V 400M 60p
350V 400M 60p
Thorn 3500
175/100/100/350v £1.00
KT3/200/25/25/385v £1.00
KT3-K30 220+40+40 75p
200+200+75+25M 325V £1.00
300+300+150+100+50MFD
350V £2.00
G11 CAP 470/250 £2.00
47/220/350v 60p
150/150/100/100/100/320v £2.00
2500/2500/63v 50p
150/200/200/300v 70p
300/100/100/16/275v £1.50
100/200/325v 40p
150/150/100/375v £1.50
200/200/75/25M 375V £1.00
Thorn TX9 Caps 500+500M 175V £1.75
300/300/100/32/32/300v 2.00
1500/2000/30v 50p
150/150/100/100/320v £2.00
100/350 + 300/200/100/16/275v £2.00
225+25/380 GEC 70p
200/100/100/350v £1.50
500/500/25v 50p
150/150/100/300v 75p
200/150/150/300v 1.00

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

CMC 301 front panel £8.00
CMC 303 front panel £8.00
CMC 302 Panel with TC mains switch
etc £8.00
CMD 800 Decoder £8.00
UPC 574 30p
BSS 38 30p
G11 £1.50
1 I.C. Receiver Panel
3 I.C. Power Supply G11 Full Remote
Receiver Panel £3.00
FET Power VN88AF 50p
PHILIPS SBC 469 Stereo Microphone
£23.00
Meters Hills 520 £17.00
Meters Hills 420 £15.00
Hills HDS000 Digital Meter 1000V DC
750AC 10 Amp 20 MRG Rangers £28
HT100 Multimeter £6.75
HT300 Multimeter £7.75
HT500 Multimeter £9.00
HD1000 Digital £20.00
HD3000 Digital £25.00
HD5000 Digital £25.00
HD6000 Digital £32.00
HD8000 Digital £37.00

Infra Red
Hanset Tester

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

Repaired Handsets

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

RC4001 Full Remote KT3 K30 Teletext
Handsets exchanged £9.00

GEC Full Remote Infra-red, 1983 models
£15.00

Timers, 60 mins, small £1.00

TOSHIBA
HAND SETS

24 Button CT938 Fulremote £5.00
32 Button CT983 Videotex £6.00

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

GEC Ultrasonic 8C11 Full Remote £15.00

G11 Full Remote Ultrasonic £32.00
G11 Touch Unit Full Remote £13.00
G11 Ultrasonic Teletext Handset £20.00
8 C.11. Ultrasonic GEC Full Remote
C20141/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 £24.00
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
G11, Full remote new ultrasonic £32.00
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 £15.00
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
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BF199	10p
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BC140	30p
BC141	25p
BC143	25p
BC147	10p
BC148	10p
BC149	10p
BC153	10p
BC154	10p
BC157a	10p
BC158	10p
BC159	10p
BC160/16	25p
BC171	5p
BC172	5p
BC173	5p
BC174	5p
BC183	5p
BC184	5p
BC204	5p
BC207	5p
BC212	5p
BC213	5p
BC214	5p
BC237	5p
BC238	5p
BC239	5p
BC250	5p
BC251	5p
BC252	5p
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BD222	30p
BD228	30p
BD226	20p
BD233	30p
BD234	25p
BD235	30p
BD238	30p
BD239	15p
BD240	50p
BD243c	30p
BD244	50p
BD250a	30p
BD252	20p
BD253B	50p
BD331	20p
BD373b	20p
BD416	25p
BD433	25p
BD437	25p
BD438	30p
BD439	50p
BD544D	40p
BD650	50p
BD678	30p
BD681	30p
BD682	90p
BD507	50p
BD509	30p
BD510	30p
BD517	30p
BD519	30p
BD534	30p
BD535	30p

I.C. Holders

DIL – DIL		DIL – QIL	
40 Pin × 4	£1.00	16 Pin × 10	£1.00
42 Pin × 5	£1.00	18 Pin × 10	£1.00
28 Pin × 5	80p	28 Pin × 4	£1.00
16 Pin × 10	70p	AB Mains Switch	
24 Pin × 5	75p	u/v	30p
14 Pin × 10	70p	**Philips** Electrodynamic	
18 Pin × 10	80p	Stereo Headphones N6315	£10