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For all aspects of practical amateur radio

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EXTRA PAGES

SPORADIC – E PROPAGATION

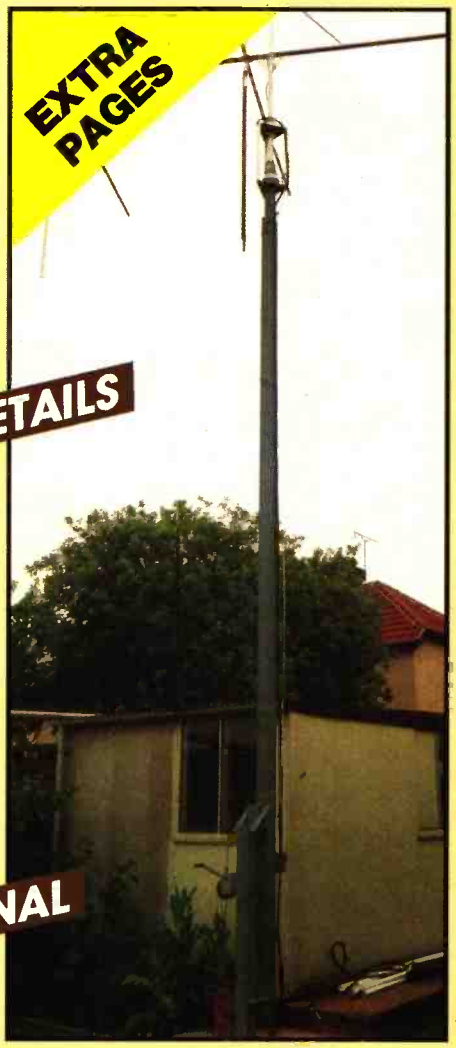
TILT OVER AND EXTENDING MAST CONSTRUCTION DETAILS

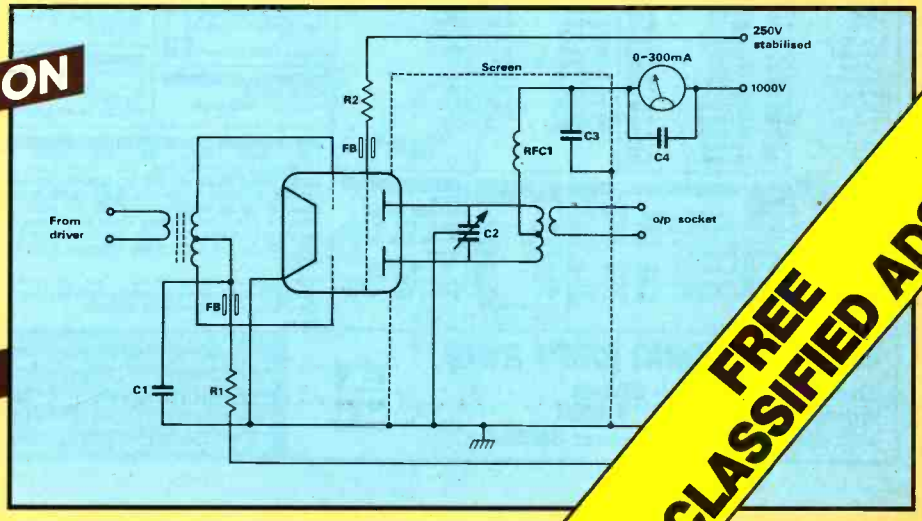
DATA FILE CONCLUDING AUDIO POWER AMPS

HIGH QUALITY DIRECTIONAL COUPLER PROJECT

COMPUTING TRANSMISSION LINE VALUES

BUILD THE QQV06-40A VALVE LINEAR AMPLIFIER





FREE CLASSIFIED ADS

MARCO TRADING

VISA — Access

TRANSISTORS DIODES

Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)
AC127	0.30	BC108	0.10	BC302	0.32	BD244A	0.65	BF258	0.30	BT101/300	1.15	BYX36/150	0.22	TIP32	0.40	2SC1909	1.20
AC128	0.30	A B or C	0.12	BC303	0.32	BD375	0.32	BF259	0.32	BT101/500	1.25	BYX36/600	0.28	TIP32C	0.60	2SC1923	0.30
AC128K	0.34	BC113	0.14	BC307	0.10	BD410	0.76	BF262	0.30	BT102/300	1.35	BYX48/300	0.72	TIP33A	0.63	2SC1945	2.88
AC132	0.55	BC114	0.12	BC308A	0.10	BD434	0.68	BF263	0.30	BT102/500	1.65	BYX49/300	0.47	TIP34A	0.72	2SC1953	0.74
AC141	0.26	BC115	0.12	BC323	0.99	BD436	0.68	BF270	0.30	BT106	1.50	BYX55/350	0.29	TIP41C	0.46	2SC1957	0.76
AC141K	0.40	BC116	0.15	BC327	0.14	BD437	0.76	BF271	0.26	BT108	1.30	BYX55/600	0.33	TIP42A	0.52	2SC1969	2.88
AC142	0.26	BC117	0.22	BC328	0.14	BD438	0.75	BF273	0.18	BT109	1.18	BYX71/600	1.18	TIP47	0.60	2SC2028	0.73
AC142K	0.48	BC118	0.17	BC337	0.12	BD439	0.68	BF274	0.32	BT116	1.25	BYZ12	0.42	TIP110	0.88	2SC2029	1.00
AC151	0.45	BC119	0.30	BC338	0.12	BD507	0.48	BF323	0.92	BT119	3.62	C106D	0.80	TIP2955	0.60	2SC2078	1.05
AC152	0.45	BC125	0.12	BC350	0.14	BD508	0.53	BF336	0.26	BT120	3.60	E1222	0.40	TIP3055	0.60	2SC2091	0.73
AC176	0.28	BC140	0.28	BC440	0.30	BD509	0.54	BF337	0.26	BT121	3.02	E5024	0.30	TIS43	0.32	2SC2098	2.90
AC176K	0.46	BC141	0.42	BC441	0.32	BD510	0.48	BF338	0.26	BT138/600	1.30	GET872	0.48	TIS88	0.40	2SC2122A	3.20
AC187	0.26	BC142	0.30	BC461	0.32	BD517	0.56	BF355	0.42	BT151/560R	0.90	ICT44	0.04	TIS90	0.25	2SC2166	1.20
AC187K	0.40	BC143	0.30	BC547	0.12	BD520	0.66	BF363	0.82	BT151/300R	1.15	ITT2002	0.11	TIS91	0.28	2SC2314	0.80
AC188	0.28	BC147	0.06	BC548	0.12	BD699	1.25	BF367	0.24	BTY79/400R	2.80	ME0402	0.20	ZTX108	0.12	2SC2335	1.50
AC188K	0.40	A or B	0.10	BC549	0.12	BD707	0.88	BF371	0.27	BU100A	2.30	ME0404/2	0.24	ZTX109	0.12	2SC2749	2.70
ACY40	0.88	BC148	0.08	BC550	0.18	BDX18	2.35	BF422	0.38	BU104	2.00	MEU21	0.60	ZTX212	0.28	2SC2752	0.30
AD142	1.10	A or B	0.10	BC550C	0.18	BDX32	2.10	BF450	0.38	BU105	1.20	MJ400	1.25	IN4001	0.05	2SD234	0.54
AD143	1.10	BC149	0.09	BC557	0.12	BF115	0.32	BF457	0.33	BU105/02	1.55	MJ2955	0.90	IN4003	0.05	2SD348	3.30
AD140	0.90	BC157	0.10	BC558	0.12	BF117	0.54	BF458	0.36	BU108	1.50	MJ3000	1.98	IN4004	0.06	2SD966	0.62
AD161	0.42	BC158	0.10	BCX34	0.27	BF119	0.82	BF459	0.44	BU124	1.75	MJE240	0.60	IN4006	0.07	2SK134	3.80
AD162	0.42	BC159	0.10	BCY70	0.15	BF120	0.38	BFR39	0.22	BU126	1.25	MJE340	0.54	IN4007	0.07	2SK135	1.90
AD161/162	0.98	BC160	0.30	BCY71	0.17	BF123	0.40	BFR40	0.22	BU133	1.80	MJE370	0.88	IN4148	0.05	3N126	1.90
AF106	0.48	BC161	0.30	BCY72	0.18	BF125	0.42	BFR41	0.22	BU204	1.35	MJE520	0.48	IN5400	0.12	3N211	2.52
AF114	2.10	BC168B	0.12	BCZ10	1.68	BF127	0.38	BFR51	0.30	BU205	1.30	MJE2955	0.99	IN5402	0.15	3SK45	0.76
AF115	2.10	BC169C	0.10	BCZ11	1.45	BF152	0.16	BFR61	0.32	BU206	1.70	MJE3055	0.70	IN5405	0.16		
AF116	2.10	BC170	0.14	BD124P	0.80	BF154	0.23	BFR62	0.28	BU208	1.55	MPSLO1	0.28	IN5406	0.18		
AF117	2.10	BC170B	0.12	BC130Y	0.68	BF157	0.40	BFR88	0.34	BU208A	1.63	OA47	0.10	IN5408	0.20		
AF118	0.85	BC171	0.10	BD131	0.34	BF158	0.22	BFR90	1.72	BU208/02	2.05	OA90	0.08	IS920	0.08		
AF121	0.62	BC171	0.10	BD132	0.34	BF159	0.24	BFT41	0.38	BU326S	1.75	OA91	0.09	2N697	0.55		
AF124	0.48	A or B	0.08	BD131/132	0.95	BF160	0.23	BFT43	0.38	BU407	1.65	OA95	0.18	2N706A	0.33		
AF125	0.48	BC172	0.08	BD135	0.32	BF167	0.30	BFW10	0.79	BU407D	1.80	OA200	0.06	2N2904	0.28		
AF126	0.48	A or B	0.12	BD136	0.36	BF173	0.25	BFW44	0.76	BUX80	3.70	OA202	0.15	2N2906	0.24		
AF127	0.48	BC177	0.20	BD137	0.36	BF177	0.42	BFX29	0.28	BUY20	1.75	OC25	2.10	2N2926G	0.10		
AF139	0.68	BC178A	0.22	BD138	0.38	BF178	0.30	BFX30	0.30	BUY69A	2.60	OC26	1.70	2N3053	0.22		
AF178	0.68	BC182	0.09	BD139	0.38	BF179	0.32	BFX80	3.56	BUY69B	1.98	OC28	1.50	2N3054	0.56		
AF239	0.68	A B or C	0.09	BD140	0.38	BF180	0.35	BFX84	0.24	BUY101	0.48	OC29	2.47	2N3055	0.45		
AF279S	0.75	BC182L	0.09	BD144	1.60	BF181	0.35	BFX85	0.26	BY118	1.10	OC35	1.75	2N3702	0.10		
AL100	2.50	A B or C	0.09	BD145	1.82	BF182	0.32	BFX86	0.26	BY122	0.85	OC36	1.75	2N3704	0.10		
AL102	1.88	BC183	0.09	BD150A	0.51	BF183	0.32	BFX87	0.26	BY126	0.12	OC42	0.72	2N3708	0.10		
AL113	2.20	A B or C	0.10	BD159	0.65	BF184	0.32	BFX89	0.65	BY127	0.10	OC42K	1.40	2N3772	1.90		
ASY80	1.75	BC183L	0.08	BD160	1.65	BF185	0.32	BFY50	0.21	BY133	0.16	OC44	0.72	2N3773	2.70		
AU110	1.40	A B or C	0.12	BD165	0.45	BF194	0.08	BFY51	0.21	BY135	0.25	OC45	0.58	2N3904	0.16		
AY102	4.32	BC184L	0.10	BD175	0.60	BF195	0.10	BFY52	0.21	BY164	0.44	OC71	0.50	2N3906	0.16		
BA102	0.34	A B or C	0.10	BD182	1.00	BF196	0.10	BFY57	0.40	BY179	0.66	OC72	0.52	2N5294	0.48		
BA110	0.67	BC207	0.15	BD183	1.10	BF197	0.10	BFY90	0.90	BY182	0.87	OC81	0.68	2N6107	0.71		
BA121	0.40	BC208	0.16	BD184	1.20	BF198	0.14	BFY90S	1.34	BY184	0.40	OC200	2.46	2N6126	0.68		
BA129	0.38	BC212	0.09	BD201	0.72	BF199	0.16	BR100	0.20	BY187	0.72	OC202	2.20	2SB337	1.60		
BA148	0.16	A B or C	0.10	BD202	0.87	BF200	0.26	BR101	0.44	BY189	4.75	ORP12	0.85	2SC1172Y	2.90		
BA154	0.08	BC212L	0.08	BD204	0.80	BF222	0.48	BR103	0.58	BY198	0.44	R2008B	1.50	2SC1173Y	0.82		
BA155	0.10	A B or C	0.10	BD222	0.80	BF224	0.20	BRC4443	1.76	BY199	0.47	R2010B	1.52	2SC1302	1.40		
BA156	0.08	BC213	0.09	BD225	0.86	BF224J	0.16	BRY39	0.38	BY206	0.24	SHG1.5	0.40	2SC1226	0.84		
BA157	0.28	A or B	0.10	BD232	0.45	BF240	0.20	BRY56	0.42	BY207	0.24	TAG1/100	1.40	2SC1279	0.50		
BA164	0.14	BC213L	0.10	BD233	0.60	BF241	0.20	BRY61	0.86	BY210/400	0.25	TAG3/400	1.78	2SC1306	0.92		
BB104B	0.52	A or B	0.10	BD234	0.62	BF244	0.26	BSS17	0.56	BY210/600	0.26	TIC44	0.40	2SC1307	1.40		
BB105B	0.30	BC237	0.11	BD235	0.63	BF244A	0.28	BSS27	0.92	BY210/800	0.30	TIC45	0.45	2SC1413A	2.70		
BB105G	0.48	BC238	0.12	BD236	0.63	BF244C	0.24	BSX19	0.34	BY233	1.20	TIC46	0.48	2SC1444	1.45		
BB110B	0.42	BC239C	0.14	BD237	0.65	BF245A	0.28	BSX20	0.34	BY927	0.85	TIC47	0.70	2AC1449	0.63		
BC107	0.10	BC251	0.12	BD238	0.56	BF254	0.15	BSX59	0.62	BY229	0.30	TIC106A	0.70	2SC1507	0.63		
A or B	0.12	A B or C	0.14	BD241	0.66	BF256	0.40	BSX76	0.29	BY238	0.68	TIP30A	0.46	2SC1678	1.06		
		BC301	0.30	BD243A	0.80	BF257	0.32	BT100A/02	0.94	BYX10	0.24	TIP31C	0.54	2SC1758	0.68		

VALVES

Type	Price (£)
DY802	0.88
DY86/87	0.75
ECC81	0.95
ECC82	0.65
ECC83	0.75
ECC84	0.65
ECC85	0.90
ECC88	0.95
ECF80	0.95
ECH81	0.75
ECH84	0.75
ECL82	0.75
ECL86	0.98
EF80	0.65
EF86	1.60
EF183	0.75
EF184	0.75
EH90	0.94
EI84	2.50
EL84	0.69
EL509	5.50
EM87	2.55
EY86/87	0.67
EY500A	1.65
PCC84	0.50
PCC85	0.65
PCC89	0.74
PCC189	0.85
PCF80	0.75
PCF86	1.25
PCF200	1.95
PCF801	1.45
PCF802	0.85
PCF806	1.20
PCL82	0.90
PCL83	2.50
PCL84	0.90
PCL86	0.98
PCL805/85	1.35
PD500	3.75
PFL200	1.35
PL33	1.50
PL36	1.45
PL81	0.85
PL82	0.75
PL83	0.65
PL84	0.75
PL95	2.00
PL504	1.20
PL508	2.40
PL509/519	5.95
PY88	1.80
PY500A	2.40
U26	1.90
UCH81	0.90
UCL82	1.70
6J5GT	1.75
GSJ7	2.20
30FL12	1.60

ROTARY POTS

0.25W CARBON
LOG: 4K7 - 2M2
IN: 1K -2M2
32p ea 10 for £3
Any 100 for £27.50

VEROBOARD

2¾ x 3¾	0.85
2¾ x 5	1.00
3¾ x 17	3.25
3¾ x 17	1.05
3¾ x 5	1.15
3¾ x 17	4.10
4¾ x 17¾	4.95
Pkt of 100 pins	0.50
Spot face cutter	1.48
Pin insertion tool	1.80
Vero wiring pen & spool	3.50
DIP board	3.85
Vero Strip	1.25

HV Disc Ceramic

1kV 1.5nF	0.18
8kV 10, 47, 82, 100, 120	
150, 180	
200, 220pF	0.30
270, 300pF	0.39
10kV 1nF	0.67

ZENER DIODES

400mW Plastic 3V-75V 8p each 10/75p
1.3W Plastic 3V-200V 150 each 10/£1.40
1.5W Flange 4.7-47V £1.26 each
2.5W Plastic 7.5-75V 87p each
20W Stud 7.5-75V £1.31 each

INTEGRATED CIRCUITS (IC) EACH

AN240P	3.42	SN76530P	1.40
AN2140Q	3.88	SN76533N	1.60
AN715Q	2.90	SN76650N	1.05
CA3065	1.75	SN76660N	0.75
CA4031P	2.88	SN76666N	0.80
CA4102	3.30	STK015	6.50
CA4250	3.50	TA7108P	3.20
CA4400	3.07	TA7120P	3.20
CA4422	3.07	TA7129AP	3.65
LC7120	5.33	TA7130P	1.65
LC7130	5.26	TA7172P	1.80
LC7137	5.16	TA7193	5.50
LM380N	0.80	TA7172P	1.80
LM1303N	2.52	TA7176	5.50
HA1151P	3.12	TA7202P	4.18
MC1307P	1.85	TA7204P	1.86
MC1310P	1.85	TA7205AP	1.50
MC1312P	2.25	TA7208P	3.27
MC1327P	1.25	TA7210P	6.50
MC1330P	0.83	TA7222P	1.88
MC1349P	1.80	TA7223P	3.68
MC1350P	1.20	TA7227P	5.60
MC1351P	2.50	TA7310A	1.80
MC1352P	1.50	TA7609P	4.28
MC1357P	2.88	TA7611AP	2.88
MC1358P	1.30	TAA263	2.46
MC1496P	1.15	TAA310A	2.68
ML231B	2.10	TAA550	0.50
ML232B	2.10	TAA570	1.99
ML237B	2.30	TAA611A12	3.50
NE555	0.25	TAA611B12	2.85
C-mos555	0.88	TAA630S	3.90
NE556	0.80	TAA661B	1.70
SAA1024	5.35	TAA700	2.80
SAA1025	8.40	TAA840	3.38
SAS560A	2.50	TAD100	2.80
SAS560S	1.85	FM FILTER	1.20
SAS570S	1.85	TBA120A	1.00
SAS580	2.85	AS, S, SA, SB	1.20
SAS590	2.82	Q, T, U, UQ	1.32
SC9503P	1.10	TBA120B	1.30
SL432A	4.00	TBA231	1.45
SL901B	5.20	TBA281	2.65
SL917B	6.25	TBA395	1.20
SL1327Q	1.10	TBA480Q	1.50
SN76003N	2.44	TBA400	2.30
SN76013	1.90	TBA510	2.60
SN76023ND	2.90	TBA510Q	2.60
SN76033N	2.45	TBA520/Q	1.60
SN76110N	1.12	TBA530/Q	1.30
SN76115N	2.00	TBA540/Q	1.40
SN76131N	1.65	TBA550/Q	1.52
SN76226ND	1.80	TBA560C	1.70
SN76227N	1.10	TBA560CQ	1.40
TBA570	1.50	UPC1025H	2.90
TBA641BX1	4.50	UPC1032H	0.90
TBA673	2.40	UPC1156H	4.20
TBA700	2.85	UPC1158H	0.76
TBA750	2.80	UPC1163H	0.98
TBA800	1.60	UPC1181H	1.60
TBA810P	1.10	UPC185H2	3.75
TBA810S	1.20	UPC1212C	1.30
TBA820	1.60	UPC1230H	3.90
TBA890	3.88	UPC1350C	3.90
TBA920/Q	3.00	UPC1367C	2.40
TBA940/2A	3.05	UPC1378H	4.40
TBA970	4.05	UPC2002H	2.80
TBA990	1.88		
TCA160C	3.90		
TCA270S	4.00		
TCA270SA	4.02		
TCA800	3.10		
TCA940	1.90		
TDA440	3.80		
TDA1002	1.90		
TDA1003A	5.50		
TDA1004A	2.90		
TDA1006A	2.40		
TDA1035S	4.50		
TDA1044	4.30		
TDA1170S	3.00		
TDA1190	3.50		
TDA1200	2.98		
TDA1270Q	3.70		
TDA1327A	1.63		
TDA1352A/B	1.56		
TDA1412	1.20		
TDA2002	2.80		
TDA2020	4.60		
TDA2030	2.78		
TDA2140	5.90		
TDA2521	4.10		
TDA2523	3.50		
TDA2530	2.70		
TDA2540	3.80		
TDA2541	3.80		
TDA2560	3.50		
TDA2571A	2.50		
TDA2581	3.20		
TDA2590	3.20		
TDA2591	2.98		
TDA2593	2.98		
TDA2610	3.20		
TDA2611A	1.94		
TDA2641	2.90		
TDA2680	3.40		
TDA2690	3.50		
TDA3950A/B	2.60		
UPC554C	1.32		
UPC557H	0.90		
UPC566H	2.95		
UP575C2	3.20		
UPC1018C	1.10		

BRIDGES

1½A 50V	0.27
100V	0.28
200V	0.32
400V	0.40
600V	0.67
800V	0.58
2A 100V	0.52
200V	0.55
400V	0.61
600V	0.67
800V	0.70
6A 100V	0.66
200V	0.68
400V	0.74
600V	0.80
800V	0.86
10A 50V	2.20
100V	2.24
200V	2.35
400V	2.50
600V	3.50
25A 50V	2.05
100V	2.25
200V	2.40
400V	3.20
600V	3.95

PANEL METERS

FSD
60 x 46 x 35mm
0-50μA
0-100μA
0-500μA
0-1mA
0-5mA
0-10mA
0-50mA
0-100mA
0-500mA
0-1A
0-2A
0-25V
0-50V AC
0-300V AC
'S'
'VU'

ALL – £5.00 EACH

RESISTOR – CARBON FILMS 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) **7p each** 65p/10.6.00/100
2W 10R to 2M2 (E6 Range) **8p each** 70p/10.6.00/100

RESISTOR KITS
each value individually packed

¼W pack 10 each value E12 – 10R to 1M 610 pieces	4.80
¼W pack 5 each value E12 – 10R to 1M 305 pieces	2.75
½W pack 10 each value E12 – 2R2 to 2M2 730 pieces	5.25
½W pack 5 each value E12 – 2R2 to 2M2 365 pieces	3.00
1W pack 5 each value E12 – 2R2 to 1M 353 pieces	15.00
2W pack 10 each value E6 – 10R to 2M2 317 pieces	18.00

RESISTORS – WIREWOUND Generally 5%

2.5W – 0.22 to 270R – Available in preferred values 0.20
4W – 1RO to 10K – Available in preferred values 0.21
7W – 0476R to 22K – Available in preferred values 0.25
11W – 1RO to 22K – Available in preferred values 0.29
17W – 1RO to 22K – Available in preferred values 0.37

TERMINAL BLOCKS AUGUST SPECIAL

2 amp 12 way 0.10
5 amp 12 way 0.20
10 amp 12 way 0.40 AU110
15 amp 12 way 0.46 BC308A
32 amp 12 way 0.90 BC170

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Phillips Video Projection Screen 60"
£50 each p&p £8
10 for **£12** 100 for **£85**
10 for **50p** 100 for **£3**
10 for **50p** 100 for **£3**

MULTIMETER SPECIAL

Russian type U4324-(20,000 O.P.V.)
DC Volts: 0.6, 1, 2, 3, 12, 30, 60, 600, 1200.
AC Volts: 3, 6, 15, 60, 150, 300, 600, 900,
DC Curr: M/A 0.06, 0.6, 6, 60, 600, 3000
AC Curr: M/A 0.3, 3, 30, 300, 3000
DC Resistance: 0.2, 5, 50, 500, 5000K
level dB - 10 to +12

Supplied with rechargeable batteries
Price £12.00 incl. of **p/p & VAT**

FUSEHOLDERS

20mm Panel Mounting **0.28**
20mm Chassis Mounting **0.06**
1¼in Panel Mounting **0.35**
1¼in Chassis Mounting **0.12**
Carline 1¼in holder **0.10**

CHART RECORDERS

Brand new 3 channel pen recorders complete with charts spares kit. Full spec upon request - Once only bargain **£40** +£10 p&p plus 15% VAT

BUZZERS

SOLID STATE
6v and 12v - **80p each**

POWER SUPPLY

Integral 13A plug - 1 metre lead with 3.5m jack plug - 12v 250mA
PRICE: **£3.00** (p&p 50p)

FUSES - Prices per 10

1¼" Quick Blow, 100, 150, 250mA **£1.30**
1,1.25,1.5,2,2.5,3,10,15A **55p.** 1¼" Time Delay 100mA **£3.50** 150mA **£2.25** 250, 300, 500, 600, 750, 850mA **£1.84** 1.25, 1.9,1.6, 2A, E1.34,2.6A 0.15, G, 6A **£2.82** 20mm Quick Blow. 100,125,160, 200,250, 315,400, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A, **40p.** 20mm Time Delay 100, 125, 160, 200mA **£1.80** 250, 315, 400, 500, 630, 800mA **£1.00.** 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A **85p. 1" mains.** 2, 3, 5, 7, 10, 13A **85p**

Manufacturers please note - we can offer very competitive production quantities of 20mm Quick Blow & Time Delay range - apply for quotation.

SOLDERING SECTION

Antex 15W iron	5.00
Antex 18W iron	5.00
Antex 25W iron	5.20
Antex elements	2.00
Antex bills	0.95
Antex ?	1.90
Soldersucker	4.50
Spare nozzles for Soldersucker	0.45
Antex Soldering station complete with 1 iron-30W or 4DW	49.95
25W KIT - iron with 13A plug and stand	6.40
15W KIT - iron with 13A plug and stand	3.20

SERVICE AIDS
All Servicol Products

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Excel Polish	0.76
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Video Head Cleaner	0.88
Solda Mop (Std)	0.72
Solda Mop (L/Gauge)	0.72

Additional p&p on above 30p

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Universal Ni-Cad charger, charges PP3 AA C D
Price **£5.00**

MULTIBLOCK

Multiblock 4-Way Extension Socket
PVC body with internal cable grip fitted with 13A fuse and neon Indicator. Max total load 13A 250V, length 16½" Width 2½"
Price **£3.90** each (p&p) 25p in addition to 35p normal charge
Quantity Discount upon Request

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Metal Co-ax Plug	0.18
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FM Plugs	0.20
1PL259	0.36
Reducer	0.15
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¼" Metal-Mono Plug	0.30
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3.5mm Plug Metal	0.16
2.5mm Chassis Socket	0.10
3.5mm Chassis Socket	0.10
2 pin ¼" Mono Chassis Socket	0.14
4 pin ¼" Mono Chassis Socket	0.20
6 pin ¼" Mono Chassis Socket	0.30
4mm Banana Plug	0.15
4mm Banana Socket	0.15
PP3 Battery Connectors	0.08
PP9 Battery Connectors	0.15
13A Mains Plugs 45p ea - **10 for £4.00**	

10 OFF ANY ONE PLUG OR SOCKET LESS 10%

1984 CATALOGUE

Send now for our latest catalogue - 108 pages - packed with complete range of components - fully illustrated price 65p per copy includes 30p credit note, special offers sheets, order form and prepaid envelope

TOGGLESWITCH MIN

SPST-2TAG	65p
SPDT-3TAG	68p
DPDT-6TAG	72p
DPDT-6TAG (C-off)	85p

ROTARY SWITCHES

1p12W	40p
2p6W	40p
3p4W	40p
4p3W	40p

TRANSFORMERS - All 240V primary

	1+	10+	100+	1000+
4.5.0-4.5v 400 m/A	50p	45p	35p	30p
6-0 6v 100 m/A	58p	52p	43p	40p
6-0 6v 500 m/A	65p	60p	48p	45p

Carriage-45p per transformer; £1.60 per 10; £4.50 per 100; £30 per 1,000

IC SOCKETS

DIL to DIL

8 pin	0.08	0.70/10
14 pin	0.10	0.95/10
16 pin	0.11	1.00/10
18 pin	0.14	1.60/10
22 pin	0.21	1.95/10
24 pin	0.25	2.25/10
28 pin	0.30	2.75/10
40 pin	0.34	3.10/10

D CONNECTORS

	9 way	15 way	25 way
MALE			
Solder lugs	0.80	1.05	1.60
Angle pins	1.50	2.10	2.50
FEMALE			
Solder lugs	1.05	1.60	2.00
Angle pins	1.65	2.15	2.90
COVERS	0.85	0.80	0.80

VOLTAGE Regulators

78L06	30p
78L12	30p
78L15	30p
7805	55p
7812	55p
7815	55p
LM317K-3.50	
LM317T-90p	

LED's

3mm
red-**10p** 10/"k
green-**13p** 10/1.00
yellow-**13p** 10/100

5mm
red-**10p** 10/85p
green-**13p** 10/1.00
yellow-**13p** 10/1.00

EUROPEAN ADAPTORS

These very high quality British made two pin European adaptors are ideal for driving Radios, cassette recorders, TV games, calculators etc. The adaptors fit in the UK shaver socket

REF	DC Voltage	Current	1+	10+	100+
EO8	4.5V	200m/a	50p	45p	32p
EM3	6V	200m/a	£1.00	80p	55p
EO9	6V	400m/a	£1.50	£1.25	85p

Postage & Packing: 45p per adaptor or £1.60 per 10; £4.50 per 100
(1,000 off qty price on application)

MARCO TRADING (DEPT RW8)
The Maltings, High Street
Wem, Shropshire SY4 5EN
Tel: 0939 32763 - Telex: 35565

VISA

ORDERING: All components are brand new and to full specification. Please add 45p postage/packing (unless otherwise specified) to all orders then add 15% VAT to the total. Either send cheque/cash/postal order or send/telephone your Access or Visa number. Official orders from schools, universities, colleges etc most welcome. (Do not forget to send for our 1984 catalogue - only 65p per copy. All orders despatched by return of mail NEW RETAIL 1000 sq.ft. shop now open Mon-Fri 9.00-5.00. Sat 9-12.00

Radio & Electronics World

CONTENTS

SAFETY IN THE SHACK

Some of the constructional projects described in ***R&EW*** refer to additions or modifications to equipment. Any alteration or addition to the circuit may invalidate the guarantee.

We prefer that each constructional project contains its own power supply or battery. A constructional project will occasionally describe how the power supplies of any equipment may be used to supply the circuit of that project. Ensure that the power unit in the equipment is adequate to provide the additional load current. In all cases, check that the equipment mains fuse is correctly rated.

Safety in the shack, please at all times.

The new 13 metre satellite earth station antenna, known as System 2, under construction by Marconi Communication Systems Ltd for Mercury Communications Ltd at the Isle of Dogs in London

COVER PICTURES

Left: 40ft Extending Mast courtesy of G6TNC
Top right: High Quality Directional Coupler
Centre right: DATA COM courtesy of OWC6557 and John G6MOK
Bottom: QQV06-40A Linear Amp circuit diagram

Editor ..... **DENNIS PADFIELD G1AJQ**

Advertisement Manager ..... **NICOLA DYER**
Advertisement Executive ..... **ANNE BRADY**

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PRODUCT NEWS

Featured on these pages are details of the latest products in communications, electronics and computers. Manufacturers, distributers and dealers are invited to supply information on new products for inclusion in Product News.
Readers, don't forget to mention ***Radio & Electronics World*** when making enquiries

BENCH POWER SUPPLY INCLUDES DELAY

New from Thurlby is a 15V 4A version of the PL Series of laboratory bench power supplies. Designated the PL154, the new supply operates in constant voltage or constant current modes from a few milliamps to 4 amps continuous.

A new feature is switchable current limit delay which makes peak currents up to 7 amps available to circuits with fluctuating loads.

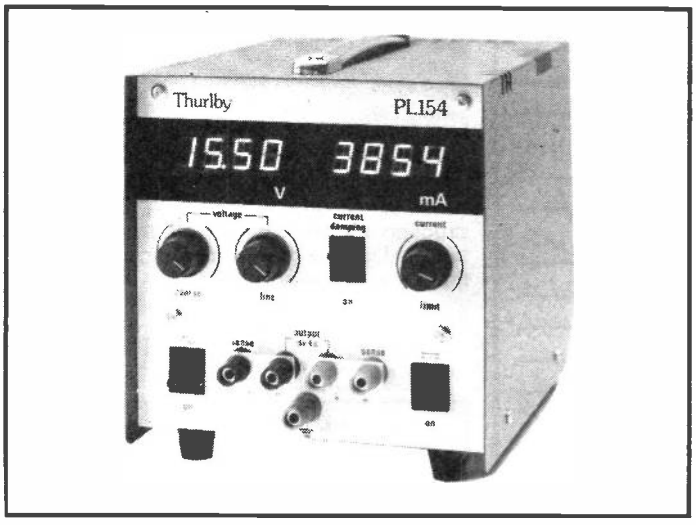
Twin digital meters give a highly accurate display of voltage and current levels to a resolution of 10mV and 1mA respectivly.

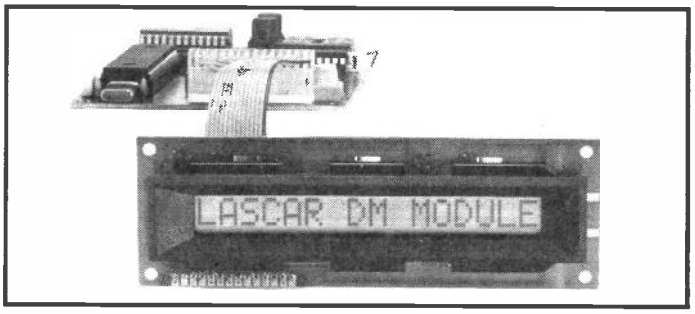
Remote sense terminals are provided to allow precision to be maintained at high current, and a separate dc output switch enables voltage and current levels to be set before connecting the supply to the load.

The PL154 is part of a wide range of digitally metered bench power supplies from Thurlby which includes single, dual and triple output models.

The PL154 is available from Thurlby Electronics Ltd and their distributors. Price in the UK is £145.00 plus VAT.

Thurlby Electronics Ltd, New Road, St Ives, Huntingdon, Cambridgeshire PE17 4BG. Tel: 0480 63570





DOT MATRIX EVALUATION SYSTEM

A Dot Matrix Evaluation System now available from Lascar Electronics is claimed to save hundreds of man-hours and thousands of pounds in development costs. It allows use of Dot Matrix Displays by users without specialised microprocessor knowledge.

The system is available at a special offer price of £49.95 (+ p&p and VAT) and comprises a 16-character line display complete with bezel and panel mounting kit, a microprocessor-based controller module, inter-connecting cable and a full instruction manual. A 5V dc supply is all that is required to have an LCD Dot Matrix Display system up and running in minutes.

The controller module contains a pre-programmed EPROM which contains the initialisation programme plus 15 standard 'messages'. On-board hexadecimal and programme switches allow custom messages and programmes to be developed. These can then be saved, either by implementing a 'power down-mode' or by reprogramming the EPROM.

Expansion of the system is easily attained as all controls, data lines etc are brought out to a 32 way double-sided edge connector.

The programme messages can also be switched to the display by contact closure or open collector transistor output.

The EVAL-1 Evaluation system will allow many potential new users of Dot Matrix Displays to fit them to their instruments in the minimum time and cost.

Lascar Electronics Ltd, Module House, Whiteparish, Salisbury, Wiltshire SP5 25J. Tel: 07948 567. Telex 447876.

GAS-TIGHT INSULATED TERMINALS

Oxley has extended its range of insulated terminals to include both stand-off and lead-through versions designed to provide optimum sealing against gasses and liquids.

These new components, known as CEEL^{R} terminals, differ from the standard Barb^{R} range by having an enlarged middle section to the spill and a silicone rubber sealing ring recessed into the PTFE insulator bush.

After assembly, this enables increased pressure to be applied to the silicone rubber and the chassis to ensure a gas-tight seal.

CEEL^{R} terminals are available in 5A and 15A versions with rated voltages of, respectively, 3KV and 4KV, and mounting hole diameters of 3.96mm and 6.35mm.

The spills are precision formed from brass and are finished with heavy silver plating.

Assembly is easy and rapid and is effected by inserting the bush into the mounting hole and then pressing the metal spill firmly and slowly into the bush until the positive detent action locks the assembly in place.

Simple tools are available to facilitate this operation.

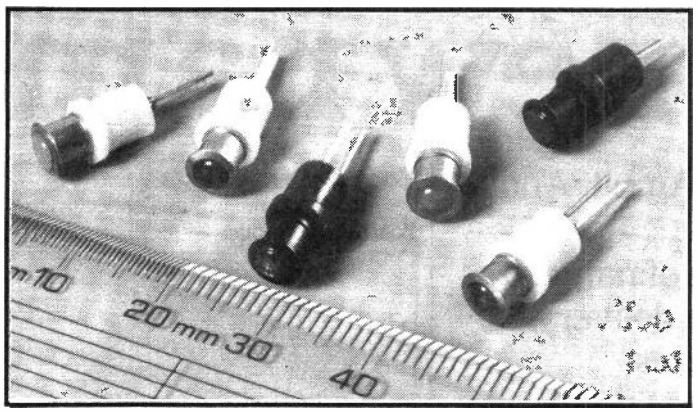
Leakage rate of correctly sealed terminals is less than 10^{-3} microlitres per second of helium at one atmosphere differential pressure at 20°C ie 15lb per square inch.

CEEL^{R} terminals meet the 56 day damp heat climatic category of IEC68 (IEC68: 55/200/56).

Operating temperature range is -55°C to +200°C.

Insulation resistance is greater than 2×10^{6} megohms.

PRODUCT NEWS



NEW WIDE ANGLE SOLID STATE INDICATORS

A range of wide angle viewing press-fit solid state indicator lamps, the SSI/5 series is available from Oxley.

Approved for military applications against DEF/STAN 59-61/90/195, these lamps are available in red, green and amber versions. They are ruggedly constructed and feature the patented Barb[R] self-locking body outline which allows rapid assembly to panels drilled with 5mm holes.

They are supplied with high dispersion grade PTFE bushes; the bush together with the self-locking mounting providing an excellent seal tested to one atmosphere (15 pounds per square inch equivalent to 33.5 feet or 10 metres of sea water) with a leakage rate of less than 1 millilitre per hour under standard laboratory conditions for sealing against gasses, vapours and liquids.

Terminations can be either tin-lead or silver plated and versions with a black PTFE bush and black anodised aluminium bodies are available for improved visual contrast.

Nominal operating current for the red lamps is 20 milliamps and for the green and amber versions: 40 milliamps.

Nominal luminous intensity is 1.4mcd for the red lamps; 1.5mcd for the green and amber lamps.

Oxley Developments Co Ltd, Priory Park, Ulverston, Cumbria LA12 9QG. Tel: 022952621.

A HOT STORY FROM WEST HYDE!

Problems of heat dissipation can be particularly hard to solve on small electronic instruments, where forced ventilation is impractical, and external heat sinks both mar the aesthetic appearance of a product, and add significantly to the cost. Two new case ranges from West Hyde meet this problem head on, and incorporate heat dissipation properties into the case bodies themselves.

The first type of case is panel-mounting to DIN standard 43700 dimensions. Lengths of U-shaped aluminium extrusion are linked together in a number of ways to produce cases in twelve standard sizes. The use of an aluminium profile results in a case with an ideal strength/weight ratio, and allows several useful features to be designed in.

As well as slots to carry PCBs or chassis, the extrusion includes T-slots to accept nuts or hex-head bolts with which hot components such as plastic-package semi-conductors can be mounted. Further external slots take rotating fixing pawls, which allow an instrument to be installed in a panel entirely without access at the rear.

The West Hyde DIN case has a semi-matt black epoxy powder paint finish to assist heat radiation, and a clip-in front panel concealing all assembly screws.

The second case range is intended for free-standing or wall-mounting applications, and is formed from a hollow extrusion in various sizes and lengths.

Being made from a single extrusion, the 'Sink Box' has extreme rigidity and is inexpensive to produce and simple to assemble.

As well as two rows of internal PCB slots, the extrusion incorporates a row of deep fins on one face around a central T-slot, to maximise heat dissipation. Two further T-slots on the opposite outer face allow brackets to be fitted for wall mounting, belt mounting, or to attach the Sink Box within a second enclosure.

The case has a black anodised finish as standard, with matching aluminium end panels and optional moulded nylon bezels.

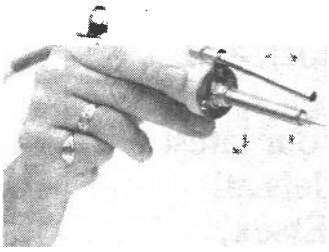
Both these ranges are available ex-stock from:
West Hyde Developments Ltd, Unit 9 Park Street Ind Estate, Aylesbury, Bucks HP20 1ET. Tel: Aylesbury (0296) 20441

FUME EXTRACTION FOR SOLDERING IRONS

Now available in the Climavent range of soldering fume extraction equipment are low-cost suction adaptors which can be attached to conventional soldering irons for efficient extraction of fumes at source.

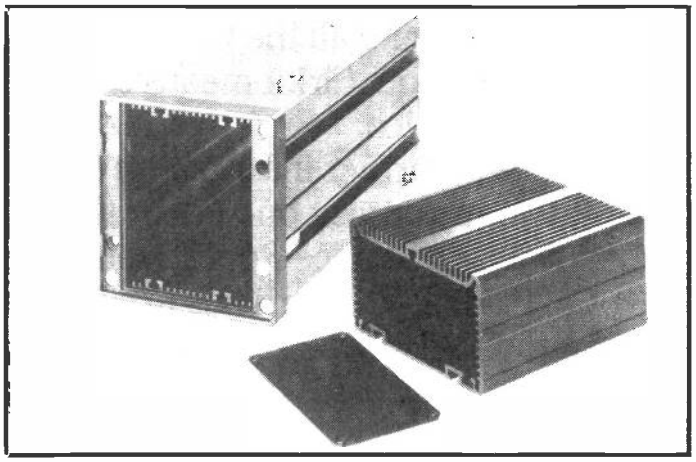
Introduced as a cost-saving facility, these attachments will allow industrial companies to make full use of their existing soldering appliances when installing a fume extraction system. The range of adaptors available covers all known makes of soldering irons.

The metal suction nozzle of the Climavent adaptors is positioned on the soldering appliance to remove soldering fumes at the point of work, for optimum operator protection. The fumes collected at the nozzle are transferred by a lightweight tubing connection to high velocity extractors in the fume extraction system.



Solder fume extraction systems can be supplied by Climavent Ltd to suit any factory layout for the protection of from two to 450 operatives. Based on a high-vacuum suction ring main arrangement with tubing connections to each soldering appliance, the systems will ensure that the presence of colophony (solder/flux fumes) within the operator's breathing zone is undetectable.

Available from:
Climavent Ltd, 326 Haydock Lane, Haydock Industrial Estate, St Helens, Merseyside WA11 9UY. Tel: 0942 726164



WAVE GUIDE FILTERS

Now available from M M MICROWAVE Ltd, a member of the Micro Metalsmiths Group of Companies, is a new fully illustrated shortform catalogue detailing their extensive range of waveguide filters.

M M Microwave design, manufacture and test a wide range of radar and telecommunications components and sub systems. The company is approved to Defence Standard 05-24 and facilities include a fully equipped research and development department and a comprehensive computer aided design library.

This allows engineers to optimise design without having to evaluate prototypes. In addition, high precision computer controlled machining

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To: Cirkit Holdings PLC, Park Lane, Broxbourne, Hertfordshire.
I enclose 80p. Please send me your latest catalogue and 3×£1 discount vouchers!
If you have any enquiries please telephone us on Hoddesdon (0992) 444111.

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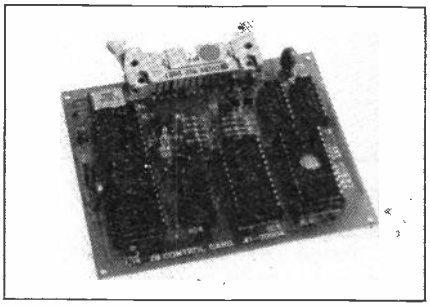

C12 Computer Cassette	21-00012	0.55
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25 way D Plug	10-25100	1.30
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20 up Eprom Eraser	40-82100	31.25
Z80 A Industrial Controller	40-82000	49.95
6802 Industrial Controller	40-68020	49.95
6502 Industrial Controller	40-65020	49.95
Z8 Basic/Debug Controller	41-00904	50.00

Nicad Batteries & Chargers

Minimum life 600 (300 PP3 size) full charge/discharge cycles. Batteries must be charged from a constant current source only. All batteries are supplied only with a residual charge and should be charged before used.

				1-9	10-49
AA	1.2V	500mAH	01-12004	0.80	0.74
'C'	1.2V	2.2AH	01-12024	2.35	1.99
'D'	1.2V	4.0AH	01-12044	3.05	2.85
PP3	8.4V	110mAH	01-84054	3.70	3.50

CH1/22 PP3 Charger 11mA for 16 hours 01-00159 4.30

CH8/RX Multi-purpose Charger 01-02204 9.40

Will recharge AA, C, D and PP3 size cells with automatic voltage selection. Will recharge following combination: 6×D, 6×AA, 6×C, 2×PP3, 2×D+2×C, 2×D+2×AA, 2×D+1×PP3, 2×C+2×AA, 2×C+1×PP3, 2×AA+1×PP3.

Battery Adaptor 01-12001 0.96

Sold in pairs: one to convert AA size to C size and one to convert C to D size. Both may be used together to convert an AA to D size.

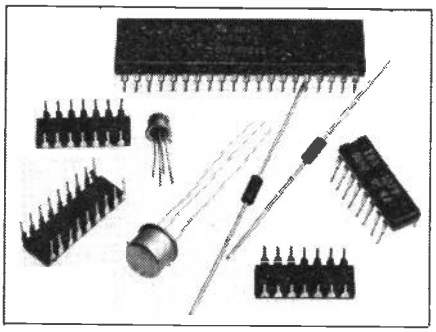
Semiconductors

Linear IC's

LM301AN	DIL version	61-03011	0.44
LM308CN	DIL version	61-03081	0.65
LM311CN	Popular comparator	61-00311	0.46
LM324	Low power quad op amp	61-03240	0.67
LM339N	Low power quad comparator	61-03390	0.68
LM346	Programmable quad op amp	61-00346	3.72
LF347	Quad Bi-FET op amp	61-00347	1.82
LM348	Quad 741 type op amp	61-03480	1.26
LF351	Bi-FET op amp	61-03510	0.49
LF353	Dual version of LF351	61-03530	0.76
LM380N	1W AF power amp	61-00380	1.00
NE555N	Multi-purpose low cost timer	61-05550	0.45

for a better service.

NE556N	Dual version of the 555	61-05560	0.50
uA741CN	DIL low cost op amp	61-07411	0.22
uA747CN	Dual 741 op amp	61-07470	0.70
uA748CN	741 with external frequency comp	61-04780	0.40
HA1388	18W PA from 14V	61-01388	2.75
TDA2002	8W into 2 ohms power amp	61-02002	1.25
ULN2283	1W max. 3-12V power amp	61-02283	1.00
MC3357	Low power NBFM IF system and detector	61-03357	2.85
ULN3859	Low current dual conversion NBFM IF and detector	61-03859	2.95
LM3900	Quad norton amp	61-39000	0.60
LM3909N	8-pin DIL LED flasher	61-39090	0.68
KB4445	Radio control 4 channel encoder and RF	61-04445	1.29
KB4446	Radio control 4 channel receiver and decoder	61-04446	2.75
ICM7555	Low power CMOS version of timer	61-75550	0.98
ICL8038CC	Versatile AF signal generator with sine/square/triangle OPs	61-08038	9.50
TK10170	5 channel version of KB4445	61-10170	1.87
HA12002	Protection monitor system for amps, PSUx, TXs etc	61-12002	1.22
HA12017	83dB S/N phono preamp 0.001% THD	61-12017	0.80
MC14412	300 baud MODEM controller (Eduro/US specs)	61-14412	6.85



Microprocessor & Memories

Z80A	Popular and powerful 8-bit CPU	26-18400	3.40
Z80AP10	2 port parallel input/output	26-18420	2.95
Z80A CTC	4 channel counter/timer	26-18430	2.90
Z8671	Z8 Micro comp. and Basic	26-08671	17.50
6116-3	16K (2kx8) CMOS RAM 200nS	26-36116	6.68
Z6132-6	32K (4kx8) quasi RAM 350nS	26-06132	15.00
4116-2	16K (16kx1) 150nS	26-24116	1.59
2764	64K (8kx8) 450nS	26-02764	9.50
2732	32K (4kx8) 450nS	26-02732	5.70

Voltage Regulators

7805	5V 1A positive	27-78052	0.40
7812	12V 1A positive	27-78122	0.40
7815	15V 1A positive	27-78152	0.40
7905	5V 1A negative	27-79052	0.49
7912	12V 1A negative	27-79122	0.49
7915	15V 1A negative	27-79152	0.49

Transitors

BC182	General purpose	58-00182	0.10
BC212	General purpose	58-00212	0.10
BC237	Plastic BC107	58-00237	0.08
BC238	Plastic BC108	58-00238	0.08
BC239	Plastic BC109	58-00239	0.08
BC307	Complement to BC237	58-00307	0.08
BC308	Complement to BC238	58-00308	0.08
BC309	Complement to BC239	58-00309	0.08
BC327	Driver/power stage	58-00327	0.13
BC337	Driver/power stage	58-00337	0.13
MPSA13	NPN Darlington	58-04013	0.30
MPSA63	PNP Complement to MPSA13	58-04063	0.30
J310	JFET for HF-VHF	59-02310	0.69
J176	JFET analogue switch	59-02176	0.65
3SK51	Dual gate MOSFET-VHF amp	60-04051	0.60
3SK88	Dual gate MOSFET-Ultra lo noise	60-04088	0.99
TIP31A	Output stage	58-15031	0.35
TIP32A	Complement to TIP31A	58-15032	0.35
VN66AF	VMOS Power FET	60-02066	0.95
IN4001	Rectifier diode	12-40016	0.06
IN4002	Rectifier diode	12-40026	0.07
IN4148	General purpose silicon	12-41486	0.05

Silicon Controlled Rectifiers

BRY55-100	100V .8A	52-55100	0.50
C106DI	400V 4.0A	52-00106	0.70
C122DI	400V 8.0A	52-00122	1.45

3mm Diameter LEDs

V178P	Red	15-01780	0.15
V179P	Green	15-01790	0.16
V180P	Yellow	15-01800	0.18

5mm Diameter LEDs

CQY40L	Red	15-10400	0.12
CQY72L	Green	15-10720	0.15
CQY74L	Yellow	15-10740	0.15

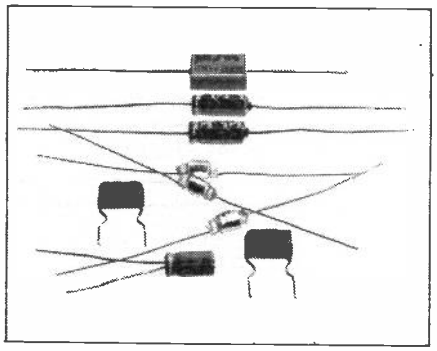
Infra-Red LEDs

CQY99	Emitter	15-10990	0.56
BPW41	Detector	15-30410	1.51

Tri Colour LED

V518	Orange-Green-Yellow	15-05180	0.60

Capacitors



Aluminium Electrolytics Radial PCB Mounting

			Pack of 4
10u	16V	05-10606	0.24
47u	16V	05-47606	0.28
47u	25V	05-47607	0.28
470u	6.3V	05-47705	0.36
470u	16V	05-47706	0.48

Tantalum Beads

			Each
1uf	35V	05-10501	0.18
10uf	16V	05-10601	0.28
47uf	6.3V	05-47601	0.45
47uf	16V	05-47602	0.92

Monolithic Capacitors

		Pack of 3
1n	04-10204	0.39
10n	04-10304	0.42
100n	04-10404	0.45

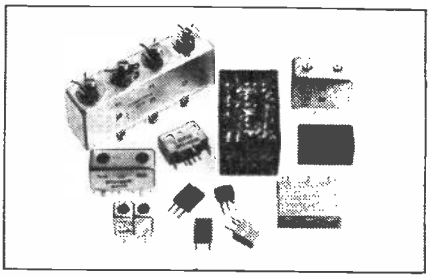
Low Voltage Disc Cermaic

		Pack of 5
1n	04-10203	0.20
10n	04-10303	0.20

Polyester (C280)

		Pack of 3
10n	04-10305	0.18
47n	04-47305	0.24
100n	04-10405	0.24
470n	04-47405	0.51
1uF	04-10505	0.66

R F Components



Filters

CFU/LFB CFW/LFH SERIES

Miniature 455kHz filters. I/P and O/P impedance 2K.

		-6dBW	-40dBW		
LFB6/CFU455H		6kHz	18kHz	16-45512	1.95
LFB12/CFU455F		12kHz	26kHz	16-45515	1.95
LFH6S/ CFW455HT		6kHz	14kHz	16-45525	2.45
LFG12S/ CFW455FT		12kHz	22kHz	16-45528	2.45
CFM2455A Mechanical IF Filters for 455kHz				19-45530	0.77

Crystal Filters 2 Pole Types

10M15A	10.7 Centre Freq.	20-10152	2.10
10MO8AA	10.695 Centre Freq.	20-11152	3.49

Inductors

We offer the complete Toko range of fixed and variable inductors. Over 500 coils from audio to V.H.F. See catalogue for details.

Soldering Irons (Antex)

CS240	Iron 240VAC 17 Watts	54-22300	5.20
XS-240	Iron 25W 240V High heat capacity	54-22500	5.40
SK6	Presentation pack of one XS-240 with ST4 stand	54-22510	7.20
MLXS	Handy 12V 15W soldering iron complete with crocodile clips and solder	54-20004	5.60

Please add 15% VAT to all advertised prices and 60p post and packing. Minimum order value £2 please. We reserve the right to vary prices in accordance with market fluctuation.

facilities maintain tight tolerances for critical applications, and sophisticated fabrication and evaluation techniques guarantee performance to the highest specifications.

The shortform catalogue details bandpass, bandstop and microwave integrated circuit filters over the frequency range 2GHz to 100GHz. Available with Tchebyshev, maximally flat or linear phase designs, the filters cover a wide range of bandwidth and rejection values.

The catalogue also includes diagrammatic references for Design Engineers and a standard filter specification sheet for specific enquiry/order information.

M M Microwave Ltd, Ings Lane, Kirkbymoorside, York, North Yorkshire YO6 6DW. Tel: (0751) 31955

TELETEXT AND PRESTEL ADAPTORS

GEC (Radio and Television) Limited are to relaunch their Teletext and Prestel adaptors which not only upgrade a standard television set into receiving these functions, but also convert any television set into remote control capability.

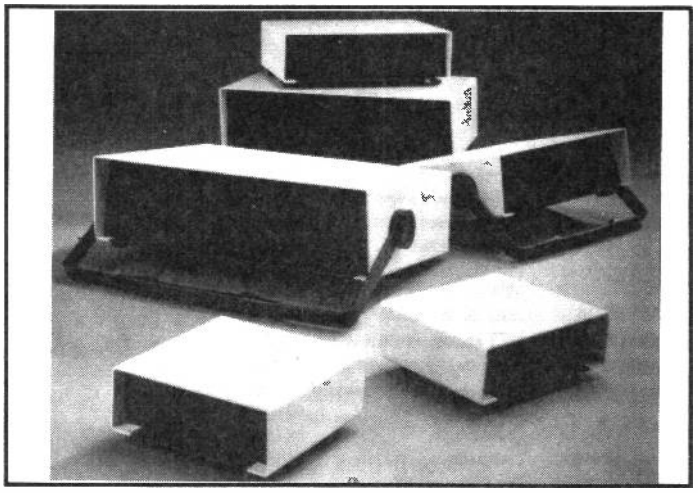
Two versions of these machines have been developed for the UK and overseas markets: one which operates in black and white and the other which operates with colour text and graphics. In addition, the Prestel adaptor is available with either numeric information input or full alphanumeric capability.

This unique product is already proving of great interest to the deaf and hard of hearing. Not only does it offer remote control facility, it also means that for the first time they can record programmes with subtitles.

Special arrangements have been made by GEC with the RNID to give preferential terms to registered deaf people through the GEC network of local dealers.

The price of the Teletext adaptors are: Black and white text (MRP) £114.80. Colour £129.30

GEC (Radio and Television) Ltd, Byfleet Industrial Estate, 2 Canada Road, Byfleet, Surrey. Tel: Byfleet 53134



NEW 'G' CASE

BICC-Vero Electronics has introduced its new range of 'G' cases which provide the latest in soft-line modern styling and are ideal for housing peripheral equipment or portable instrumentation.

They provide all round accessibility for mounting components, wiring and servicing. An integral chassis forms the mounting plate for components, front and rear panels and the cover. The front and rear panels are each secured through the chassis by two screws, which do not intrude onto the panel area thus there are no unsightly fixings visible and the whole panel areas are free for mounting components.

The cover, which comprises the top and sides, slides onto the chassis and fits closely over the front and rear panels. This is secured in position by four further screws which each pass through foot mouldings and tighten onto the chassis to provide a minimum of assembly operations. The cover also forms a cowl over the front panel, which protects projecting components such as switches and provides a degree of shading for illuminated components such as neons and LCDs.

The new 'G' cases are available in three sizes, of which the largest two can be supplied with a comfortable carrying handle. This handle combines the function of portability with an adjustable tilt feature, as it can be folded back and locked at any angle to suit the user. The range is available as standard finished in epoxy textured paint in an attractive combination of seafoam and bitter chocolate and a choice of other colours is available subject to a minimum order quantity.

BICC-Vero Electronics Ltd, Hedge End Industrial Estate, Flanders Road, Hedge End, Southampton SO3 3LG. Tel: 04892 81424/5

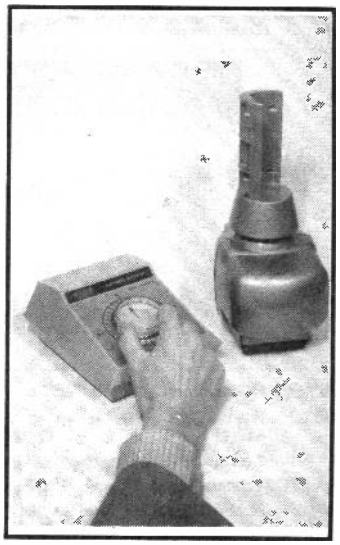
REMOTELY CONTROLLED ROTATOR UNIT

A substantially built rotatable mounting with remote direction control gets the best out of television, CB or FM radio aerials, or can be used to mount security cameras. Known as the type 200 XL, it is available from Semiconductor Supplies, Sutton, Surrey, by mail order for only £49.45 inclusive.

Television security cameras or other equipment weighing up to 45Kg (100lb) can be mounted and rotated by mains power over 365 degrees. Speed of movement is one revolution per 65 seconds. The weatherproof case is made of metal castings.

Dimensions: Rotator – 290 x 120 x 150 mm (h x w x d). Control box – 80 x 197 x 160 mm.

Semiconductor Supplies International Ltd, Sutton, Surrey. Tel: 01-643 1126



PUSH-ON/TAB CONTACTS AND HOUSINGS

Now available from BICC-Vero Electronics is its Finclik range of push-on/tab contacts and housing for applications in the domestic appliance and automotive industries and for use by business, gaming and vending machine manufacturers.

The Finclik system consists of reeled 6.3mm receptacle and tab contacts and a range of nylon male and female housings. The contacts are machine applied to wires and then inserted into the housings from the rear. An integral spring lance latches behind a shoulder in the housing and prevents 'backing out'.

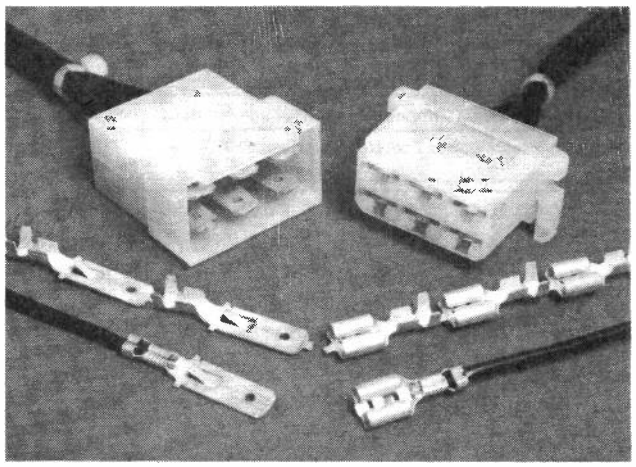
The contacts are available in brass, tin plated brass and phosphor bronze as required. Wire sizes accommodated by the receptacle are 0.5 to 2.5sq mm and 3 to 6sq mm. Wire ranges covered by the tab are 0.75 to 2.5sq mm and 3 to 6sq mm.

The male and female housings are in nylon 6/6 and have a melting/distortion temperature level of 105°C. They are available in single, 2, 3, 4, 6 and 8 way versions for free hanging applications.

The 6 and 8 way sizes are also available in board mounting versions.

The entire system is readily available ex-stock and has been enthusiastically received in the market place.

BICC-Vero Electronics Ltd, Hedge End Industrial Estate, Flanders Road, Hedge End, Southampton SO3 3LG



PORTABLE 1 GHZ FREQUENCY COUNTER

Fieldtech Heathrow announces the arrival of a new 1 GHz frequency counter designated the Sencore FC71. The FC71 meets the demands for portable frequency counting applications for avionics, broadcast, two-way communications, and general servicing.

The FC71 is the first, portable, 1 GHz frequency counter to provide consistant longterm accuracy measurements for more than 9 hours on one battery charging. The FC71 uses a unique method to hold 0.5 part-per-million accuracy (0-40 degrees C) all the way to 1 GHz.

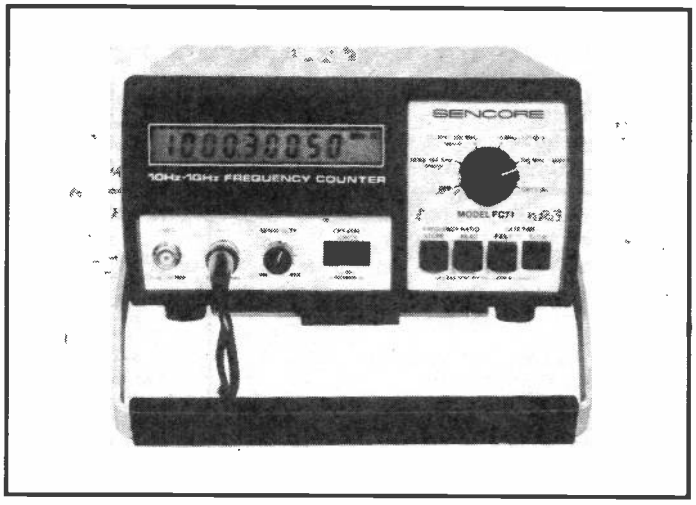
The instrument allows accurate measurements wherever needed: e.g. Broadcast towers; 2 way radio repeater stations; aircraft for testing of nav/comm equipment. It's the first portable counter that's really practical because it provides the technician or engineer with a full day's testing on one battery charge.

The FC71 provides extra tests not found on other counters. Its single-input Frequency-Ratio calculator tests frequency multiplier and divider stages. Sencore's exclusive Crystal Check function tests any crystal for fundamental frequency operation.

The FC71 can be used as a 'talker' for any IEEE 488 Bus system, allowing its frequency measurements to be sent to a computer. The FC71 sends its full 8-½ digit frequency readings down the bus, along with the correct range labels: Hz, KHz, MHz, or multiply or divide symbols for the ratio function. All FC71s come equipped with a special connector on the back that mates with the Sencore IB72 IEEE Interface Bus Adapter. The IB72 contains all the circuits necesary to interface the FC71 with the IEEE 488 bus circuits.

The FC71 sells for only £640.

Fieldtech Heathrow Limited
Huntavia House
420 Bath Road
Longford
Middlesex
UB7 0LL
Tel: 01 897 6446.



BIB COMPACT DISC CLEANER

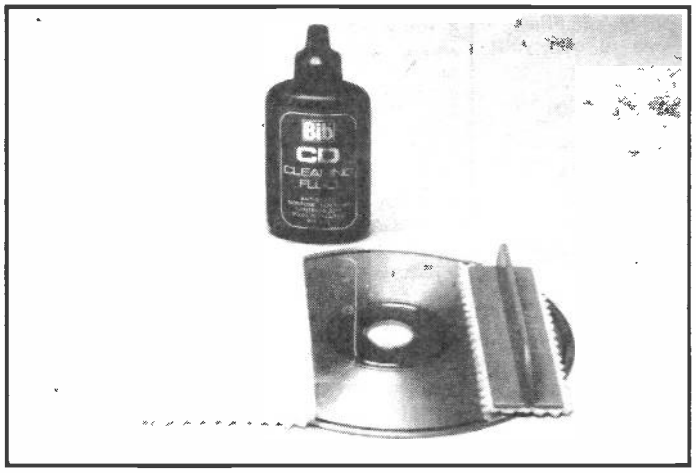
Bib announce the introduction of their first accessory product for the Compact Disc, which is a cleaning kit, comprising a bottle of special formula cleaning liquid, applicator cloths and a special purpose high quality chamois leather polisher. All these items are packed in a convenient storage wallet for dust free protection.

Bib recommend regular use of this product, as essential to maintain high quality production of C-D discs. It is necessary to keep the surface of Compact Discs free from finger prints, dust and dirt and other contaminants, as these prevent the laser optical system operating correctly, resulting in distortion and poor performance.

Bib also state that the same kit is suitable for cleaning video laser discs.

Attractively packaged in fully descriptive blister card, this kit has a recommended retail price of only £2.99 including VAT.

Bib Audio/Video Products Limited, Kelsey House, Wood Lane End, Hemel Hempstead, Herts HP2 4RQ. Tel: (0442) 61291



REGULATORS FROM GOTHIC CRELLON

The MC78TOO series from Motorola is a new family of three terminal, 3.0A positive voltage regulators available in a range of output voltages from 5V to 24V. Gothic Crellon are now able to supply the range ex-stock.

Besides being offered in a wide variety of voltage options, these devices offer improved performance characteristics over existing regulators with superior load and line regulation, output voltage tolerance and ripple rejection specifications.

Additionally, these devices are specified for thermal regulation which is an indication of the careful thermal layout of the IC and the integrity of the die bond to the package heat sink.

These monolithic devices employ internal current limiting, thermal shutdown and safe-area compensation. The series is offered in both metal and plastic packages and in two operating temperature ranges.

R WITHERS COMMUNICATIONS

584 HAGLEY ROAD WEST, OLDBURY, WARLEY
B68 0BS (QUINTON, BIRMINGHAM)
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Blazetone FM200–15w 2mtr PRT Shift	**£129.00**	£3.00
Century 210–AM–FM–SSB Digital PLL SW Receiver 0–30mhz	**£199.00**	£5.00
Kenwood/Trio TR3500 UHF/H/H	**£199.00**	£2.50
Kenwood/Trio TR 7950 45W Mobile	**£319.00**	£5.00

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UNMODIFIED £33.00 with RPT shift £58.00. All parts available seperately HURRY ONLY 30 left! Some seconds available, please phone

£47.50 COMPLETE

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Complete mod kit for LCL 2740 DNT M40 inc 2 × XTALS, 2 x c's XTAL filter full instructions @ £12.95 inc post.

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500mhz 7 Digit Mini Frequency Counter	**£59.98**	£2.00
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Spring Silly Price Rotator Offer 50KG – Kopek Straight Through Rotator	**£38.95**	£2.00
Oskerblock SWR 200 maximum power 2kw. Normal price £59.95 –3.5–144MHz only	**£39.95**	£2.50

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* Hand Made
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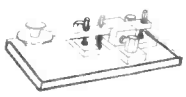

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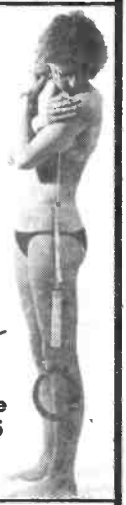

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PRODUCT NEWS

MULLARD POWERMOS

Gothic Crellon are now stocking a range of Mullard POWERMOS devices (BUZ Series) in both plastic and metal international standard packages offering high current and voltage stability.

Typically POWERMOS offers a combination of fast switching times and high cut-off frequencies. Maximum drain source voltages vary across the range of devices from 50V to 500V and maximum continuous drain current is between 2.5A and 32A. Maximum continuous power dissipation is 75W for the plastic packages (TO-220) and ranges from 78W to 125W in the metal range (TO-3).

The POWERMOS range has been designed for easy connection in parallel to increase performance if required.

Gothic Crellon Ltd, 380 Bath Road, Slough, Berks. Tel: 06286 4300.

'SLOPEFRONT' LCD MULTIMETER

A new low-cost LCD Multimeter now available from Lascar Electronics is of totally British design. A unique feature is the angled display which makes the instrument extremely easy to use, whether hand held or laid flat on a bench. The elegantly styled case is moulded in ABS, making the DP2020 equally suitable for laboratory or rugged field use.

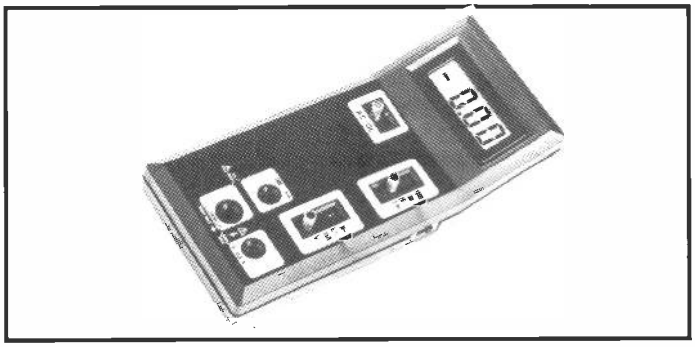
Six full functions are available – dc volts, ac volts, dc amps, ac amps, resistance and diode check – a total of 21 measurement ranges.

Complete protection against accidental overload is built into the meter.

A large LCD readout gives clear unambiguous readings and allows over 2,000 hours use from a standard PP3 battery.

The DP2020 is available from stock at a price of £24.95 + VAT. Substantial discounts are available to organisations with large numbers of service technicians.

Lascar Electronics Limited, Module House, Whiteparish, Salisbury, Wiltshire SP5 2SJ. Tel: Whiteparish (07948) 567. Telex 477876.



DIGITAL HUMIDITY & TEMPERATURE METER

The model RHT 200 is a lightweight hand held instrument designed for fast and easy determination of relative humidity and temperature. The instrument covers the ranges 10% to 95% R H and -10° to +60°C, to a resolution of 0.1% and 0.1° respectively. Readout is by large liquid crystal display (LCD).

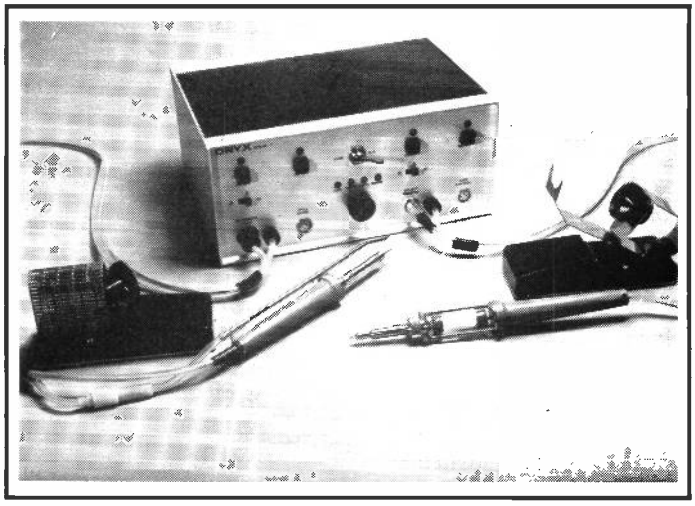
The capacitive RH sensor consists of a non-conductive foil which is covered on each side with a layer of gold. Temperature sensing is by semiconductor. Both sensors are mounted in a tubular hand held probe which is connected to the instrument by one metre of flexible self-coiling cable.

Powered by one small 9 volt battery (PP3 or equivalent) the RHT 200 is completely portable and controls are limited to an ON/OFF slide switch and another to select RH/TEMP mode.

To complete the package a good quality carrying case is provided which has compartments for the unit and probe. A mains charger unit with rechargeable cell is available if required.

The weight of the instrument and probe is only 300 grammes and the overall dimensions of the unit and carrying case are 260 x 145 x 45mm.

Channel Electronics (Sussex) Ltd, PO Box 58, Seaford BN25 3TB. Telephone: 0323 894961.



REWORK STATION FROM GREENWOOD ELECTRONICS

Greenwood Electronics has introduced a new, totally self-contained rework station, the Oryx HSR1, which requires neither external air, nor vacuum, supply lines.

Designed to be simple to operate, the HSR1 offers advanced features including soldering/desoldering temperature selection for different PCB materials, independent ON/OFF and earthing control of the soldering and desoldering irons and fume extraction during soldering. A unique desoldering iron facilitates quick and accurate desoldering and avoids the potential damage to the pcb tracks and adjacent components that can occur with conventional desoldering equipment.

The HSR1 consists of five major units: the TC84 temperature controlled soldering iron, the unique SR84 vacuum solder removing iron, the main control unit and two demountable magnetic base safety stands for the irons.

The TC84 is fitted with a fume extractor. This vacuum line from the main unit can be switched from the TC84 to the SR84 as required. A comprehensive range of long life, iron plated tips is available for the TC84 and interchanging tips is a simple operation.

The SR84 desoldering iron is, like the rework station itself, a new development. It features a hollow tip which allows the operator extremely precise control over the desoldering operation and facilitates very clean, neat reworking. It has been designed to overcome the problems associated with conventional desoldering equipment – such as burning, damage to the PCB tracks and to adjacent components.

The temperature of the tip can be set to its optimum for the type of board being reworked, a four position switch control being provided on the main unit which gives settings for paper and fibre-based PCBs. The unique Oryx design of filters and interchangeable tips makes the SR84 both easy to use and easy to maintain.

The main unit contains the temperature selector for the irons, independent ON/OFF and earthing switches for each iron, the vacuum pump and switched front panel mounted DIN sockets for foot control of the vacuum line and 'power out' (12Vdc) for powering a hand held type P1 PCB drill – available as an optional extra.

A feature of the main unit is the independent electrical control over the two iron circuits. This allows the HSR1 to be used for soldering only, desoldering only, or both operations sequentially. Also, the vacuum line is only fed to one iron at a time, a switch on the front panel controlling its routing.

Considerable attention has been paid to safety and the HSR1 is designed to meet all the relevant UK and European safety requirements.

Power requirements of the HSR1 are 240Vac, 140 watts maximum.

Dimensions are: 305mm (w) x 228mm (d) x 136mm (h). Total weight is 8.5Kg. Price £495 (ex VAT).

Greenwood Electronics, Portman Road, Reading, Berks. RG3 1NE. Reading (0734) 595844.

ENFIELD ELECTRONICS

208 Baker Street, Enfield, Middlesex. EN1 3JY. Tel: 01-366 1873

TRANSISTORS

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AC126	30p	BC183L	12p	BF199	14p	TIP30A	40p
AC127	30p	BC183LB	12p	BF200	35p	TIP30B	50p
AC128	30p	BC184	12p	BF224B	20p	TIP30C	45p
AC132	90p	BC184B	12p	BF244B	35p	TIP31	38p
AC141	30p	BC184L	12p	BF256	35p	TIP31A	40p
AC142	30p	BC186	30p	BF257	35p	TIP31B	40p
AC176	30p	BC187	30p	BF258	35p	TIP31C	45p
AC187	30p	BC212A	14p	BF259	35p	TIP32A	40p
AC188	30p	BC212L	12p	BF594	40p	TIP32C	40p
AD149	80p	BC213	12p	BF595	30p	TIP36C	140p
AD161	45p	BC213B	12p	BFR39	20p	TIP41A	50p
AD162	45p	BC213L	12p	BFR79	30p	TIP41B	50p
BC107	12p	BC214	12p	BFR80	30p	TIP42A	60p
BC107A	14p	BC214B	14p	BFX85	30p	TIP42B	65p
BC107B	14p	BC214L	12p	BFX87	30p	TIP121	80p
BC108	12p	BC237	18p	BFX88	30p	TIP142	120p
BC108A	14p	BC238B	18p	BFY50	28p	TIP2955	70p
BC108B	14p	BC307	18p	BFY51	25p	TIS43	36p
BC108C	14p	BC308	14p	BFY52	25p	TIS44	40p
BC109	12p	BC327	16p	BFY90	80p	TIS90	30p
BC109B	14p	BC328	16p	BRY39	40p	TIS91	30p
BC109C	14p	BC337	16p	BSX20	30p	VN10KMA	75p
BC140	35p	BC338	16p	BSX29	35p	VN66AF	95p
BC141	35p	BC441	36p	BU105	170p	VN88AF	110p
BC142	35p	BC461	36p	BU205	200p	ZTX107	12p
BC143	35p	BC477	40p	BU208A	220p	ZTX108	12p
BC147	12p	BC478	40p	MJ2955	90p	ZTX109	12p
BC148	12p	BC517	45p	MJE340	50p	ZTX300	15p
BC157	12p	BC547	15p	MJE371	90p	ZTX301	18p
BC158	12p	BC548	15p	MJE2955	110p	ZTX302	20p
BC159	12p	BC549	16p	MJE3055T	80p	ZTX303	20p
BC160	50p	BC556	20p	MPSA06	25p	ZTX304	20p
BC161	45p	BC557	16p	MPSA56	30p	ZTX330	35p
BC167	15p	BC558	16p	MPSU05	65p	ZTX500	18p
BC168	12p	BC559	16p	MPSU56	60p	ZTX501	18p
BC169	12p	BCY70	20p	OC22	150p	ZTX502	18p
BC170	20p	BCY71	20p	OC23	150p	ZTX503	18p
BC171	13p	BCY72	23p	OC26	100p	ZTX504	30p
BC172A	12p	BD131	50p	OC28	200p	ZTX531	30p
BC173	13p	BD132	50p	OC36	220p	ZTX550	30p
BC177	20p	BD133	60p	OC41	75p	ZN696	35p
BC178	20p	BD135	50p	OC42	75p	ZN698	45p
BC179	25p	BD136	40p	OC70	60p	ZN699	40p
BC181	23p	BD137	40p	OC76	60p	ZN706A	26p
BC182	12p	BD138	40p	OC81	60p	2N708	30p
BC182B	14p	BD139	45p	OC82	60p	2N914	36p
BC182L	12p	BD140	45p	OC84	50p	2N918	30p
BC183	12p	BF194	14p	TIP29A	35p	2N930	30p
BC1838	12p	BF195	14p	TIP29B	50p	2N1131	30p
						2N1132	30p
						2N1303	80p
						2N1304	80p
						2N1305	80p
						2N1307	70p
						2N1308	80p
						2N1613	36p
						2N2222A	30p
						2N2369A	28p
						2N2646	68p
						2N2904A/5A	30p
						2N2906A	60p
						2N2907A	30p
						2N2926G	12p
						2N2926R	12p
						2N2926Y	12p
						2N3053	30p
						2N3054	75p
						2N3055E	60p
						2N3442	150p
						2N3615	200p
						2N3702	12p
						2N3703	12p
						2N3704	12p
						2N3705	12p
						2N3706	12p
						2N3707	12p
						2N3708	12p
						2N3710	12p
						2N3711	12p
						2N3771	200p
						2N3772	200p
						2N3773	200p
						2N3819	25p
						2N3820	45p
						2N3823	50p
						2N3866	100p
						2N3903	15p
						2N3904	15p
						2N3905	15p
						2N3906	15p
						2N5172	30p
						2N5194	80p
						2N5457	42p
						2N5458	48p
						3N128	85p
						3N140	85p
						3N141	85p
						3N163	110p
						3N201	110p
						3N202	125p
						40406	80p
						40407	80p

TTL

7400	18p	7417	28p	7447	75p	7486	35p	74119	70p	74160	65p	74190	58p
7401	18p	7420	20p	7448	55p	7489	140p	74121	35p	74161	55p	74191	55p
7402	18p	7422	28p	7450	21p	7490	37p	74122	41p	74162	46p	74192	55p
7403	18p	7425	28p	7451	20p	7491	46p	74123	41p	74163	46p	74193	55p
7404	18p	7426	28p	4753	21p	7492	40p	74126	70p	74164	46p	74194	52p
7405	18p	7427	30p	7454	21p	7493	41p	74132	65p	74165	80p	74195	52p
7406	32p	7428	30p	7460	21p	7494	41p	74135	50p	74166	60p	74196	56p
7407	32p	7430	26p	7470	25p	7495	41p	74141	51p	74167	185p	74197	55p
7408	25p	7432	26p	7472	25p	7496	41p	74144	250p	74170	195p	74198	95p
7409	25p	7433	35p	7473	30p	7497	60p	74145	575p	74173	120p	74199	95p
7410	18p	7437	30p	7474	35p	74100	95p	74147	125p	74174	65p	74221	60p
7411	25p	7438	30p	7475	40p	74104	58p	74148	65p	74175	65p	74279	60p
7412	26p	7440	23p	7476	35p	74105	58p	74150	70p	74176	46p	74284	95p
7413	26p	7441	51p	7480	30p	74107	30p	74151	46p	74177	55p	74285	95p
7414	37p	7442	40p	7481	110p	74109	30p	74153	46p	74180	50p	74366	64p
7416	28p	7443	71p	7482	70p	74110	41p	74154	81p	74181	121p	74390	325p
		7444	95p	7483	58p	74111	70p	74155	46p	74182	70p	74393	100p
		7445	71p	7484	81p	74116	70p	74156	46p	74184	105p		
		7446	71p	7485	75p	74118	65p	74157	35p	74185	105p		

LS TTL

74LS00	40p	74LS28	20p	74LS85	60p	74LS148	160p	74LS173	80p	74LS244	140p		
74LS01	40p	74LS30	40p	74LS86	65p	74LS151	60p	74LS174	120p	74LS245	180p	74LS293	58p
74LS02	35p	74LS32	50p	74LS90	35p	74LS153	55p	74LS175	85p	74LS247	80p	74LS353	80p
74LS04	60p	74LS33	22p	74LS93	30p	74LS154	220p	74LS181	130p	74LS248	80p	74LS365	80p
74LS05	36p	74LS37	50p	74LS95	55p	74LS155	80p	74LS183	195p	74LS249	80p	74LS366	80p
74LS08	60p	74LS38	47p	74LS96	125p	74LS156	75p	74LS190	75p	74LS251	45p	74LS367	85p
74LS09	21p	74LS40	35p	74LS107	52p	74LS157	140p	74LS191	75p	74LS253	45p	74LS368	150p
74LS11	45p	74LS42	65p	74LS109	36p	74LS158	75p	74LS192	75p	74LS257	85p	74LS373	80p
74LS12	36p	74LS49	22p	74LS113	36p	74LS160	45p	74LS193	50p	74LS258	50p	74LS374	80p
74LS13	25p	74LS51	22p	74LS122	45p	74LS161	50p	74LS194	50p	74LS259	80p	74LS375	70p
74LS14	160p	74LS55	150p	74LS123	160p	74LS162	50p	74LS195	50p	74LS260	45p	74LS386	244p
74LS15	20p	74LS63	60p	74LS124	125p	74LS163	50p	74LS196	65p	74LS266	55p	74LS390	80p
74LS20	30p	74LS73	65p	74LS125	95p	74LS164	75p	74LS197	65p	74LS273	160p	74LS393	150p
74LS21	20p	74LS74	30p	74LS132	100p	74LS165	130p	74LS221	130p	74LS275	160p	74LS398	170p
74LS22	20p	74LS75	30p	74LS136	35p	74LS166	150p	74LS240	110p	74LS279	55p	74LS541	130p
74LS26	20p	74LS76	30p	LS74138	165p	74LS168	200p	74LS241	160p	74LS280	140p	74LS629	200p
74LS27	40p	74LS78	25p	74LS139	80p	74LS169	90p	74LS242	50p	74LS283	70p	74LS669	180p
		74LS83	85p	74LS147	135p	74LS170	65p	74LS243	80p	74LS290	55p	74LS670	120p

CMOS

CD4000	15p	CD4015	46p	CD4035	55p	CD4054	100p	CD4093	40p	CD4503	46p	CD4568	80p
CD4001	15p	CD4016	30p	CD4038	125p	CD4060	80p	CD4099	140p	CD4511	52p	CD4572	80p
CD4002	15p	CD4017	40p	CD4040	50p	CD4066	30p	CD4160	75p	CD4512	60p	CD4581	80p
CD4006	60p	CD4018	52p	CD4041	50p	CD4068	20p	CD4161	75p	CD4514	140p	CD4582	80p
CD4007	16p	CD4019	30p	CD4042	45p	CD4069	20p	CD4162	75p	CD4515	200p	CD4583	60p
CD4008	45p	CD4020	52p	CD4043	46p	CD4070	16p	CD4163	75p	CD4516	85p	CD4584	60p
CD4009	30p	CD4021	46p	CD4044	46p	CD4071	18p	CD4175	75p	CD4518	52p	CD4585	110p
CD4010	35p	CD4022	46p	CD4045	120p	CD4072	18p	CD4402	75p	CD4520	60p	CD40100	200p
CD4011	15p	CD4023	20p	CD4046	55p	CD4075	25p	CD4412	75p	CD4528	81p	CD40106	80p
CD4012	20p	CD4024	40p	CD4047	46p	CD4076	60p	CD4419	75p	CD4538	100p	CD40109	100p
CD4013	25p	CD4025	18p	CD4048	45p	CD4077	30p	CD4445	75p	CD4539	78p	CD40114	200p
CD4014	55p	CD4026	100p	CD4049	30p	CD4078	25p	CD4446	75p	CD4541	100p	CD40174	80p
		CD4027	25p	CD4050	30p	CD4081	25p	CD4449	75p	CD4555	60p		
		CD4028	45p	CD4052	70p	CD4082	25p	CD4501	35p	CD4561	110p		
		CD4029	55p	CD4053	60p	CD4085	72p	CD4502	70p	CD4568	80p		

LINEAR

CA1310E	185p	CA3090	415p	LM339	80p	LM3911	140p	SAA5020		TDA1008	347p	TL074	117p
CA1350E	90p	CA3130	105p	LM348	90p	LM3914	285p	SN76013N	295p	TDA1022	570p	TL081	40p
CA3020	230p	CA3140	52p	LM358	62p	LM3915	285p	TAA621A	290p	TDA1024	120p	TL082	65p
CA3028	110p	CA3240	125p	LM380	85p	LM3916	285p	TAA661B	175p	TDA2002	150p	TL083	92p
CA3035	270p	ICM7555	105p	LM381	170p	MC1458	70p	TBA120B	70p	TDA2003	345p	TL084	85p
CA3043	305p	ICM7556	200p	LM382	130p	MC1488	80p	TBA120S	68p	TDA2020	350p	UA748	40p
CA3055	85p	LF347	200p	LM384	160p	MC1489	90p	TBA120U	98p	TDA2030	340p	ZN414	95p
CA3065	150p	LF351N	55p	LM386	100p	NE555	20p	TBA540Q	161p	TDA2102		ZN424	150p
CA3080	80p	LF353N	100p	LM387	140p	NE556	55p	TBA651		TDA2522		ZN425	400p
CA3081	225p	LM224	150p	LM389	110p	NE564	405p	TBA800	95p	TDA9400		ZN426	345p
CA3085	145p	LM301	30p	ILM732	55p	NE566	173p	TBA810S	110p	TL061	50p	ZN427	715p
CA3086	65p	LM308	100p	ILM747	75p	NE567	161p	TBA820	81p	TL062	75p	ZN1034	230p
CA3089	230p	LM311N	81p	ILM1458	115p	NE570	391p	TBA920Q	175p	TL064	150p	ZN1040	750p
		LM318N		ILM3900	70p	NE571	387p	TCA270S	171p	TL071	50p		
		LM324	50p	ILM3909	92p	SAA5010		TDA1004	345p	TL072	80p		

RIBBON CABLE

(Priced per ft)

COLOUR	
WAYS	
10	26p
20	53p
26	76p
34	100p

D CONNECTORS

MALE		FEMALE
9 way	75p	100p
15 way	100p	1140
25 way	140p	195p

D-CONNECTOR COVERS

9 way	110
15 way	110
25 way	125

RECHARGEABLE BATTERIES

HP2, 1.2v, 4.0AH	£3.95
HP2, 1.2v, 1.2AH	£2.60
HP11, 1.2v, 1.2AH	£2.40
HP7, 1.25v, 500mAH	£1.00
AAA, 1.2v, 180mAH	30p
PP3, 8.4v, 110mAH	£4.50

DIODES

AA119	15p	OA200	9p	1N5060	18p
AA215	16p	OA202	5p	1N5062	20p
BAX13	10p	1N823	5p	1N5400	11p
BY100	30p	1N914	5p	1N5401	12p
BY127	18p	1N916	6p	1N5402	14p
BY133	20p	1N4001	5p	1N5403	15p
BY206	30p	1N4002	5p	1N5404	16p
BY207	30p	1N4003	6p	1N5405	17p
BY299	40p	1N4004	6p	1N5406	18p
BYX10	18p	1N4005	7p	1N5407	22p
OA47	10p	1N4006	7p	1N5408	25p
OA90	8p	1N4007	8p	IS44	5p
OA91	8p	1N4148	5p	IS921	7p
OA95	8p	1N4448	6p	IS922	7p
				IS923	7p

I.C. SOCKETS

LOW PROFILE		TURNED PIN	
D.I.L Type	Price	D.I.L. Type	Price
8 pin	10p	8 pin	35p
14 pin	12p	14 pin	50p
16 pin	14p	16 pin	60p
18 pin	18p	18 pin	65p
20 pin	24p	22 pin	75p
22 pin	25p	24 pin	80p
24 pin	30p	28 pin	100p
28 pin	32p	40 pin	150p
40 pin	35p		

ZENER DIODES

BZX61C/1.4 watt: 3V3, 3V6, 3V9, 4V7, 5V6, 6V2, 7V5, 8V2, 10V, 11V, 12V, 13V, 15V, 18V, 20V, 22V, 24V, 27V, 30V, 33V, 36V, 39V, 43V, 47V, 56V, 68V, 75V, 82V, 100V, 180V, 200V

16p each

BZY88C/0.4 watt: 1V3, 2V7, 3V, 3V3, 3V6, 3V9, 4V3, 4V7, 5V1, 5V6, 6V2, 7V5, 8V2, 9V1, 10V, 11V, 12V, 13V, 15V, 16V, 18V, 22V, 24V, 27V, 30V, 33V, 36V

10p each

LEDs

5mm	Red	10p	113:	Red	
	Green	13p		Red	20p
	Yellow	13p		Yellow	25p
3mm	Red	10p	323:	Tri.	
	Green	13p		Red	20p
	Yellow	13p		Green	25p
COX21:	Red			Yellow	25p
flashing		65p			
251:	Rect/stack		503:	Square	
	Red	20p		Red	20p
	Green	25p		Green	25p
	Yellow	25p		Yellow	25p

REGULATORS

LM304H	180p	UA723C	77p	78H12 (3A/5V)	
LM309H	80p	7805A	50p		460p
LM309K	130p	7812A	50p	78L05	35p
LM317K	350p	7812Kc	121p	78L12	35p
LM317T	130p	7815A	50p	78L15	35p
LM320/5	65p	7818A	50p	78L18	35p
LM320/12	65p	7824A	50p	78L24	35p
LM320/15	65p	7905A	55p	78L62	35p
LM320/24	65p	7912A	55p	79L05	45p
LM337T	180p	7915A	55p	79L12	45p
LM1469	324p	7918A	55p	79L15	45p
UA78P (8A/5V)		7924A	55p	79L18	45p
	450p			79L24	45p

ALUMINIUM BOXES

3 1/8" × 1 9/16" × 9 1/2"	
80 × 50 × 25	80p
100 × 65 × 50	1.20
100 × 70 × 40	1.20
100 × 100 × 40	1.20
135 × 70 × 40	1.20
135 × 105 × 40	1.40
180 × 125 × 65	1.95
205 × 155 × 75	2.50

VERO PLASTIC BOXES

White 71 × 49 × 25	60p
Blk 71 × 49 × 25	60p
Blk 120 × 80 × 35	1.10
Blk 180 × 110 × 55	1.75

VERO BOARDS

127 × 63	1.10
95 × 63	95p
431 × 63	3.17
127 × 95	1.20
95 × 95	1.15
431 × 95	4.20
454 × 119	5.50
63 × 25	pk of 5 1.30

SOLDER

20 swg. 3 core

500g 495p

POTENTIOMETERS

Carbon track, ½ watt log & linear values:

Range	Price
470R-2.2MR (single track)	40p
4.7K-2.2MR (dual gang)	100p
4.7K-2.2MR (single gang D/P switch)	90p

SLIDER POTS

60mm track, log & linear values:

Range	Price
5K-500K	80p

THYRISTORS

BT101	104p	T05 1A/400V	104p	600mA/200V	45p
BT102	104p	2N1599	40p	1A/50V	40p
BT106	104p	2N4441	170p	1A/100V	45p
BT107	132p	2N4444	150p	1A/200V	50p
BT108	143p	2N5060	36p	1A/400V	60p
TIC44	20p	2N5061	33p	1A/600V	75p
TIC106D	40p	2N5062	42p	1A/800V	90p
TIC106M	77p	2N5063	47p	3A/50V	46p
TIC126D	99p	2N5064	47p	3A/100V	53p
TIC206D	80p	600mA/20V	21p	3A/200V	58p
TIC226D	90p	600mA/30V	24p	3A/400V	71p
TIC246D	130p	600mA/100V	30p	3A/600V	79p
				3A/800V	99p
				5A/50V	43p
				5A/400V	60p
				5A/600V	70p
				5A/800V	80p
				7A/100V	55p
				7A/200V	60p
				7A/400V	70p
				7A/600V	80p
				7A/800V	90p
				10A/50V	55p
				10A/100V	60p
				10A/200V	65p
				10A/400V	70p
				10A/600V	88p
				10A/800V	115p

TRIACS

2A/200V	50p	6A/400V	80p
2A/400V	60p	8A/100V	80p
2A/600V	60p	8A/200V	80p
4A/400V	60p	8A/400V	80p
6A/100V	80p	8A/600V	90p
6A/200V	80p	10A/100V	80p
6A/400V	90p	10A/200V	100p
8A/400V	80p	10A/400V	110p
10A/100V	80p	10A/400P	100p
10A/200V	100p		

BRIDGE RECTIFIERS

1A/50V	30p	6A/50V	75p
1A/100V	30p	6A/100V	75p
1A/200V	35p	6A/200V	80p
1A/400V	40p	6A/400V	100p
2A/50V	35p	10A/200V	200p
2A/100V	45p	10A/400V	200p
2A/200V	50p	25A/200V	250p
2A/400V	55p	25A/400V	300p

Dalo Etch resist

£1.10

PRESETS

Pre-set pots ½ watt

Range	Price
50R-4.7MR (mini vert. & horiz.)	10p

RESISTORS

High stability, ¼ watt, 5%

Range	Price (1-99)	(100+)
1R-10MR	2p	1p

High stability, ½ watt, 5%

Range	Price (1-99)	(100+)
1R-10MR	3p	1.5p

CAPACITORS

CERAMIC 1pF, 2p2, 2p7, 3p3, 3p9, 4p7, 5p6, 6p8, 8p2, 10pF, 12pF, 15pF, 18pF, 22pF, 27pF, 33pF, 39pF, 47pF, 56pF, 68pF, 82pF, 100pF, 120pF, 150pF, 180pF, 220pF, 270pF, 330pF, 470pF, 560pF, 680pF, 820pF, 1000pF, 1n5, 1n8, 2n2, 3n3, 3n9, 4n7, 5n6, 6n8, 8n2, 10nF, 22nF, 47nF, 100nF 6p each

MYLAR: 100V 1nF, 2n2, 3n3, 4n7, 6n8, 10nF 7p each. 15nF, 22nF, 33nF, 47nF 9p each. 68nF, 100nF 11p each. 220nF 15p, 330nF 18p, 470nF 20p.

POLYSTYRENE 22pF, 47pF, 68pF, 82pF, 100pF, 120pF, 150pF, 220pF, 270pF, 330pF, 390pF, 470pF, 680pF, 820pF, 1000pF, 1200pF, 1500pF, 1800pF, 2000pF, 2200pF, 3300pF, 4700pF, 5600pF, 47pF, 50pF, 56pF, 68pF, 75pF, 82pF, 100pF, 120pF, 150pF, 180pF, 200pF, 220pF, 250pF, 270pF, 10nF 8p each 300pF 15p each. 330pF, 390pF, 470pF 19p each. 500pF, 560pF, 680pF 22p each. 820pF 24p.

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NEWS DESK

Cellular radio prices

British Telecom Radiophone today announced the details of its prices for the new Cellnet cellular radio service which is scheduled to start operating early in 1985.

The new car radiophone, to be called the Telecom Topaz, will cost £1350. Installation will cost around £100 depending on the make of car. The phone will be manufactured by NEC in Japan.

Telecom Topaz features a 16-memory store, a ten-digit display of the number dialled, hands-free operation, electronic security lock and last number recall.

In addition, British Telecom Radiophone also announced its intention to place orders with Motorola and Mobira for cellular radiophones, for use in the car and as hand-held portables.

The new products from motorola and Mobira are expected to cost between £1350 and £2000 for car radiophones, and between £2000 and £2500 for the hand portables. All prices exclude VAT.

As a special service to existing radiophone customers, British Telecom Radiophone will be offering a trade-in deal for people switching over to Cellnet.

From April 1 next year, customers who own either of British Telecom's automatic car radiophones, Sapphire and Emerald, will be able to switch to Telecom Topaz for only £850 - a discount of £500 - provided they have been using the service for at least one year.

Sales of Cellnet equipment will be handled by British Telecom Radiophone's retail division which has a nationwide network of dealers selling the existing range of British Telecom radiophones.

The opening of the Cellnet service will mean the introduction of a new range of products, the first of which is Telecom Topaz.

Telecom Topaz charges (excluding VAT) start at £1350 for the equipment (approx £92 per quarter for a five-year lease). Connection to the Cellnet system costs an initial £60 plus a quarterly subscription of £75. Call charges range between 8p and 25p per minute according to the timing of the call.

Sales enquiries for British Telecom Radiophone products should be made to Al Tingey on 01-730 1570. The Marketing Manager is David Pugh on 01-730 1412.

British Amateur Television Club

Amateur TV enthusiasts in Central Scotland who would be willing to participate in financial support or construction of a 24cm ATV Repeater for the area are asked to contact Norrie, GM4BVU, 3 Townhill Road, Earnock, Hamilton, ML3 9UX.

Prestel for Australia

Prestel, British Telecom's world-beating viewdata system based on GEC computers, has recorded another major international success by winning the prestige Australian public service contract.

The all-British system has been chosen by Telecom Australia for its new Viatel service which will start early next year.

The contract for GEC computers and Prestel software was won against stiff international competition. It is worth £2 million initially with more to follow as Viatel develops and expands.

More than 1,000 Prestel-type terminals are already operating on private Australian networks and local firms will be able to supply terminals, TV-set adaptors and personal computers to work with Viatel.

The Australian decision means that 10 countries have now purchased national videotex systems from GEC-Prestel – more than all other international competitors combined.

Three GEC 4190 minicomputers will be installed at the Melbourne headquarters Australia's Viatel service which will start public operations in February 1985. Each computer is capable of handling 2,000 simultaneous calls.

Unlike most other countries, Australia has decided to omit the normal public trial stage.

New business opportunities created in mobile radio

The Department of Trade and Industry has published a consultative document on the future of the radio frequencies known as Band I (41-68 MHz) and Band III (174-225 MHz), which will cease to be used for 405-line black and white television services from the end of 1984.

This move will create one of the largest single additions to the spectrum available for mobile radio in Great Britain, and is bound to attract much business interest.

A summary of this document is given on page 58.

NEWS DESK

RSGB news

Some Raynet members in East Anglia participating in Intex, the national home defence exercise held recently, were actively canvassed by a group who claimed that such participation would be an infringement of national and international radio regulations.

Fortunately the situation was clarified by reference to DTI and participating members were reassured by information issued very rapidly from HQ.

It is probably worth restating that Raynet exists purely to provide a communication resource to the community at large in times of national and local need.

It is open to all radio amateurs and SWLs, whether they be RSGB members or not. It is not a political organisation, nor does it wish to promote any particular political point of view.

Members and groups are free to decide for themselves their level of support for any user service. In particular they are free to decide their level of support for CEPOs in work related to peace time, disaster, or to home defence training.

The Chinese Radio Sports Association, which represents radio amateurs in the People's Republic of China, has applied for membership of the IARU. CRSA was originally founded in 1964 but it became inactive soon after that date because of the suspension of amateur radio in China until early 1982. Amateur radio in China is still club-based, with no licences for individual stations having yet been granted: there are at present three club stations, BY1PK near CRSA headquarters (box 6106, Beijing), BY4AA at the Shanghai branch (box 205, Shanghai) and BY8AA at the Sichuan branch (box 6106, Beijing).

There are at present 30 authorised operators, and other applicants are being trained at present.

Another application for membership of the IARU has been received from the Vanuatu Amateur Radio Society, which represents amateurs in the Republic of Vanuatu. The society was founded in May 1980, at which time the country was known as New Hebrides and was jointly administered by France and the United Kingdom. There are 25 amateurs in Vanuatu, of which 18 are members of VARS, and the country's licensing authority is reported to have a very favourable attitude to the hobby.

VARS has a headquarters station with the callsign YJ8DX, and the callsign YJ8ES is used by the Society's branch on Espiritu Santo Island.

The Department of Trade and Industry is at present considering ways of restricting the use of illegal 27MHz CB equipment without adversely affecting the operation of licensed radio amateurs on the 28MHz band.

European Space Agency astronaut Huber Ocolls from the Netherlands may become the first European amateur in space. He is due to fly on one of the USA space shuttle missions during 1985. Although he is not yet licensed, he intends to obtain his ticket prior to launch. The Dutch National Society, VERON, is apparently to make an official request to NASA for him to use equipment similar to that used by W5LFL.

Packet Radio is another acea of rapid growth within amateur radio which is gaining popularity in the UK. Packet data exchanges between two individual amateurs is quite legal. As such, it is just another form of data transmission which is quite permissible under the terms of the UK licence. The initial confusion was because of the third party message facilities associated with packet radio at present being used by many amateurs in North America. Needless to say, as with any other form of data transmission, identification of transmissions should always comply with UK licence regulations.

High Quality Precision Directional Coupler

by Derrick Simpson

In the course of work on the development of an antenna system the need to be able to measure voltage standing wave ratio at 432MHz and higher frequencies prompted a look at commercially available directional couplers. The cost of these was enormously high, certainly out of reach of the pocket of most radio amateurs.

It was found that the basic concept was very simple and that the high cost is almost entirely due to the high mechanical precision necessary in order that the accuracy, reliability and repeatability could be achieved and maintained over long periods of time.

SWR meter

A directional coupler in some form or other is used in every instrument and is commonly called a SWR meter. It is a device that is capable of separating the forward or incident voltage from the reverse or reflected voltage, which occur in a transmission line, co-axial or parallel carrying radio frequency energy that is not perfectly terminated.

Note: A line that is infinitely long can be considered as perfectly terminated if all the energy fed into it is totally absorbed, dissipated in the loss resistance along its length.

The circuit and the electrical form of the directional coupler is as shown in *Figure 1*, and may be recognised by some. It consists of a central line somewhat larger in diameter than the two smaller lines coupled to it, but maintaining the characteristic impedance of the co-axial line of 50ohm.

The smaller lines are diametrically opposite one another on each side of the main line. These secondary lines also have their characteristic impedance set at 50ohm so that the measuring equipment will also see a matched line. In use we very often find that one end of the secondary lines are in fact terminated with 50ohm dummy loads. This ensures that there is a standard that is common to all the measurements made, and can always be referred to.

The physical dimensions of the directional coupler are determined by the size of the flange on the 'N' type socket used and the necessity to make the instrument with a 50ohm characteristic impedance. The formula used to calculate the sizes of the lines is given in the appendix.

Standing waves

At this point it may be helpful to consider how standing waves form and how they relate to the measurements made and to what is happening in the transmission line.

The sine wave of the voltage being propagated in a line towards a short circuit, produces an incident wave moving from left to right (refer to *Figure 2*).

Since there can be no voltage sustained across the short circuit assuming no losses, an equal voltage is reflected and is propagated back down the line with such a phase that the voltage at the short is always zero.

It is also true that the current is a maximum into the short circuit and that the current wave is also reflected in the same way. This is important because it does not matter whether the voltage or current is measured as the result is the same.

Diode voltmeter

The conception of two independent waves existing on the line and travelling in opposite directions at the same time is correct, but it is not sufficient for all problems.

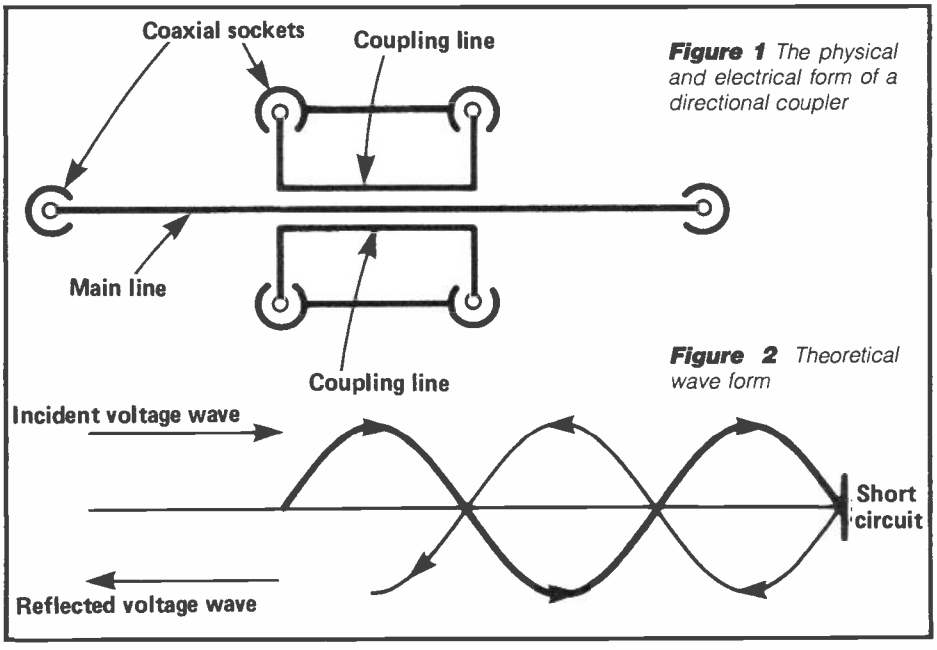

Figure 1 *The physical and electrical form of a directional coupler*

Figure 2 *Theoretical wave form*

For example, a simple diode voltmeter (see *Figure 3*) connected across such a line could not separate the two waves but would give a reading that would be dependent upon the magnitude and the relative phase of the two voltages existing on the line at that point.

If the voltmeter was moved then it would be found to give a different reading depending upon its position on the line.

For instance, if both reflected and incident voltages were in phase at the point of measurement, then the meter would show a reading of twice the incident voltage. Conversely, if both voltages were out of phase by 180°, then the meter would show zero voltage.

So it can be seen that a reading can be taken simply by moving the diode voltmeter along the line.

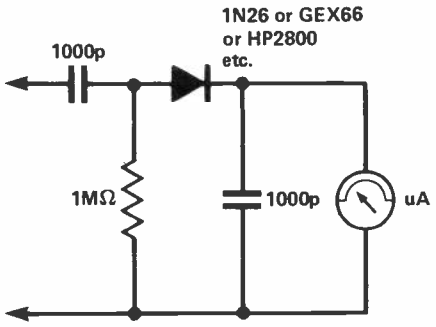

Figure 3 *Circuit of a simple diode voltmeter*

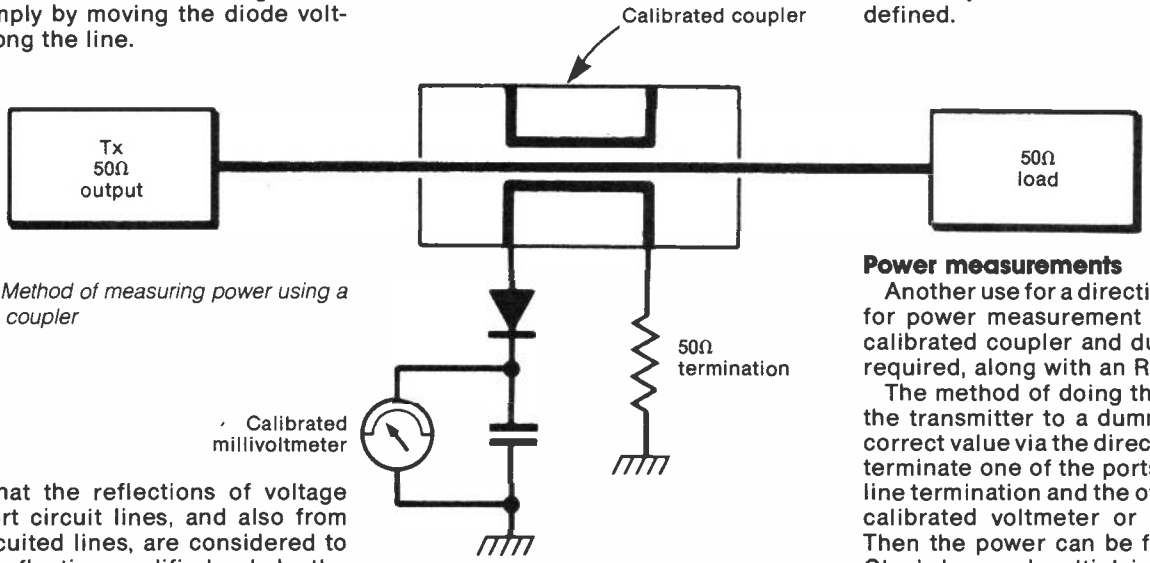

Figure 4 *Method of measuring power using a directional coupler*

Note that the reflections of voltage from short circuit lines, and also from open circuited lines, are considered to be total reflection modified only by the losses inherent in all transmission lines; the losses having the effect of making the measured voltage reflected lower by the amount of loss in the line.

Care should be taken when measuring the reflected voltage at the transmitter end because the measurement must take into account the loss incurred from transmitter to the load, and add the loss from the load back to our measurement point at the transmitter. In other words, the cable loss reduces the forward voltage and also reduces the reflected voltage. The same also applies to the current.

Between the extremes of open and short circuited lines the terminating impedance may have any values of resistance and reactance. Therefore, if the termination has a resistive component then power will be absorbed in that resistance and the reflected power will decrease in magnitude, the actual value depending upon the amount of power fed into the line and the loss of the line.

Therefore it can be seen that if the load is purely resistive, but is not the correct value to terminate the line fully, there will be a standing wave on the line that is a function of the forward power minus the power absorbed in the load.

This is a measure of how closely the cable impedance and the load impedance match. For a resistive load the forward and reflected voltages are in phase with one another, but if there is a reactance associated with the load impedance, then the phase angle of the reflected voltage will vary between plus 90° and minus 90° with respect to the forward voltage. The phase angle is therefore dependent upon the magnitude and the sign of the associated reactance.

Unfortunately a directional coupler, like the diode voltmeter, cannot distinguish between loads that are purely resistive and loads which are partially or totally reactive, in so much as reactances dissipate no power. All that can be done is to measure the values of forward and reflected voltages or currents and allow them to be expressed as a ratio.

However, this information can be very valuable because it can be used to determine the load impedance, if the conditions under which the measurement is taken are precisely defined. One of these is that the directional coupler can be connected directly to the antenna terminals without the use of any intervening co-axial cable, so that a measurement can be taken determining the complex impedance of the terminations.

To make further measurements would need a slotted line, but these are necessary if the load is to be totally defined.

Power measurements

Another use for a directional coupler is for power measurement and for this a calibrated coupler and dummy load are required, along with an RF voltmeter.

The method of doing this is to couple the transmitter to a dummy load of the correct value via the directional coupler, terminate one of the ports with a 50ohm line termination and the other end with a calibrated voltmeter or millivoltmeter. Then the power can be found by using Ohm's Law and multiplying the result by the coupler loss factor for that frequency (see *Figure 4*).

Construction

In order to construct this directional coupler it must be said that a fair amount

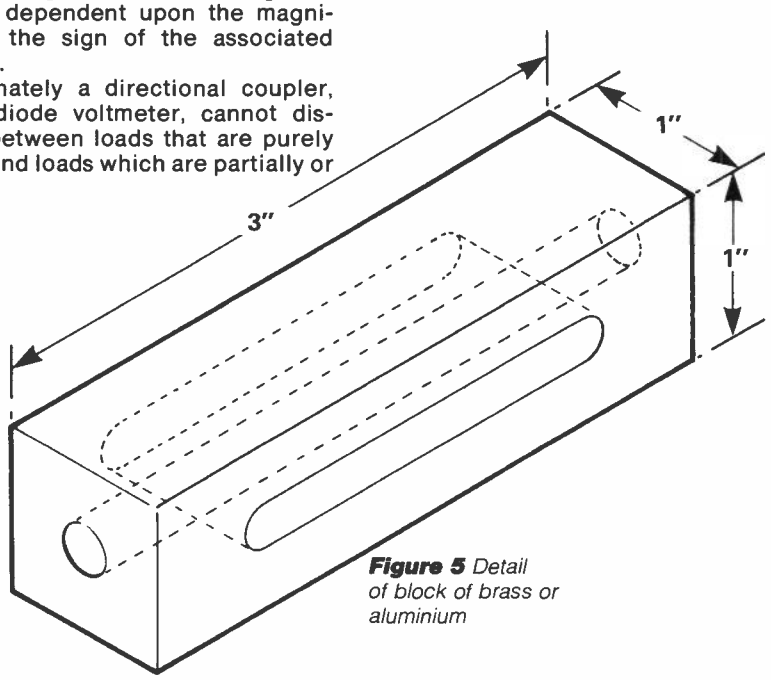

Figure 5 *Detail of block of brass or aluminium*

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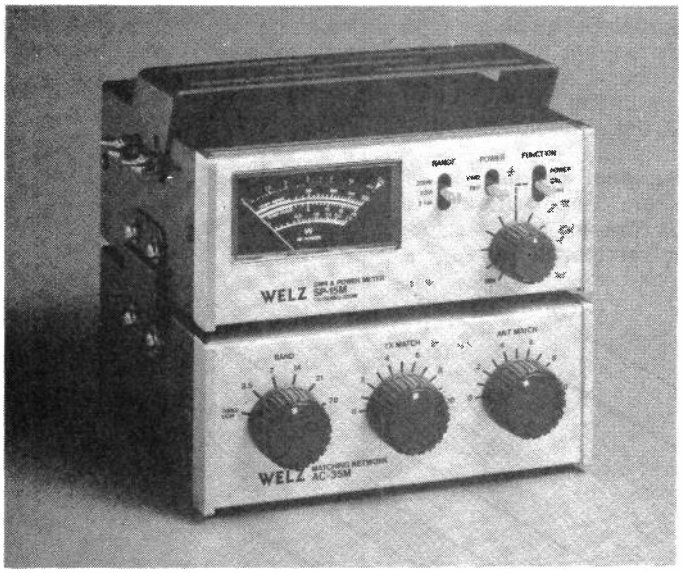

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Frequency Range (MHz)	1.8-150	140-470
Power Measurement (W) CW	0-200	0-100
Accuracy (power measurement) at full scale	±10%	
Power Range (W)	2.5/20/200	3.0/20/100
Measurement Function	Forward/Reflected Power, Calibration & SWR	
Insertion Loss (dB)	0.2	0.5
SWR Measurement	1:1 – 1:∞	
SWR Sensitivity (W)	1.5	3.0
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of precision engineering and lathe work is necessary, but this is a must if meaningful use is to be made of the information gained by the measurements that can be performed by this device.

Some of the parts must be manufactured to an accuracy of plus or minus one-thousandth of an inch, mainly turned parts; most of the other parts can be finished to a standard engineering tolerance of plus or minus one-hundredth of an inch.

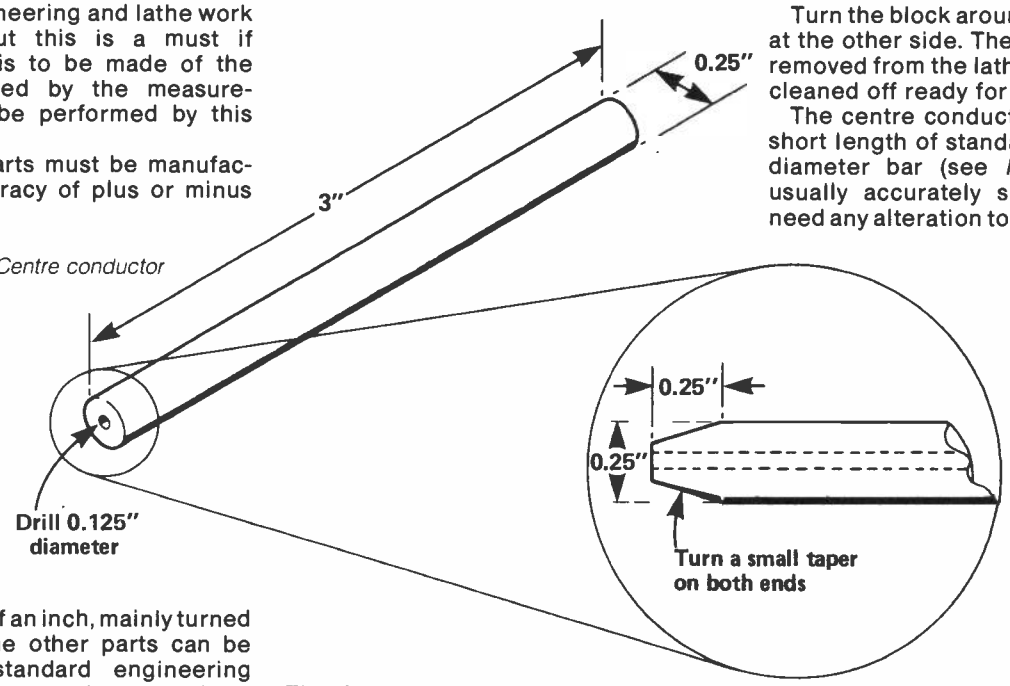


Figure 6 *Centre conductor*

The body of the coupler is machined from a block of brass (see *Figure 5*) or aluminium 3 inches long and 1 inch square. It is set up on the cross slide using a lathe as a boring machine. A pilot hole .250 inches in diameter is drilled through the block as accurately as possible.

Next, using a long series drill, without removing the block from the lathe cross slide or moving the cross slide in any way (experienced machinists may adjust the cross slide in order to correct an out of true of the pilot hole as it exits the block), fit a boring bar with a cutter set for .265 inches and take a slow cut. Keep taking fine cuts until .565 inches is arrived at. The final bore diameter must be .575 inches ±.001 inches if a 50ohm line is to be achieved. When the bore is finished turn the block through 90°.

Make sure that the block is square to the chuck and reclamp to the cross slide ensuring that the height of the block is not altered in any way from the previous operation.

Fit a cutter holder into the headstock and mount slot drill or four flute milling cutter of .227 inches diameter. Carefully mill a slot 1.181 inches long, deep enough so that it cuts through into the bore. This must be done in one cut and with very great care.

If a lathe with a power cross slide is available then this will present little difficulty.

Turn the block around and do the same at the other side. The block can now be removed from the lathe and sharp edges cleaned off ready for the next step.

The centre conductor is made from a short length of standard brass .250 inch diameter bar (see *Figure 6*). This is usually accurately sized and will not need any alteration to its diameter but be careful not to damage its surface when handling; use soft jaws in the vice and in the lathe chuck when drilling and turning the ends.

Two brass plates ⅛ inch thick, three inches by one inch are drilled as per the drawing and the holes threaded as marked (*Figure 7*). Carefully mark out using a centre punch on hole centres. Use a sharp drill and be careful to avoid snatching if using a press drill.

The body of the coupler should be drilled and tapped to take the fastening screws for the 'N' type sockets. 4 BA screws could be used and the holes opened out in the socket flange to 9/64 inches. The other holes are drilled

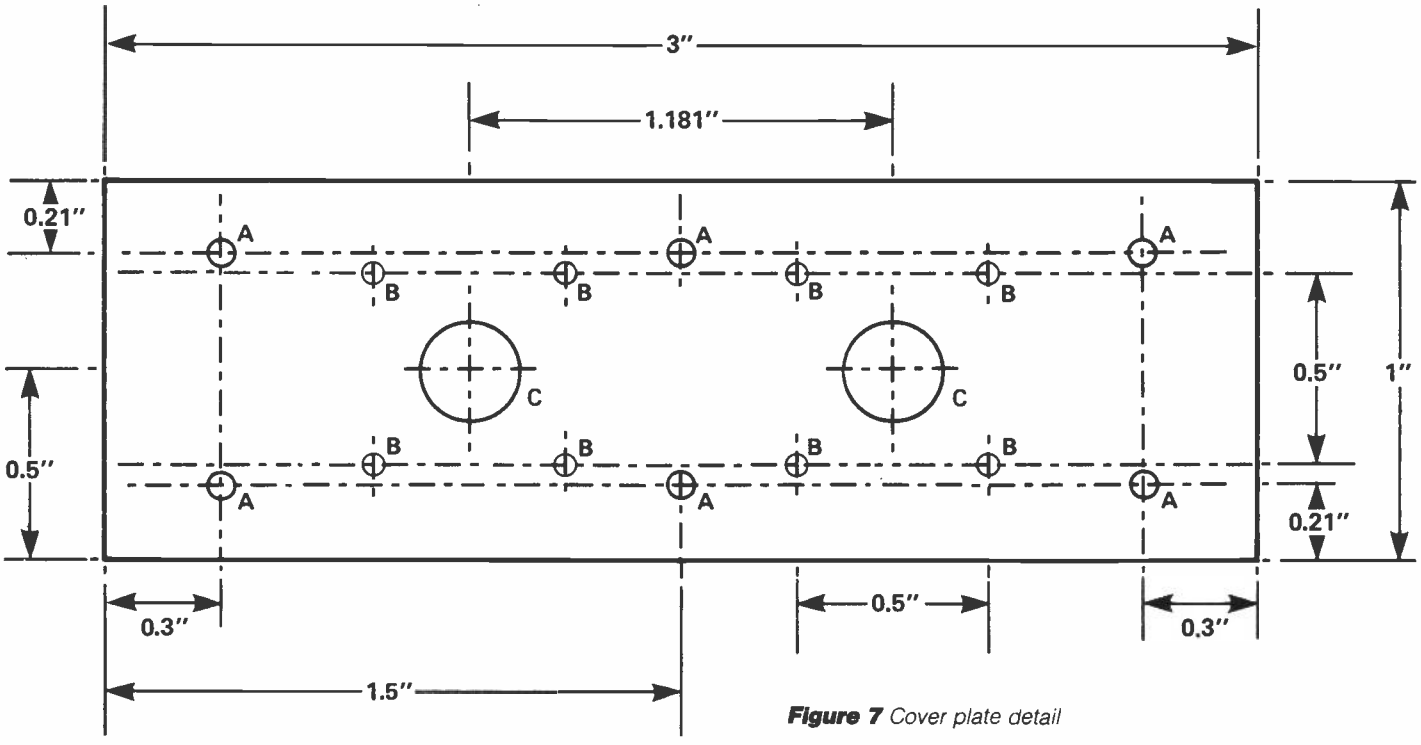


Figure 7 *Cover plate detail*

5/64 inch and tapped to take a 6 BA bolt.

All the sockets are modified by turning off the raised part on the back of the flange. On most 'N' and BNC sockets this will release the pin in the centre. It will be found that there are two teflon washers supporting the pin and the rear one should be discarded. On some types of BNC socket the rear teflon washer must be turned down so that it fits into the .250 inch hole in the mounting plate.

Once all the parts have been sorted out a dummy assembly run can be tried and any mechanical adjustments can be made. Parts should be marked so that they can be reassembled later to be put back in the same place.

The centre conductor should have the pins from the 'N' type socket soldered in place and any excess solder cleaned off. Care should be taken to ensure that the pins are straight and in line with the centre conductor, otherwise problems could occur when trying to mate the 'N' type plugs at the sockets. This can now be set aside ready to be fitted later.

The modified BNC sockets can now be fastened permanently to the brass plates and then all the screw threads and the excess pin length can be removed from the BNC sockets. (Care should be taken if your BNC sockets have the long teflon support for the centre pin because there must be at least 1/8 inch of pin showing through the teflon in order to allow the pickup line to be fitted).

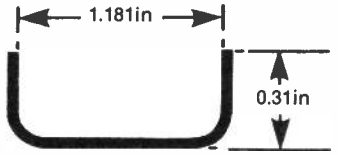
The pin on the BNC socket should be flush with the surface of the brass mounting plate, as should the screw threads which protrude through the mounting plate.This can most easily be achieved by rubbing the assembly against fine carborundum paper laid on a glass plate, to ensure a flat surface and a good finish. All traces of grit and dust particles must be removed before any further assembly can take place.

Two lengths of copper wire .098 inches in diameter and 2 inches long (allowing plenty for cutting to size) are used for the pick-up loops.

It is very important that the dimensions of the pick-up loops are adhered to, because unless there is access to calibration facilities, the coupling loss and balance will not be known precisely. Adjustment of balance can be made with simple test equipment and this will be described in Appendix A.

A simple jig should be made in order to help make the loops. A piece of plate about 1/8 inch thick has to have two holes drilled in it .114 inches in diameter and 1.181 inches apart. The copper wire should be bent into a flattened 'U' shape (*Figure 8*), the ends should pass through both holes, and the wire should lay flat against the plate between the holes. The height of the pick-up loops should be .310 inches measured by placing the loop legs upwards on a flat surface and scribing a mark across the legs with a height gauge set for .310 inches. Cut the legs and file flat to the mark made.

Once this has been done four copper



Material: 0.098in diameter copper wire
2 required

Figure 8 *Coupling loop*

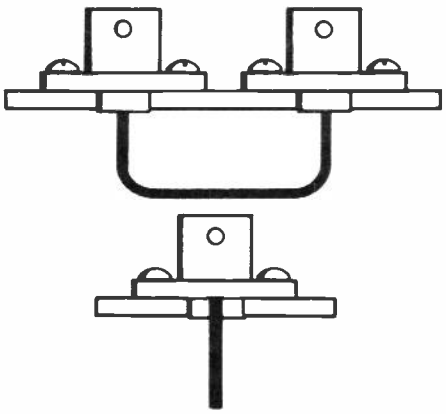


Figure 9 *Detail of coupling connections*

or brass ferrules are needed so that the coupling loops can be soldered onto the BNC socket pins and kept square. They must not lean to either side or be twisted to one side or the other (*Figure 9*). The ferrules are made from copper or brass shim stock cut into a strip 1/4 inch wide and wrapped around a spare piece of .098 inch diameter copper wire a couple of times to form a tube 1/4 inch long and .098 inches inside diameter. Solder the loops using a hot soldering iron and the minimum amount of cored solder.

The BNC mounting plates can now be fitted onto the body and secured lightly with the fastening screws. The loops should protrude into the bore of the body by the diameter of the wire (*Figure 10*).

This will produce a coupling loss of about -35dB at 144MHz dropping to -26 dB at 432MHz and about -17dB at 1296MHz, cut off being about 3.5GHz with a coupling of -6dB or less (but could still be useful).

Continue assembly by fitting the 'N' type sockets and centre line. When these have been fitted the screws can be tightened securely and varnish applied to prevent them from coming loose.

Appendix A

The finished directional coupler can be adjusted so that both the pick up lines have the same coupling loss. If the details have been followed closely then the out of balance will not exceed 2dB and hopefully we should be able to do better than .25dB.

Some test equipment is needed but apart from a good 50ohm termination load, a 50ohm dummy load and an avometer with a diode probe will suffice. The source of RF can be a transmitter for 70cm. It is not necessary that the diode probe be calibrated: all that is needed is an indicator of the voltage developed.

The 50ohm dummy load termination must be able to handle all the power that the transmitter can produce. Set up the coupler as shown in the drawing (see *Figure 4*) and switch the transmitter on. Measure the voltage produced at the transmitter end of the coupling line with a 50ohm terminaton at the other end of the line. Swap sides and compare the voltage measured with the other side. The voltages measured should be exactly the same. If they are then the coupler is ready to use.

The likelihood of both lines producing the same voltage is remote, so one line will have to be adjusted slightly in order to alter the pick-up a little. Move the line in to increase the pick-up. This could be done by bending the flat part of the loop slightly using snipe-nosed pliers. A better method of very fine adjustment can be used by putting several 1 thou thick copper shim stock under the socket mounting plate on the side with the higher voltage measurement (a convenient source for copper shim material is the outer from Pope h100 co-axial cable).

Appendix B

If the constructor has access to a good attenuator of at least 40dB range adjustable in 1dB steps, capable of working at 500MHz or more and of handling the RF power that will be used, then it is quite easy to measure the coupling loss at 432MHz.

Set up the equipment as shown in *Figure 11*. With the attenuator set to 35dB and using a Tee connector measure the voltage across the 50ohm load, then without disturbing anything measure the voltage at the end of the coupling lines.

Reduce the attenuation until the measured voltage is the same as the first measurement. If required the measuring detector could be a receiver or spectrum analyser etc. Because the coupler lines are all 50ohm and indeed should be terminated in 50ohm so a length of 50ohm coaxial cable can be used between the coupler and whatever detector is used without incurring errors.

It would only be necessary to add the

The formula used for calculating the impedance of the main line is:

138 x Log ^{10} D/d

Rearranging to give ratio of D to d from Zo

⁂ Zo = 50 Ohm/138 = .3623

⁂ Ratio of D/d = .3623 ^{10} = 2.30:1

⁂ d = .25 inch x 2.30 = .575 inch

⁂ Line inner diameter = .250 inch

⁂ Line outer diameter = .575 inch

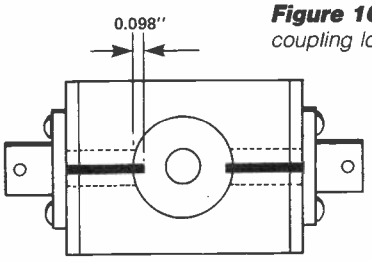


Figure 10 *Detail shows the coupling loops protruding*

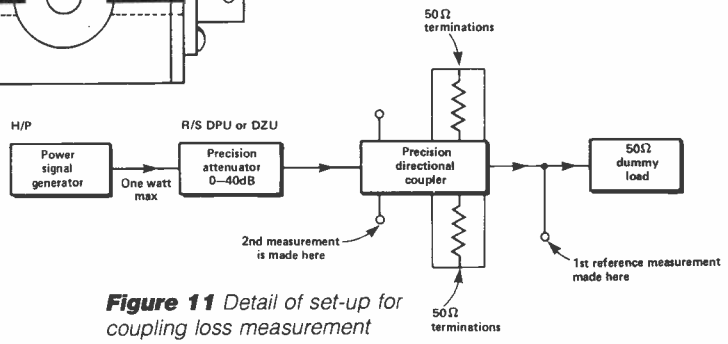


Figure 11 *Detail of set-up for coupling loss measurement*

insertion loss of the co-axial cable used to the insertion loss of the coupler at the frequency used for the measurement.

The physical dimensions of the lines used in this directional coupler are determined by the requirement that the device has a characteristic impedance of 50ohms.

Note the number of dB's of attenuation removed. This figure is then the coupling loss in dB at the frequency that the measurement was made, and if repeated at say 150, 300, 450, 1000 and 1500MHz, a curve showing the coupling loss against frequency can be drawn and this graph can be very useful for some applications.

Once the coupler is finished and calibrated we can now use it in order to measure VSWR very accurately, certainly to within 5% or better at 1296 MHz. It must be remembered that both lines are for all intents and purposes exactly the same, so that it does not matter which line is used to measure forward or reflected voltage.

The pick up coupling is the same in any case, but for the maximum accuracy the same diode detector should be used to make both forward and reflected measurements.

The coupler should be fitted at the antenna when making VSWR measurements, or if this is not possible then the length of the connecting cable must be an electrical multiple of a half wavelength at the frequency in use and be measured very accurately at that.

Don't forget that the length of the cable must include the plugs and sockets and also about one third of the length of the coupler itself. The terminating loads are ½W line terminations and are available from Greenpart or Schuner. These are highly recommended since they are good to well over 1.5GHz and are relatively inexpensive.

The same procedure is used for the secondary line sizes but 276 is substituted for 138, the result gives an approximation of dimensions. It should be remembered that the exact impedance of the secondary lines will vary slightly with variations in the wire diameter, cavity size and also the coupling to the main line.

Therefore the line impedance must be measured in order to say precisely what the actual characteristic impedance is.

For the directional coupler described using the given dimensions, and obtaining the coupling factor specified, the secondary line impedance will be within a few per cent of 50ohms.

RADIO RALLIES

BY STEPHEN IBBS

Two rallies have been held in the Midlands recently, one at Drayton Manor Park, and the other at Elvaston Castle (near Derby). It is interesting to compare these two and see how they serve the amateur and his/her family looking for a day out.

The Drayton rally was held on the 20th May, and the weather was good but not brilliant. I arrived at about 8.15am to help a friend set up a stall, and was relieved to find that they have at last moved the three marquees to a new site further away from the main entrance. It had always been a dice with death wandering around the rally because of cars streaming in, and this move was an excellent and necessary improvement. However, the recurring criticism of Drayton is that they always try to cram too many stalls into the tents. One more marquee with the same number of firms would ensure much more room, and less irritability from crowds unable to move.

The stewards tend to be rather over-zealous, or officious, depending on your view-point, and though the rally was not due to open until 11am, it was clear that most stall holders were ready for business well before time... not that this had any effect on the stewards, who delighted in keeping the crowds out, until finally somebody saw sense. There were a great many bargains to be had at Drayton.

Clearly, the bottom has dropped out of the secondhand market for certain items... eg Pye equipment, and these were being snapped up by those not susceptible to the flashing lights of the latest Japanese offerings.

The big advantage of Drayton is, of course, the fun-fair and zoo for the rest of the family. There is an excellent system whereby children can pay £2.50 and then go on as many rides as they like, all day. This enabled Shelagh (G4TCD) and myself to wander round at our leisure, wishing we could afford to buy lots of things.

The Elvaston rally was held on the 10th June, and the weather was glorious. Here we had to pay 40p car parking ... compared with Drayton's £1 per adult plus car parking... a very pleasant surprise, but what sort of day could the children expect? As things turned out, it was marvellous. There were beautiful grounds to explore, the castle and its exhibitions, as well as fun-fair rides, traditional fair-organ, WW2 lorries and jeeps, dog-handling displays, and a special childrens' show arranged by the rally organisers. Their efforts were greatly appreciated, in what I think must be the best rally I have ever attended. Scouts were on hand to direct the very spacious parking facilities, a PA system was working through the day to announce the various attractions etc, and the refreshments were of a very high standard, with a radio ham wandering around in full chef's gear (plus shorts), directing operations.

With all these distractions it was difficult at times to concentrate on the job in hand... spending the hard-earned pennies. There were a lot of attractive goodies on offer, particularly on the well-organised 'bring-and-buy' stand. There were a lot of stalls out in the open, and the marquees only had stalls around the edges (unlike Drayton which also squeezes in a double row along the centre), and this made so much difference in terms of comfort.

Drayton will always be popular because of its well established side-attractions, but its organisers would do well to remember the thousands of amateurs who object to being kept out, then squashed in to marquees holding too many stalls.

Finally, many congratulations to the Elvaston organisers... long may it continue.

ICOM

FOR THE SWL...

IC-R70, £565.

The R70 covers all modes (when the FM option is included), and uses 2CPU-driven VFOs for split frequency working, and has 3 IF frequencies. 70MHz, 9MHz and 455KHz, and a 100dB dynamic range. It has a built-in mains supply. Other features include input switchability through a pre-amplifier, direct or via an attenuator, selectable tuning steps of 1KHz, 100Hz or 10Hz, adjustable IF bandwidth in 3 steps (455KHz). Noise limiter, switchable AGC, tunable notch filter, squelch on all modes, RIT, tone control. Tuning LED for FM (discriminator centre indicator). Recorder output, dimmer control.

The R-70 also has separate antenna sockets for LW-MW with automatic switching, and a large, front-mounted loudspeaker with 5.8W output. The frequency stability for the 1st hour is ± 50Hz, sensitivity – SSB/CW/RTTY better than 0.32 uv for 12dB (S + N) ÷ N, Am – 0.5 uv. FM better than 0.32 for 12dB Sinad. DC is optional.

Ever since its introduction the IC-R70 has proved to be a popular and reliable HF receiver making your listening hours a pleasure. Please contact us for further details on this excellent set.

IC-R71E, £649.

For those who like the easy life, the R71E has the option of an infra-red remote control unit, making it a very sophisticated rig indeed, here are some details.

100 KHz – 30 MHz all mode (with FM option). Quadruple conversion superhet. IF frequencies 70MHz, 9MHz and 455KHz with continuous bandpass tuning and notch filter. Virtually immune from adjacent channel interference with 100db dynamic range. Adjustable AGC, noise blanker and switchable pre-amplifier. Direct keyboard into twin VFO's with 32 programmable memories. 5 year lithium memory backup cell. Memory and band scan with auto-stop. Tuning rates 10Hz, 50Hz and 1 KHz with 6 digit readout. AC mains operation. Auto squelch tape record function.

OPTIONS:- Synthesized voice readout, infra-red remote controller, 12 V DC kit, mobile mounting bracket, two CW filters 500 and 250 Hz, FM unit, computer interface, headphones.

You can get what you want just by picking up the telephone. Our mail-order dept. offers you: free, same-day despatch whenever possible, instant credit, interest-free H.P., telephone Barclaycard and Access facility and a 24 hour answering service.

Please note that we now have a new retail branch at 95, Mortimer Street, Herne Bay, Kent. Give it a visit, BCNU.

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ICOM

FOR THE DX'er...

IC-745, £839.

ICOM's IC-745 is the all-in-one transceiver featuring an HF all band SSB, CW, RTTY, AM (receive only) ham transceiver, plus a general coverage receiver. Options for FM transceive and an internal power supply make the IC-745 the complete transceiver in an all-in-one package.

The receiver section features a 100KHz to 30MHz general coverage receiver, this allows access to all HF bands plus all the frequencies in between. The IC-745 has an adjustable AGC circuit and DFM (Direct Feed Mixer) giving a wide dynamic range of 103dB with an intercept point at + 18dBm. Exceptionally clean reception is achieved with a low noise PLL circuit and a 70MHz first IF.

The IC-745's features include IF shift, 16 programmable memories with lithium battery back-up, passband tuning, a noise blanker both wide and narrow, threshold level control, notch filter, receive audio tone control and an all mode squelch. Also available is a front end switchable receiver preamp providing 12dB gain. RIT has a ±1KHz range.

We could go on all day about the 745, get in touch with us and we will send you the full story

IC-271H, £819.

The IC-271H is the most advanced 2 meter transceiver available today, it covers the spectrum from 144-146 MHz with FM, SSB, or CW using the most advanced 10Hz PLL system. The IC-271H is suitable for simplex, repeater operation, moonbouce or satellite work, and has features found on no other transceiver.

Some standard features include 32 tunable memories, a high visibility fluorescent display, RIT readout, scanning, 12V DC operation with optional AC power supply.

The 271H has a speech synthesizer that announces the displayed frequency, ideal for blind operators, this is an optional extra along with the SM6 desk microphone and 22 channel memory extension with scan facilities.

As you can see from this brief description the IC-271H, (and its 430-440MHz brother the IC-471H) are very versatile sets indeed. More detailed literature can be easily obtained from Thanet Electronics Limited.

Agent: Gordon G3LEQ, or telephone Knutsford (0565) 4040.
Please telephone first, anytime between 0900 – 2200 hrs.

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Thanet Electronics
Dept RW,143 Reculver Road, Herne Bay, Kent.
Tel:(02273) 63859/63850

BARCLAYCARD VISA

TWENTY QUESTIONS

A self-test for those who are studying for the City and Guilds 765 Radio Amateurs Examination. Otherwise it can be used to 'brush-up' the memory and revive knowledge that is rusty

Compiled by Dennis Hayes

The City and Guilds 765 Radio Amateurs Examination takes approximately 3 hours and contains two separate papers which have to be answered during the period of the examination.

One hour is allowed for the first paper (765-1-01) which has 35 multiple choice questions covering licensing conditions and transmitter interference. A short break is allowed before commencing the second paper (765-1-02) containing multiple choice questions about operating practices, procedures and theory. This paper has 60 questions and the time allowance is 1¾hours.

The Amateurs Handbook (published in three parts and included in the December 83, January & February 84 issues of ***Radio & Electronics World***) is a useful source of information and is recommended reading for the intending candidate. Page 20 of Part 1 of this book gives a comprehensive guide to other sources of information.

Although the following quiz is not as extensive as the City and Guilds examination and does not give a preview of the questions actually set, it may provide a useful indication of your state of readiness if you answer the quiz questions over a self-timed interval.

Now try the quiz, then look at the answers (on page 70).

Questions

1. Which of the following organisations is entitled to request assistance from a licensed amateur radio station during an emergency (disaster relief operation)?

   (a) Emergency County Planning Officer
   (b) St John Ambulance Brigade
   (c) The DHSS
   (d) British Red Cross Society
   (e) Police Force

2. An amateur radio station may use any class of emission provided it is within the amateur frequency bands.
   (True or False?)

3. The Morse Test includes sending---- words, averaging 4 letters per word, in 4 minutes.
   (True or False)

4. What is the maximum number of corrections and uncorrected errors that are allowed in the Morse Sending Test?

	Correction	Uncorrected Errors
(a)	2	2
(b)	1	3
(c)	4	0
(d)	3	4

5. The Morse Test involves receiving ---- words, averaging 5 letters per word and --- five figure groups in --- minutes.

6. Related to Question 5. A word with more than one letter incorrectly received counts as --- errors.

7. The maximum number of errors in receiving plain language and figures during the Morse Test is:

	Plain Language	Figures
(a)	1	1
(b)	2	1
(c)	3	2
(d)	4	2

8. What speeds of transmission are permitted for RTTY?

	Bauds	
(a)	40	45
(b)	45.5	50
(c)	49	54
(d)	47.5	56

9. When using telegraphy it is particularly important to ensure that interference due to ---- is eliminated.

10. The amateur must notify the authority when he is testing for the presence of harmonics or other spurious emissions in his transmission.
    (True or False?)

11. If the station is temporarily operated elsewhere the call – sign must be amended.

    (True or False?)

12. The input power requirement for an equipment is 550W. A suitable rating for its supply fuse would be:
    (a) 13A (b) 3A

13. The ohmic value of a resistor with colour coded bands of yellow, brown, orange is:

(a)	31,000
(b)	41,000
(c)	25,000
(d)	6,000

14. The input level of 100 mW to an amplifier of equal input and output impedances produces an output of 10 W. The power gain of the amplifier (in dB) and its output level (in dBW) is:

	Gain (dB)	Output Level (dBW)
(a)	20	10
(b)	17	7
(c)	14	4
(d)	10	10

15. If the maximum deviation of an FM signal is 3KHz either side of the carrier when the modulating frequency is 100Hz, the modulation index is:
    (a) 5 (b) 3 (c) 100 (d) 30

16. When a 14.1MHz carrier is frequency modulated at 1KHz, first and second sideband pairs will be produced at:

	1st	2nd
(a)	14,087 & 14,103KHz	14,094 & 14,106KHz
(b)	14,098 & 14,102KHz	14,096 & 14,104KHz
(c)	14,101 & 14,099KHz	14,102 & 14,098KHz

17. A pre-emphasis circuit restricts the bandwidth of an FM signal and a clipper attenuates the lower frequencies.
    (True or False?)

18. A Lissajous figure can be displayed when comparing two low frequency sinusoidal signals and the oscilloscope pattern will depend on:
    (a) signal amplitudes (b) phase relation (c) frequencies (d) a,b,c

19. The Lissajous figure will be stationary when a constant ratio exists between
    (a) phase (b) frequency (c) both.

20. An antenna designed for operation on 435MHz has the same gain as another designed for operation at 145 MHz. Are they equally effective?
    (a) No (b) Yes

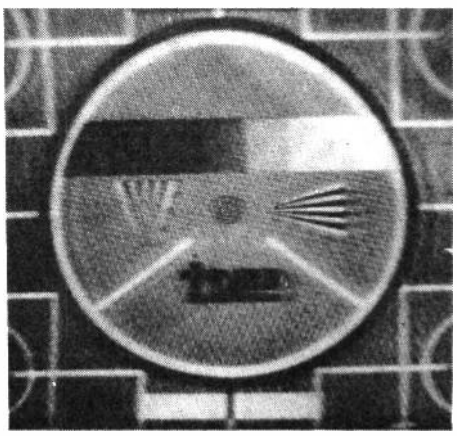
SPORADIC-E PROPAGATION

by Keith Hamer and Garry Smith

Throughout Europe there are literally hundreds of broadcast radio and television transmitters operating in Bands I and II within the 40 to 110MHz spectrum. Many outlets are low-power relays but there are dozens of main transmitters with effective radiated powers (ERPs) of between 10 and 100 KW. These can be easily received in the UK with the aid of Sporadic-E propagation.

The established DX enthusiast will already be aware of those countries and transmitters which are readily received, and those which are more elusive, requiring patience and technical expertise. The newcomer has to start from basics and it is hoped that this article will provide an insight as to which countries can be expected during good conditions and how to identify reception.

It shouldn't be assumed that a large aerial and sophisticated equipment will automatically guarantee an endless selection of extra TV and radio programmes on a permanent basis. One of the thrills of DX reception is the uncertainty and surprise element of what may be received, since it is atmospheric conditions which have the upper hand in the matter. TV-DXers with years of experience still find the sight of a foreign test card or clock caption on their screens fascinating, especially when the signal has originated several hundred miles away.



Spanish test card

Sporadic-E reception

Under normal conditions signals radiating from a high power transmitter cannot be satisfactorily received beyond the optical horizon. This is approximately 80 to 100 miles from the transmitting site and is due to the curvature of the Earth. Signals will leave at a tangent and continue into space after passing through the E-layer, situated some 75 miles above the surface of the Earth. At certain times of the year patches of ionised gasses within the E-layer become capable of reflecting signals at VHF frequencies back to the Earth.

Since reflection takes place a skip distance is involved. This is typically 700 miles, but occasionally the signal is reflected again producing multi-skip reception. Sometimes reflection will take place at a more acute angle, thus producing a very short skip of 250 miles or less. Such instances are, however, rare.

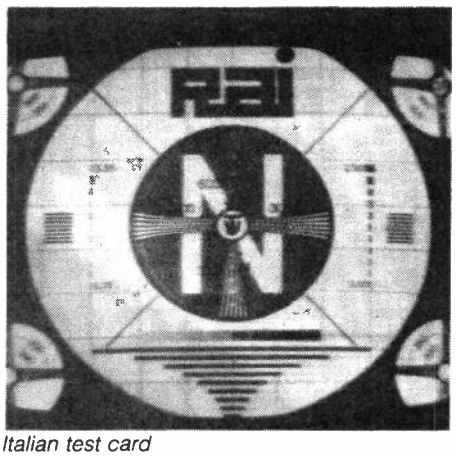
Sporadic-E ionisation occurs mainly between mid-May and early September, when DX reception can be an almost daily event. However, Sporadic-E activity can occur at other times of the year, although it is less frequent and less dramatic than the summer period. 'Openings', as they are termed, are completely random and can present themselves at any time of the day or night.

On some days activity can be non-existent or last for only a few minutes, while on others there may be several openings. Occasionally an opening can last for much of the day with signals arriving from every direction.

Openings are more common on the lower VHF frequencies. Consequently there will be fewer instances of signal propagation on the FM radio band compared with Band I television channels. During very intense activity the maximum usable frequency (MUF) will occasionally rise above the 2-metre amateur band and permit Band III TV reception, albeit on the lower channels such as E5 and E6. However, on at least one occasion the MUF rose sufficiently to allow Soviet TV to be seen on all its Band III channels including R12 at 223.25MHz. Details of channel frequencies are given in the table.

Signals propagated via Sporadic-E ionisation can vary in strength and quality even over a period of seconds, although the higher the frequency at which reception takes place the more stable and slow-fading it tends to be. Television signals propagated on the lower Band I channels are often very strong, attaining levels of several mV, but they can suffer from reduced bandwidth effects, producing smeary and distorted video.

Colour and sound are more easily resolved on the higher Band I channels



Italian test card

EAST CORNWALL COMPONENTS

TRANSISTORS DIODES

Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)
AC126	0.35	BC108	0.10	BC302	0.32	BD244A	0.65	BF258	0.30	BT101/300	1.15	BYX36/150	0.22	TIP32	0.40
AC127	0.30	A B or C	0.12	BC303	0.32	BD375	0.32	BF259	0.32	BT101/500	1.25	BYX36/600	0.28	TIP32C	0.60
AC128	0.30	BC113	0.14	BC307	0.10	BD410	0.76	BF262	0.30	BT102/300	1.35	BYX48/300	0.72	TIP33A	0.63
AC128K	0.34	BC114	0.12	BC308A	0.10	BD434	0.68	BF263	0.30	BT102/500	1.65	BYX49/300	0.47	TIP34A	0.72
AC132	0.55	BC115	0.12	BC323	0.99	BD436	0.68	BF270	0.30	BT106	1.50	BYX55/350	0.29	TIP41C	0.46
AC141	0.26	BC116	0.15	BC327	0.14	BD437	0.76	BF271	0.26	BT108	1.30	BYX55/600	0.33	TIP42A	0.52
AC141	0.26	BC117	0.22	BC328	0.14	BD438	0.75	BF273	0.18	BT109	1.18	BYX71/600	1.18	TIP47	0.60
AC141K	0.40	BC118	0.17	BC337	0.12	BD439	0.68	BF274	0.32	BT116	1.25	BYZ12	0.42	TIP110	0.88
AC142	0.26	BC119	0.30	BC338	0.12	BD507	0.48	BF323	0.92	BT119	3.82	C106D	0.80	TIP2955	0.60
AC142K	0.48	BC125	0.12	BC350	0.14	BD508	0.53	BF336	0.26	BT120	3.60	E1222	0.40	TIP3055	0.60
AC151	0.45	BC140	0.28	BC440	0.30	BD509	0.54	BF337	0.26	BT121	3.02	E5024	0.30	TIS43	0.32
AC152	0.45	BC141	0.42	BC441	0.32	BD510	0.48	BF338	0.26	BT138/600	1.30	GET872	0.48	TIS88	0.40
AC176	0.28	BC142	0.30	BC461	0.32	BD517	0.56	BF355	0.42	BT151/560R	0.90	ITT44	0.04	TIS90	0.25
AC176K	0.46	BC143	0.30	BC547	0.12	BD520	0.66	BF363	0.82	BT151/300R	1.15	ITT2002	0.11	TIS91	0.28
AC187	0.26	BC147	0.08	BC548	0.12	BD699	1.25	BF367	0.24	BTY79/400R	2.80	ME0402	0.20	ZTX108	0.12
AC187K	0.40	A or B	0.10	BC549	0.12	BD707	0.88	BF371	0.27	BU100A	2.30	ME0404/2	0.24	ZTX109	0.12
AC188	0.28	BC148	0.08	BC550	0.18	BDX18	2.35	BF422	0.38	BU104	2.00	MEU21	0.60	ZTX212	0.28
AC188K	0.40	A or B	0.10	BC550C	0.18	BDX32	2.10	BF450	0.38	BU105	1.20	MJ400	1.25	IN4001	0.05
ACY40	0.88	BC149	0.09	BC557	0.12	BF115	0.32	BF457	0.33	BU105/02	1.56	MJ2955	0.90	IN4003	0.05
AD142	1.10	BC157	0.10	BC558	0.12	BF117	0.54	BF458	0.36	BU108	1.80	MJ3000	1.98	IN4004	0.06
AD143	1.10	BC158	0.10	BCX34	0.27	BF119	0.82	BF459	0.44	BU124	1.75	MJE240	0.60	IN4006	0.07
AD149	0.96	BC159	0.10	BCY70	0.15	BF120	0.38	BFR39	0.22	BU126	1.25	MJE340	0.54	IN4007	0.07
AD161	0.42	BC160	0.30	BCY71	0.17	BF123	0.40	BFR40	0.22	BU133	1.80	MJE370	0.88	IN4148	0.05
AD162	0.42	BC161	0.30	BCY72	0.18	BF125	0.42	BFR41	0.22	BU204	1.35	MJE520	0.48	IN5400	0.12
AD161/AD162	0.98	BC168B	0.12	BCZ10	1.68	BF127	0.38	BFR51	0.30	BU205	1.30	MJE2955	0.99	IN5402	0.15
AF106	0.48	BC169C	0.10	BCZ11	1.45	BF152	0.16	BFR61	0.32	BU206	1.70	MJE3055	0.70	IN5405	.16
AF114	2.10	BC170	0.14	BD124P	0.80	BF154	0.23	BFR62	0.28	BU208	1.55	MPSLO1	0.28	IN5406	0.18
AF115	2.10	BC170B	0.12	BC130Y	0.68	BF157	0.40	BFR88	0.34	BU208A	1.63	OA47	0.10	IN5408	0.20
AF116	2.10	BC171	0.10	BD131	0.34	BF158	0.22	BFR90	1.72	BU208/02	2.05	OA90	0.08	IS920	0.08
AF117	2.10	BC171	0.10	BD132	0.34	BF159	0.24	BFT41	0.38	BU326S	1.75	OA91	0.09	2N697	0.55
AF118	0.85	A or B	0.08	BD131/BD132	0.95	BFR160	0.23	BFT43	0.36	BU407	1.65	OA95	0.18	2N706A	0.33
AF121	0.62	BC172	0.08	BD135	0.32	BF167	0.30	BFW10	0.79	BU407D	1.80	OA200	0.06	2N2904	0.28
AF124	0.48	A or B	0.12	BD136	0.36	BF173	0.25	BFW44	0.76	BUX80	3.70	OA202	0.15	2N2906	0.24
AF125	0.48	BC177	0.20	BD137	0.36	BF177	0.42	BFX29	0.28	BUY20	1.75	OC25	2.10	2N2926G	0.10
AF127	0.48	BC178A	0.22	BD138	0.38	BF178	0.30	BFX30	0.30	BUY69A	2.60	OC26	1.70	2N3053	0.22
AF139	0.68	BC182	0.08	BD139	0.38	BF179	0.32	BFX80	3.56	BUY69B	1.98	OC28	1.50	2N3054	0.56
AF178	0.68	A B or C	0.09	BD140	0.38	BF180	0.35	BFX84	0.24	DBY101	0.48	OC29	2.47	2N3055	0.45
AF239	0.68	BC182L	0.09	BD144	160	BF181	0.35	BFZ85	0.26	BY118	1.10	OC35	1.75	2N3702	0.10
AF279S	0.72	A B or C	0.09	BD145	1.82	BF182	0.32	BFX86	0.26	BY122	0.68	OC36	1.75	2N3704	0.10
AL100	2.50	BC183	0.09	BD150A	0.51	BF183	0.32	BFX87	0.25	BY126	0.12	OC42	0.72	2N3708	0.10
AL102	1.88	A B or C	0.10	BD159	0.65	BF184	0.32	BFX89	0.65	BY127	0.10	OC42K	1.40	2N3772	1.90
AL113	2.20	BC183L	0.06	BD160	1.65	BF185	0.32	BFY50	0.21	BY133	0.16	OC44	0.72	2N3773	2.70
ASY80	1.75	A B or C	0.12	BD165	0.45	BF194	0.08	BFY51	0.21	BY135	0.25	OC45	0.58	2N3904	0.16
AU110	1.40	BC184	0.10	BD175	0.60	BF195	0.10	BFY52	0.21	BY154	44	OC71	0.50	2N3906	0.16
AY102	4.32	A B or C	0.10	BD182	1.00	BF196	0.10	BFY57	0.40	BY179	0.60	OC72	0.52	2N5294	0.48
BA102	0.34	BC207	0.15	BD183	1.10	BF197	0.10	BFY90	0.90	BY182	0.87	OC81	0.68	2N6107	0.71
BA110	0.67	BC208	0.16	BD184	1.20	BF198	0.14	BFY90S	1.34	BY184	0.40	OC200	2.45	2N6126	0.65
BA121	0.40	BC212	0.09	BD201	0.72	BF199	0.16	BR100	0.20	BY187	0.72	OC202	2.20	2SB337	1.60
BA129	0.38	A B or C	0.10	BD202	0.87	BF200	0.48	BR101	0.44	BY189	4.75	ORP12	0.85	2SC1172Y	2.90
BA148	0.16	BC212L	0.08	BD204	0.80	BF222	0.48	BR103	0.58	BY198	0.44	R2008B	1.50	2SC1173Y	0.82
BA154	0.08	A B or C	0.10	BD222	0.80	BF224	0.20	BRC443	1.76	BY199	0.47	R2010B	1.52	2SC1302	1.40
BA155	0.10	BC213	0.09	BD225	0.86	BF224J	0.16	BRY39	0.38	BY206	0.24	SHG1.5	0.40	40251	0.95
BA156	0.08	A or B	0.10	BD232	0.45	BF240	0.20	BRY56	0.42	BY207	0.24	TAG1/100	1.40	40361	0.58
BA157	0.28	BC213L	0.10	BD233	0.60	BF241	0.26	BRY61	0.86	BY210/400	0.25	TAG3/400	1.78	40362	0.50
BA164	0.14	A or B	0.10	BD234	0.62	BF244	0.26	BSS17	0.56	BY210/600	0.26	TIC44	0.40	40411	3.72
BB104B	0.52	BC237	0.11	BD235	0.63	BF244A	0.28	BSS27	0.92	BY210/800	0.30	TIC45	0.45	40530	0.80
BB105B	0.30	BC236	0.12	BD236	0.63	BF244C	0.24	BSX19	0.34	BY223	1.20	TIC46	0.48	40673	0.80
BB105G	0.48	BC239	0.14	BD237	0.66	BF245A	0.26	BSX20	0.34	BY227	0.26	TIC47	0.70	40964	1.54
BB110B	0.42	BC251	0.12	BD238	0.56	BF254	0.15	BSX59	0.62	BY229	0.30	TIC106A	0.70	Quantity	prices
BC107	0.10	A B or C	0.14	BD241	0.80	BF256	0.40	BSX76	0.29	BY238	0.68	TIP30A	0.46	available	
A or B	0.12	BC301	0.30	BD243A	0.80	BF257	0.32	BT100A/02	0.94	BYX10	0.24	TIP31C	0.54	on all listed items	

VOLTAGE REGULATORS

Type	Price (£)
78L05	0.30
78L08	0.30
78L12	0.30
78L15n	0.30
78M05	0.50
78M08	0.50
78M12	0.50
78M15	0.50
78M24	0.50
7805	0.55
7808	0.55
7812	0.55
7815	0.55
7818	0.55
7824	0.55
7905	0.65
7912	0.65
7915	0.65
7918	0.65
7924	0.65
CA3085	0.95
723C	0.36
LM317K	3.50

CONVERGENCE POTENTIOMETERS

5, 7, 10, 15, 10, 50, 100
200, 500W
38p each

SPECIAL OFFER

30, 120, 270, 470,
all at 20p each

CAPACITORS

Metallised Paper

2n2F 1500V DC	60p
2n2F 600V AC	24p
3n6F 1700V DC	60p
4n7F 1500V DC	60p
10nF 1000V DC	22p
10nF 500V AC	80p
15nF 300V AC	30p
22nF 300V AC	32p
100nF 1000V DC	46p
470nF 1000V DC	85p

HV Disc Ceramic (†)

1kV 1.5nF	18p
3kV 1.5nF	20p
8kV 10, 47, 56, 82, 100, 120, 150, 180, 200, 220pF	30p
270, 300pF	39p
10kV 1nF	67p

VALVES

Type	Price (£)	Type	Price (£)
DY802	0.88	PCC84	0.50
DY86/87	0.75	PCC85	0.65
ECC81	0.85	PCC89	0.74
ECC82	0.65	PCC189	0.85
ECC83	0.75	PCF80	0.75
ECC84	0.65	PCF86	1.25
ECC85	0.90	PCF200	1.55
ECC88	0.95	PCF801	1.45
ECF80	0.90	PCF802	0.85
ECH81	0.75	PCF806	1.20
ECH84	0.75	PCL82	0.90
ECL82	0.75	PCL83	2.50
ECL86	0.98	PCL84	0.90
EF80	0.65	PCL86	0.58
EF86	1.65	PCL805/85	1.35
EF183	0.75	PD500	3.75
EF184	0.75	PFL200	1.35
EH90	0.54	PL33	1.50
EL34	2.50	PL36	1.45
EL84	0.69	PL81	0.85
EL509	5.50	PL82	0.75
EM87	2.55	PL83	0.65
EY86/87	0.67	PL84	0.75
EY500A	1.65	PL95	2.00
PCC84	0.50	PL504	1.20
PCC85	0.65	PL508	2.40
PCC89	0.74	PL509/519	7.50
PCC189	0.85	PY88	1.80
PCF80	0.75	PY500A	2.40
PCF86	1.25	U26	1.90
PCF200	1.55	UCH81	0.30
PCF801	1.45	UCL82	1.70
PCF802	0.85	6J5GT	1.75
PCF806	1.20	6SJ7	2.20
PCL82	0.90	30FL12	1.60
PCL83	2.50	6JB6A	4.00

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400mW Plastic 3V-75V **8p each 10/75p**
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1.5W Flange 4.7-47V **£1.26 each**
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20W Stud 75-75v **£1.31 each**

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AN214Q	3.88	SN76533N	1.60
AN715Q	2.90	SN76650N	1.05
CA3065	1.75	SN76660N	0.75
CA4031P	2.88	SN76666N	0.80
CA4102	3.30	TBA915	6.50
CA4250	3.50	TA7108P	3.20
CA4400	2.98	TA7120P	2.20
CA4422	3.07	TA7129AP	3.65
LC7120	5.33	TA7130P	1.65
LC7130	5.26	TA7172	1.80
LC7137	5.16	TA7193	5.50
LM380N	0.80	TA7172P	1.80
LM1303N	2.52	TA7176	2.50
HA1151P	3.12	TA7202P	4.18
MC1307P	1.85	TA7204P	1.86
MC1310P	1.85	TA7205AP	1.50
MC1312P	2.25	TA7208P	3.25
MC1327P	1.75	TA7210P	.50
MC1330P	0.83	TA7222P	1.88
MC13449P	1.85	TA7223P	3.68
MC1350P	1.20	TA7227P	5.60
MC1351P	2.50	TA7310P	1.80
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MC1357P	.88	TA7611AP	2.88
MC1358P	1.30	TAA263	2.46
MC1496L	1.15	TAA310A	2.68
ML231B	2.10	TAA550	0.50
ML232B	2.10	TAA570	1.99
ML237B	2.30	TAA611A12	3.50
NE555	0.25	TAA611B12	2.85
C-mos 555	0.88	TAA630S	3.90
NE556	0.80	TAA661B	1.70
SAA1024	5.35	TAA700	2.80
SAA1025	8.40	TAA840	3.38
SAS560A	2.50	TAD100	2.80
SAS560S	1.65	FM FILTER	1.20
SAS570S	1.85	TBA120A	1.00
SAS580	2.85	AS,S,SA,SB	1.30
SAS590	2.62	Q,T,U,UQ	1.32
SC9503P	1.10	TBA120B	1.30
SL432A	4.00	TBA231	1.45
SL901B	5.20	TBA281	2.65
SL917B	6.25	TBA395	1.20
SL1327Q	1.10	TBA480Q	1.50
SN76003N	2.44	TBA400	2.30
SN76013N	1.90	TBA510	2.80
SN76023ND	2.90	TBA510Q	2.60
SN76033N	2.45	TBA520/Q	1.60
SN76110N	1.12	TBA530/Q	1.30
SN76115N	2.00	TBA540/Q	1.40
SN76131N	1.65	TBA550/Q	1.52
SN76226DN	1.80	TBA560C	1.70
SN76227N	1.10	TBA560CQ	1.60
		TBA570	1.50
		TBA641BX1	4.50
		TBA651	2.80
		TBA673	2.40
		T8A700	2.85
		TBA750	2.80
		TBA800	1.60
		TBA810P	1.10
		TBA810S	1.20
		TBA820	1.60
		TBA890	3.88
		TBA920/Q	3.00
		TBA950/2A	3.05
		TBA970	4.05
		TBA990	1.88
		TCA160C	3.90
		TCA270S	4.00
		TCA270SA	4.02
		TCA800	3.10
		TCA940	1.90
		TDA440	3.80
		TDA1002	1.90
		TDA1003A	5.50
		TDA1004A	2.90
		TDA1006A	2.40
		TDA1035S	4.50
		TDA1044	4.30
		TDA1170S	3.00
		DA1190	3.50
		TDA1200	2.98
		TDA1270Q	3.70
		TDA1327A	1.86
		TDA1352A/B	1.56
		TDA1412	1.20
		TDA2002	2.80
		TDA2020	4.60
		TDA2030	2.78
		TDA2140	5.90
		TDA2521	4.10
		TDA2523	3.50
		TDA2530	2.70
		TDA2540	3.80
		TDA2541	3.80
		TDA2560	3.50
		TDA2571A	2.50
		TDA2581	3.20
		TDA2590	3.20
		TDA2591	2.98
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		TDA2610	3.20
		TDA2611A	1.94
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		TDA2690	3.50
		TDA3950/A/B	2.60
		UPC554C	1.32
		UPC557H	0.90
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		UPC1018C	1.10
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		UPC1158H	0.76
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		UPC1181H	1.60
		UPC1185H2	3.75
		UPC1212C	1.30
		UPC1230H	3.90
		UPC1350C	4.25
		UPC1367C	3.40
		UPC1378H	4.40
		UPC2002H	2.80

BRIDGES

1½A 50V	0.27
100V	0.28
200V	0.32
400V	0.40
600V	0.50
800V	0.58
3A 100V	0.52
200V	0.55
400V	0.61
600V	0.67
800V	0.60
6A 100V	0.66
200V	0.68
400V	0.74
600V	0.80
800V	0.86
10A 50V	2.20
100V	2.24
200V	2.35
400V	2.50
600V	3.50
25A 50V	2.05
100V	2.25
200V	2.40
400V	3.20
600V	3.95

SERVICE AIDS

ALL SERVISOL PRODUCTS

Switch Cleaner	0.88
Circuit Freezer	0.96
Foam Cleanser	0.84
Aero Klene	0.78
Silicone Grease (Aerosol)	1.00
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Plastic Seal	0.88
Excel Polish	0.76
Fire Extin 640g	2.80
Video Head Cleaner	0.88
Silicone Grease (ICI) 75g tube	1.00
Solda Mop (Std)	0.72
Solda Mop (L/Gauge)	0.72

Additional P&P on above 30p

RESISTORS — CARBON FILM 5%

¼W 1R0 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) **7p each. 65p/10. 6.00/100**
2W 10R to 2M2 (E6 Range) **8p each. 70p/10. 6.00/100**

RESISTOR KITS — each value individually packed

¼W pack 10 each value E12 — 10R to 1M 610 pieces	4.80
¼W pack 5 each value E12 — 10R to 1M 305 pieces	2.75
½W pack 10 each value E12 — 2R2 to 2M2 730 pieces	5.25
½W pack 5 each value E12 — 2R2 to 1M 365 pieces	3.00
1W pack 5 each value E12 — 2R2 to 1M 353 pieces	15.00
2W pack 5 each value E6 — 10R to 2M2 317 pieces	18.00

RESISTORS — WIREWOUND Generally 5%

2-5W 0-22 to 270R Available in preferred values	0.20
4W 1Ro to 10K. Available in preferred values	0.21
7W 0.47R to 22K. Available in preferred values	0.25
11W 1R0 to 22K. Available in preferred values	0.29
17W 1R0 to 22K Available in preferred values	0.37

VEROBOARD 0.1in. CLAD

2½2x3¾4	.85
2½2x5"	1.00
2½2x17"	3.25
3¾4x3¾4"	1.05
3¾4x5"	1.15
3¾4x17"	4.10
4¾4x17¾4"	4.95
Pkt. of 100 Pins	.50
Spot Face Cutter	1.48
Pin Insert Tool	1.83
Vero Wiring Pen + Spool	3.50

VEROBOARD 0.1in. PLAIN

3¾4x5"	.95
3¾4x17"	2.70
DIP Board	3.85
VERO Strip	1.25
HAND HELD CONTROL BOXES	.75
72x50x25 Boxes	.52

NI-CAD

Universal Ni-Cad charger, charges PP3, AA, C.D Price **£5.00**

PLUGS & SOCKETS

Metal Co-ax Plug	0.18
Plastic Co-ax Plug	0.14
Single Junction Socket	0.80
Plastic Phono	0.10
F M Plugs	0.20
PL259	0.38
Reducer	0.15
2.5mm Plug Meta	0.15
2.5mm Plug Metal	0.16
2.5mm Chassis Socket	0.10
3.5mm Chassis Socket	0.10
2 pin ¼in Mono Chassis Socket	0.14
4 pin ¼in Mono Chassis Socket	0.20
6 pin ¼in Mono Chassis Socket	0.30
4mm Banana Plug	0.15
4mm Banana Socket	0.15
PP3 Battery Connectors	0.08
PP9 Battery Connectors	0.16

Terminal Blocks

2 amp 12 way	0.19
5 amp 12 way	0.20
15A	.46
32A	.92

Soldering Section

ANTEX 15W IRON	5.00
ANTEX 18W IRON	5.00
ANTEX 25W IRON	5.20
ANTEX ELEMENTS	2.00
ANTEX BITS	0.95
ANTEX STANDS	1.90
SOLDERSUCKER	4.50
500gm SOLDER	6.80
SOLDA MOP	0.70
ANTEX SOLDERING STATION complete with Iron - 30W or 40W	49.95
Spare nozzles for Soldersucker	0.45

ALL LISTED ITEMS. TEL SALES DESK.

FUSES

1¼in Quick Blow 100 150 250mA £1.30 1 1.25 1.5 2 2.5 3 10 15A **65p**
1¼in Time Delay 100mA **£3.50** 150mA **£2.25** 250 300 500 600 750 850mA **£1.84** 1 1.25 1.5 1.6 2A **£1.84** 2.5A 3.15 3.5A **£2.82 20mm Quick Blow** 100 125 160 200 250 315 400 500 600 800mA 1 1.25 1.5 2 2.5 3.5 4 5 6 3A **40p 20mm Time Delay** 100 125 150 200mA **£1.80** 750 300 400 500 600 800mA **£1.00** 1 1.25 1.5 2 2.5 3 3A **85p 1in Mains** 2 3 5 7 10 13A **85p**

Manufacturers please note — we can offer very competitive quantity prices of 20mm Quick Blow & Time Delay range — please apply for quotation

TRANSFORMERS

Sil 240v Primary 4 5 0-4 5v 400m/A **50p** 6-0-6 100m/A **58p** 6-0-6 500m/A **65p**
Postage and packing **45p** per transformer
Competitive bulk prices on request

EUROPEAN ADAPTORS

These very high quality British made two pin European adaptors are ideal for driving Radios, cassette recorders, TV games, calculators etc. The adaptors fit in the UK shaver socket

REF	DC Voltage	Current	1+	10+	100+
EOB	4.5V	200m/a	**50p**	**45p**	**32p**
EM3	6V	200m/a	**£1.00**	**80p**	**55p**
EO9	6V	400m/a	**£1.50**	**£1.25**	**85p**

(Postage & Packing: 45p per adaptor or £1.60 per 10, £4.50 per 100)

MULTIMETER SPECIAL

Russian type U4324 — (20,000OPV)
DC Volts 0.6, 1, 2, 3, 12, 30, 60, 600, 1200
AC Volts: 3, 6, 15, 60, 150, 300, 600, 900
DC Curr M/A 0.06, 0.6, 6, 60, 600, 3000
AC Curr M/A 0.3 3, 30, 300, 3000
DC Resistance 0.2, 5, 50, 500, 5000K
level dB: — 10 to — 12

Supplied with rechargeable batteries

PRICE £12.00 INC OF P/P & VAT

Fuseholders

20mm Panel Mounting	0.28
20mm Chassis Mounting	0.06
1¼in Panel Mounting	0.35
1¼ Chassis Mounting	0.342
Carline 1¼in Mounting	0.10

"D" CONNECTORS

	9 way	15 way	25 way
Male			
Solder	75	1.00	1.50
Angle	1.40	2.00	2.40
Female			
Solder	1.00	1.45	1.85
Angle	1.50	2.00	2.40
Covers	.80	.80	.80

IC SOCKETS Dil to Dil

8	pin	0.08 0.70/10
14	pin	0.10 0.95/10
16	pin	0.11 1.00/10
18	pin	0.14 1.60/10
22	pin	0.21 1.95/10
24	pin	0.25 2.25/10
28	pin	0.30 2.75/10
40	pin	0.34 3.10/10

B.T. Approved Telephone Plug & 4-core Lead **£3.10**
B.T. Approved Telephone Secondary Socket **£3.20**

EAST CORNWALL COMPONENTS
DEPT REW 8 119 HIGH STREET
WEM
SHROPSHIRE SY4 5TT TEL: 0939 32689
Telex: 35565

VISA Access

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due to improved signal stability and quality. Where the FM radio band is affected via Sporadic-E the signal characteristics often resemble those of tropospheric propagation.

Initial experiments in Sporadic-E reception should be conducted during the summer, to take advantage of frequent openings and high signal levels. This means that fairly simple receiving apparatus can be employed. A dipole can be used for both TV and FM radio reception, with each rod cut to 50 inches for the centre of Band I or 30 inches for the FM band.

Aerials should be mounted horizontally and some method of rotation is desirable since a horizontal dipole is directional. Height is not of great importance because signals propagated via Sporadic-E arrive at an angle but, local shielding should be taken into account.

For more serious and regular experiments most enthusiasts progress to the luxury of a multi-element beam covering the appropriate channels. The use of masthead amplifiers should be avoided, no matter how tempting these may be. Signal levels in Band I can attain many mV without amplification, and using such a device may introduce cross-modulation and other spurious effects.

Equipment requirements

A typical domestic FM radio receiver will suffice for the reception of Western European FM stations where the frequency range 88 to 108MHz is used. Eastern bloc countries have their own FM band situated between 64 and 73MHz, with the exception of Yugoslavia where standard Western European allocations have been adopted. One solution to Eastern bloc FM reception is to use a scanner such as the SX200-N.

This would also allow monitoring of the various Italian private radio station transmitter links operating between 45 and 60MHz. These carry popular music programmes and are usually present during reception of television signals from Italy on channels IA and IB. As a bonus, foreign TV sound can be monitored with such a scanner.

For television reception via Sporadic-E, a receiving system capable of covering the necessary frequencies is an obvious essential. With the exception of France, who use 625 lines with positive vision modulation and AM sound, all other European services use 625 lines with negative video and FM intercarrier sound. In fact they are very similar to our own system except that the sound spacing differs and they utilise Bands I and III as well as UHF. The intercarrier sound spacing is 6.0MHz in the UK and Eire, 6.5MHz in Eastern-bloc countries and 5.5MHz in Western Europe (including Yugoslavia), Africa and the Middle East.

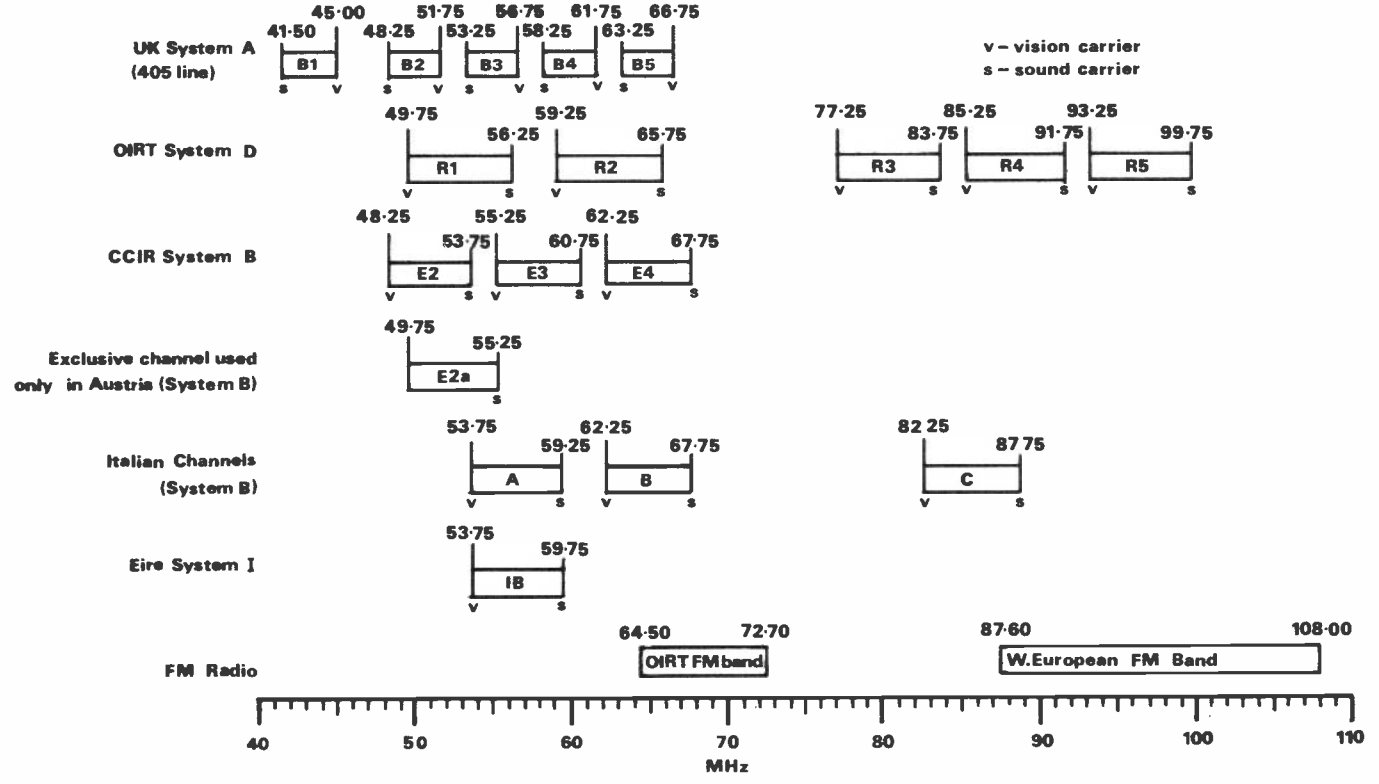
Certain domestic television receivers already possess a multiband tuner as standard. These are mainly imported models from manufacturers such as Grundig, Luxor and Telefunken. A few domestic video cassette recorders have multiband facilities. The Sanyo 930-00 and the Hitachi VT 11E (DS) are two examples. By simply connecting a suitable aerial and setting the bandswitch selector to Band I, DX signals can be tuned in with the VCR.

There are many small-screen portable TV sets which cover the appropriate European channels. Prospective purchasers should look for tuning scales marked 2-4 and 5-12; this will indicate Western European E channels 2 to 12. Some portables have switching for Continental and UK sound standards and colour receivers catering for both PAL and SECAM transmissions are readily available.

For the keen experimenter a multiband tuner could be fitted to an existing receiver although modifications and additions of this type demand a certain level of competence on the part of the individual. The usual safety precautions must be observed when dealing with domestic receivers since these employ live-chassis techniques.

Battery/mains portables are normally equipped with an integral mains isolating transformer, thus making modifications more attractive from the aspect of safety.

Inexpensive varicap tuners suitable for Band I experiments are available



Frequency allocations for 40-110MHz

from mail-order companies such as Sendz Components. Most have only the basic Band I coverage of 47 to 68MHz but others provide an extended coverage well into the FM radio spectrum. The ELC 2060 is an example and covers OIRT channels R3, R4 and R5.

Simple modifications of this type will provide vision-only signals, but it is not considered too much of a disadvantage. The intercarrier sound IFs could be realigned to the appropriate sound spacing of 5.5MHz or 6.5MHz if required, although many circuits use fixed ceramic filters and these would have to be changed.

The more intrepid experimenter could build the multiband DX-TV converter described in the August 1983 issue of ***R&EW***. This can be used with an unmodified receiver.

Identifying TV signals

Programme content and presentation quality both contribute in providing signal identification in the absence of captions and test cards. The experienced DXer finds his 'sixth sense' offers assistance too. Familiarising oneself with the positions of various channels in Band I is advisable and is a relatively easy task, especially if the local BBC-1 transmitters are still on the air to act as markers.

Reference to the channel allocations in the table should help. Once their relative positions have been established, with practice it should be easy to differentiate between E and R channels. Some countries do not use all channels in Band I and by a process of elimination it is possible to work out which service is being received. For instance, Rumania does not appear on channel R1 and Denmark does not transmit on channel E2.

The general direction from which a signal originates can often give a valuable clue, although on rare occasions signals can be reflected within the E-layer and arrive from a totally different direction than that of the transmitter. Neighbouring countries may be present, especially during intense openings. Yugoslavian signals usually accompany Italian transmissions, and if these are present it is often worthwhile to be on the look out for double skip signals from Jordan.

The accompanying sound channel can provide more clues, but unless one is conversant with foreign languages it may be best to leave well alone, although it does tend to add a touch of glamour to the reception.

Test cards provide a positive form of identification. Most television services use an electronically generated colour pattern and nearly all incorporate some form of identification. Norway even displays the time and the transmitter location on their test card; other services simply include station initials. On Russian test cards there are lots of unusual numbering systems and small lettering in the Cyrillic alphabet.

Test cards in Europe are radiated prior to programmes but there is a growing trend to display sample teletext pages. Unfortunately these all look alike, especially on weak signals. Identification captions and clocks are other possible means of identifying services, but not all clocks carry identification.

However, clock captions can give an indication as to the country of origin even without identification. A check should be made of the time. Is it GMT +1 hour or GMT +4 hours? If it's the latter and on an E channel then the signal is almost certainly an 'exotic', probably from the Middle East.

Weather maps can be a useful guide to identifying a signal. By noting which area of the map is receiving the most attention it is often possible to pin-point the source of reception.

Some services regularly use subtitling in the lower portion of the picture, especially with imported programmes and feature films. Scandinavia, Yugoslavia and Rumania frequently show subtitled programmes. While spoken foreign languages may be difficult to understand it is surprising how quickly one recognises them when in subtitle form.

Several European countries such as West Germany, Switzerland and Italy now incorporate station identification in the corner of the picture in an attempt to prevent piracy. These inserts frequently change position but they do provide yet another means of identification.

Most countries use some form of digital information known as vertical interval test signals (VITS) within the frame bar. These differ between services and also from studio to studio within a particular service. As the VITS tend to change periodically they cannot be relied upon to provide definite identification on a permanent basis. The frame amplitude of the receiver may have to be reduced in order to display these test pulses.

The style of dress and sometimes the complexion of presenters can offer an overall clue to the country of origin, although the sighting of a big beefy battleaxe doesn't always indicate Soviet TV. Early morning TV from Russia is easy to spot: it's normally a diet of keep-fit classes followed by a concert, poetry or a military parade.

In other Eastern bloc countries services are more Westernised in their approach, with cartoons and advertising. This is especially true of Hungarian TV. Spanish TV tends to feature bullfighting very regularly – in fact, it's their version of 'Match of the Day'. Popeye cartoons, Tom and Jerry dubbed in Spanish, The Avengers and a few 'heavy' drama programmes are also typical offerings.

The DX-TV enthusiast will have to search for Icelandic TV if it's late-night test cards he's after. Programmes do not start until approximately 2000GMT and closedown is never more than about three hours away. Consequently, the test card is radiated for lengthy periods, even throughout the night on some occasions. A late evening opening to this area could mean trans-Atlantic DX since there will

be little chance of signals being swamped by European stations, especially during the early hours.

When to tune in

As mentioned previously, Sporadic-E reception can occur at any time of the day or night, the only limiting factor being the hours of transmission. Since Western Russia is GMT +3 hours (CET +2 hours) test transmissions may be present as early as 0400 CET with programmes at 0600. Several other countries usually commence test transmissions shortly after. Italian reception is common during the main season and in 1983 it was seen virtually on a daily basis with a blank raster followed by the test card at 0800.

There is often a decrease in activity towards mid-morning. Spain is a frequent visitor around noon showing test cards, some of which include transmitter location details. Regional programmes in Spain are radiated at 1300.

Many European services devote mornings to schools television followed at lunchtime by lengthy news bulletins and magazine programmes. At such times identifying stations can often prove a headache, especially for the newcomer to DX-TV. During afternoon periods, Spain and Portugal may close down some of the transmitters and, if conditions are good to the south, there is the possibility of double-hop or even triple-hop reception, perhaps from Ghana or Nigeria.

There is a tendency for intense openings to manifest themselves during the late afternoon or early evening and the FM radio band can become extremely active with signals from the south-east. Albanian TV on channel IC often appears during such activity. The 'magic' time for exotics seems to be between 1815 and about 1930 with the possibility of Jordanian signals appearing.

Western Russia is well populated with Band I transmitters and their current affairs programme 'ВРЕМЯ' is a familiar sight at 1900, preceded by a clock caption showing 2100 hours local time. It is not uncommon for Soviet transmissions to end at about 2130 CET but some other Eastern-bloc countries radiate programmes until approximately 0100.

Successful reception

We have concentrated mainly upon reception of television signals propagated via Sporadic-E ionisation since Band I frequencies are regularly affected. Many would-be experimenters often feel that reception of this nature is too technically demanding for them to undertake and that large receiving arrays and ultra-sensitive receivers are necessary.

The authors' thoughts were similar some 15 years ago but success is assured even for beginners. New enthusiasts usually see Soviet, Italian and Spanish TV programmes within a few days of starting during the main summer season. This year's Sporadic-E may be the quietest yet as regards local interference problems since few 405-line VHF transmitters are operating at full strength. The whole of the band will eventually be re-organised to incorporate the 6 metre amateur band and various other communication services, a development which will be peculiar to the United Kingdom.

Further reading

The following two books should prove to be of interest to radio and television enthusiasts:-

Radio Stations Guide – Apart from covering long wave, medium wave and short wave stations, this book also lists European FM transmitters in ascending order of frequencies.

Guide to World-Wide Television Test Cards-Edition 2 – A comprehensive book featuring test cards and identification captions to help DX-TV enthusiasts identify reception.

Both books are available from *HS Publications, 17 Collingham Gardens, Derby DE3 4FS.* Further details are available by sending a stamped-addressed envelope.

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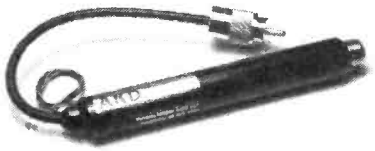

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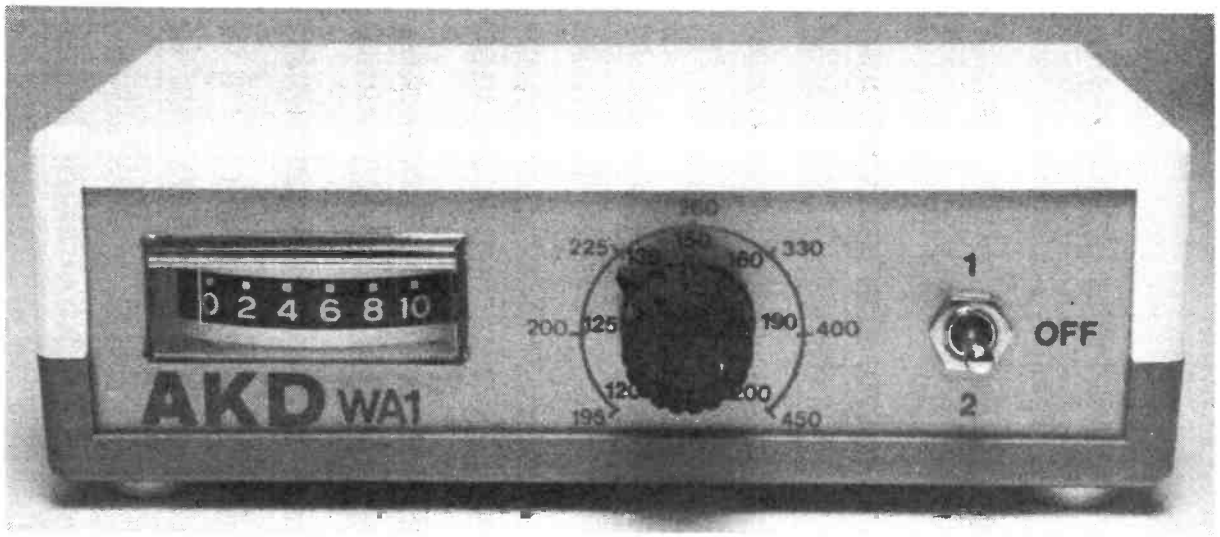

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The QQV06-40A

as a linear amplifier

by Brian Dale

In this article Brian Dale discusses the gentle art of coaxing in excess of 100 watts from the QQV06-40A double beam tetrode. Although not a constructional article as such, nevertheless it provides sufficient information to construct a linear amplifier based on his experience of constructing half a dozen such amplifiers in as many years:

Having wet his feet on the band, the newcomer to 2 metres will often decide that he requires more power. Technically this is not very difficult for several manufacturers produce ranges of linear amplifiers with output ratings from ten to nearly 200W.

All of these are capable of giving excellent results. However, when the cost of the complete system is analysed, particularly for higher powers, the newcomer may well have second thoughts. The combined cost of a 100W amplifier and the associated power supplies will almost certainly exceed £200 and if higher powers are contemplated, considerably more.

Frequently, therefore, thoughts turn to a 'home brew' solution.

Designs for 2 metre 100W solid-state linear amplifiers have appeared from time to time in the amateur press. A costing exercise, however, will frequently reveal that, given the expense of high power VHF transistors, there is little financial advantage over purchase and, furthermore, one mishap will make the project hopelessly uneconomic.

The next consideration is for the use of those old fashioned generators of heat, light and RF valves.

Choice of valves

Here there is a choice. The high power alternative is to use a ceramic tetrode such as the 4CX250, but the cost of this plus the special valve base, blower and the high voltage power supply unit will almost certainly run far higher than the solid-state option previously rejected.

The other choice is to consider the use of a medium power double tetrode such as the well tried QQV06-40A, which is capable of an output well in excess of 100W in SSB service, relatively inexpensive and, provided that reasonable precautions are taken, quite straightforward to construct and operate.

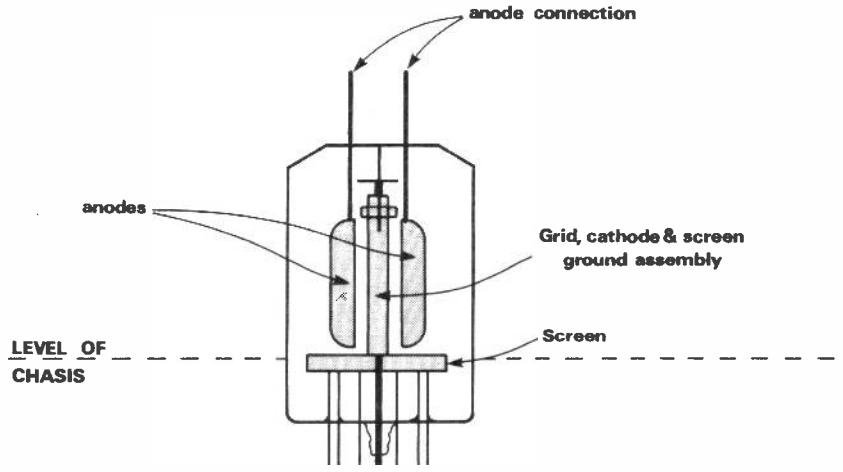
With regard to the economic aspects, these valves are regularly advertised at prices from £6 to £60 but it is frequently possible to purchase ex-equipment samples for considerably less at rallies and radio club junk sales.

The remaining costly item for such an amplifier is the HT mains transformer. This again is best found at a rally or a junk sale. The power requirements are quite modest and a 350-0-350V or 375-0-375V, 125mA transformer should be quite capable of powering an output well in excess of 100W. A small ex-broadcast receiver transformer giving 250-0-250V and sundry heater windings will provide bias and heater supplies.

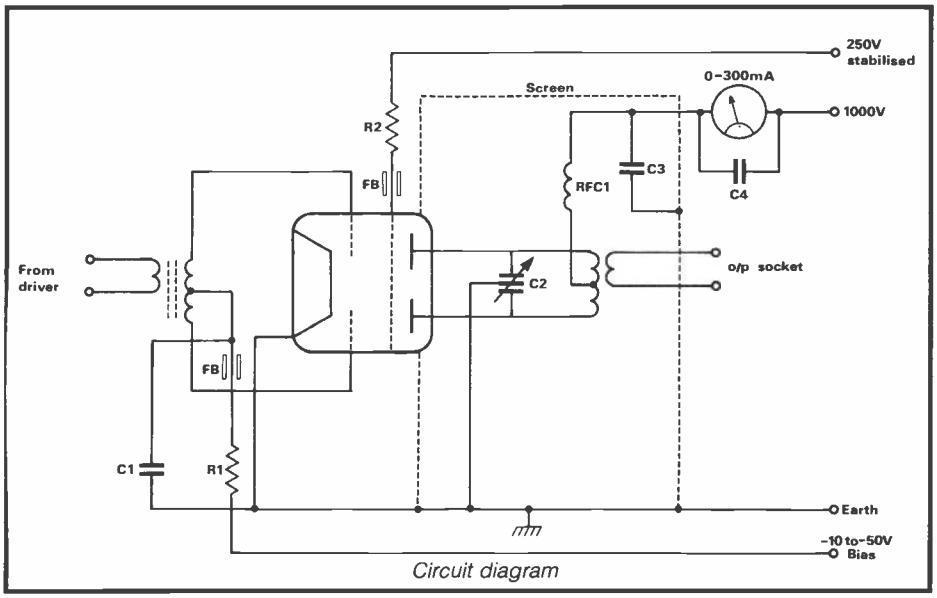
The QQV06-40A is a VHF double tetrode with a total anode dissipation rating of 40W for which most handbooks quote the use of a maximum anode voltage of 750V for CW and 600V for amplitude modulation operation, giving a carrier output of up to 90W. The latter, however, gives the clue to the power possibilities in SSB operation.

During 100% amplitude modulation peaks, the anode voltage reaches twice its steady value and the peak output power is one and a half times the unmodulated carrier level. It would therefore appear that the valve is capable of withstanding anode voltages up to 1200V and of giving a peak output power in the order of 130-140W.

Experience gained in the construction



Mounting valve below so that the internal screen aligns with the chassis



Circuit diagram

of several QQV06-40A linear amplifiers over the past few years indicate that such output powers are quite possible and practical. Some particular examples of these valves do not seem too happy at the 1200V HT level, but all seem reasonably content at around 1000V.

Many excellent articles have been written about the design of QQV06-40A amplifiers for use at the normal rated voltages. However, when the voltages are increased, the stage gain increases to something in excess of 20dB and in consequence more care has to be taken to ensure that stability is maintained.

The first stage in construction at which stability must be considered is in the physical layout. There must be maximum isolation between input and output circuits and in consequence these must be separated by either a shield or the chassis. This requirement has also been recognised by the valve designers who have fitted an internal shield between the base of the valve and the electrodes.

To ensure maximum shielding effect the valve holder must be mounted below the chassis or shield at a level which ensures the internal screen is exactly level with the chassis or screen. Furthermore the cutout through which the valve is mounted must be sufficiently large to accept the valve but without more than about 1mm clearance.

The valveholder mounted, it is then convenient to consider wiring those electrodes which must be earthed. These may be earthed individually to a single earth point on the chassis, but I have found that greater stability can be obtained by cutting a strap from an old 50gm tobacco tin, shaped such that it will join all earthed electrodes and reach down to the chassis to which it is firmly bolted *(Figure 3)*.

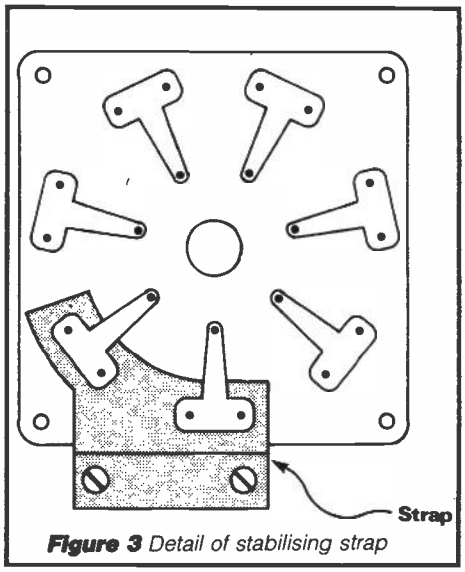


Figure 3 *Detail of stabilising strap*

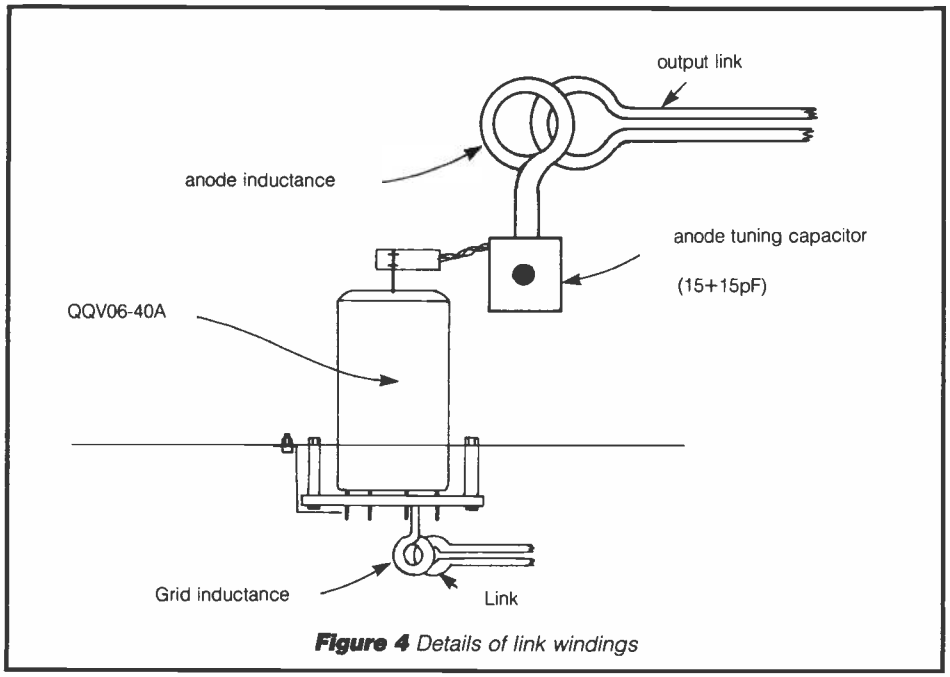


Figure 4 *Details of link windings*

The grid circuit

Most conventional published circuits show a grid circuit comprising a coil and split stator capacitor. This may be perfectly satisfactory at lower voltage levels but experience has shown that better stability is obtained if the split stator capacitor is omitted and the grid inductance is resonated by the input capacity of the valve.

This is a simple operation if a grid dip oscillator is used. A coil of about six turns of 18 gauge wire is wound around a pencil, connected across the two grids and the resonant frequency determined. If the frequency is too high, squeeze the turns together; if too low, stretch the coil. If resonance cannot be obtained, remove a turn or substitute a larger coil as appropriate.

When resonance is achieved, solder a 100ohm wire wound resistor (which will later be connected to the bias supply) and the bypass capacitor to the centre point of the coil.

As a further precaution, slip a couple of ferrite beads onto the resistor lead. A wire wound resistor should be used for the resistive element and also acts as a radio frequency choke.

The screen circuit

Similarly, the screen grid should also be fed through a wire wound resistor with a couple of ferrite beads on the lead.

Under no circumstances should a bypass capacitor be fitted for to do so would upset the internal neutralisation of the valve.

The anode circuit

The anode circuit may comprise either tuned lines or a coil and split stator capacitor.There is little to choose between them. The tuned lines are reputed to be slightly more efficient, but on the other hand the coil-capacitor arrangement takes far less space. I have invariably used the latter system and found no cause for complaint.

The components used have usually been a 15 x 15pF or a 10 x 10pF split stator capacitor with a 3 turn, 1 inch inside diameter, 1½ inch long coil. The dimension of this inductance should be checked during construction and before connecting the power supplies. With valve in position and the capacitor about half enmeshed, check the resonance of the combination in the same way as described for the grid circuit.

The link winding should be a single turn of well insulated wire. For this, I use a length of TV low loss coax with the outer insulation and braiding removed.

In an early linear a link of PVC insulated wire was used. After several months operation, during a 2 metre contest (Murphy's Law again), a loud bang and a flash announced that the insulation had failed. On inspection it was found that the insulation had melted. As the temperature within the case was quite moderate, it can only be surmised that heating due to losses within the PVC had caused the insulation to melt and eventually fail.

Power supplies

All power supplies for a QQV06-40A linear may be obtained from a single 350-0-350 or 375-0-375V transformer with a 6.3V heater winding, although, if available, it is preferable to use a separate transformer to power heater and bias supplies.

The high voltage output is obtained by fitting a bridge rectifier across the whole secondary winding. With a 350-0-350V winding this will give a peak of 990V whilst a 375-0-375V winding will give 1060V. This is smoothed by three 100μF capacitors in series, each in parallel with a suitable balancing resistor. The resultant value is 33μF at 1350V working which is more than adequate for the task. A suitable capacitor is R S Components stock number 103-890. Using these capacitors in conjunction with a 375-0-375V transformer, my power unit gives an off-load voltage of 1050V and on 200mA load is about 60 or 70V less – quite adequate regulation for the purpose.

A lower voltage for the screen supply may be obtained from the centre tap of

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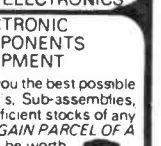

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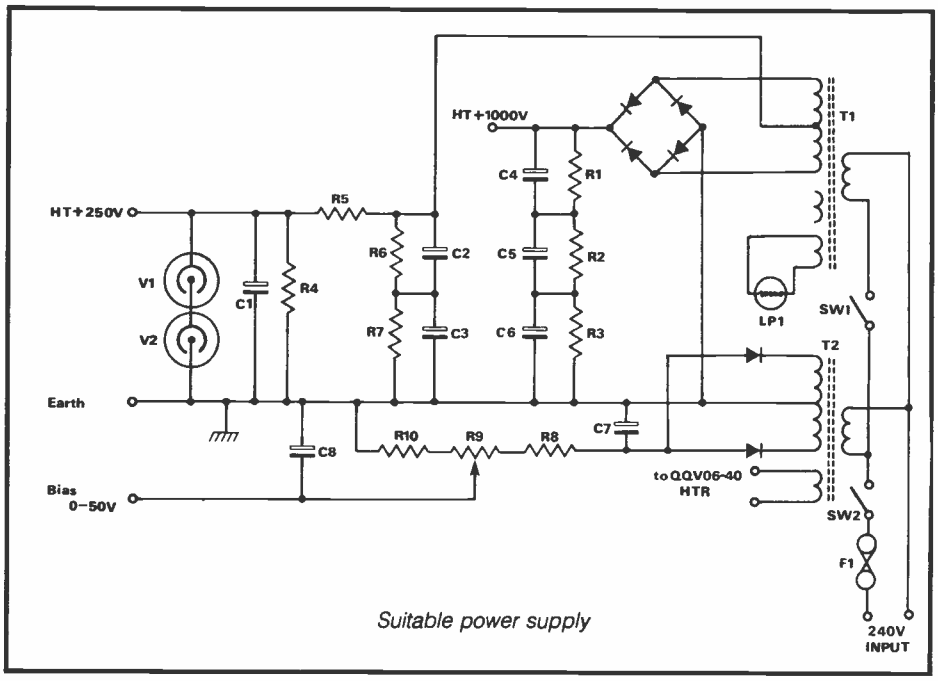


Suitable power supply

the transformer and reduced by a suitable resistor network to the appropriate voltage. Ideally the screen should be stabilised at about 250V and if stabiliser tubes or suitable zener diodes are available, they should be used. If stabilisers are not available, the screen supply should be smoothed by another of the 100μF capacitors mentioned previously.

Whilst the heater and bias supplies may be obtained from the transformer which supplies the main HT voltage, it is preferable to use a separate transformer for two reasons.

First, it reduces the loading on the HT transformer and, secondly, it is then possible to switch off all high voltages to the amplifier during prolonged reception periods whilst maintaining the bias and heater supplies.

The heater requirement is either 12.6V at 0.9 amps or 6.3V at 1.8 amps, a figure which should be within the capability of almost any small broadcast receiver transformer. The bias requirement is around 30V but this must be variable to enable the operational conditions to be set accurately.

For this purpose, I use in my present linear a small transformer which originally saw service in an old VHF FM valve tuner. This has windings of 6V and 250V. The heater of the QQV06-40A is fed from the 6V winding. One side of the high voltage winding is earthed and a single diode rectifier is attached to the other. The output is smoothed and feeds a resistor chain whose value is arranged to pass a current of approximately 50mA.

At the 'earthy' end of the chain is a 100ohm resistor and a 1000ohm wire wound potentiometer. The bias for the amplifier valve is taken from the slider of the potentiometer and in order to ensure that this voltage remains reasonably constant with varying load it is bypassed with a large capacitor of several hundreds of microfarads capacity.

The purpose of the 100ohm resistor is to make it impossible to remove all bias from the valve by misadjustment of the potentiometer. The value of the resistors above the potentiometer will have to be calculated to allow for the output voltage of the particular transformer used.

I have found it extremely useful to mount the bias potentiometer on the front panel so that the bias level can be varied at will. By this means the amplifier can be adjusted for class AB operation when using SSB or for class C when using either FM or CW.

Testing

The testing of a valve linear amplifier takes two distinct phases. Firstly, to ensure that it remains stable and secondly to set up the correct operating parameters.

In order to check stability, with drive and aerial disconnected, set the bias control to maximum and switch on the heater and bias supplies. Wait for a minute or so for the valve to heat up and then switch on anode and screen grid voltages. With over 50V grid bias the anode current should be completely cut off.

Wait for a minute or two, watching carefully and listening for any sign of distress which might indicate a wiring fault or component failure.

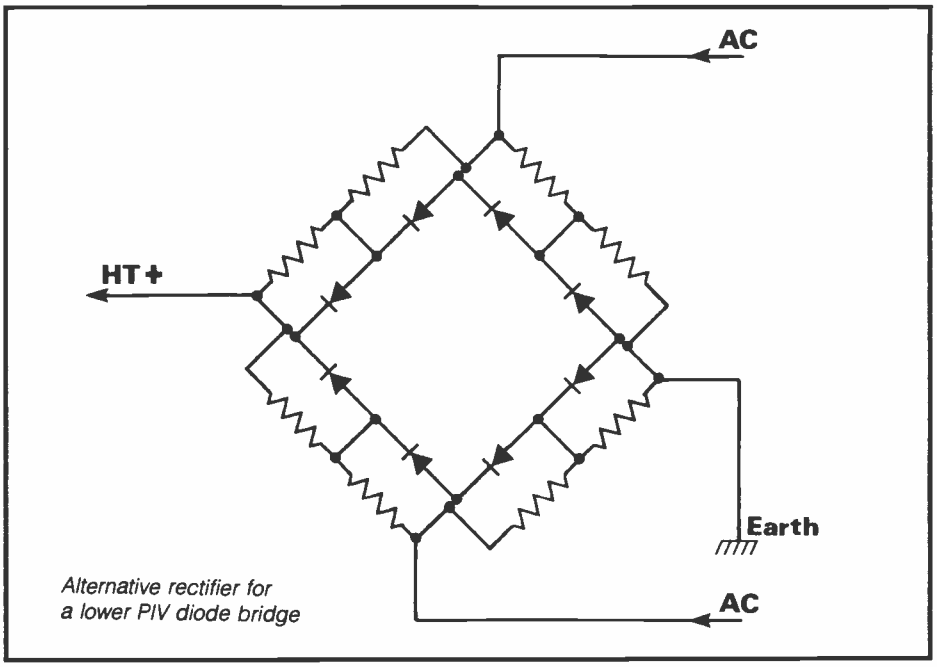
If any smoke is seen or 'sizzling' noises heard, switch off immediately and investigate.

If all is well, slowly rotate the bias control until the anode current reads about 35mA. Quickly rotate the PA tuning capacitor whilst observing the anode current. If this remains constant, *quickly* increase the anode current to 100mA, repeat and drop it again to 30-35mA. Any variation may indicate that instability, in the form of tuned plate – tuned grid oscillation, is present. If all is well, connect the input to the RF drive source (ie transceiver) and the output to a dummy load.

Apply sufficient CW or FM from the transmitter to drive the anode current to 100mA off resonance and tune for maximum dip. Rotate anode tuning to see whether there is more than one dip in anode current. If there is, this could indicate instability. However, if the PA tuning capacitor is 'ex-equipment', this effect could also be caused by an intermittant contact between the rotor of the capacitor and the earth wiper.

The latter can easily be cured by turning off power and giving the points at which the wiper touches the rotor a liberal dose of Servisol or similar switch cleaner. Try this remedy first but if unsuccessful, a thorough investigation of earthing, soldered joints and serviceability of components will have to be made.

The final stage in the testing is to



Alternative rectifier for a lower PIV diode bridge

adjust the position of the output link. For this, an RF power meter should be placed in series with a dummy load.

Position the link about halfway into the PA coil. Without drive applied, set the anode current to about 35mA and then apply sufficient CW or FM drive to raise this to about 100mA on resonance. Note the reading on the RF meter. Switch off the HT voltages, earth the PA coil with a screwdriver and push the link another ⅛ to ¼ inch into the coil.

Remove the screwdriver, switch on the HT voltages, check the PA tuning and again note the power output. If it has increased, repeat the process. If it has decreased, move the link in the opposite direction. Continue until maximum output is obtained. This should be in the order of 60W.

If it is found that with the link fully in, there is still insufficient coupling, substitute a link of greater diameter.

Operating conditions

The operating conditions of the QQV06-40A amplifier are set by the anode dissipation of the valve which is 40W. Thus in FM operation, as the amplifier will be operating for periods of several minutes at a time and assuming an efficiency of about 60%, the maximum input power should be about 100W, ie 100mA anode current.

In CW operation, however, the valve is only operating in 'key-down' conditions for about one third of the time, and it might be thought that the input could be increased in proportion.

This, however, is not so, for this would be exceeding the safe cathode emission of the valve. 200mA would be within this limit, at which level the output would be in the order of 120W.

In both CW and FM operation, efficiency, cooling and valve life will be improved if maximum bias is applied with the drive level increased accordingly. In either case, several milliamps of grid current will be flowing.

For SSB operation, adjust the bias for 30-35mA standing anode current under no-drive conditions, and set the drive level such that speech peaks cause the grid meter to just flicker upwards. At this drive level the anode current meter will probably be kicking to about 150-180mA. This does not indicate, however, that the input is 150-180W, for these peaks are of such short duration that the PA meter is unable to follow.

Similarly, the RF output meter will only be following the average output level, which can vary widely with the type of meter, the characteristics of the voice and the level of processing employed.

As a very broad rule of thumb, on unprocessed speech the RF output meter will normally indicate in the order of 30-40% of peak output.

The thought of exceeding published valve ratings may well give rise to concern regarding valve life. In my experience, however, such worries are groundless, for the QQV06-40A valve in use in my present linear has been used in this and previous linears for the past six years, and I know of several operators whose experience is similar.

PARTS LIST

R1, R2, R3 37Kohm
R4 47Kohm, 2W
R5 8.2Kohm, 11W
R6, R7 37Kohm, 5W
R8 6Kohm, 15W (see text)
R9 1000 ohm W/W Pot
R10 100 ohm
F1 5A
C1-C9 100μF, 450V wkg
C8 330μF, 63V wkg
T1 350-0-350V or 375-0-375V, 125mA
T2 250-0-250V, 60mA
LP1 6V, 0.3A
SW1 SPST 240V 5A
SW2 SPST 240V 5A
V1 VR150/30
V2 VR105/30

Rectifiers associated with T1 – 1500V PIV
Rectifiers associated with T2 – 750V PIV

. . . DATA FILE

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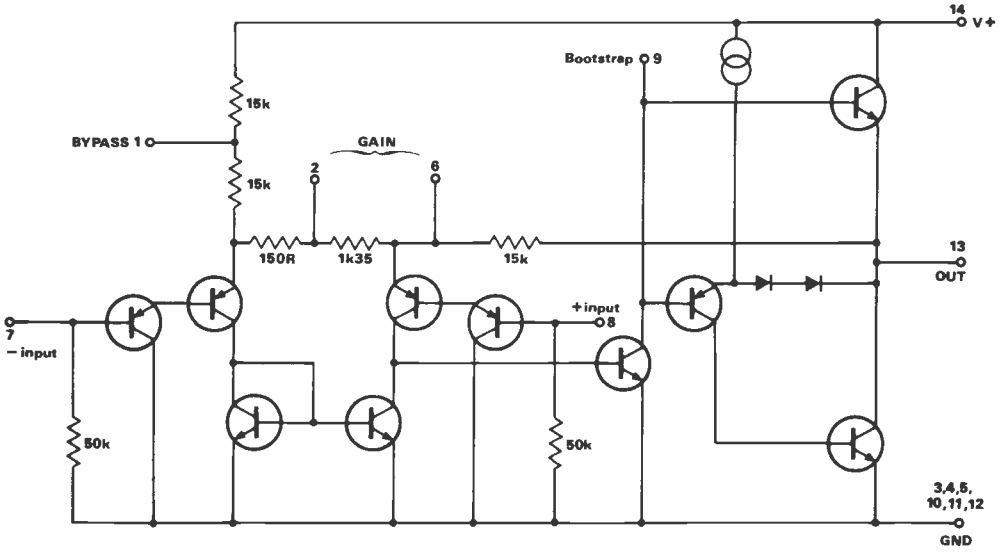

Figure 1a *Internal circuit and pin connections of the LM390 1 watt battery-operated audio power amplifier*

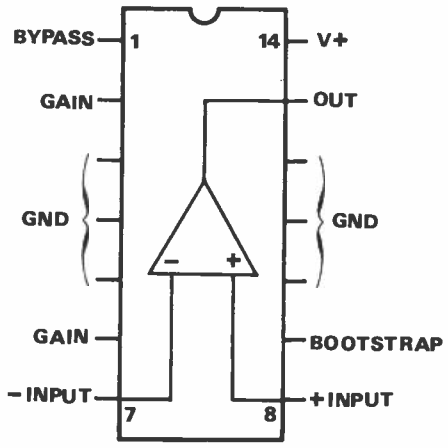

Figure 1b *Pin layout of LM390*

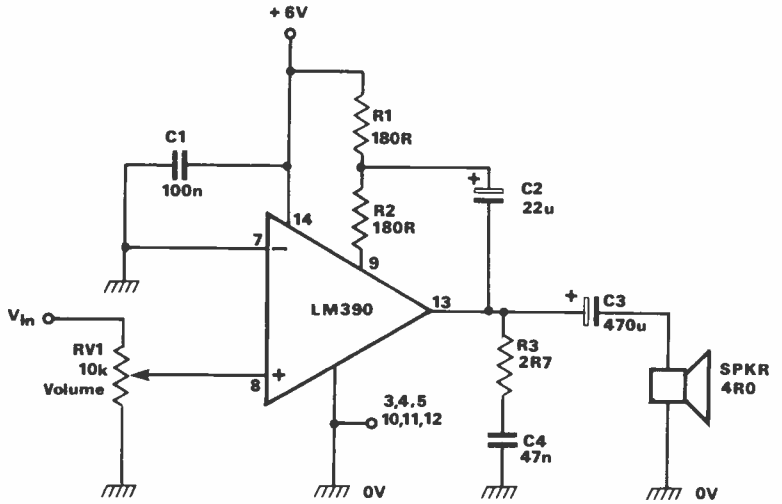

Figure 2 *LM390 1 watt amplifier with Av=20*

LM390 circuits

The LM390 is described in the manufacturer's literature as a '1 watt battery operated audio power amplifier', and is optimised for operation with 6V to 9V power supplies (10V maximum): specifically, the IC can feed 1W into a 4R0 load when powered from a 6V supply.

Figure 1a shows the internal circuit and pin connections of this IC, which is internally very similar to the LM388 (described last month) but has its output stage modified to give the maximum possible output voltage swing. The device is housed in a 14-pin DIL package with an internal heatsink connected to pins 3-4-5 and 10-11-12 (*Figure 1b*).

The overall voltage gain of the LM390 is internally set at x20, but can be increased to x200 by wiring a shunt capacitor between pins 2 and 6. The IC inputs are ground referenced, and the output automatically self-biases to a quiescent value of half-supply volts when the output stage of the IC is suitably dc-biased via external resistors wired between pins 9 and 14.

Figures 2 to 6 show some practical applications of this IC. *Figure 2* shows one way of using the LM390 as a 1W amplifier driving a 4R0 load from a 6V supply. Here, R1 and R2 are wired in series between the positive supply line and pin 9 of the IC, to give dc biasing to the output stage of the IC. Note that the R1-R2 junction is boot-strapped from the output of the IC via C2, to raise the ac-impedance of R2 to a value far greater than its dc value.

The overall voltage gain of the LM390 is internally determined in the same way as in the LM388, and thus equals x20 in the *Figure 2* circuit.

Figure 3 shows how the gain can be increased to x200 by simply wiring C5 between pins 2 and 6.

Figure 4 shows an alternative way of using the LM390. Here, dc current is fed to pin 9 of the IC via the speaker and R1. Note here that R1 is boot-strapped via C2, and that this circuit therefore gives a

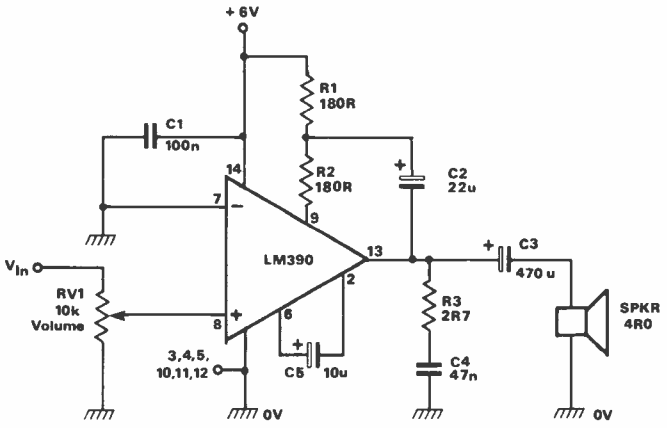

Figure 3 *LM390 1 watt amplifier with Av = 200*

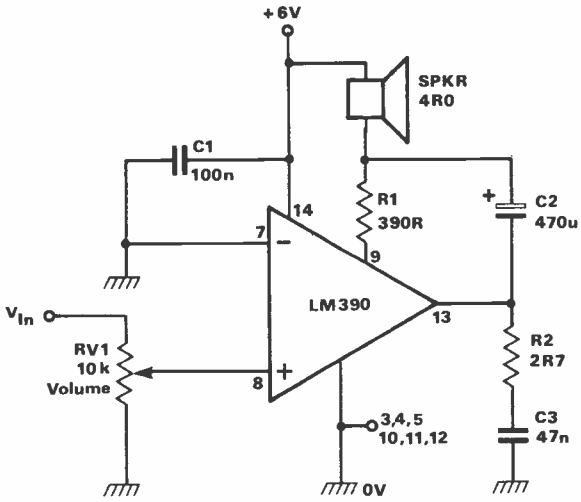

Figure 4 *LM390 1 watt amplifier with Av = 20 and load returned to +ve supply*

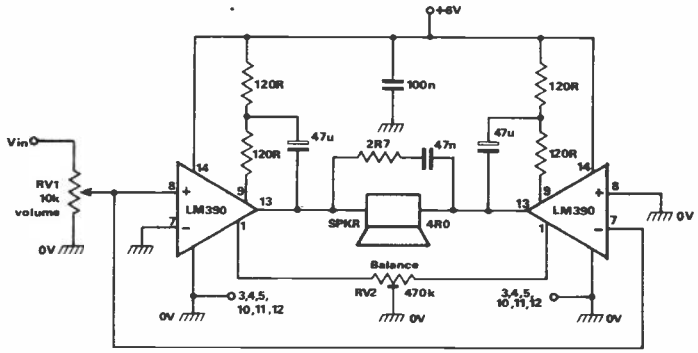

Figure 5 *LM390 bridge amplifier delivers 2.5 watts into 4R0 load*

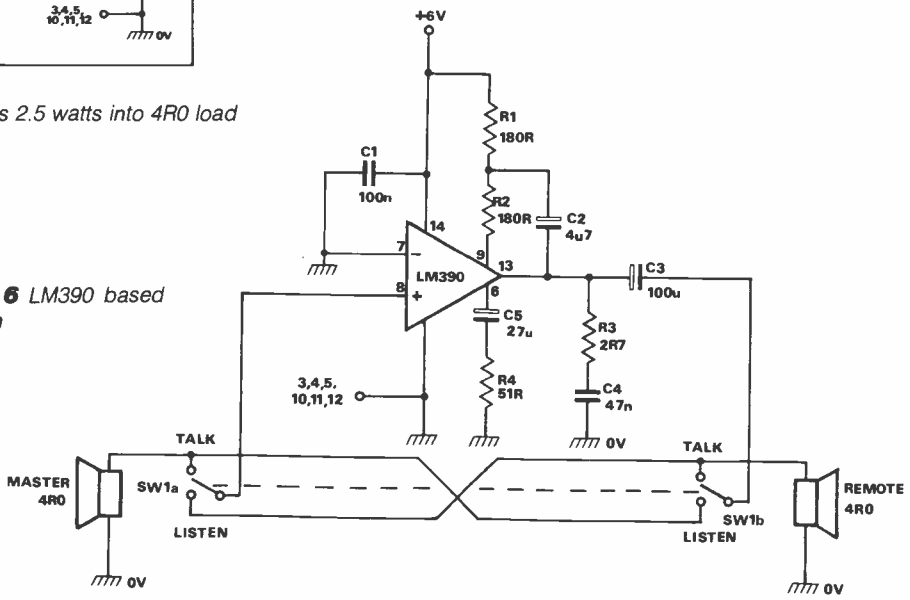

Figure 6 *LM390 based intercom*

performance similar to that of *Figure 2*, but does so with a saving of two components.

Figure 5 shows how to connect a pair of LM390 ICs in the bridge configuration, to provide 2.5W of drive to a direct-coupled 4R0 load when using a 6V supply. Pre-set pot RV2 is used to balance the quiescent outputs of the two ICs and thus minimise the quiescent current consumption of the circuit.

Finally, *Figure 6* shows how to use a single LM390 IC to make a simple 2-way intercom circuit. Note here that C5-R4 are used to provide the IC with an overall voltage gain of x300 (= 15K/51R).

Before leaving the LM390, note that this IC has a fairly poor ripple-rejection performance, and if any problems are met in this respect they can usually be overcome by wiring a 10uF (or larger) capacitor between pin-1 and ground. Also note in *Figures 2* to *6* that the 2R7 resistor and 47nF capacitor wired in series across the output of the IC form a Zobel network, to enhance circuit stability, and may be eliminated in some applications.

LM383 Circuits

The LM383 *(Figure 7)* is described in the manufacturer's literature as an 8W audio power amplifier IC. This device is specifically designed for use in automobile applications, in which the 'running' supply voltage has a nominal value of 14.4V, and at this voltage the IC can in fact typically deliver 5.5W into a 4R0 load or 8.6W into a 2R0 load. In reality, the IC will operate with any supply voltage in the range 5V to 20V, can supply peak output currents of 3.5 amps, and has a current-limited and thermally-protected output stage.

The LM383 is housed in a 5-pin package, as shown in *Figure 7*, and is a very easy device to use.

Figure 8 shows how to wire the device as a 5.5W amplifier for use in automobiles. Here, the closed-loop voltage gain is set at x100 via the R1-R2-C3

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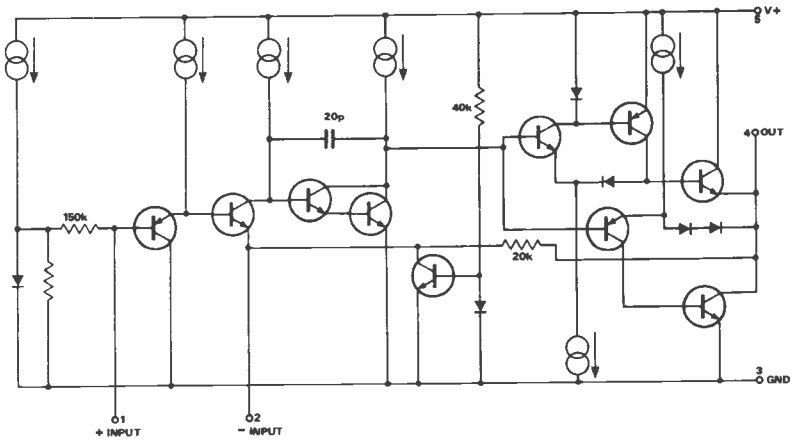


Figure 7 *Internal circuit and pin connections of the LM383 8 watt audio power amplifier IC*

feedback network, and the IC is operated in the non-inverting mode by simply feeding the input signal to pin-1 via C1. Capacitors C2 and C4 are used to ensure the high-frequency stability of the IC, and it is vital that C4 be wired as close as possible between pins 3 and 4.

Figure 9 shows how a pair of LM383 ICs can be connected as a 16W bridge amplifier for use in automobiles. Pre-set pot RV1 is used to balance the quiescent output voltages of the two ICs and to thus minimise the quiescent operating current of the circuit.

LM2002 (TDA2002) circuits

The LM2002 *(Figure 10)* is described as an 8W audio power amplifier IC, and is actually a direct equivalent of the popular TDA2002 IC.

Like the LM383, the LM2002 is specifically designed for use in automobile applications, in which it can typically deliver 5.2W into a 4R0 load or 8.0W into a 2R0 load. The LM2002 can in practice operate with any supply voltage in the range 5V to 20V, can supply peak output currents of 3.5 amps, and has a current-limited and thermally-protected output stage.

The LM2002 is internally very similar to the LM383, but uses a slightly less efficient output stage, with a consequent slight reduction in the available output power into a given load. The device is housed in a 5-pin package, as shown in *Figure 10,* and is a very easy device to use.

Figure 11 shows how to wire the LM2002 as a 5.2 W audio amplifier for use in automobiles, with a closed-loop voltage gain set at x100 via R1-R2-C3. Note that C4 and R3 help ensure the high frequency stability of the IC, and it is vital that these components are wired as close as possible between pins 3 and 4.

Figure 12 shows how to wire a pair of LM2002 (or TDA2002) ICs as a 16W bridge amplifier for use in automobiles. Balance control RV1 is set to give minimum quiescent operating current.

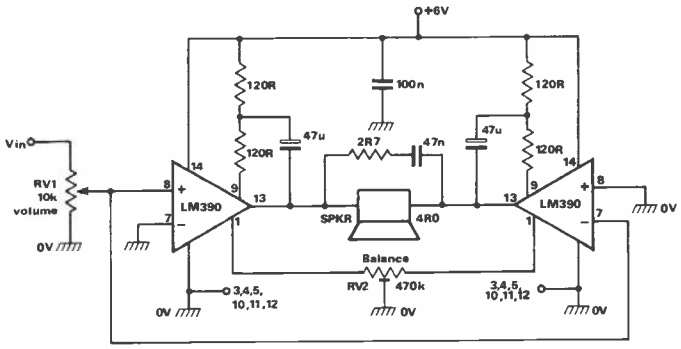


Figure 8 *LM383 5.5 watt amplifier for use in automobiles*

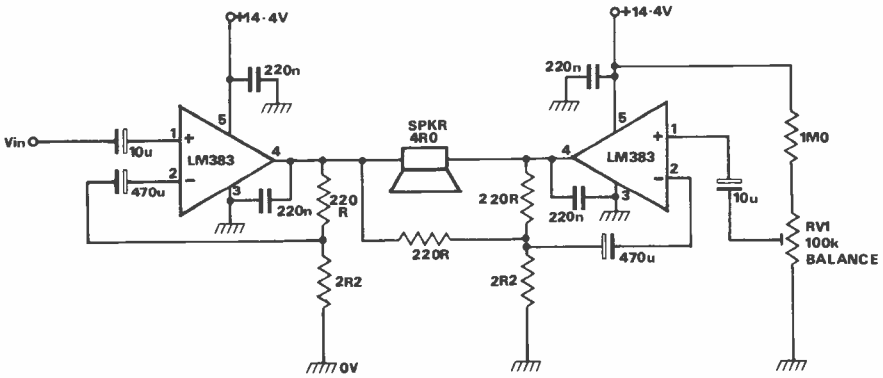


Figure 9 *LM383 16 watt bridge amplifier for use in automobiles*

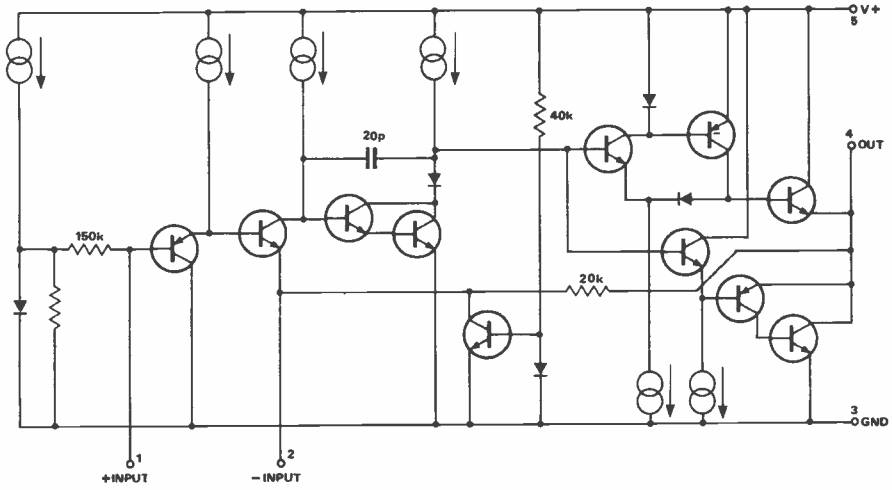


Figure 10 *Internal circuit and pin connections of the LM2002 (TDA2002) 8 watt audio power amplifier IC*

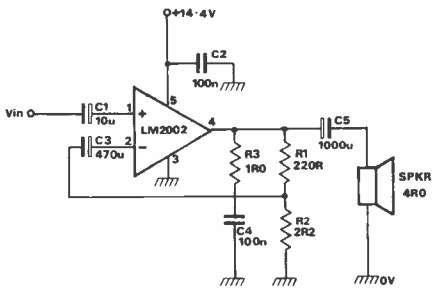


Figure 11 *LM2002 5.2 watt amplifier for use in automobiles*

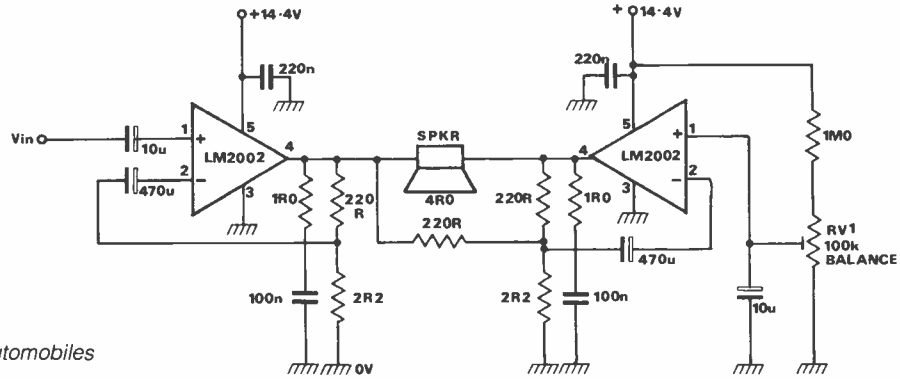
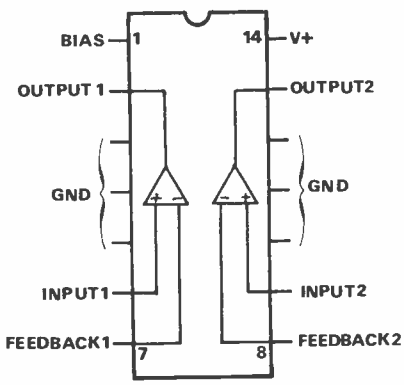
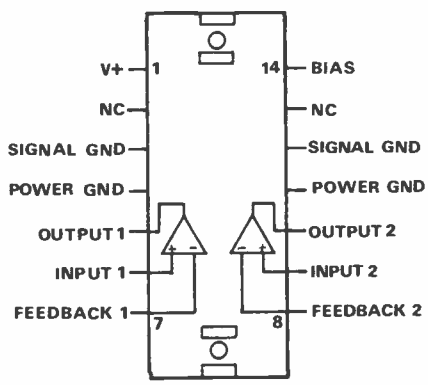


Figure 12 *LM2002 16 watt bridge amplifier for use in automobiles*



LM377 DUAL 2WATT AMPLIFIER
LM378 DUAL 4WATT AMPLIFIER



LM379 DUAL 6WATT AMPLIFIER

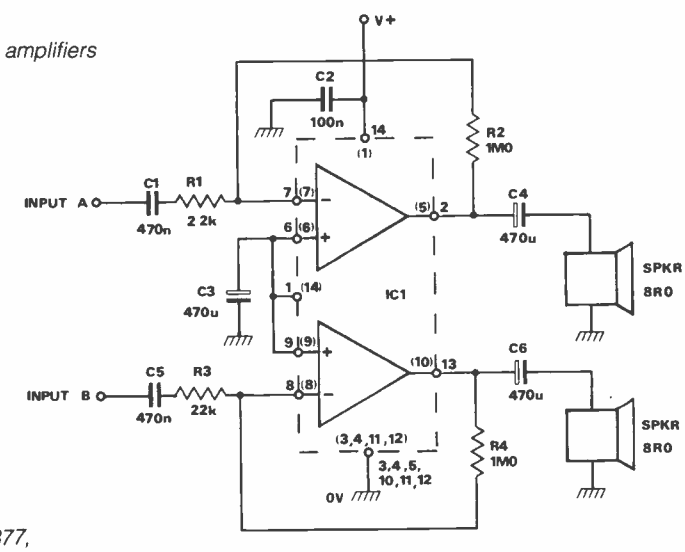
Figure 13 *Outline and pin notations of three popular 'dual' amplifiers*

V+	LM377	LM378	LM379	MAX O/P POWER PER CH. INTO: 8R0	16R
12V	LIMIT TO 2·5W PER CHANNEL	LIMIT TO 5W PER CHANNEL	LIMIT TO 6W PER CHANNEL	1·6W	1W
16V				2·2W	1·5W
18V				3W	1·8W
20V				3·8W	2·4W
22V				4·6W	2·8W
24V				5·4W	3·6W
26V				6W	4·2W
28V				7W	5W
30V				—	5·5W

Figure 14 *Approximate performance characteristics of the LM377/378/379 dual amplifiers*

	IC1 LM377	LM378	LM379
V+ (max)	18V	24V	28V
P_{OUT} / Ch	2W	3W	4W
e_{IN} (max)	80mV	100mV	115mV
A_V approx	50	50	50
Z_{IN}	22k	22k	22k

TYPICAL PERFORMANCE OF THE INVERTING STEREO AMPLIFIER



NOTE:- LM379 PIN NUMBERS ARE SHOWN IN PARENTHESES

Figure 15 *Simple inverting stereo amplifier using the LM377, LM378, or LM379 dual amplifier ICs*

LM377/378/379 circuits

National Semiconductors produce a range of 'dual' power amplifier ICs for use in stereo amplifier and bridge-configured mono amplifier applications. The best known of these devices are the LM377 dual 2W, the LM378 dual 4W, and the LM379 dual 6W amplifiers. *Figure 13* shows the outlines of these devices, and *Figure 14* shows the approximate performance characteristics of the three ICs.

The LM377/378/379 range of ICs all have similar internal circuits, with high-impedance differential input stages and fully-protected output stages, and differ primarily in their voltage/power ratings and in their packaging styles. It should be noted that the input stages of these ICs are intended to be dc-biased to half-supply volts, and a bias generator is built into the ICs for this purpose.

The LM377/378/379 range of ICs are very easy to use. *Figure 15* shows the connections for making a simple inverting stereo amplifier powered from a single-ended power supply. Here, the amplifier is biased by connecting each non-inverting input pin to the BIAS terminal (pin-1 on the LM377 or LM378, or pin-14 on the LM379), and the closed-loop voltage gain of each amplifier is set at approximately x50 by the ratio of R2/R1 or R4/R3. The table shows the typical performance of this circuit.

Figure 16 shows how the above circuit can be modified for use as a non-inverting amplifier. The voltage gain of each half is again set at roughly x50, in this case via the ratio of R4/R3 or R6/R5, and the non-inverting input terminals are biased via the internal network of the IC.

Figure 17 shows how the above 'non-inverting' amplifier circuit can be modified for use with split power supplies. Note in this case that the internal BIAS generator is ignored, and that the non-inverting input of each amplifier is dc-coupled to the ground 'half-supply' point via volume control RV1.

Figure 18 shows a highly effective way

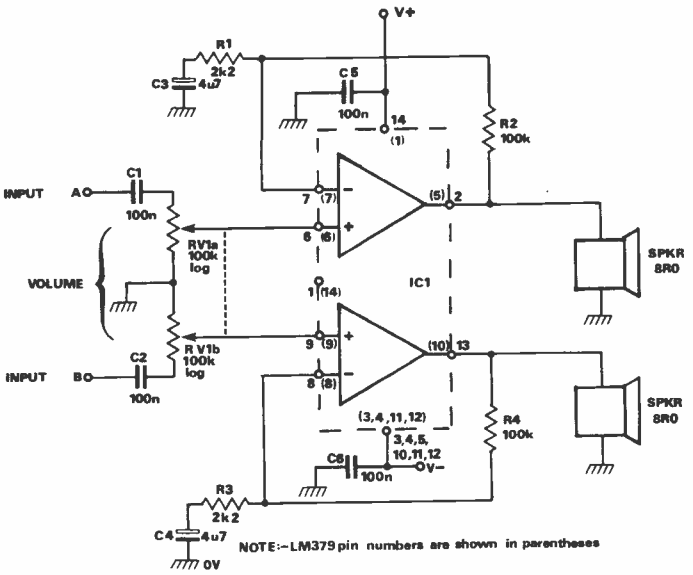


Figure 16a *Non-inverting stereo amplifier using a single-ended supply*

V+	IC1	P_{OUT}
18V	LM377	2W/Ch
24V	LM378	3W/Ch
28V	LM379	4W/Ch

Figure 16b *Power ratings*

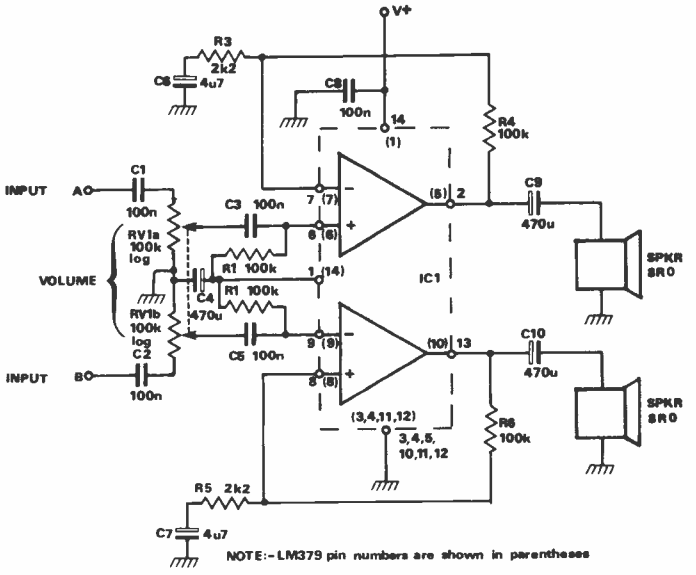


Figure 17a *Non-inverting stereo amplifier using a split supply*

V+	V−	IC1	P_{OUT}
+9V	−9V	LM377	2W/Ch
+12V	−12V	LM378	3W/Ch
+14V	−14V	LM379	4W/Ch

Figure 17b *Power ratings*

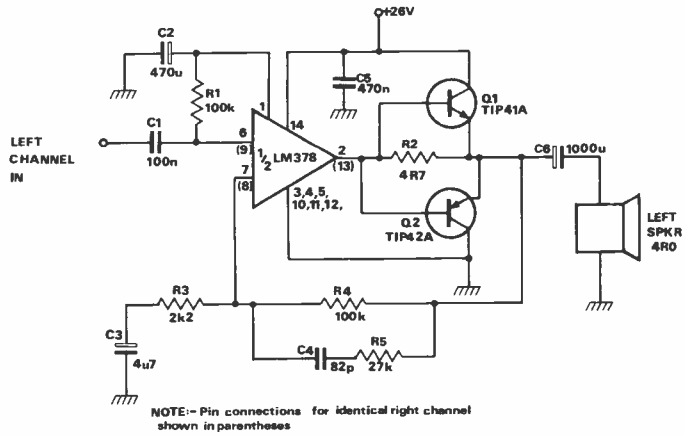


Figure 18 *One channel of a 15 watt per channel stereo amplifier using a single-ended supply*

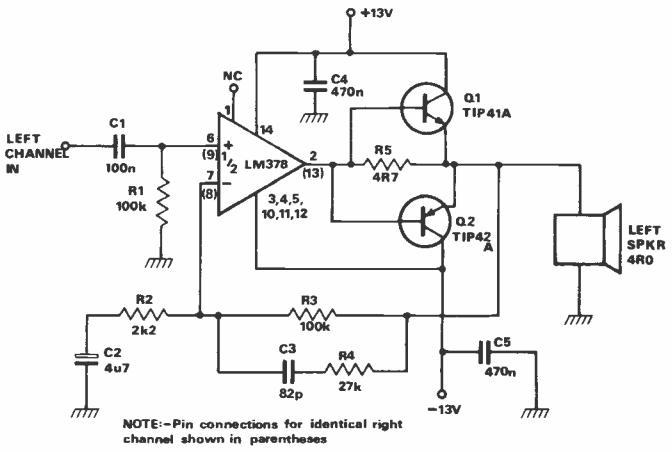


Figure 19 *One channel of a 15 watt per channel stereo amplifier using a split supply*

of boosting the available output power of one half of the LM378 to 15W. This remarkably simple circuit generates a typical THD of only .05% or so at an output power level of 10W. At very low power levels, Q1 and Q2 are inoperative and power is fed directly to the speaker via R2: at higher power levels Q1 and Q2 act as a normal complementary emitter follower and provide most of the power drive to the speaker. R2 and Q1-Q2 are effectively wired into the negative feedback network of the circuit, which consequently generates negligible cross-over distortion.

Figure 19 shows how the above circuit can be adapted for use with a split power supply. This circuit produces negligible output dc-offset, thus enabling the speaker to be direct-coupled to the output of the circuit.

Finally, *Figure 20* shows how the two halves of a LM377, LM378 or LM379 can be used to make a bridge-configured 'mono' amplifier which can feed relatively high power levels into a direct-coupled speaker load.

The LM1877 IC

The LM1877 dual 2W power amplifier IC is an improved pin-for-pin replacement for the LM377, and should be used in place of the latter IC whenever possible. The LM1877 gives an improved performance in terms of very low cross-over distortion, very high input impedance, and a high slew rate, but has a slightly poorer ripple-rejection performance, and typically consumes a higher quiescent current than the LM377.

In the remainder of this article, Ray Marston gives very brief descriptions of a few popular audio power amplifier ICs, complete with one or more 'application' circuits for each IC.

The TBA810S

This IC can supply several watts of audio power output, and is particularly well suited for use in automobile

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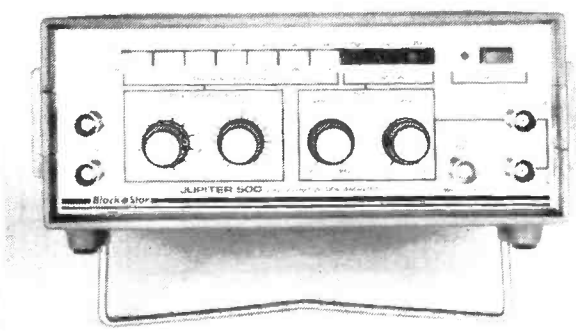

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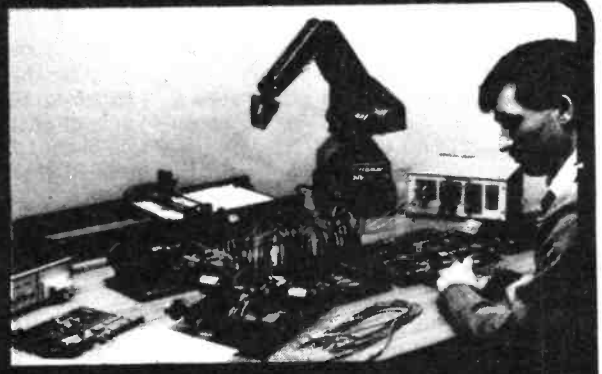

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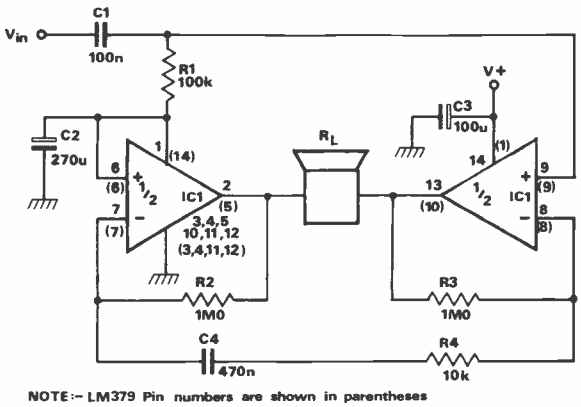


IC1	V+	R_L	P_{OUT}
LM377	14V	8R0	4W
LM378	22V	16R	8W
LM379	28V	16R	12W

Figure 20 *Bridge amplifier circuit using dual-amplifier ICs*

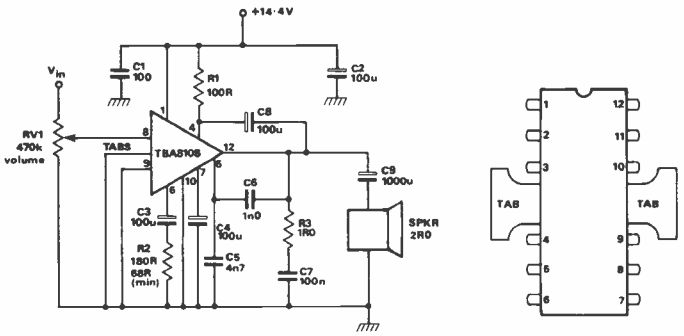


Figure 21 *TBA810S 7 watt amplifier for use in automobiles*

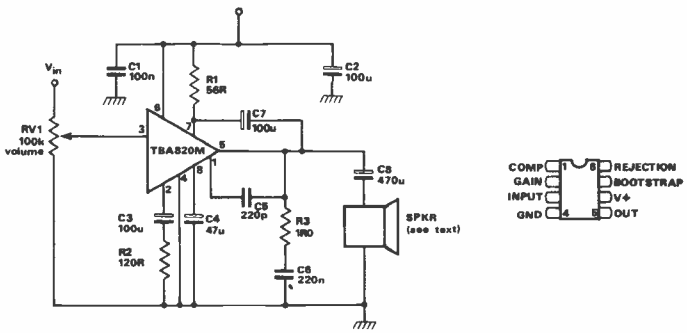


Figure 22 *TBA820M low-power audio amplifier circuit*

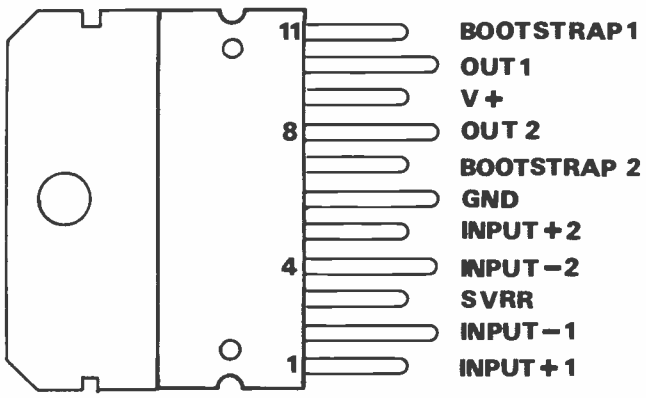


Figure 23a *Pin layout*

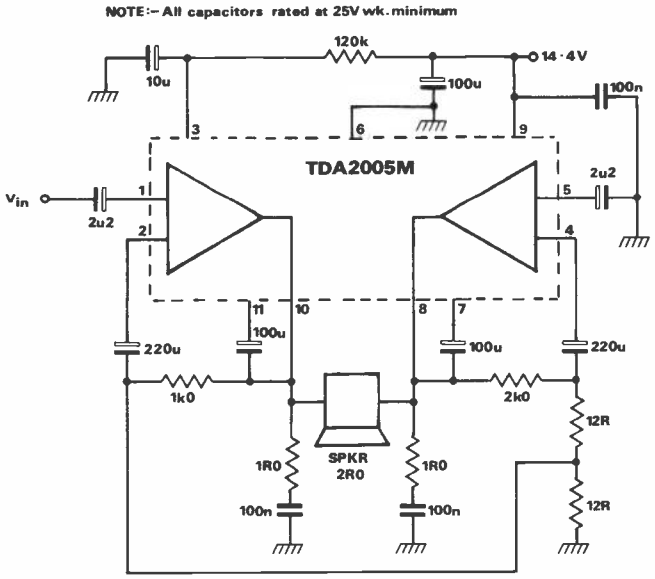


Figure 23b *TDA2005M 20 watt power booster for use in cars*

applications. The device features protection against supply polarity inversion and high-voltage supply transients. *Figure 21* shows a practical applications circuit: voltage gain is determined by R2: R1 is an output biasing resistor and is boot-strapped via C8: R3-C7 is a Zobel network.

The TBA820M

This is a low-power amplifier capable of generating a few hundred milliwatts in a 4R0 to 16R0 speaker load, and is housed in an 8-pin DIL package. The IC can operate from supply voltages as low as 3V, and features low quiescent current, good ripple rejection, and low cross-over distortion. *Figure 22* shows a practical applications circuit, in which the voltage gain is determined by R2, and R3-C6 form a Zobel network. This circuit can use a maximum supply voltage of 16V with a 16R0 speaker, 12V with an 8R0 speaker, or 9V with a 4R0 speaker.

The TDA 2005M

This is a 20W audio power booster specifically designed for use in automobiles, and is fully protected against output short circuits etc. The IC actually houses two power amplifiers which are internally connected in the bridge configuration to provide the high power output (into a 2R0 load) from the 14.4V (nominal) power supply of an automobile. The IC is housed in an 11-pin package. *Figure 23* shows a practical applications circuit. Note that all capacitors must be rated at 25V minimum.

The TDA2006

This is a high-quality amplifier that can be used with either split or single-ended power supplies, and which typically generates less than 0.1% distortion when feeding 8W into a 4R0 speaker load. The IC is housed in a 5-pin T0220 package that has an electrically insulated heatsink tab, which can consequently be bolted directly to an external heatsink without need of an insulating washer.

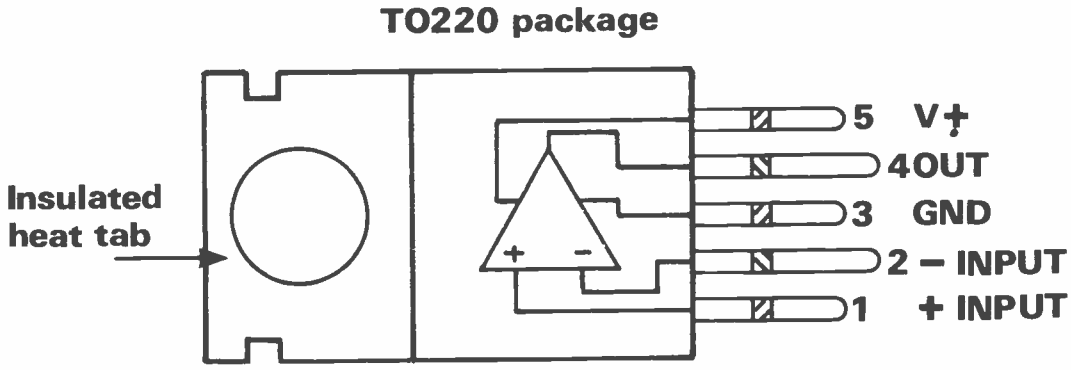


Figure 24 *Outline and pin connections of the TDA2006 and TDA2030*

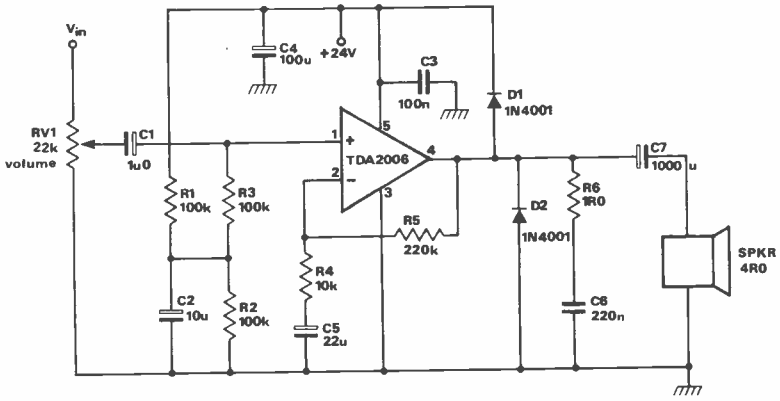


Figure 25 *TDA2006 8 watt amplifier with single-ended supply*

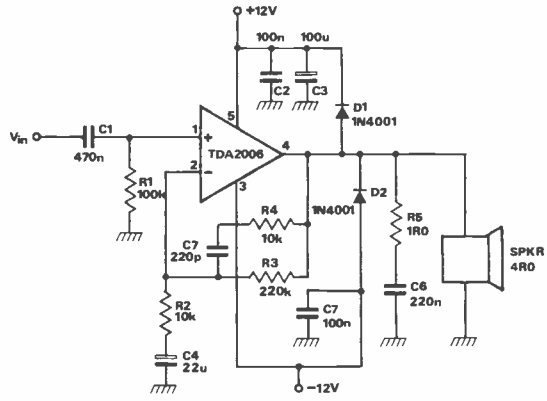


Figure 26 *TDA 2006 8 watt amplifier with split power supply*

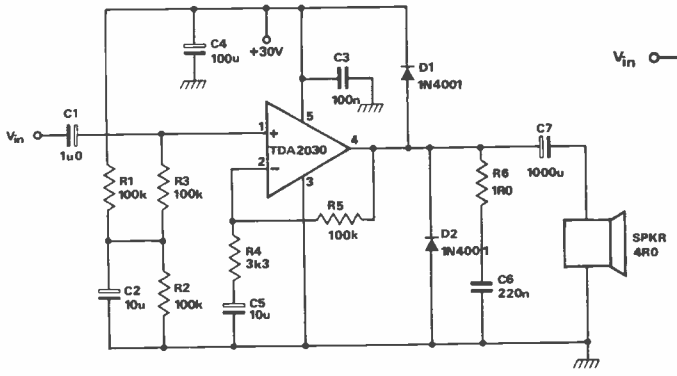


Figure 27 *TDA2030 15 watt amplifier with single-ended supply*

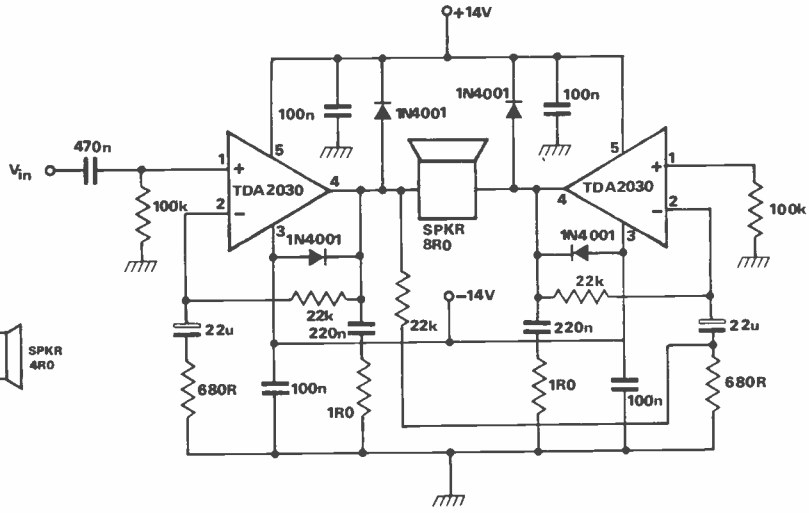


Figure 28 *TDA2030 24 watt bridge amplifier with split supply*

Figure 25 shows how to use the TDA2006 with a single-ended supply. The non-inverting input pin is biased at half-supply volts via R3 and the R1-R2 potential divider, and the voltage gain is set at x22 via R5/R4. D1 and D2 protect the output of the IC against damage from back EMF voltages from the speaker, and R6-C6 form a Zobel network.

Figure 26 shows how to modify the above circuit for use with split power supplies. In this case the non-inverting input is tied to ground via R1. This circuit also shows how high-frequency roll-off can be applied to the amplifier via C5-R4.

The TDA2030

This very popular IC can be regarded as an upgraded version of the TDA2006, and is housed in the same 5-pin TO220 package with insulated heat tab. It can operate with single-ended supplies of up to 36V (± 18V, split). When used with a +28V single-ended supply, it gives a guaranteed output of 12W into 4R0 or 8W into 8R0. Typical THD is .05% at 1KHz at 7W output.

Figure 27 shows how to connect the TDA2030 as a 15W amplifier using a single-ended +30V supply and a 4R0 speaker load and a voltage gain of 30dB. Finally, *Figure 28* shows how to wire a pair of these ICs as a split-supply 'bridge' amplifier that can deliver 24W into a 4R0 speaker load with a typical THD of less than 0.5%.

BBC MICRO MORSE TUTOR

by M LAVOCAH

This is a Morse tutoring program for the BBC Micro that has a maximum sending speed of about 20wpm. The limitation on speed lies in the sound generator chip, which cannot make a sound shorter than 1/20 second.

Since the BASIC is running a lot faster than this there is no advantage to be gained in using machine code.

Data structure

The 36 characters (26 letters and 10 digits) are held in the integer array A% as sequences of 1's and 3's – the comparative values of the dots and dashes – and the number of dots and dashes in each character is held in the array L%.

When a character is sounded, the information is converted to a string and examined bit by bit.

This is preferable to using a string array which would waste an incredible amount of memory, although memory itself is not a problem.

The zero is placed first of the numbers in accordance with the sequence in the ASCII code, rather than last as is normal in Morse.

Timing

The real time clock in the BBC runs in Hz (1/100 second) but the sound chip runs in units of 1/20 second – 5Hz. This is therefore the minimum duration of a dot. The conversion factor between these two timings is DUR%.

When a sound statement is reached the CPU passes this to the sound chip and is then free to carry on with the next statement while the sound chip makes the noise.

Therefore when pausing between dots and dashes we must first pause for the time it takes to make the sound, and then pause for the gap itself.

The program

PROCinit selects the mode of operation. First of all you select between sending phrases or random characters. (PA% 1,2)

If you select phrases, you then have to type in a phrase before the computer sends it back to you. Knowing what's coming isn't too much of a problem, but you could always get a friend to type something in or else hit the keys at random.

This has the advantage (?) that the Morse sent contains a disproportionate amount of 'hard' letters.

If you choose to receive random characters, you can then choose between letters only, numbers only, both, or a particular range of letters (G 1,2,3,4).

The characters are tokenised as follows:

Space	0
A – Z	1 – 26
0 – 9	27 – 36

When picking random letters, two variables are used:
R% base of range
Q% length of range
eg R% 1,Q% 26 is the alphabet.

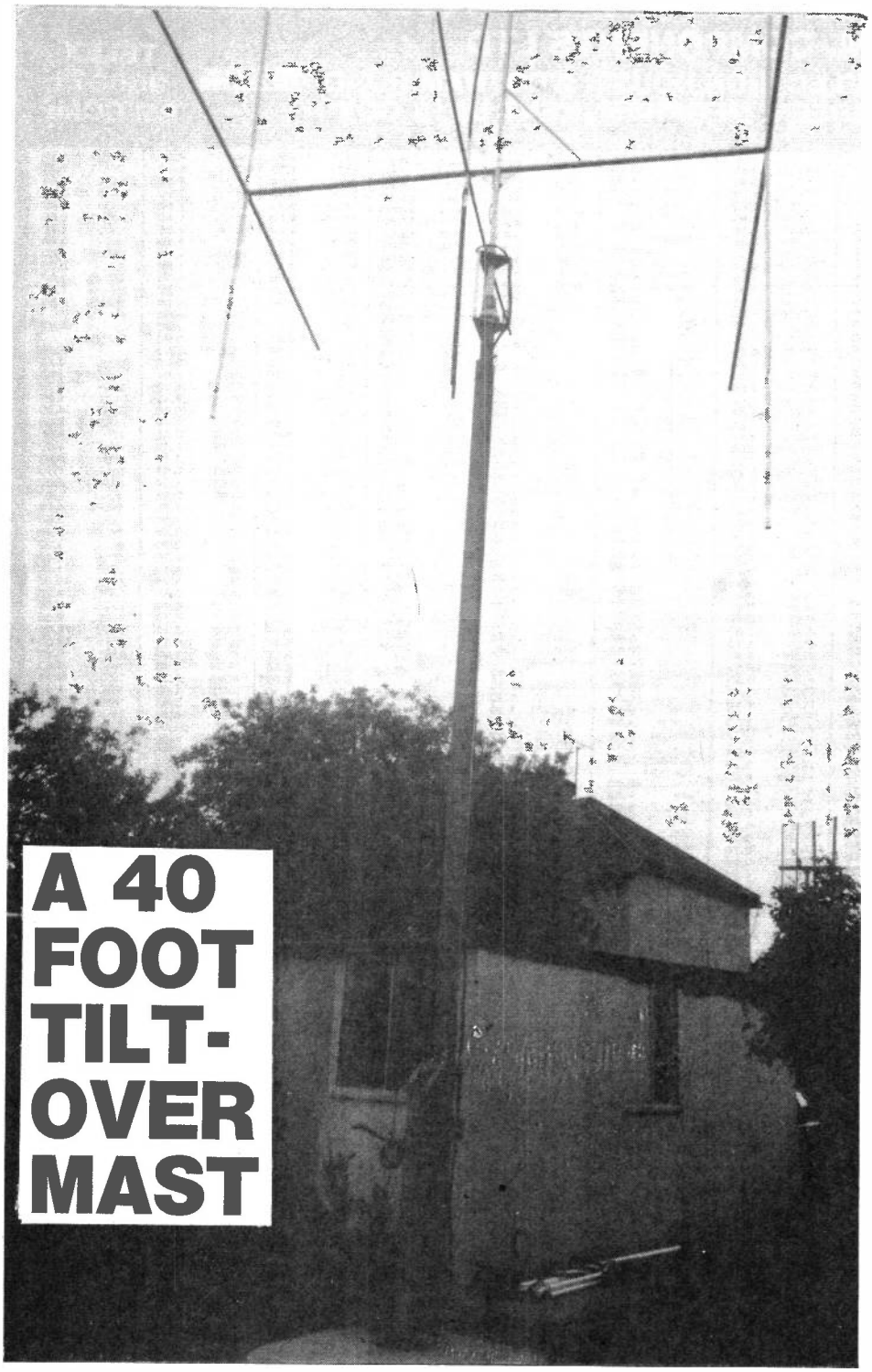
As it stands the program runs in an endless loop; when you get bored, press ESCAPE. It's all legal due to the REPEAT....UNTIL FALSE syntax.

The noises

The syntax of the SOUND statement is SOUND channel, loudness, pitch, duration. The pitch can be altered at your discretion, high numbers giving a high pitch. The duration (and hence the speed) can also be varied, but only down to 5Hz.

Some of you may have already noticed the extra sound statement in line 370, which provides a bit of background interference. For more difficult reception, make this noise louder and the morse itself quieter. A louder noise is given by a more negative loudness parameter, up to -15.

```
L.
  10 REM (c) M.LAVOCAH APR'84
  20 MODE7
  30 PROCdata
  40 PROCinit
  50 IF PA%=2 THEN REPEAT:PROCphrase:UNTIL FALSE
  60 REPEAT:PROCrandom:UNTIL FALSE
  70 END
  80 :
  90 DEF PROCrandom
 100 TIME=0
 110 FOR PASS%=1 TO H%
 120   C%=0%*RND(1)+R%
 130   REPEAT
 140     PROCchar:PROCcorrect
 150     UNTIL COR%=1
 160   PRINT"CORRECT:";CHR$(ANS%)
 170   NEXT
 180 T=TIME:PRINT"ELAPSED TIME ";INT(T/100);" SECS"
 190 PRINT"CHARACTERS PER MINUTE:";INT(H%*6000/T)
 200 ENDPROC
 210 :
 220 DEF PROCphrase
 230 INPUT"WHAT IS THE PHRASE "P$:I%=LEN(P$)
 240 CLS:PRINT"PRESS ANY KEY TO START":G=GET
 250 TIME=0
 260 FOR PASS%=1 TO I%
 270   C%=ASC(MID$(P$,PASS%,1))
 280   IF C%=32 THEN C%=0
 290   IF C%>64 THEN C%=C%-64 ELSE C%=C%-21
 300   IF C%<0 THEN C%=0
 310   PROCchar:PROCpause(4*DUR%)
 320   NEXT
 330 T=TIME:PRINT"TIME ";T:PRINT"PRESS ANY KEY":G=GET
 340 ENDPROC
 350 :
 360 DEF PROCchar
 370 N%=L%(C%):A$=STR$(D%(C%)):SOUND&10,-5,4,20
 380 FOR A%=1 TO N%
 390   B%=VAL(MID$(A$,A%,1))
 400   B1%=B%*DUR%/5:IF B1%=0 THEN B%=8 ELSE SOUND 1,-15,PITCH%,B1%
 410   PROCpause(DUR%+B%*DUR%)
 420   NEXT
 430 ENDPROC
 440 :
 450 DEFPROCcorrect
 460 COR%=0:*FX 12,0
 470 IF C%<27 THEN ANS%=C%+64 ELSE ANS%=C%+21
 480 G%=GET
 490 IF G%=ANS% THEN COR%=1
 500 ENDPROC
 510 :
 520 DEFPROCpause(P)
 530 T%=TIME:REPEAT UNTIL TIME>=T%+P
 540 ENDPROC
 550 :
 560 DEF PROCinit
 570 PRINT"MORSE TUTOR":PRINT
 580 PRINT"DURATION OF DOT IN CS(TRY 5) ";
 590 REPEAT:INPUTDUR%:UNTIL DUR%<15 AND DUR%>4
 600 PRINT"PITCH (50-150) ";
 610 REPEAT:INPUT PITCH%:UNTIL PITCH%>30 AND PITCH%<200
 620 PRINT:PRINT"RANDOM LETTERS(1) OR A PHRASE(2) ?"
 630 REPEAT:PA%=VAL(GET$):UNTIL PA%=1 OR PA%=2
 640 IF PA%=2 THEN ENDPROC
 650 PRINT"HOW MANY CHARACTERS ";
 660 REPEAT:INPUTH%:UNTIL H%<100 AND H%>5
 670 PRINT"LETTERS(1) NUMBERS(2) BOTH(3) SELECTED LETTERS(4)"
 680 REPEAT:G=VAL(GET$):UNTIL G>0 AND G<5 AND G=INT(G)
 690 IF G=2 THEN R%=27:Q%=10 ELSE R%=1
 700 IF G=1 THEN Q%=26
 710 IF G=3 THEN Q%=36
 720 IF G=4 THEN PRINT"FIRST LETTER":REPEAT:INPUTR$:R%=ASC(R$)-64:UNTIL R%<26:P
RINT"LAST LETTER":REPEAT:INPUTT$:T%=ASC(T$)-64:UNTIL T%<26:Q%=T%-R%+1
 730 CLS
 740 ENDPROC
 750 DEFPROCdata
 760 DIM L%(36),D%(36)
 770 FOR A%=1 TO 36
 780   READ L%(A%),D%(A%)
 790   NEXT
 800 ENDPROC
 810 :
 820 REM ABC,DEF,GHI,JKL
 830 DATA 2,13,4,3111,4,3131
 840 DATA 3,311,1,1,4,1131
 850 DATA 3,331,4,1111,2,11
 860 DATA 4,1333,3,313,4,1311
 870 REM MNO,PQR,STU,VWX,YZ
 880 DATA 2,33,2,31,3,333
 890 DATA 4,1331,4,3313,3,131
 900 DATA 3,111,1,3,3,113
 910 DATA 4,1113,3,133,4,3113
 920 DATA 4,3133,4,3311
 930 :
 940 REM NUMBERS
 950 DATA 5,33333,5,13333
 960 DATA 5,11333,5,11133
 970 DATA 5,11113,5,11111
 980 DATA 5,31111,5,33111
 990 DATA 5,33311,5,33331
```



A 40 FOOT TILT-OVER MAST

How many of us have gazed up in awe and stood green-eyed at the mast of a rich amateur and wished for the same thing? How many of us have turned the pages of the magazines and wistfully eyed the advertisements for tilt-over masts, only to decide that the cost is prohibitive?

Here is a mast which will cost you just over £100 to build.

All you will need are the materials, which are not expensive, plus the determination to get down to the job – yes, some hard work *is* involved but it isn't beyond anyone's capability. My mast was constructed in a very short time and I used a standard hacksaw, a drill, and a few other simple tools. The only 'extras' were the use of an arc-welder and a few hundredweight of cement for the base. This was bought ready-mixed and barrowed to the hole at a very reasonable price.

The result was a first-class mast which extends to forty feet unguyed, and is extremely easy and simple to tilt and raise. I set about it in the following way.

First I applied through the usual channels for planning permission. A word of advice here: *always* call it a *mast*, not a tower!

While this is taking place, contact as many of your local metal stockists as possible to obtain prices and delivery dates. It is worth shopping around as prices can vary considerably.

Foundations

You need to dig a hole 4 foot 6 inches square by 2 foot 6 inches deep. This will take the cement for the base. Bang in two lengths of angle-iron on each side at an angle of 45 degrees and to a depth of three feet. These will help to make a good anchorage. If you bond them with heavy wire and connect it to the ground-post it will serve as a useful ground plane (detail shown in *Figure 1*).

The main mast and groundpost are constructed from 100 x 100 x 4mm RHS tube. The inner sliding mast is made from 70 x 70 x 2.9mm RHS. No guy-wires or ropes are needed.

All the necessary brackets, pulleys, etc can be made in a day by a skilled person, but if you don't feel confident about it, your local blacksmith will knock them up for you. Welding and assembly will take about two days for a skilled worker, but the average ham will probably spend a couple of weeks of spare time labour.

Observe the small sump hole at the bottom. When the groundpost is constructed it is set firstly into this small hole with a bag of ready-mixed cement. Check for true vertical with a spirit level and allow two days for it to set before the bulk cement is barrowed in.

Three and a half tons of cement are required for this, and your local barrow-mix firm is probably your best answer here...

After filling, leave for two weeks before any additional strain is put on it. This will give you time to get on with the rest of the construction.

The diagrams (*Figure 2a, b and c*)

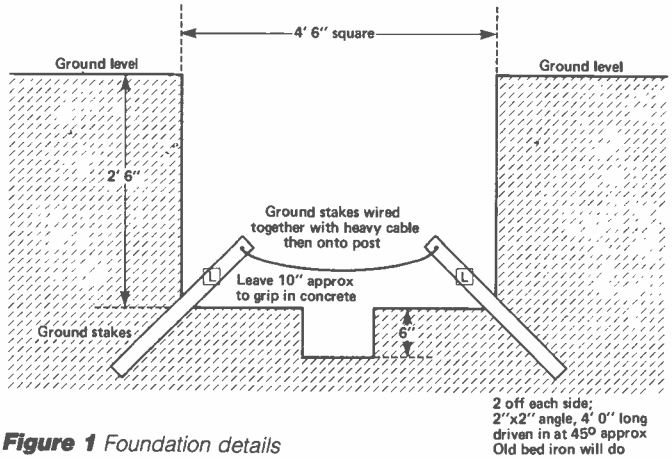


Figure 1 *Foundation details*

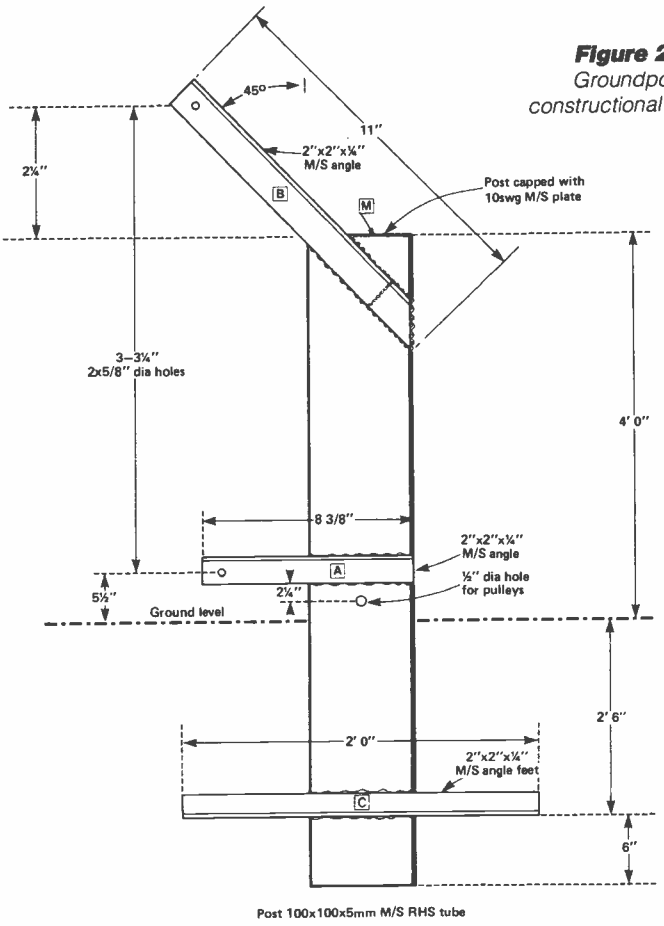


Figure 2a *Groundpost constructional details*

clearly show the dimensions and constructional details of the ground post. The hatching shown on the angle-iron indicates welding (for the uninitiated!).

On this subject it should be mentioned that unless you can weld it is better to get in a professional to do it. It goes without saying that the welds must be very good in view of the weights and strains involved, so perhaps it would be a good idea to do all the measuring and cutting first and have everything prepared so that you can call in a welder to do the whole job at once. It won't be that expensive, by the way.

Pulleys

If you don't feel confident to make these you will have to buy them, but *don't* go to a boatbuilders – they will charge the earth. Local bearing shops will often have them at more reasonable prices. Measurements are given in the following diagrams.

In any case most of the odd bits you will need may be found quite cheaply at scrapyards or from your local blacksmith. The pull needed to raise the mast from 90 degrees to the vertical is in the region of 1500 pounds, decreasing of course as the mast rises, so your pulleys and wire must be of very sound quality to say the least...and you can understand from this poundage why the welding has to be of top quality!

Little difficulty should be encountered in the construction providing the measurements are adhered to. Note the

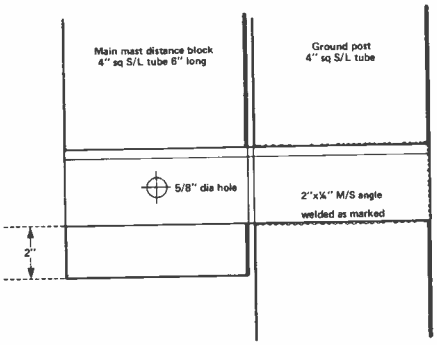


Figure 2b *Detail showing retention of bottom of mast to groundpost*

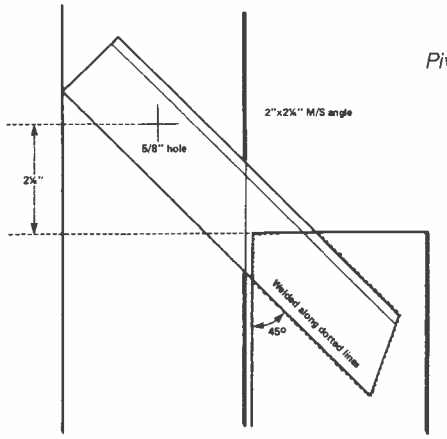


Figure 2c *Pivot point detail*

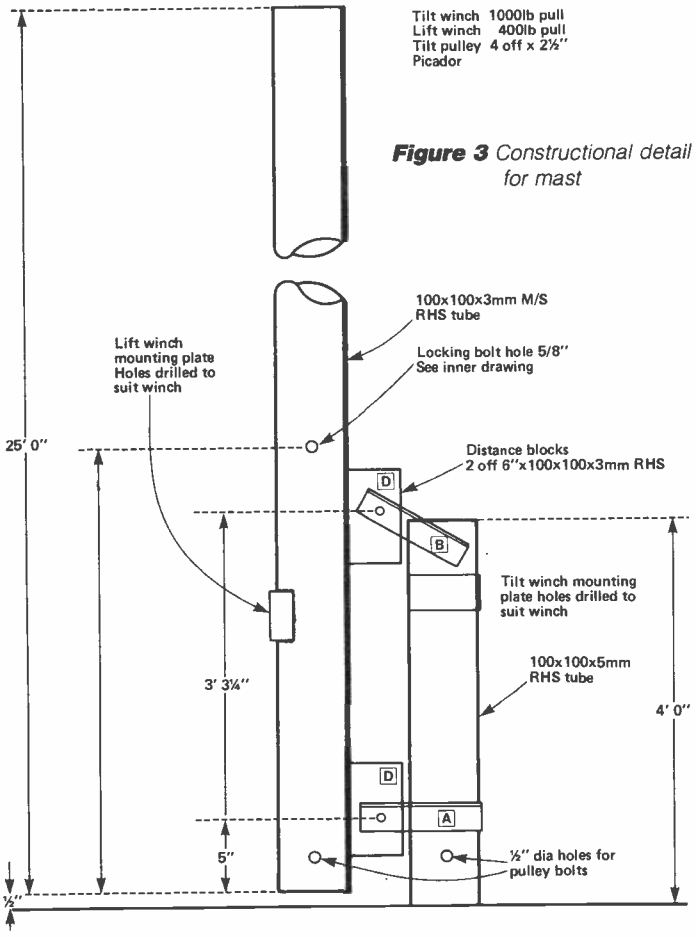


Figure 3 *Constructional detail for mast*

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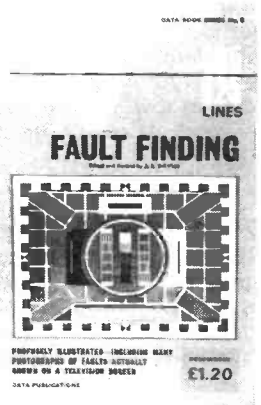

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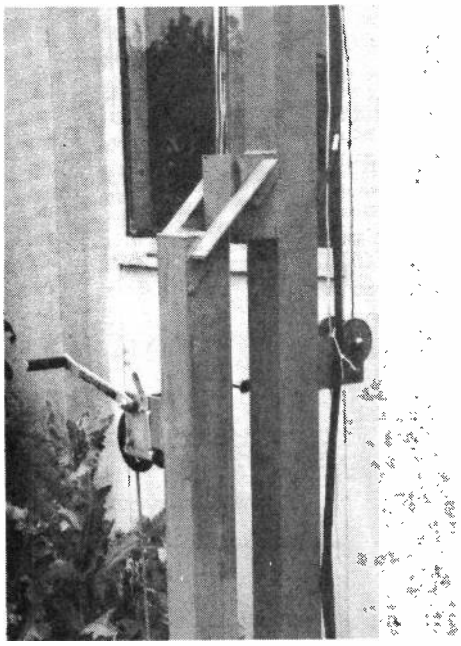
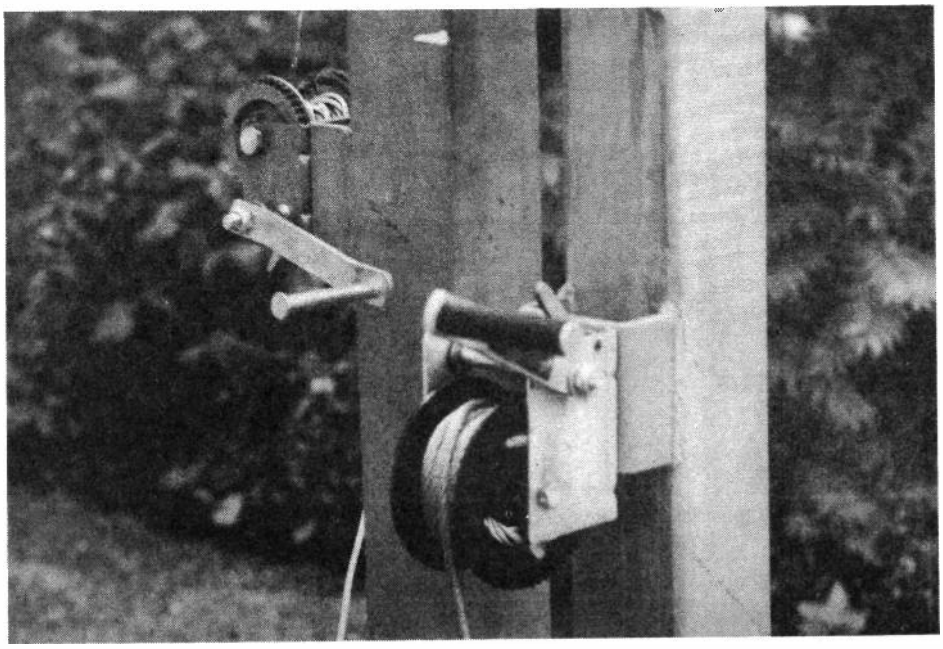




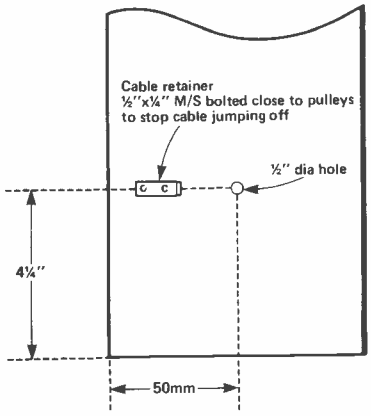
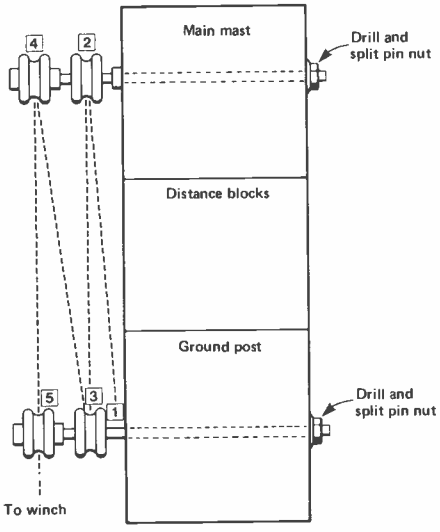


Figure 4a



Pulleys 4 off 2½" dia Picador with "Oilite" bushes
2 off 6½"x½" H/T M/S bolts and nuts
Cable is 6mm stainless steel
Anchor with eye at point 1 Pass over pulley at point 2 then 3 then 4 then 5 and up to tilt winch
Cable length required is 25' approx

Figure 4b

half-inch clearance between the ground level and the mainmast. The following diagram shows the details of the bottom pulley mounting of the mainmast in detail.

Basic principles

Figure 3 shows the position of the two winches. As can be seen the principle of tilting the mast follows the orthodox methods. The pictures show the tilt pulley mounting details.

Tilt pulley mounting details

You will need four 2½inch dia. Picador pulleys with Gilite bushes and 2 x 6¼" x½" H/T M/S bolts and nuts. Approximately 25 feet of 6mm stainless steel cable is also needed. Anchor the cable with its eye at point 1, pass it over the pulley at point 2, then over 3,4 and 5, and then up to the tilt winch. As shown in *Figure 4b*.

Counterweights

It was found that counterbalancing was needed in order to facilitate raising the main mast. Approximately 300lbs are required and it is possible to obtain old 56lb weights from your local coalman.

The weights do not need to be attached to the mast directly, but by a chain, so that when the mast tilts to about 10 degrees from the vertical the slack is taken up and the weights rise as the mast tilts further.

If the weights are fixed directly to the mast there is the danger that it will snap shut and 'flick' the mast top and cause damage.

Guide plate

Clearly, the inner mast cannot be allowed to 'sit' within the main mast and wobble. The method of stabilising this is again quite simple. *Figure 5a* shows the view from the bottom of the mainmast, looking upwards, and the guide plate in position.

The diagonal mounting prevents any

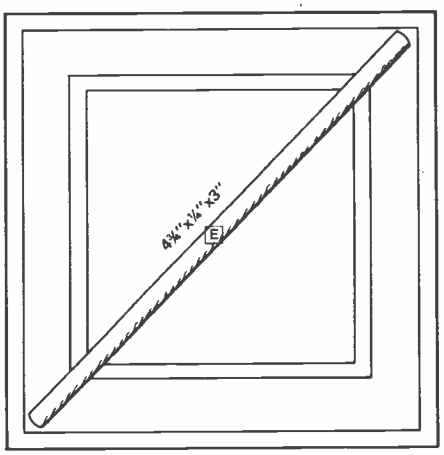


Figure 5a *Guide plate details*

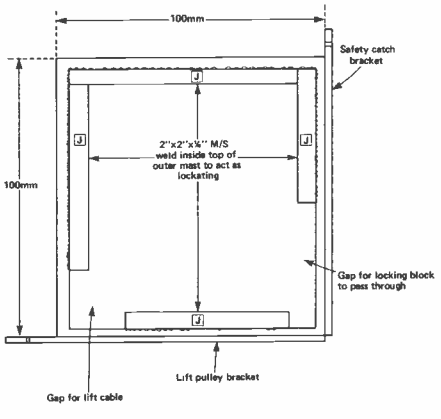


Figure 5b *Inner mast locating plate details*

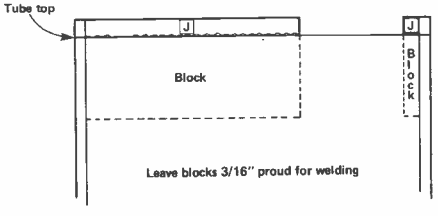


Figure 5c *Welding details*

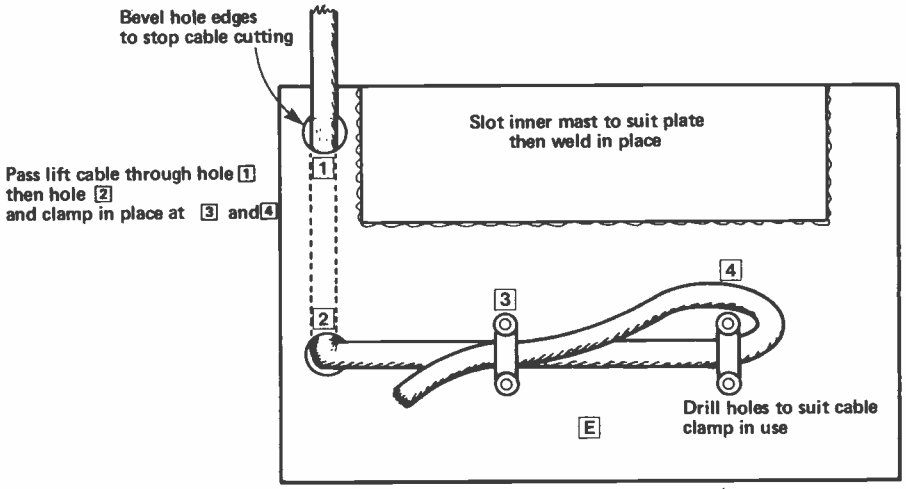


Figure 5d *Inner mast lifting cable fixings*

Bottom guide and rope anchor plate F/S cable is 6mm stainless steel 50' 0" approx

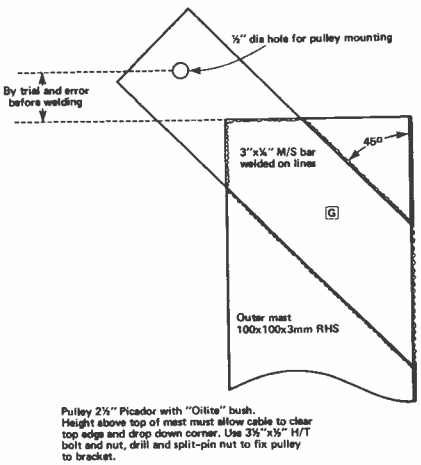
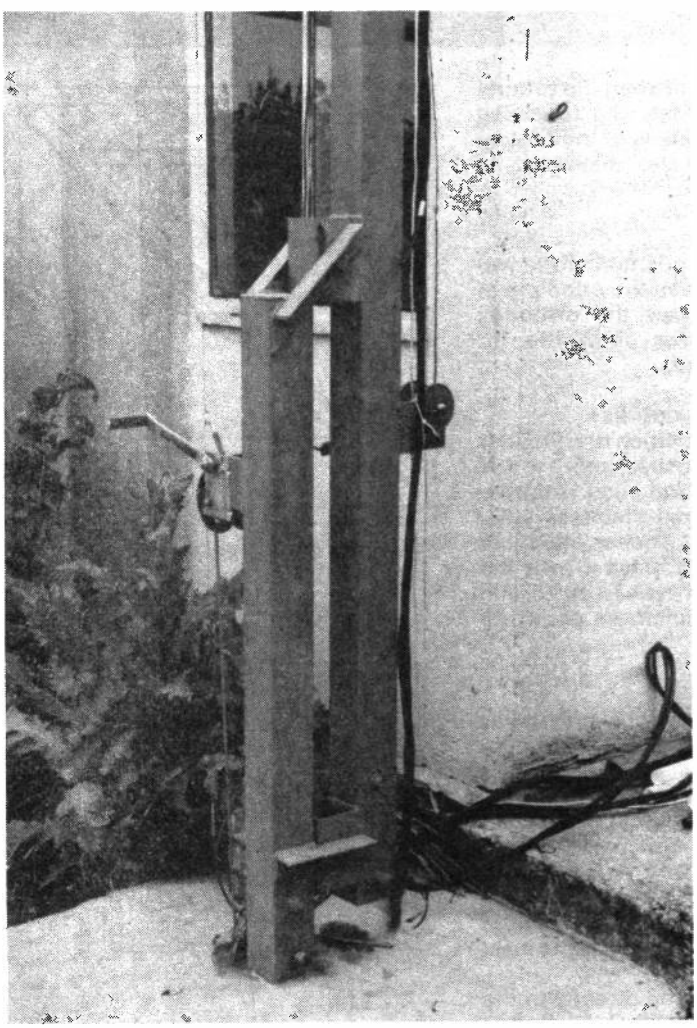


Figure 6 *Pulley mounting detail*



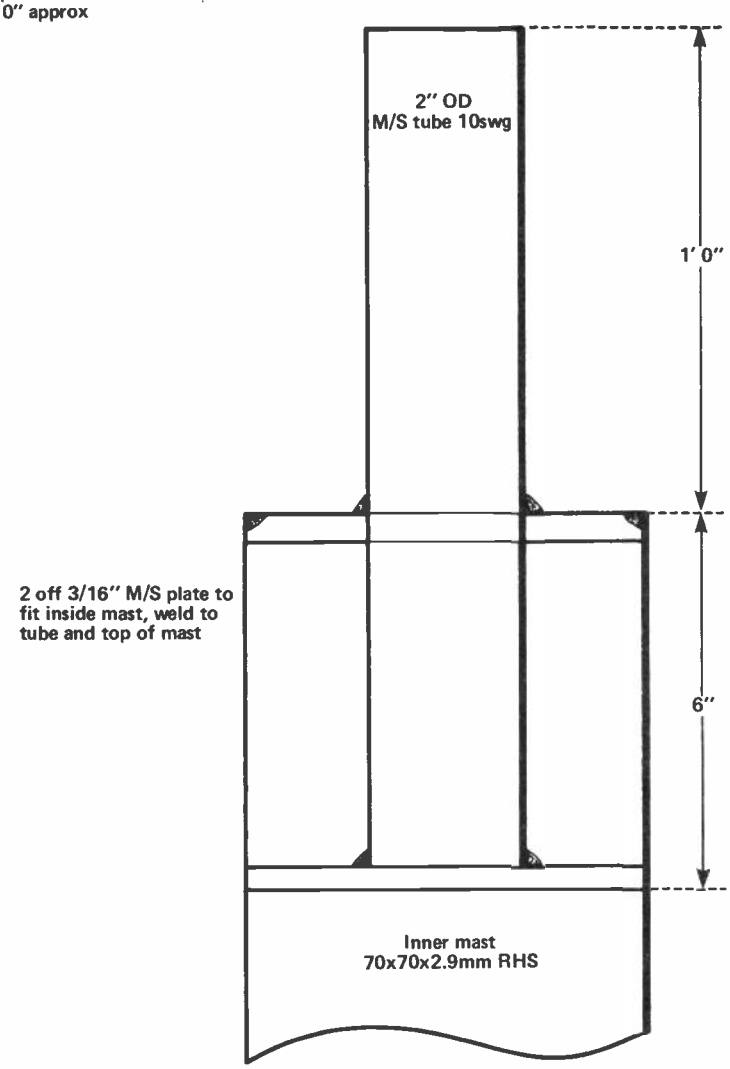


Figure 7a *Rotator mounting tube detail*

motion except up or down and is perfectly adequate for the task. The plate measures 4¾" x¼" x 3". The inner mast is slotted to take the plate before it is welded into position.

Holes are drilled in the guide plate for the stainless steel cable which will raise the inner mast. These may be of a size appropriate to the diameter of cable used. About 50 feet of 6mm cable is required.

Pass one end of it through holes 1 and 2, then clamp it in place at holes 3 and 4 as shown in *Figure 5d*.

The diagrams are self-explanatory and call for little comment beyond noting the remarks about positioning the blocks. Observe too the gaps for the locking block and the lift cable.

Observe the caution to use trial and error tactics before welding the 3" x¼" bar in order to ensure the pulley is mounted in the best position for alignment of the lifting cable. As shown in *Figure 6*, the actual position is not difficult to obtain, but one must ensure that the cable does not graze on the inner wall of the main mast, and that an even strain is imparted.

This fitting shown in *Figure 7a* is to take standard 2" dia. antenna mounting arrangements. Construction is simple and no problems should be encountered.

Winches

No details of winches have been shown

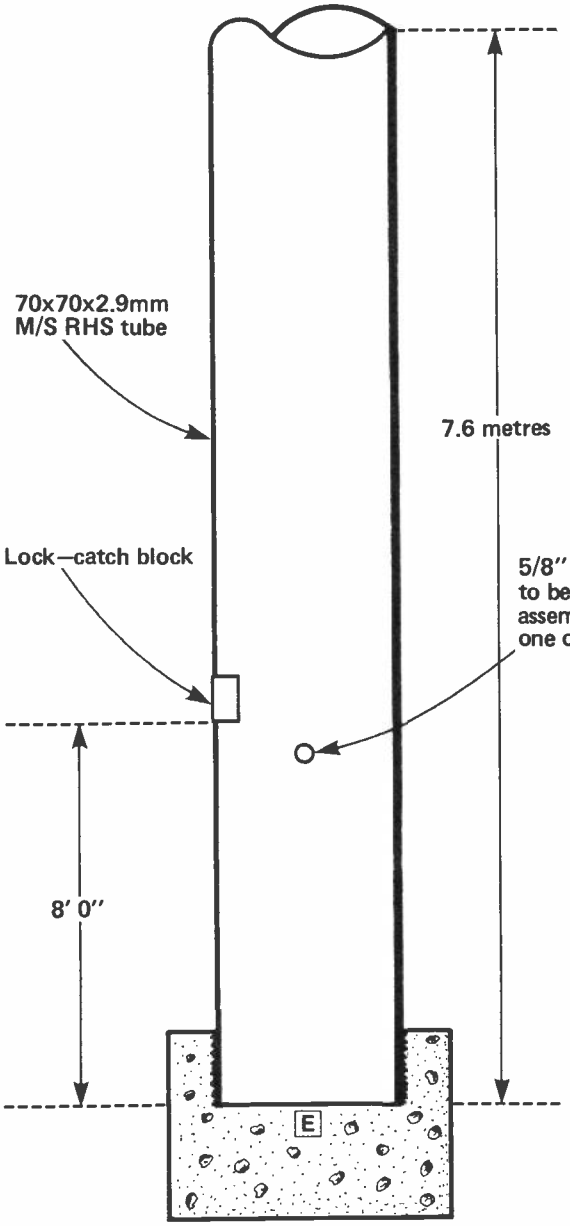


Fig 7b *Inner mast constructional detail*

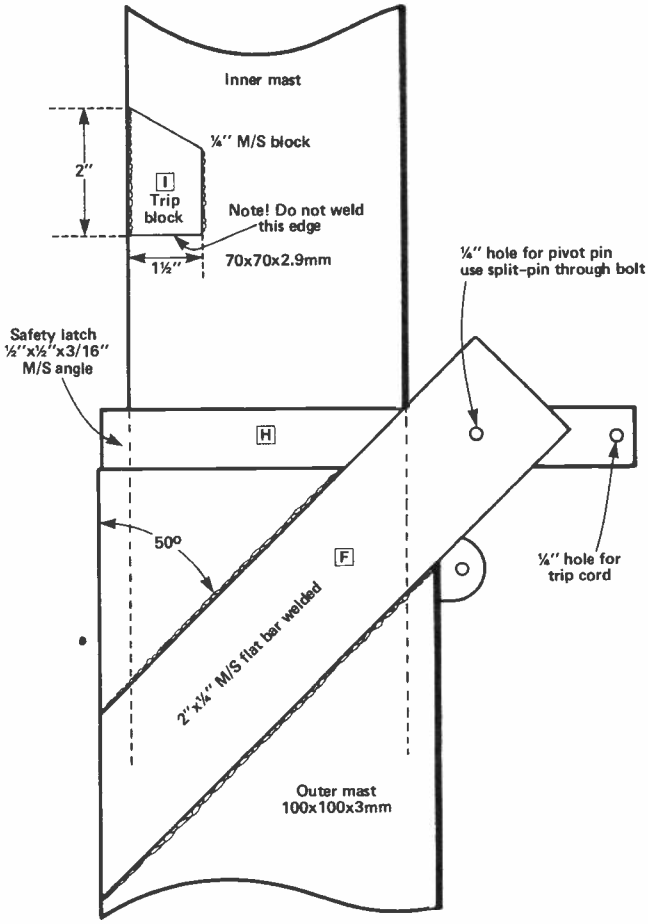


Fig 8 *Safety latch detail*

as these are readily obtainable from local trailer makers. Again, avoid your boatyard or ship's chandlers because their prices are often astronomical.

The luffing and telescoping cables may also be found at the trailer maker. If you bear in mind the weights and stresses involved in raising the mast you should have no problems in finding the right winches for the job.

Hints and tips

Obviously the first job is to dig the hole and to make the groundpost. Take the trouble to doublecheck all measurements before you cut or drill or do anything else.

Give the groundpost two coats of red oxide undercoat and three coats of black bitumastic. When this is finished, set it in the hole in the manner already described, and start building the mainmast. This can be painted in the same way. You will have a couple of weeks for this job as the groundpost requires this time to set solidly in the cement.

The rest of the mast can now be tackled and should be quite straightforward.

An additional refinement is to fit a 4' to 5' length of tube to a bracket about 15 feet up the mainmast. This is hinged by nut and bolt so that it hangs down when the mast is lowered and supports its weight.

No detail of the cord used for the safety latch has been shown either, as tough cord is readily obtainable from many sources.

The weight and balance of the safety latch is shown in *Figure 8*, and is of course sufficient to enable it to fall back into place when the block on the inner mast has passed it on the way up. But if any doubt should be experienced it is a simple matter to incorporate a mild spring.

Conclusion

Naturally the best bit has been left to the end. How do you lift the mainmast on to the groundpost? The best way (and probably the only way) is to get a few tough guys from the club to come round and help. A Saturday morning is not usually the best time as most local amateurs seem to be busy then.

Although the mainmast weighs nearly 400lbs it is by no means a daunting task to get it in place.

One little extra might be to make up a plastic cover to snugly fit over the inner mast at the junction of the mainmast to prevent water from getting in. A child's bucket and a little ingenuity are all you need for this task.

So there you have it! And the cost? Bearing in mind that I was able to tackle the greater part of the work myself, it came to between £85 and £100.

If you employ a welder then you must expect it to cost a little more, but then, a commercial mast will cost you anything from £285 to £300... Have fun!

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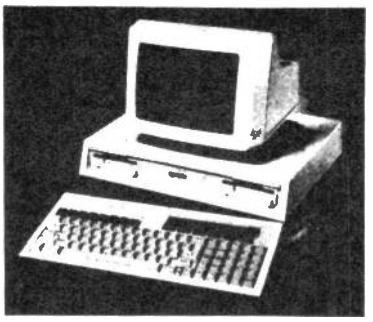

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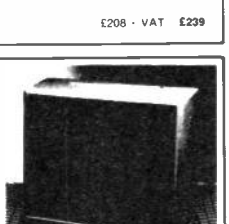

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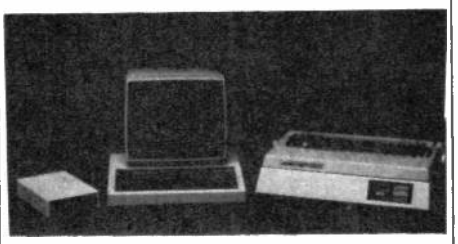

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IMPROVING RESISTORS

by Dr CJD Catto

There are occasions when it is worth winding a resistor oneself, for example when an odd value or high wattage low resistance is required. If a precision component is needed, it is advisable to make a four-terminal device, ie by bringing out the current and voltage leads separately. This is best done by spot-welding a pair of voltage tapping points, as shown in *Figure 1*.

Manganin is a convenient material to use for a low value, low temperature-coefficient resistor. It is a good idea to wind a loose non-inductive coil (see *Figure 1*): if the wire is on a former, differential expansion can make the wire act as a strain-gauge, and spoil the low temperature-coefficient of resistance.

There is also the thermal EMF between the manganin and the copper circuit wires, but this is only a few microvolts per °C, and its effect can be made negligible by using a symmetrical layout, with junctions isothermal. For higher powers, the wire can be suspended in a gently-stirred oil-bath.

Alternatively, a temperature-controller can be employed, as shown in the block diagram of *Figure 2*. The full circuit diagram is given in *Figure 3*, and its operation is described below.

Resistance wires made of copper-manganese or quaternary alloys[1] and certain film resistors have a temperature coefficient that passes through zero at some temperature. The circuit shown in *Figure 3* has been used to maintain a four-terminal resistor R_1 at its zero-TC point, despite changes in the current I_1 passed through it.

The auxiliary heater R_2 brings the block in which R_1 is embedded up to temperature, but the fan F_1 permits efficient extraction of heat if I_1 is increased.

The feedback loop using the thermistor bridge $T_1P_1R_{3-7}$ and the op-amp N_1 followed by the heater/fan combination ensures that the temperature settles rapidly. The speed of the fan motor is controlled by varying the load presented to the transformer-rectifier inserted in series with the ac supply and the motor. T_1 is mounted in the middle of the block, close to both R_1 and R_2, to minimise thermal overshoot, and a thermocouple junction T_2 is used to check the temperature.

It is important to bed R_1 in a resilient but thermally-conductive material (eg Redpoint Thermpath) to minimise strain-gauge effects. The potential-tapping points v+v- are symmetrically disposed, to minimise thermocouple effects.

The somewhat odd supply rails were chosen to fit in with the rest of the equipment, of which this circuit was but one part.

Readers will no doubt be able to simplify the circuit arrangements but, as in any analogue circuit dealing with small signals, it is worth keeping the ac and hum-bearing components separate from the 'precision' side as far as possible.

In the application described, R_1 was employed as the current-sensing resistor of an electromagnetic lens supply with a stability of the order of a tenth of one part per million!

Reference 1: GWC Kay & TH Laby 'Tables of Physical and Chemical Constants' 14th Edn, Longman 1975, pp 105-106.

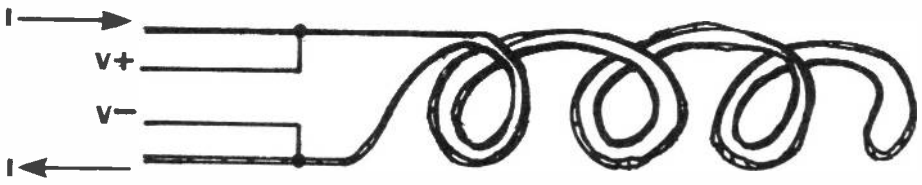


Figure 1 *Voltage tapping points*

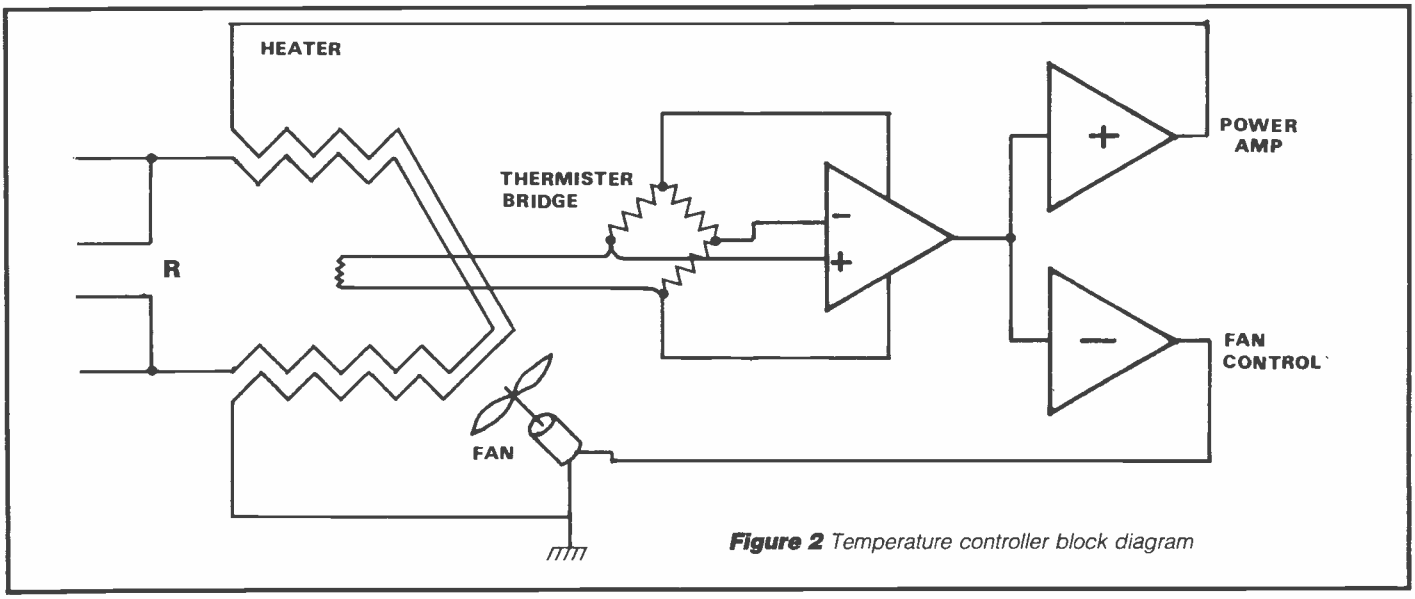


Figure 2 *Temperature controller block diagram*

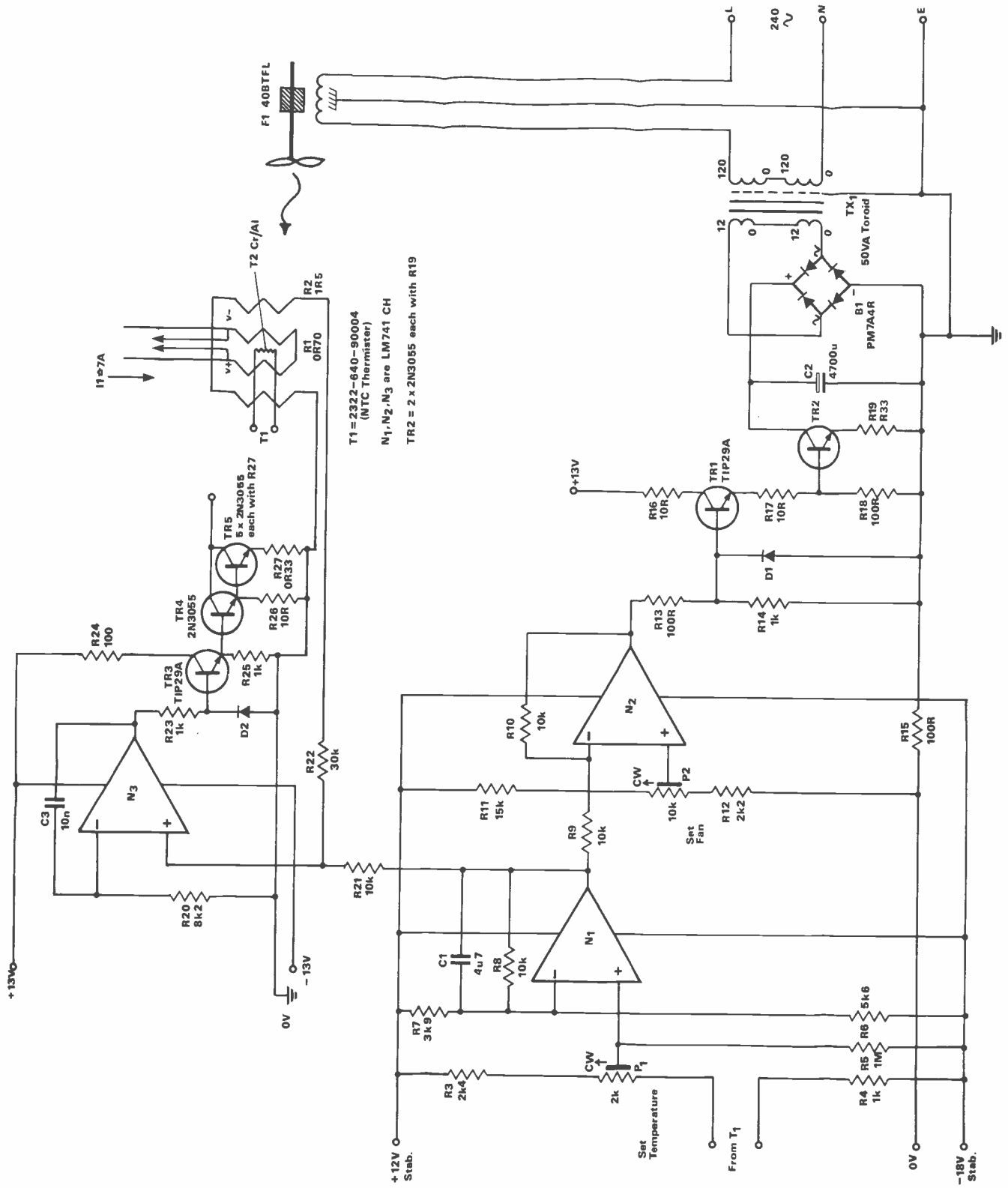


Figure 3 *Temperature control circuit*

SUMMARY OF GREEN PAPER ON MOBILE RADIO

Land mobile radio services, especially those in densely populated areas, have suffered from congestion of radio channels for a number of years with frustrating consequences for users and industry alike. But relief – in the form of the release of broadcasting Bands I and III for land mobile radio services – is at hand. This release of frequencies will double the amount of spectrum currently available for mobile radio services.

At the beginning of 1985 the 405-line television services in the United Kingdom will close down and the radio frequencies (known as Bands I and III) will become available for land mobile radio services. The growth of land mobile services (radiotelephone systems and other forms of mobile radio communication) has been inhibited for some years because of the shortage of suitable radio spectrum.

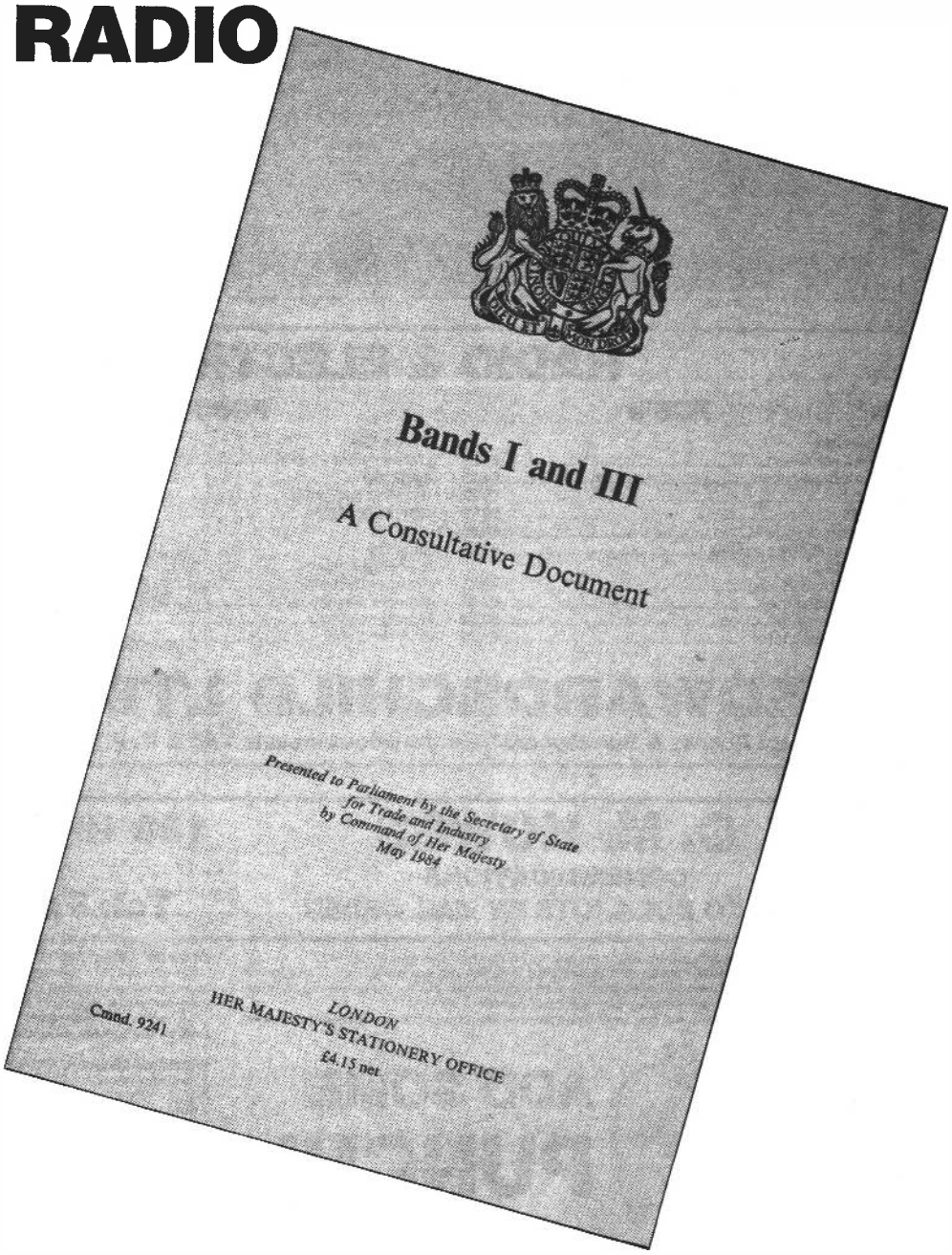
The release of Bands I and III will constitute one of the biggest ever additions to land mobile spectrum in the United Kingdom. At least 1000 channels should be available in London in Band III alone – a substantially larger block of spectrum than that to be used for the two cellular radiotelephone systems to be operated by Racal Vodafone, formerly Racal Millicom, and TSCR.

In spite of the restrictions imposed by the shortage of spectrum, the use of mobile radio has grown at a rate of eight per cent per annum or more for many years. If this were maintained, the number of mobile radios in use would more than double in 10 years.

The relief to the current congestion would, therefore, be only temporary unless the spectrum were used efficiently. The Government believe that multi-channel trunked radio systems, which offer considerable gains in spectrum efficiency, will make the best use of the available radio channels.

Individual users providing their own communication services are unlikely to justify the allocation of the blocks of channels necessary to achieve trunking gains and the Government have therefore identified service providers – companies offering communication services to others – as the likely major operators in Bands I and III.

If the approach that the Government suggest is adopted, it should be possible to meet the demands for mobile radio spectrum until the end of the century.



Opportunities

The release of such a large block of radio spectrum will permit an enormous increase in the use of mobile radio, in terms of the numbers of people having access to it and the range of services offered, and will lead to the creation of new jobs in both the manufacturing and the service industries.

Most radio communication in the UK is local in character. The spectrum in Band III will make it possible to set up a network of local and regional systems meeting this need.

The demand for mobile radio services will probably mean that the first systems are established in the London area and in the other main conurbations. In these areas, where the mobile radio bands are generally overcrowded, the systems will benefit both new and established users.

The former will be able to obtain an immediate service from a company operating in the new bands; the latter will have the option of transferring to one of the new services.

The size of the new systems has to be decided, but it is clear that there will be opportunities for large operators to bid for substantial blocks of 20 channels or more to provide trunked services and message handling facilities.

An operator of this scale would be capable of meeting the mobile communications requirements of even the largest existing private mobile radio systems.

The size of such an operator may suggest a need for it to accept certain obligations regarding access to the system by others: the Government will wish to consider any views that are expressed on this question.

Smaller operators should also be able to bid for more modest frequency allocations, with the prospect of expansion if they were successful.

Competition

The Government's belief is that the introduction of new competing services will be the best way of ensuring that the consumer's needs are met.

Within the new bands, competition, and the ability of successful companies to obtain additional radio channels, will

lead to the development of a range of radio services that reflects the range of consumer demands.

These services will also provide some additional competition to the newly established cellular radiotelephone operators. In this way the consumer will have a choice in the quality of service he obtains and the price he pays.

The question of competition with the cellular radiotelephone systems will be an important one. By 1989 the cellular operators will have achieved virtually national coverage. Before then it should be possible to judge whether there is a need for a further national radiotelephone system.

The existence of further systems would add to the competition in the provision of this type of service, and small and medium-sized systems in Band III will offer a local alternative to the cellular systems. The use of fully interconnected services on a substantial scale would, however, make significant inroads on the overall capacity on Band III to accommodate future mobile radio services.

There may also be implications for the development of the cellular systems which are undertaking major and high investments and are subject to special licence conditions and public interest obligations. A related question will also be the continuation of the existing VHF radiotelephone service operated by British Telecom.

New technology

The availability of the new block of spectrum should act as a stimulus to the development of new radio technologies. The Government propose that part of Band III should be used exclusively for the introduction of new and advanced communication systems, eg single side band and time division code multiplexing, since these offer the means of meeting future growth in demands for radio communication.

Companies with an interest in developing advanced communication systems may wish to put forward proposals for using this part of the band.

Operators

The Telecommunications Act 1984 provides that from July 1 1984 the Director General of Telecommunications should be available to advise the Secretary of State on what mobile radio services are required and how effective competition in their provision can best be ensured.

The selection of the operators in different areas, and decisions as to the number and size of operators will require careful consideration. The Government hope that the Director General will assist in reaching the necessary decisions.

The issues

The key issues addressed in the consultative document and on which the Government invite views are:

a) – what services should new systems be expected to provide?
– what size should the systems be initially?
– how many systems should be licensed in each area?
– what obligations and conditions should be attached?

b) – how should the candidates be selected?
– should restrictions be imposed on who is allowed to apply, in particular on public telecommunications operators and on manufacturers?

c) – should the Government license further national radiotelephone systems?
– should local services be permitted to provide full interconnection with the PSTN and if so what conditions should be imposed to avoid excessive demands on the spectrum?

There may be other issues that those commenting will wish to raise, but these are the ones the Government see as crucial to the introduction of fully competitive services benefiting all areas of Great Britain.

DATA COMMUNICATIONS

How to get started

In the 1980s, data communication by amateur radio takes many forms: RTTY, AMTOR, Packet Radio, mailboxes and digital repeaters are just a few examples. This article from *Datacom,* the journal of the British Amateur Radio Teleprinter Group, describes some of the more popular techniques, and outlines how BARTG can help individual amateurs to get started.

Different forms

RTTY, AMTOR and Packet Radio are all examples of digital data communication, allowing text or computer data to be transmitted to a distant point by radio.

RTTY *(Radio Teleprinter)* is the oldest and simplest of these modes, whereby messages typed at a teleprinter keyboard at one end of the radio link appear as printed characters at the other end, in the same manner as the familiar office telex machine. In fact, many amateurs still use surplus telex machines, but nowadays these are being replaced in many stations by home microcomputer systems with visual display units (VDUs), which are much cleaner and quieter and more flexible.

AMTOR *(AMateur Teleprinter Over Radio)* is a computer-driven data communication system, incorporating automatic error detection and correction facilities, dramatically reducing errors caused by interference. The main characteristic of AMTOR is that messages are broken down into 3-character blocks, and the receiving station acknowledges successful receipt of each block before the transmitting station sends the next one. Messages are transmitted at about the same speed as RTTY, and almost all the errors appearing at the receiving end are due to typing mistakes!

Packet Radio is a more complex mode, intended for high integrity data links. The main features of Packet Radio are its very low undetected error rate, message transfer speeds about 15-20 times faster than RTTY or AMTOR, and the capability automatically to route messages to specified destinations. Packet Radio also allows several independent QSOs to be conducted at the same time on a single frequency, thus conserving valuable spectrum space.

The basic requirements

All of these modes of data transmission have very similar basic requirements. At the transmitting end, message characters are encoded into streams of bits (binary digits, or elements), which can have two states: by convention, a binary '1' is usually called the *Mark* state, and a binary '0' is called the *Space* state. These bits are fed into a Tone Generator, such that a *Mark* produces a high audio frequency tone, and a *Space* produces a low audio frequency tone. It is these tones which modulate the transmitter.

At the receiving end, the high and low audio tones appearing at the loudspeaker or headphone output of the receiver are routed to a Terminal Unit (TU). The TU detects the tones and converts them back to *Mark* and *Space* signals to drive the teleprinter or computer.

Character codes

The sequence of *Mark* and *Space* bits used to represent each character is agreed internationally. Several different codes are used, depending on the mode.

In standard RTTY, each character is represented by 5 data bits, plus Start and Stop bits, as defined in the International Telegraph Alphabet (ITA) No 2. Also used in RTTY are the Murray and Baudot codes, which are similar to ITA2.

A further code sometimes used in RTTY is the International Telegraph Alphabet No 5. This has 7 data bits per character, and is more or less the same

as the American Standard Code for Information Interchange (ASCII, pronounced 'askee'), used in almost all home computers.

AMTOR uses a special 7-bit code defined in CCIR Recommendation 476. The main characteristic of this code is that all valid characters contain a combination of 4 *Mark* bits and 3 *Space* bits. This fact is made use of at the receiver – if a received character contains this combination of *Marks* and *Spaces* it is assumed to be valid, but if not it is rejected. AMTOR uses synchronous transmission, and message characters do not have Start or Stop bits.

Packet Radio uses ASCII for message characters, together with special control characters for packet framing, routing and error checking. The way in which these characters are used is defined in the recently agreed AX.25 protocol, which closely resembles the High Level Data Link Control (HDLC) protocol used in commercial packet networks.

Speeds

For ITA2, the two speeds in general use are 45.45 and 50 baud. The former is by far the most popular on the HF bands, because of the worldwide availability of surplus American equipment. However, the increasing availability of 50 baud telex machines in Europe means that there is now a trend to this speed, particularly at VHF.

For ITA5/ASCII, the most usual speeds are 110, 300, 600 and 1200 baud.

For AMTOR, the speed is always 100 baud. However, because of the error detection techniques used in this mode, about half the time is taken up by handling control codes, so the effective message rate is about the same as 50 baud RTTY.

Most present day Packet Radio networks operate at VHF/UHF, allowing high data rates, typically 1200 baud. However, Packet Radio is still in its infancy, and it is likely that other standards will emerge in due course.

The signal

As mentioned above, the usual way of sending a data signal is by modulating the transmitter with the *Mark* and *Space* tones. In practice, these tones are used to produce frequency shift keying (FSK). The most common method is standard FSK, whereby the *Mark* tone appears as one radiated frequency and the *Space* tone is 170Hz below this frequency. The 170Hz shift is standard for all lower speeds, with 425Hz and occasionally 850Hz being used at the higher speeds.

At VHF, use of Audio Frequency Shift Keying (AFSK) of an FM transmitter is popular. The standard frequencies are 1445Hz for *Mark* and 1275Hz for *Space*.

Where to find data signals

Data signals are to be found on virtually all bands from 160m to 70cm. FSK is the only mode used on the HF bands, but both FSK and AFSK are used at VHF. The most popular frequencies in use today are:

RTTY: 3.590, 14.090, 144.600, 145.300 and 432.600MHz

AMTOR: 3.588, 14.075 and 144.590MHz

RTTY repeaters operate on 70cm.

The equipment

The equipment required to operate RTTY can be very simple. The cheapest approach is to buy a teleprinter for a few pounds and to connect this to a home-made Tone Generator (for transmission) and a Terminal Unit (for reception). BARTG publishes a book entitled *RTTY the Easy Way*, which contains full circuit and constructional details of suitable units, together with full information on how to connect them together and set them up. As an alternative to a mechanical teleprinter, the home micro can be used instead, and several trade suppliers provide suitable RTTY programs for the more popular machines.

To run AMTOR, a more ambitious setup is needed. This can be a complete 'black box', or alternatively there are kits available containing the necessary control hardware and software, for interfacing to an existing teleprinter or micro.

A similar situation exists in the world of Packet Radio, which requires a complex Terminal Node Controller (TNC) to handle the transmission and reception of packets. Again, TNCs are available as 'black boxes' or as kits.

BARTG

The British Amateur Radio Teleprinter Group was formed in 1959, and exists to encourage and promote interest in all modes of data communication. The Group publishes a regular magazine covering technical matters, contest news, tutorials for beginners and general gossip. Other services include a Sunday RTTY news bulletin, contest sponsorship, and the supply of specialist components and books.

Most important, the Group offers advice and assistance to individual members to get their systems working. The current annual membership subscription is £5. No application form is necessary – simply send the £5 (cheques etc made payable to 'BARTG'), together with a note of your name, address and callsign (or a QSL card) to Mr John Beedie, G6MOK, 161 Tudor Road, Hayes, Middlesex UB3 2QG. Tel: 01-561 0010.

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COMPUTING TRANSMISSION LINES

By Brian Kendal, G3GDU

Whenever a radio signal is passed along a wire, that wire, together with its environment forms a transmission line which has a characteristic impedance – and losses.

In most equipment, wiring is kept short and, in consequence, losses are minimal. Sometimes, however, particularly at the higher frequencies, even the shortest connections are significant in terms of wavelength and losses can only be minimised by matching the impedance of these connections to their associated circuits.

When designing and constructing aerials, it may often prove necessary to insert a quarter wave matching section of some unusual impedance. Often this is achieved by paralleling lines of standard impedance, such as using two lengths of 300ohm ribbon to make a 150ohm section, but if the required impedance is known, it is often quite simple to manufacture an accurate section from materials at hand.

A more common example is in the construction of VSWR meters. Many of these use the case as the screen of the transmission line.

Consequently the selection of the correct diameter of wire between the input and output connectors can ensure that the correct impedance is maintained.

The insertion of the meter in an aerial circuit will not then upset the VSWR previously attained nor affect the loading on the transmitter.

In each of these and many more cases, it is quite possible to calculate the necessary parameters with pencil, paper and a book of log tables.

Recently, however, when working on a problem which required this type of calculation, it occurred to me that a program for calculating the parameters of the most common forms of transmission lines would form a most useful addition to my program library.

The formulae for the calculations were found in the *Radio Data Reference Book* by G Jessop G6JP, published by the RSGB. This gives the basic impedance calculations for seven types of transmission line.

One of these formulae is unfortunately ambiguous, so it was decided to omit this from the program until it could be confirmed from an alternative source.

The program may be considered to comprise seven sections, the menu and calculations for each of the six different types of transmission line.

The menu (lines 10 to 210)

This is the section of the program in which the various options are listed and the appropriate calculation selected.

This description is for the BBC Model B Micro, but could be adapted for other popular machines.

The first line of significance is '30 MODE 6'. Prior to writing this program, it had been decided that wherever possible, simple diagrams of the selected transmission line should be given.

MODE 6 was chosen as an appropriate low definition mode which could also be output to the printer without a graphics screen dump routine. On line 70, the gap between the words 'USING' and 'AIR' is to prevent the latter word being split onto two lines and also improve the presentation of the display. This technique has also been used elsewhere in the program.

Some readers may be unfamiliar with the style of line 210. This is a single line statement which equates exactly to:

```
PRINT 'SELECT REQUIRED CALCULATION' INPUT A
```

The succeeding line, 220 is also a complex statement, this being the equivalent of:

```
IF A = 1 GOTO 230
IF A = 2 GOTO 650 etc.
```

However, only six valid alternatives exist but it is possible for 0 or a higher number than six to be keyed in. This would confuse the computer and cause it to initiate an error message. To prevent this, the line is completed by:

```
ELSE GOTO 10
```

which, if an invalid selection is made, loops the program back to the beginning.

At this point it might be worthwhile to explain the PRINT statements which appear throughout the program. It is well known that this causes a blank line.

In some cases, however, it appears as 'PRINT" or 'PRINT"', these causing the computer to output two or three blank lines. Some computers, such as the ZX81, will not accept this statement and it will be necessary to include a separate 'PRINT' statement for each blank line required.

Calculations

The second part of the program starts with a CLS in order to remove the menu from the screen. This is followed by a simple diagram. In this, the parallel lines are built up from 'underlines' and the arrow heads on lines 270 and 300 are the 'raise the power' symbol whilst that on line 290 is a lower case 'V'.

The three parameters for a parallel

TRANSMISSION LINE FORMULAE

PARALLEL STRIPS (SLAB LINES)

$Z = 377\ a/b$ if $a<b$

where a is the spacing and b is the width of the line

PARALLEL WIRE

$Z = 276 \log D/d$ if $d<D$

where d is the diameter of the wire and D the spacing

WIRE PARALLEL TO INFINITE PLANE

$Z = 138 \log D/d$ if $d<D$

where d is the diameter of the wire and D the spacing

WIRE PARALLEL TO TWO INFINITE PLANES

$Z = 138 \log [(4D)/(2\pi)]$ if $d<D$

where d is the diameter of the wire and D the spacing

CIRCULAR COAXIAL

$Z = 138 \log (1.178D)/d$

where d is the diameter of the inner wire and D the side length of the outer

COMPUTING TRANSMISSION LINES

```
 10 REM  THIS PROGRAM CALCULATES THE    CHARACTERISTIC IMPEDENCE OF VARIOUS
TYPES OF TRANSMISSION LINES
 20 REM    BY BRIAN KENDAL, G3GDU
 30 MODE6
 40 CLS
 50 PRINT
 60 PRINT
 70 PRINT "IMPEDENCE OF TRANSMISSION LINES USING              AIR DIELECTRIC"

 80 PRINT'
 90 PRINT "1.  PARALLEL STRIPS"
100 PRINT
110 PRINT "2.  PARALLEL WIRE"
120 PRINT
130 PRINT "3.  WIRE PARALLEL TO INFINITE PLATE"
140 PRINT
150 PRINT "4.  WIRE BETWEEN TWO INFINITE PLATES"
160 PRINT
170 PRINT "5.  CIRCULAR COAXIAL"
180 PRINT
190 PRINT "6.  SQUARE COAXIAL"
200 PRINT ''
210 INPUT"SELECT REQUIRED CALCULATION",A
220 ON A GOTO 230,650,1040,1460,1900,2010 ELSE GOTO 10
230 CLS
240 PRINT'
250 PRINT"  PARALLEL STRIPS (SLAB LINES)"
260 PRINT "            -------- "
270 PRINT "               ^"
280 PRINT "               a        if a<<b"
290 PRINT "            ---v----"
300 PRINT "            ^       ^"
310 PRINT "            :   b   :"
320 PRINT
330 INPUT " DO YOU REQUIRE a, b or Z",B$
340 IF B$="a" GOTO 380
350 IF B$="b" GOTO 490
360 IF B$="Z" GOTO 570
370 GOTO330
380 PRINT
390 INPUT "     INPUT b ",b
400 PRINT
410 INPUT "     INPUT Z ",Z
420 PRINT
430 PRINT "THEN a =  "(b*Z)/377
440 PRINT
450 INPUT "PRESS C FOR FURTHER CALCULATION OR M FOR MENU",X$
460 IF X$="C" GOTO230
470 IF X$="M" GOTO10
480 GOTO450
490 PRINT
500 INPUT "     INPUT a ",a
510 PRINT
520 INPUT "     INPUT Z ",Z
530 PRINT
540 PRINT "THEN b =  "(377*a)/Z
550 PRINT
560 GOTO450
570 PRINT
580 INPUT "     GIVE a",a
590 PRINT
600 INPUT "     GIVE b",b
610 PRINT
620 PRINT "THEN Z =  "(a*377)/b  "ohms"
630 PRINT
640 GOTO450
650 CLS
660 PRINT'
670 PRINT"          PARALLEL WIRE"
680 PRINT"           (TWIN LINE)"
690 PRINT''
700 PRINT"LET d BE WIRE DIAMETER AND D THE SPACING"
710 PRINT'
720 INPUT "       DO YOU REQUIRE d,D OR Z",W$
730 CLS
740 IF W$ ="d" GOTO770
750 IF W$ ="D" GOTO880
760 IF W$ ="Z" GOTO960
770 PRINT''
780 INPUT "     INPUT D",D
790 PRINT
800 INPUT "     INPUT Z",Z
810 PRINT
820 PRINT "     THEN  d =",((2*D)/(10^(Z/276)))
830 PRINT''
840 INPUT "   PRESS C FOR FURTHER CALCULATION OR M FOR MENU",U$
850 IF U$="C" GOTO650
860 IF U$="M" GOTO 10
870 GOTO840
880 PRINT''
890 INPUT "     INPUT d",d
900 PRINT
910 INPUT "     INPUT Z",Z
920 PRINT
930 PRINT "     THEN D =",(d*(10^(Z/276)))/2
940 PRINT''
950 GOTO840
960 PRINT''
970 INPUT"     INPUT d",d
980 PRINT
990 INPUT "     INPUT D",D
1000 PRINT
1010 PRINT "     Z   =  ",(276*LOG((2*D)/d))," ohms"
1020 PRINT
1030 GOTO 840
1040 CLS
1050 PRINT''
1060 PRINT "   WIRE PARALLEL TO INFINITE PLATE"
1070 PRINT''
1080 PRINT"                    o"
1090 PRINT
1100 PRINT"                ------------"
1110 PRINT
1120 PRINT"  d = DIAMETER OF WIRE AND D = SPACING"
1130 PRINT'
1140 INPUT"  DO YOU REQUIRE d, D OR Z",S$
1150 IF S$="d" GOTO1180
1160 IF S$="D" GOTO1290
1170 IF S$="Z" GOTO1380
1180 PRINT''
1190 INPUT"       INPUT D ",D
1200 PRINT
1210 INPUT"       INPUT Z ",Z
1220 PRINT
1230 PRINT"       THEN d =",(D/10^(Z/138))
1240 PRINT''
1250 INPUT"   PRESS C FOR FURTHER CALCULATION OR M FOR MENU",R$
1260 IF R$="C" GOTO1140
1270 IF R$="M" GOTO10
1280 GOTO1250
1290 PRINT''
1300 INPUT"       INPUT d ",d
1310 PRINT
1320 INPUT"       INPUT Z ",Z
1330 PRINT
1340 PRINT"       THEN D = ",(d*10^(Z/138))
1350 PRINT''
1360 GOTO1250
1370 GOTO1360
1380 PRINT''
1390 INPUT"       INPUT d ",d
1400 PRINT
1410 INPUT"       INPUT D ",D
1420 PRINT
1430 PRINT"       THEN Z = ",(138*LOG(D/d)) "ohms"
1440 PRINT''
1450 GOTO1250
1460 CLS
1470 PRINT''
1480 PRINT" WIRE PARALLEL TO TWO INFINITE PLATES"
1490 PRINT''
1500 PRINT"                ----------"
1510 PRINT"                     ^"
1520 PRINT"                     o     D"
1530 PRINT
1540 PRINT"                ----------v"
1550 PRINT''
1560 PRINT"   WIRE OF DIAMETER d PLACED CENTRALLY      BETWEEN TWO INFINITE PLAT
ES SPACED D"
1570 PRINT''
1580 INPUT"  DO YOU REQUIRE d, D OR Z",O$
1590 IF O$="d" GOTO 1620
1600 IF O$="D" GOTO 1730
1610 IF O$="Z" GOTO 1820
1620 PRINT''
1630 INPUT"      INPUT D ",D
1640 PRINT
1650 INPUT"      INPUT Z ",Z
1660 PRINT
1670 PRINT"      THEN d =",(4*D)/(PI*(10^(Z/138)))
1680 PRINT''
1690 INPUT"PRESS C FOR FURTHER CALCULATION OR M FOR MENU",N$
1700 IF N$="C" GOTO1460
1710 IF N$="M" GOTO10
1720 GOTO1690
1730 PRINT''
1740 INPUT"       INPUT d ",d
1750 PRINT
1760 INPUT"       INPUT Z ",Z
1770 PRINT
1780 PRINT"       THEN D = ",((PI*d)*(10^(Z/138)))/4
1790 PRINT''
1800 GOTO1690
1810 GOTO1800
1820 PRINT''
1830 INPUT"       INPUT d ",d
1840 PRINT
1850 INPUT"       INPUT D ",D
1860 PRINT
1870 PRINT"       THEN Z = ",(138*LOG((4*D)/(PI*d))) " ohms"
1880 PRINT''
1890 GOTO1690
1900 CLS
1910 PRINT''
1920 PRINT"          CIRCULAR COAXIAL"
1930 PRINT''
1940 PRINT "    INNER CORE DIAMETER d AND SCREEN                DIAMETER D"
1950 PRINT''
1960 INPUT" DO YOU REQUIRE d, D OR Z ",K$
1970 IF K$="d"GOTO1190
1980 IF K$="D"GOTO1290
1990 IF K$="Z"GOTO1380
2000 GOTO1960
2010 CLS
2020 PRINT'
2030 PRINT"              SQUARE COAXIAL"
2040 PRINT
2050 PRINT"                 ------------ "
2060 PRINT"                 |          |"
2070 PRINT"                 |          |"
2080 PRINT"                 |          |"
2090 PRINT"                 |    o     |"
2100 PRINT"                 |          |"
2110 PRINT"                 |          |"
2120 PRINT"                 |          |"
2130 PRINT"                 ------------"
2140 PRINT"INNER WIRE DIAMETER d, OUTER CASE SIDE D"
2150 PRINT'
2160 INPUT" DO YOU REQUIRE d, D OR Z",J$
2170 IF J$="d" GOTO2210
2180 IF J$="D" GOTO2320
2190 IF J$="Z" GOTO2400
2200 GOTO 2160
2210 PRINT''
2220 INPUT"    INPUT D ",D
2230 PRINT
2240 INPUT"    INPUT Z ",Z
2250 PRINT
2260 PRINT"    THEN d = "(1.178*D)/(10^(Z/138))
2270 PRINT
2280 INPUT"  PRESS C FOR FURTHER CALCULATION          OR M FOR MENU",I$
2290 IF I$="C" GOTO 2010
2300 IF I$="M" GOTO10
2310 GOTO2280
2320 PRINT''
2330 INPUT"    INPUT d ",d
2340 PRINT
2350 INPUT"    INPUT Z ",Z
2360 PRINT
2370 PRINT"    THEN D = "(d*10^(Z/138))/1.178
2380 PRINT
2390 GOTO2280
2400 PRINT''
2410 INPUT"    INPUT d ",d
2420 PRINT
2430 INPUT"    INPUT D ",D
2440 PRINT
2450 PRINT"    THEN Z = ",138*LOG((1.178*D)/d), "ohms"
2460 PRINT
2470 GOTO2280
2480 END
```

strip line are line spacing (a), line width (b) and impedance (Z). Line 330 asks which of these is required.

In an INPUT statement, the computer expects the answer to be a number and will not accept a letter. It will, however, accept a 'string variable', so the requirement can be satisfied by the term 'B$'.

The formula for parallel strip lines is

$$Z = 377 \times (a/b)$$

when b is much larger than a.

This expression can also be transposed to give either 'a' or 'b' in terms of the other two parameters.

Lines 340 to 360 select the appropriate calculation and line 360 is a simple method of repeating the question should an invalid selection be made.

In the first of these calculations, the known parameters are input on lines 390 and 410, and the calcualtion is performed on line 430.

Line 450 invites either a further calculation or a return to menu, this being achieved at lines 460 and 470 with Line 480 as a 'backstop' in case of an invalid selection.

The alternative transpositions of the formula are handled in the same way in Lines 490 - 560 and 570 - 640, the only difference being that the selection of further calculation or menu is achieved by looping back to Line 450 with a GOTO statement.

With one exception, each section of the program works in the same way, the only difference being the graphics and the formulae. The single exception is for 'Circular Coaxial' for which the formula is the same as that for 'Wire Parallel to an infinite Plate'.

For this, it seemed superfluous to repeat the calculation, so after selecting the required parameter, the program was looped back to the appropriate part of the earlier section.

Testing and using the program

The best, in fact the only way to test a program is to run it, so, after having input the program, key 'RUN'.

On the screen should appear a menu giving six options. First, however, check the invalid selection routine by keying '7', '8', or '9'. The screen should just flicker and the input number disappear.

Now check the first option: 'Parallel Strips'. Press '1' and the screen should change to a diagram in the upper part of the screen with the question below:
'DO YOU REQUIRE a, b OR Z'.

Select 'a' and the words 'INPUT b' will appear. Input a number (say 10) and 'INPUT Z' will be printed beneath. Input another number (say 100) and below will be written:
'THEN a = 2.65251989'
and further down the screen:
'PRESS C FOR FURTHER CALCULATION OR M FOR MENU'.

Press 'C' and the previous calculation will be deleted and the diagram plus 'DO YOU REQUIRE a, b OR Z' will return.

This time select 'b' and use the result of the previous calculation with the value of Z as before.

If the formula has been correctly entered, the answer should be the original 'b'. If all is well, again repeat using 'a' and 'b' to calculate 'Z'.

Using this technique, each section may be checked and if all is well, the program may be used with confidence.

Postscript

This program was written for the BBC 'B' OS 1.2 computer. As only about 5K of memory is used, it should also be suitable for the BBC 'A'. For other makes of machine, it is possible that the graphics may not prove suitable. If so, 'MODE 6' on line 30 and the lines describing the graphics throughout the program could be removed without any effect on the calculations.

Minor alterations may also be necessary due to variations in the dialect of these machines.

A final and very important point to remember is that all the calculations have assumed an air dielectric. Should any other material be used, the value of Z calculated should be multiplied by $1/\sqrt{K}$ where K is the dielectric constant of the material.

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ONE NIGHT'S WORK

EP44 EXTRAS

by A M Tucker

The Brother EP44 is a very useful typewriter and printer, but if one does a lot of listing or typing it is advisable to use a power pack.

Not all 6V supplies are suitable, as the printer solenoid causes a current pulse of several amperes, and if the power source does not have a low impedance, the input voltage falls to a point where the data is corrupted.

The makers supply a suitable mains unit, but unless this is left permanently switched on, the plug to the printer must be withdrawn when not in use so that the internal batteries will keep the memory refreshed.

To avoid this inconvenience, I decided to use rechargeable batteries, coupled to a 12V dc supply which I already had. The circuit is shown in *Figure 1*.

Four cells are used, giving a nominal 4.8V-5V, but provided they are kept well charged the working voltage is about 5.5V and the printer operates on 32 column listings, which are the most demanding as regards power supplies.

The circuit is very simple, comprising four ½C cells (1.2AH) in series, charged by a constant current using a BD136 regulated to about 100mA. A green LED gives a reference voltage between input and base, and also indicates that the circuit is operating.

Optionally, a switch can be fitted to cut out the charging, or, as shown by dotted lines on *Figure 1*, to give a trickle charge. The whole unit is housed in a suitable box, the transistor being mounted on an aluminium strip, more for convenience than for a heatsink (*Figure 2*).

A lead with an output connector to fit the EP44 is required: *note* that the centre socket of the connector is *negative* and the outer sleeve is *positive*.

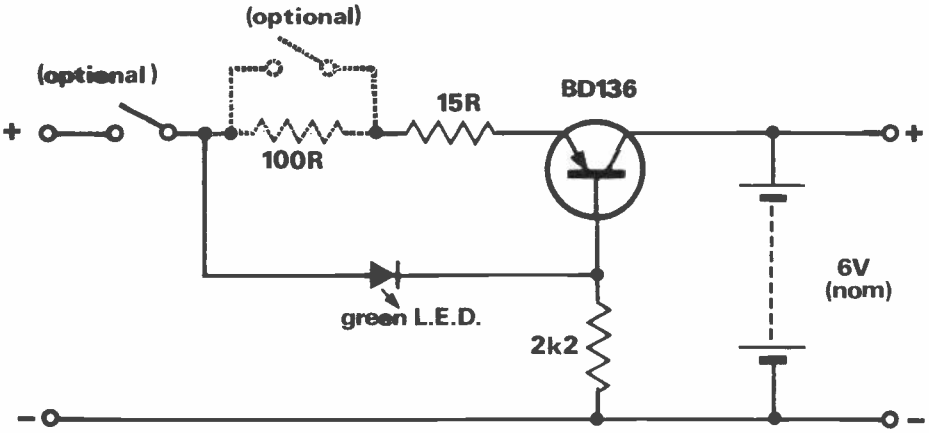

Figure 1 *Circuit diagram*

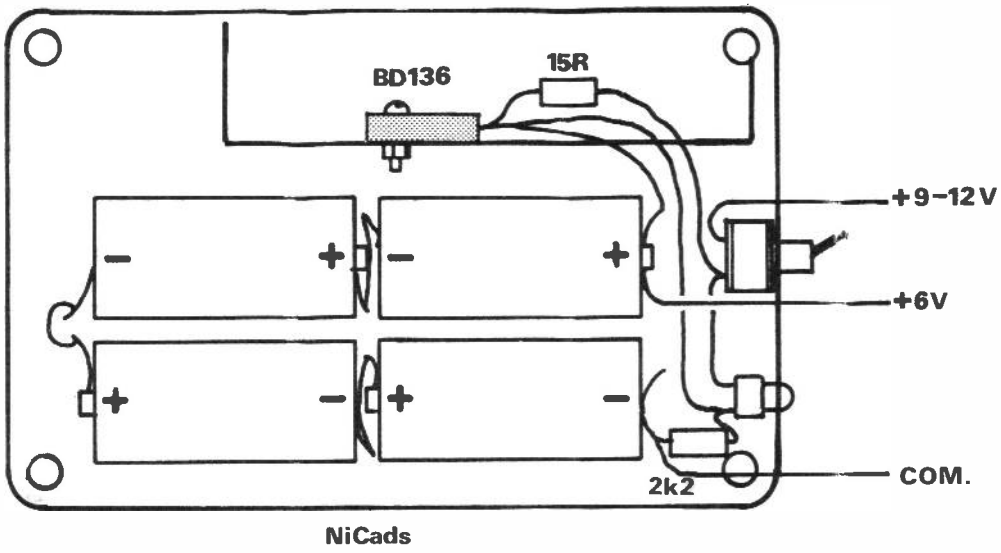

Figure 2 *Component layout*

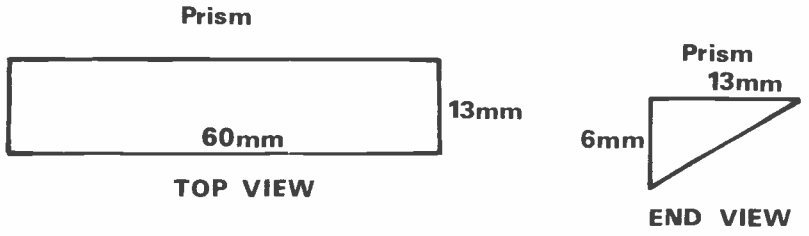

Figure 3 *Prism constructional detail*

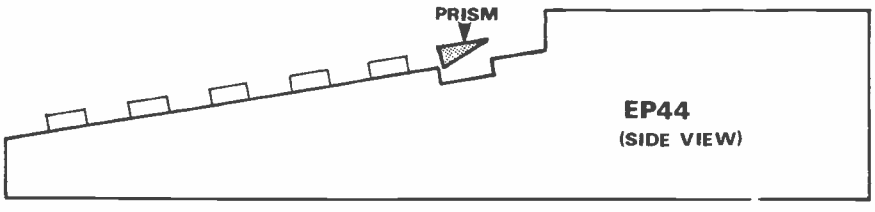

Figure 4 *Prism location*

Typing aid

This device is an aid to typing, as it was found that the LCD display viewing angle is such that one must lean over the keyboard to read it. A wedge prism is made to fit over the display (*Figure 3*). This gives a greatly improved viewing angle. The prism can be cut and filed from ¼inch perspex, and polished with fine wet and dry paper and metal polish.

Small pieces of card or thin plastic are glued to the ends as supports. The top surface should be roughly parallel with the keyboard, and it is fitted as shown in *Figure 4*.

The dimensions are not critical: within limits, the greater the angle of the prism, the further back one can sit and view the display, but the design shown seems satisfactory.

AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

Greenwich Mean Time Centenary

The Greenwich Mean Time Centenary was celebrated by radio amateurs by the operation of two stations with the callsigns GB0GMT and GB1GMT respectively. These stations were operated by the St Dunstan's College ARS throughout June. Contacts made will be confirmed in due course, by a special QSL card supplied by the National Maritime Museum.

The measurement of 'Time' goes back to antiquity – possibly as far back as 1500 years BC. The activities of man have, from the creation, been regulated by the natural time scale provided by the daily rotation of the earth giving periods of light and dark, ie day and night.

The first man-made time recorders kept a record of the position of the sun in the sky during its daily apparent passage from sunrise to sunset and even today, the time scale adopted for general use must approximate to solar time.

In the 19th century, there were observatories in many countries making observations for the determination of time. Attempts were made to co-ordinate these activities and in 1884 an international conference was held in Washington DC, USA, at which it was agreed that the meridian of Greenwich, England, should be standard reference meridian for the measurement of time – hence the origin of Greenwich Mean Time.

The measurement of time is now a most sophisticated scientific discipline. It has come a long way from sundials to ceasium beam atomic clocks, with their split second accuracy. Chod Harris, VP2ML, gives a very good description of 'WWV,' the Time and Frequency Radio Station at Boulder, Colorado, in his 'DX' column in the April last *73 Magazine*.

Readers interested in this topic should read it. Chod makes a case for every amateur radio station operator interested in DX having one very accurate clock in the shack, set at UTC. Whilst we don't go quite so far as he makes out in his column, we do agree that a really accurate clock is a boon in the shack.

The writer acquired several years ago one of Cambridge Kits' MSF Radio Clocks. This is a real 'radio clock,' in that it receives radio signals from the British Time Signal radio station at Rugby on 60KHz and displays them in real time on a digital display unit.

This gives absolutely accurate time and whilst occasional severe electrical interference or very poor propagation conditions may at times distort the display – when the error is quite obvious.

UOSAT-2 back in action

No doubt, by the time this appears in print, most readers will have heard the good news that UOSAT-2 is back in action, transmitting telemetry data again – after ten weeks silence.

Problems arose on the morning after launch, when UOSAT-2 did not respond to repeated commands from the Surrey University Satellite Command Station. Then began a long series of checks to establish the cause of the trouble, made all the more difficult by the fact that according to the telemetry so far recorded, there was nothing wrong at all! Daily attempts to gain command continued to prove unsuccessful.

Then, over the weekend of May 12, radio amateurs at the Stanford Research Institute, California, using a very sensitive radio receiving station located in Greenland, picked up faint signals on 1.2GHz. These indicated that the command receiver of UOSAT-2 was switched on. This important discovery confirmed not only that the spacecraft was still operating, but also that it was in its predicted orbit.

Armed with this encouraging information, Neville Bean and Roger Peel, of the University of Surrey UOSAT Project team, made a further attempt on Monday 14 May, to recover command of UOSAT-2.

Attempts using 144MHz were unsuccessful but, on the next orbit, commands using 438MHz resulted in the main data beacon being powered-up! The signals from the beacon are again as strong as they were immediately following launch and the telemetry indicates all seems pretty okay. The battery voltage is 14.6 volts, which is as it should be and the temperature of the satellite is between -5 to 0 degrees centigrade, ie within expected values. More tests can now be initiated, to see if the cause of the shutdown can be ascertained.

Computerisation of licensing

The licensing of radio amateurs is now being administered by the Post Office on behalf of the Department of Trade and Industry, who remain responsible for all the other aspects of the amateur radio service.

Ever since the first radio amateurs were licensed in the UK, the licensing system has been carried out by manual means.

Due to the significant increase in the number of licensees recently, the manual system has been unable to cope, so it was decided to go over to a central computer system.

To assist in this changeover, all UK licensees are being sent a request from the Post Office to confirm their name, address etc.

If this applies to you, be warned, do read the notes on the back of the letter sent with it before you complete the form, or you may make mistakes!

News

During the discussions following the recent AMSAT-UK AGM, suggestions were made that a feasibility study be made into the possibility of funding and launching a radio communication satellite within the ambit of AMSAT-UK.

The Irish Department of Communications recently released the 'new' HF amateur radio bands for use by Irish radio amateurs. These are 10.100MHz to 10.150MHz; 18.068MHz to 18.168MHz and 24.890MHz to 24.990MHz.

The Bulgarian Everest Expedition has used amateur radio for its means of communication. Due to poor propagation conditions, it is reported that communication via OSCAR 10 may be used at times.

Around the 23rd April last, a large group of sunspots began to appear over the limb of the sun. As it came more into 'view,' it was apparent that it was to be one of the largest groups seen for many years.

This was somewhat unexpected, as we are at present in a sunspot minimum period. The group subsequently produced some of the highest solar flux levels ever recorded. Very high levels of absorption, aurora and magnetic disturbances were experienced.

Secondary solar activity peaks such as this one have been observed before in sunspot cycles. It is possible this one may improve propagation conditions for HF communication during several months ahead.

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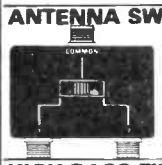
ANTENNA SWITCH 2 and 3 WAY



Co-axial switch for one transceiver to two antennae or one antenna to two transceivers. Dims: 86 × 55 × 32mm (Body).
O/No. VP 113 **£4.50**

As above but 3-way.
O.No. VP 114 **£4.75**

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CB/TV. High pass filter. Reduces unwanted signals picked up by antenna. Dims: 45 × 25 × 17mm.
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Cut-off frequency: 30MHz.
V.S.W.R.: Less than 1.2 to 1.
Insertion loss: –0.2dB @ 27MHz
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Dims: 80 × 55 × 40mm.
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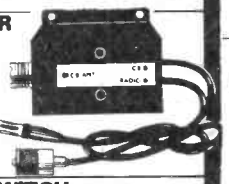
Transceiver/car radio antenna coupler. With co-axial cables. One co-axial terminates in antenna plug and the other in PL259 plug.
Dims: 67 × 46 × 30mm.
O/No. VP 117 **£2.00**



TAPE RECORDER SWITCH

Unit to control motor of tape recorder. 1.8m cord and 2.5mm plug attached. On/Off switch. Dims: 55 × 20 × 20mm.
O/No. VP 127 **£1.00**

DC-DC POWER SUPPLY

DC to DC adaptor. Plugs into car cigar lighter aperture. Output 3, 4.5, 6, 7.5, 9, 12V @ 800mA. Has universal output spider plug, also 9V battery snap and polarity reversing facility.
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Limits voltage to speaker or to the permissible max., by automatically introducing a resistor in series with speakers. When excessive voltage is reduced the unit resets itself. Electronic voltage-sensing relay circuit. Spring terminals. Cut-off level adjustable from 10W-120W. Full instructions included. Dims: 85 × 74 × 25mm.
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Miniature round piezo-electronic buzzer. White plastic. Low consumption.
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Dims: 22 (dia.) × 11.5mm
Fixing Centres: 26.5mm
O/No. VP 107 **95p**

PIEZO
Piezo buzzer. White plastic. 90mm leads. For use on a.c mains.
Frequency: 3.5kHz approx.
Output: 85dB (A) @ 1m typ.
Power: 240Va.c. 5mA.
Dims: 32 (dia.) × 14mm
Fixing centres: 38mm.
O/No. VP 108 **£1.15**

ELECTRONIC
Miniature electronic buzzers. Solid state. Ivory plastic. 150 leads. Frequency: 500 Hz approx.
Dims: 22 × 16 × 15mm
Output: 82dB (A) @ 1m typ
Fixing centres: 26mm
3V 25mA: O/No. VP 82 6V 25mA: VP 83
9V 25mA: O/No. VP 84 12V 25mA: VP 86
80p each

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A neat swivelling disc provides close tolerance substitution resistors of 36 preferred values from 5ohms to 1Kohm. Simply fix clips into circuit and swivel until optimum result is achieved.
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Miniature plastic and metal vice with strong suction base for portability. Single action to secure or release suction. Plastic jaws with rubber pads 20mm wide, open out to 40mm. Dims: 85 × 65 × 60mm approx.
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O/No. VP 120 **£4.20**

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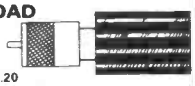

50 ohms. 30W. UHF co-axial plug fitting (PL259).
O/No. VP 121 **£5.20**

PICK-UP COIL

Large telephone pick-up coil for high sensitivity. Suction pad to stick to telephone. 90cm lead to 3.5 jack plug. Connects direct to cassette recorder. Dims: 32 (dia.) × 17mm (body) 36mm (dia.) sucker. **£1.00**
O/No. VP 87

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VP3	200		£1.00
VP4	150	¼ Watt Resistors 100 ohm-1M Mixed	£1.00
VP5	200	Assorted Capacitors All Types	£1.00
VP6	200	Ceramic Caps Miniature – Mixed	£1.00
VP7	100	Mixed Ceramics Disc 1pf – 56pf	£1.00
VP8	100	Mixed Ceramic Disc 68pf – .015pf	£1.00
VP9	100	Assorted Polyester/Polystyrene Caps	£1.00
VP10	60	C280 Type Caps Metal Foil Mixed	£1.00
VP11	100	Electrolytics – All Sorts	£1.00
VP12	60	Bead Type Polystyrene Min Caps	£1.00
VP13	50	Silver Mica Caps Ass. 5.6pf – 150pf	£1.00
VP14	50	Silver Mica Caps Ass. 180pf – 4700pf	£1.00
VP15	50	High Voltage Disc Ceramic 750v – 8Kv Mixed	£1.00
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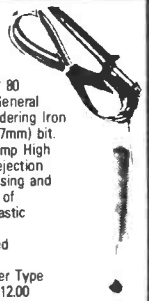

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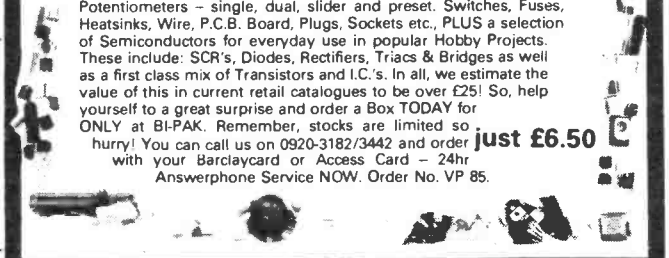

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BBC MICRO VOLUME CONTROL

by Alan Pickard

The BBC Microcomputer has a small internal loudspeaker which produces an audio output at a reasonable volume, under software control. A pre-set situated on the main PCB underneath the keyboard PCB enables the volume to be adjusted. This control could be 'brought out' to the rear of the case for more accessible adjustment, although this is probably not worth the effort as the level would not need to be changed significantly in normal use. Volume adjustment with reference to the pre-set level can also be achieved via the appropriate SOUND command parameter. If desired, the existing speaker could be connected to a changeover switch (or jack socket) and a better quality speaker of the same impedance utilised. This however would be limited by the low power capability of the internal amplifier.

Direct or decoupled connection to the audio amplifier of a television is not recommended, unless the mains input to the set is via an adequate isolation transformer, and the modifier has sufficient knowledge of the equipment and is experienced in working with TV chassis. Also remember that the manufacturer's guarantee may be invalidated by modifications to the equipment.

The most useful enhancement of the audio facility would be to connect the output directly into an external amplifier, eg domestic audio system. This is fairly simple to carry out and is described as follows.

Connections to the computer

The audio section of the computer is made up of a number of op amps, the final stage having the internal speaker connected. An output suitable for connection to an external amplifier is already provided at the output of the 'preamplifier' stage as shown in *Figure 1a*. This is brought out to the edge of the main PCB situated underneath the keyboard and adjacent to the power supply unit. Unfortunately PL16 and the associated 0V point are merely solder filled, through-plated holes (no solder pins), and it is rather awkward soldering on to these almost inaccessible points. However, it can be done providing care is taken to ensure that the plastic case, power supply cables and insulation and motherboard are not damaged, and this is easier than removing the motherboard! Small screened cable is recommended, which may then be run along the edge of the motherboard from PL16/0V to the rear of the machine. A 3 (or 5) pin DIN chassis socket can then be fitted to the 'Econet' aperture, which will necessitate the drilling of two holes in the plastic case as shown in *Figure 1b*. If twin (screened) cable is used, this enables instant connection to both channels of a stereo amplifier, but an appropriate link would suffice.

All that is now required is a suitable cable, eg 3 (or 5) pin DIN plug which will enable connection to the input of a stereo amplifier.

This facility will considerably enhance such sound effects as those found in Starfire, Space Invader, Envelbeeb programs, etc, but should not be used to annoy (or frighten) the neighbours!

Figure 1a

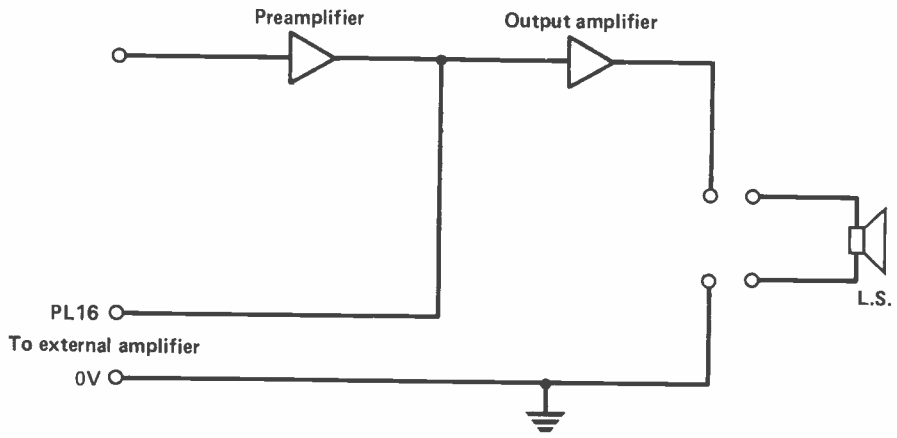
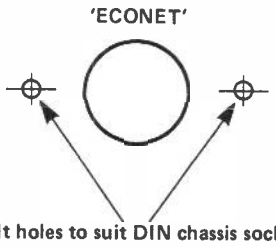


Figure 1b



ANSWERS TO TWENTY QUESTIONS

1. All except (c)
2. False. The frequency bands, power limitations *and* related classes of emission are specified.
3. The missing number and errors in the statement are in italics 'The Morse Test includes sending *36* words averaging *5* letters per word in *3* minutes'.
4. (c)
5. The missing numbers in the statement are in italics 'The Morse Test involves receiving *36* words averaging *5* letters per word and *10* five-figure groups in *1½* minutes'.
6. 2 errors.
7. 4 errors in plain language, 2 errors in figures, ie (d)
8. (b)
9. Key clicks.
10. False. Details of these tests must be recorded in the Station Log.
11. True. The prefix letters of the callsign are varied according to UK country of location, eg G for England, GD for Isle of Man, etc. The suffix '/A' is also added for location or '/P' for pedestrian or '/M' for vehicle/vessel.
12. (b)
13. (b)
14. (a)
15. (d)
16. (c)
17. False. Pre-emphasis attenuates the lower audio frequencies and, in relation to the noise distribution across the frequency band, creates a better energy distribution and S/N ratio. The clipper limits the peak amplitudes of the audio and prevents over-deviation.
18. (d)
19. (b)
20. (b). If the 435MHz antenna is one third of the size of the other it will receive one third of the energy and if the gains are equal the performance is not. If it has three times as many elements, the performance will be similar.

POINT OF CONTACT

The general interests of some of our readers and of club networks are shown below. If you have similar interests why not establish a contact at the time and on the band indicated.

If you or your club wish to be included in this scheme, would you please complete and return the form below and send to: ***Radio & Electronics World***, Sovereign House, Brentwood, Essex CM14 4SE.

MOST IMPORTANT — include a **telephone number** — if you have a particularly interesting contact so that we can contact you for details for publication.

VK5QV ex G3KGH

Usually available Mondays, Wednesdays and Fridays from: 0800 GMT on 14MHz. Uses phone. Equipment FT101Z, FL2100Z, Theta 7000, TH6, Oric 1. Special interests: working 'G' stations. Would like to contact someone from Gravesend.

GU4XGU ex GU6NAE

Usually available daily from 0800 to 0855; 1250 to 1325; and 1925 to 2200. Uses phone, CW, and RTTY. Equipment Icom IC 290H, KW 2000A, IC2E, LCL 2740 converted to 10m FM, Vic 20 with an MPTU-1 terminal unit. Special interests: operation on VHF, RTTY, and reception of amateur satellites.

G4JHI

Usually available Monday to Friday from 1730, Saturday anytime and Sunday morning on 2, 15, 20, 80 and 160 metres and occasionally on 10, 30, and 40 metres. Uses J3E/A1A on HF, and F3E on VHF. Equipment Trio TS530, FT480R plus MM 100W linear. Special interests: RS satellites, DX, WAB, local net working.

CLUB NETS

Escape

Ex-Service Communications Association. Usually available Monday, Wednesday and Sunday mornings at 0700 GMT and Monday, Wednesday and Sunday evenings at 1900 GMT. Modes used are CW and SSB on frequencies of 14020/14185/14255; 21020/21185/21255; 7005/7085; 3730/3790/3570. RTTY contact from the early Autumn. National CB channel is 34.

The following list of nets has been supplied by South Essex Amateur Radio Society.

Sunday

G5SN net starting at 0930 on 3.7MHz SSB.

The Royal Naval Amateur Radio Society net starting at 0930 on 3.660MHz SSB.

The Northern net starting at 1030 on 7.85MHz.

The Amplitude Modulation Preservation Society net starting at 1430 on 1980KHz on AM and SSB, with G4GVO in the chair.

Kent and Essex Round Robin on the first Sunday of each month starting at 1830 on 1950KHz with Basil G3LID or George G4INO in the chair.

Monday

CW net on 1950KHz starting at 2000, all are welcome.

Thursday

RAYNET Call out on 144.875 FM at 2030 GMT with Joe G3AJS as controller.

Friday

SEARS 2 metre CW net starting at 2030 on 144.410.

10 metre FM net on 29.600MHz (calling frequency) at 2130.

Weekdays

The Shaving Club starting at 0715 on 1927KHz with Arthur G3KPT in the chair.

Daily

On 1978KHz at 0930, Frank G5WL and Frank G3BLI welcome a call from anyone for a chat.

We apologise for any errors, but the information above is correct as far as we know. Please send any corrections to the Editor.

SPECIAL EVENT STATIONS

GB2ABC

The Abergavenny and Nevill Hall Amateur Radio Club will be running a special event station at the Abergavenny and Border Counties Show on 28th July. The station will be operating on SSB on all bands to 146MHz and FM on 2 metres. Further details from GW3SSY on 0873 78674.

GB2PYF

The Abergavenny and Nevill Hall Amateur Radio Club will be operating a special event station at the Pen-y-Faal Hospital Fete. The station will be using SSB on all bands upto 146MHz and FM on 2 metres. Further details from GW3SSY.

POINT OF CONTACT

Name/Club..... Address .....

..... Postcode .....

Telephone No ..... Call Sign ..... Date licensed .....

Type of Licence A.....☐B.....

Bands usually preferred.....

Operating days M T W T F S S Times.....

Equipment .....

Phone/CW.....

Special interests eg DX,AMSAT etc .....

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Most interesting contact made to date.....

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TR9130	All mode 2M	£458.00
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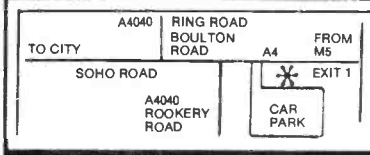

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6854	680p
6875	490p
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8T2B	120p
8T95	110p
8T96	110p
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8080A	360p
8085A	480p
8155	480p
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8216	100p
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8228	250p
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8279	480p
75107	90p
75108	90p
75110	88p
75112	150p
75182	95p
75450	85p
75451	80p
75452	80p
75453	72p
75461	40p
75491	70p
75492	70p
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Dynamic RAM

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CA3240E	120p
LA4422	295p
LF355	95p
LF356	100p
LF357	110p
LM301A	35p
LM307	50p
LM308A	95p
LM311	75p
LM324	45p
LM339	50p
LM348	75p
LM358	70p
LM380	120p
LM381	170p
LM386	95p
LM393	100p
LM3909	85p
MC1310P	210p
MC1455	75p
MC1456	135p
MC1458	45p
MC1496	75p
MC3242A	630p
MC3302	95p
MC3340	160p
MC3401	65p
MC3403	70p
MC3456	107p
MC3480	580p
MC34001	58p
NE555	20p
NE556	70p
NE565	155p
NE567	140p
SN76003	180p
SN76013	180p
SN76023	180p
TA7205A	125p
TBA480Q	160p
TBA520Q	120p
TBA530Q	140p
TBA540Q	130p
TBA550Q	280p
TBA560Q	160p
TBA750	220p
TBA800	90p
TBA820	95p
TBA820M	95p
TBA920	190p
TBA990Q	190p
TCA650	390p
TCA910	180p
TDA1004	450p
TDA1044	350p
TL061	60p
TL062	70p
TL064	100p
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TL072	60p
TL074	100p
TL081	35p
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ULN2803A	200p
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2.0000MHz	225p
2.4576MHz	225p
3.0000MHz	240p
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3.6864MHz	240p
4.000MHz	150p
4.1943MHz	190p
5.0688MHz	240p
6.00MHz	190p
6.1440MHz	190p
6.880MHz	240p
8.000MHz	160p
10.000MHz	170p
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EC940 0.016" Lines
EC941 0.031" Lines
EC942 0.039" Lines
EC943 0.049" Lines
EC944 0.061" Lines
EC945 0.079" Lines
EC946 0.100" Lines
EC947 0.124" Lines
EC950/1 0.031" 90° Bends
EC951/2 0.061" 90° Bends
EC951/1 0.031" 30°, 45°, 60° Bends
EC952/2 0.061" 30°, 45°, 60° Bends
EC960/1 TO-5 Transistor Pads
EC993/1 IC Pads
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Waveform
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Case (Maximum Dimensions)
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500VA 42 x 26 x 19 cm
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40 Way Grey -do-	209p
50 Way Grey -do-	262p

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(IDC TYPE)

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DATES FOR YOUR DIARY

Dates for your diary is updated every month.
Club secretaries and organisers are requested to send information of forthcoming events as early as possible
to ***Radio & Electronics World,*** Dates for your diary, Sovereign House, Brentwood, Essex CM14 4SE

Date	Function	Location	Contact
15 July	DF Hunt	Wirral and District AR Club	G Scott G8TRY
	DF Hunt on 160 & 2m	Dunstable Downs AR Club	Phill Morris Dunstable 607623
17 July	QRP Operating by C Page	Biggin Hill AR Club	I Mitchell G4NSD
18 July	Computer Night	S Bristol AR Club	Brian GIDBH
21 July	Radio & Electronics Fair	Royal Victoria Hall, S Borough	W Kent AR Society
22 July	Anglian Mobile Rally	Stanway School	Colchester Radio Amateurs
22 July	Home Counties Mobile Rally	McMichael Sports and Social Club, Belles Hill, Stoke Poges	
29 July	Scarborough AR Rally	The Spa, Scarborough	
5 August	Woburn Rally		
7 August	High Power Transmitters	Chelmsford AR Society	
17 August	DF Hunt on 2 & 10m	Dunstable Downs AR Club	Phill Morris Dunstable 607623
19 August	HAMFEST 84	Flight Refuelling Social Club, Merley Park Road	RAIBC & Flight Refuelling AR Society
27 August	DF Hunt	Southgate AR Club	G40BE (QTHr with SAE)
5 Sept	Sattelite Communication	Fareham & District AR Club	Brian Davey G4ITG
8-9 Sept	International Amateur TV Contest	British Amateur TV Club	G Shirville G3 VZV
9 Sept	Telford Mobile Rally	Telford Shopping Centre	G8DIR/G8 UGL G3 UKV
16 Sept	Vange AR Society Mobile Rally	Nicholas School, Basildon	Mrs D Thompson
19-23 Sept	The Personal Computer World Show	Olympia 2	
23 Sept	Lincoln HAMFEST	Lincolnshire Show-Ground	Lincoln SW Club G5FZ/G6COL
23 Sept	National Car Boot Sale	Shuttleworth Collection, Old Warden, Beds	Dunstable Downs Radio Club
7 Oct	Gt Lumley Annual Rally	Gt Lumley Community Centre	Gt Lumley AR Society G40CQ
13 Oct	Midlands VHF Convention	BT Training College, Stow, Staffs	Peter Burdem G3UBX
17-25 Jan 85	Amateur TV Winter Cumulative Contest	British Amateur TV Club	G Shirville G3VZV
	CHANGE OF VENUE		
	Worthing & District AR Club	Lancing Parish Hall, South St, Lancing	

Computer & TV Video INTERFACE

by Alan Pickard

The BBC Micro has the ability to provide a video output via socket SK2. This is standard on the Model B, but can easily be provided on the Model A by fitting the appropriate BNC socket.

This video output provides a more direct connection of the output from the video processor after amplification and dispenses with the necessity of passing through a UHF modulation stage and subsequently a demodulation stage. This signal can then be fed in to a monitor or after the vision detector stage in a television, resulting in a better quality, higher resolution display (having avoided any slight degradation of the signal by a stage of modulation and then demodulation).

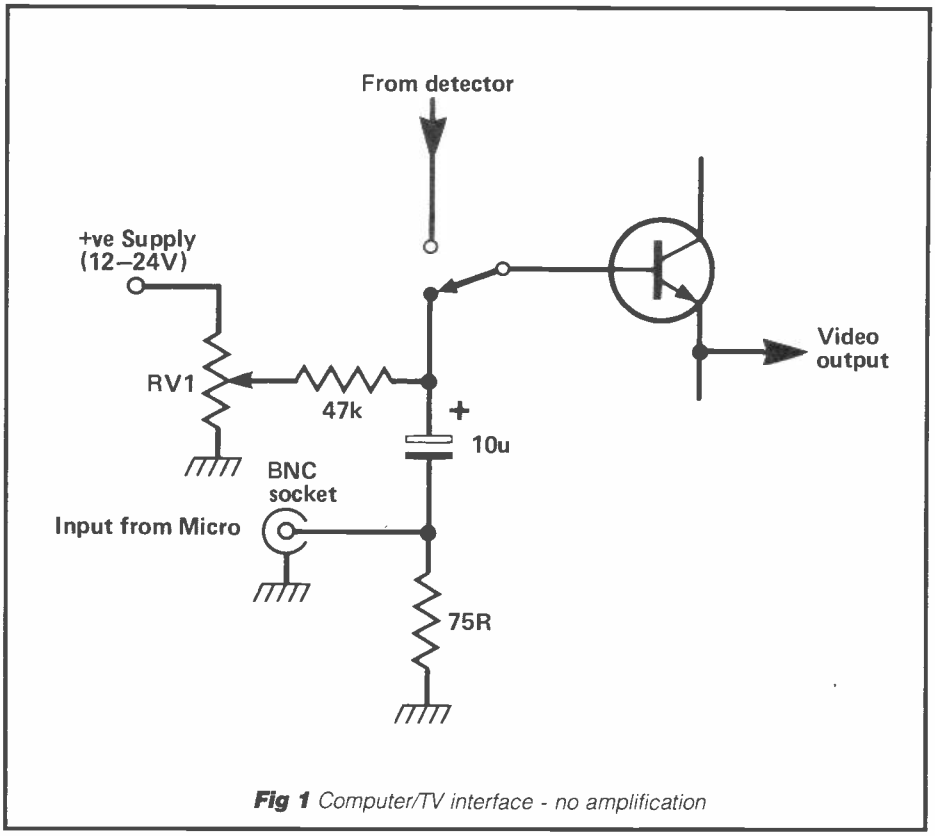

Fig 1 *Computer/TV interface - no amplification*

What is involved

The universally adopted standard for 'line level' video is 1V peak-to-peak into 75ohm impedance.

Modifying a television circuit involves feeding in the video output from the computer to the point where the vision detector stage output is normally fed. This input should be via a 75ohm coaxial cable and must present a 75ohm terminating impedance to the input circuit.

In most cases a certain amount of additional circuitry will be required to match the 75ohm, 1V positive input signal such that the impedance, amplitude and polarity required by the video stages of the receiver are correct.

Points to check

Before deciding to attempt a 'video in' modification to a black and white television, the following points should be observed.

This modification should only be attempted if you have sufficient knowledge to understand the manufacturer's circuit diagram and have previous experience of working on TV chassis. If the set is within its guarantee period, the guarantee may be invalidated by the modification.

Ensure that the chassis of the set is not connected to either the mains live or the mains neutral lines. To be compatible with connection to a micro (ie *safe*) the mains input to the set should be via a step down isolating transformer such that the video stages are supplied with low supply voltages of the order 12-24V dc.

In the case of a 'hot chassis' set (live or neutral connected to chassis), or low voltage supplies derived from mains dropper resistors, *do not* attempt modification. The best way of establishing whether or not the set is safe to modify is by consulting the manufacturer's circuit diagram.

In all cases check that the mains fuse to the TV set is correctly rated.

Computer/TV interface

Figure 1 illustrates how to connect a video input (output from micro) to the first video amplifier stage (after the detector stage). These few components would be all that were required for input matching, if the first video amplifier stage in the television stage was designed for 1V positive input (75ohm): in other words, if it is not required to change amplitude or polarity of the incoming video signal.

In some cases however, the 1V video input will not be of sufficient amplitude to drive the video stages fully (resulting in the display not 'locking'). In this case an amplification stage will be required as shown in *Figure 2*. This consists of a common base amplifier which provides a low impedance input to the first video amplifier and does not invert the signal. Amplitude is adjusted from 1-3V via RV1, and RV2 sets the bias voltage. The polarity of C2 depends on RV1 and RV2 settings.

If the television set requires a positive-going video input (see waveform), then the circuit in *Figure 3* will provide the required amplification and inversion of the signal. RV1 adjusts the bias on the following video amplifier stage and RV2 sets and gain.

The above notes are intended to be a guide only to conversion, but it should enable the successful connection of a video signal. For stable operation, the wiring to the switch should be kept as short as possible. In order to be able to switch easily from 'video in' mode to 'UHF TV' mode, the fitting of the changeover switch as indicated on the diagrams is recommended. Also, connection to the television set should be via a BNC socket.

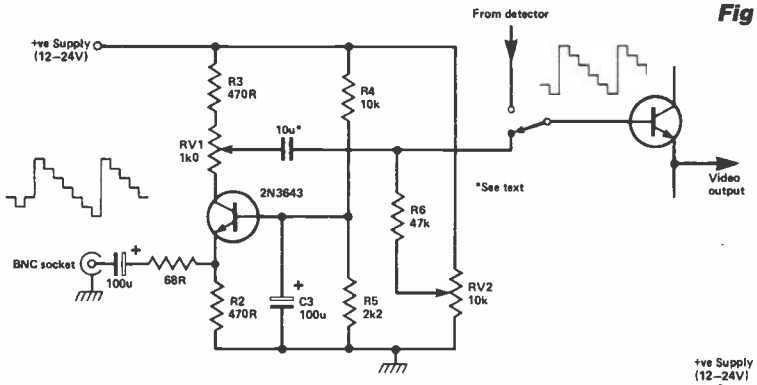

Fig 2 *Computer/TV interface (non-inverting buffer amplifier)*

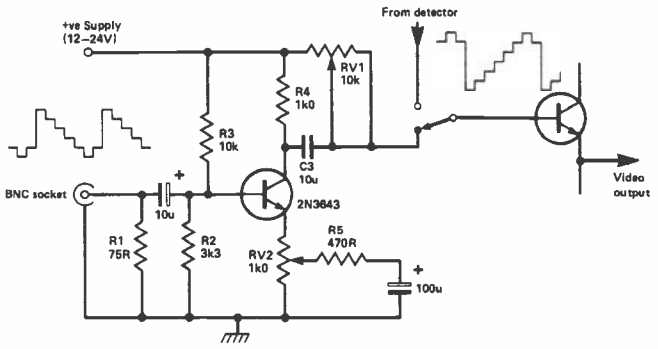

Fig 3 *Computer/TV interface inverting buffer amplifier*

The 2N3643 transistor may be difficult to obtain, but I have used a BC118 successfully. A 2N3904 is probably also suitable, the requirements being similar operational frequency (around 200MHz) and a gain of around 100 h_{fe}.

Although the conversion work requires a reasonable amount of time and effort, it is well worth it as the improved quality of the direct video display will demonstrate. As well as providing a crisper display and therefore reducing eyestrain, the use of Mode 0 for text (word processing, etc) is more realistic.

South Midlands

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AMUT77	AM unit	£24.00

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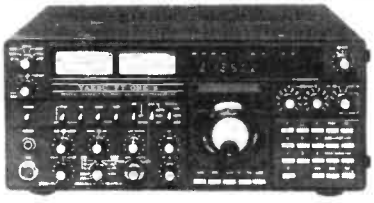

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XF8.9GA	6KHz AM filter	£29.50
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D410004	Interconnect lead FT980-FC757AT	£26.99
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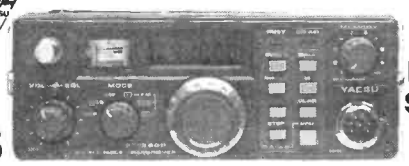

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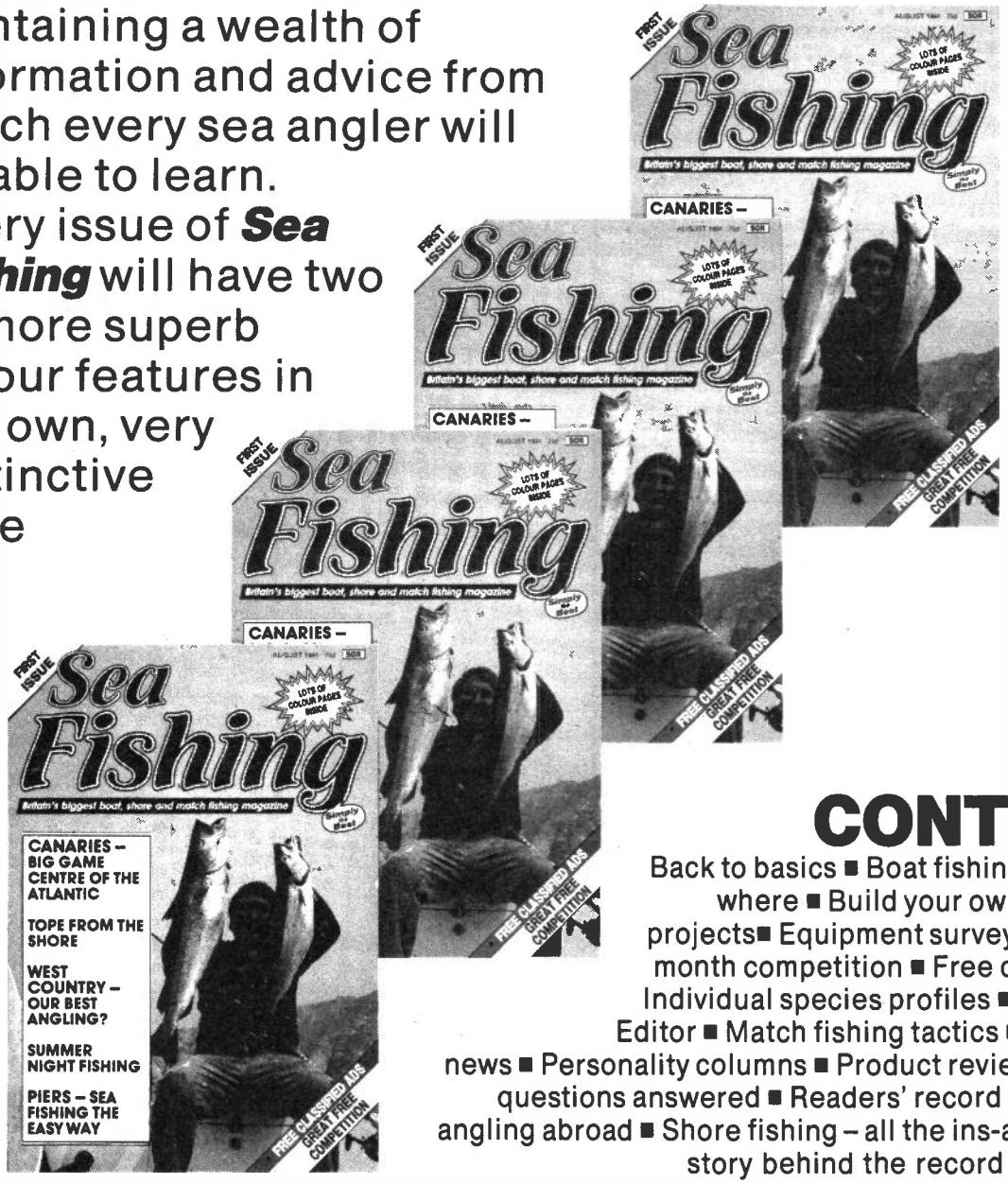

CONTENTS

Back to basics ■ Boat fishing – how, when, where ■ Build your own dinghy ■ DIY projects ■ Equipment surveys ■ Fish of the month competition ■ Free competitions ■ Individual species profiles ■ Letters to the Editor ■ Match fishing tactics ■ New product news ■ Personality columns ■ Product reviews ■ Readers' questions answered ■ Readers' record fish lists ■ Sea angling abroad ■ Shore fishing – all the ins-and-outs ■ The story behind the record ■ Tide tables

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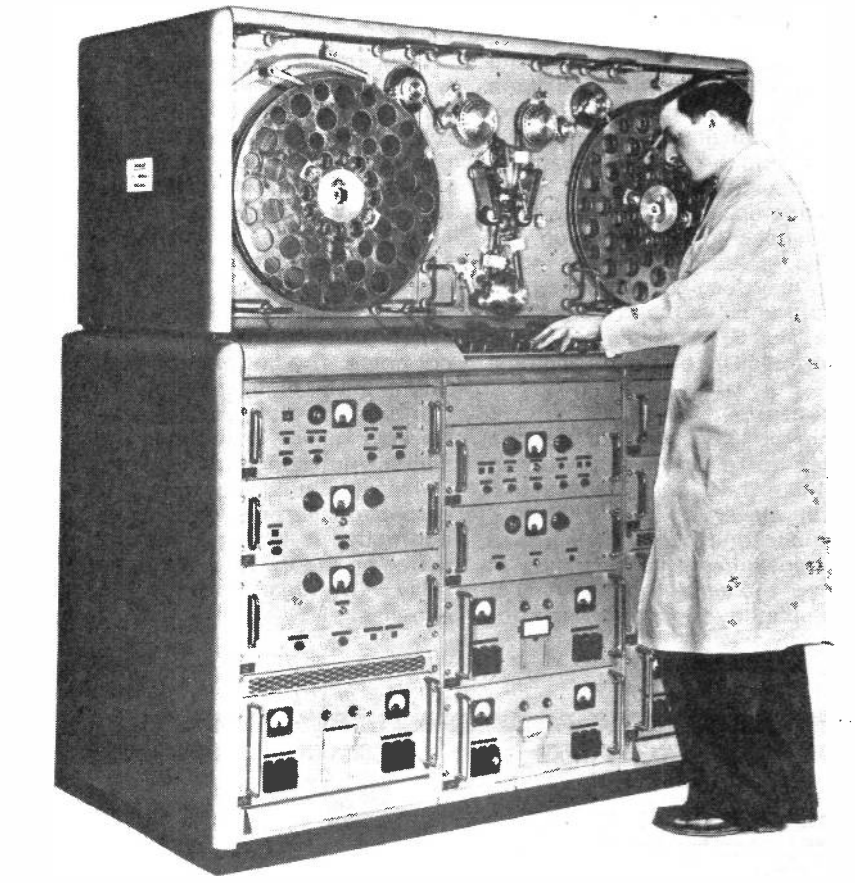
ATV on the Air

Presented by Andy Emmerson, G8PTH



Every shack should have one. This is VERA, the Vision Electronic Recording Apparatus, developed by the BBC in the 1950s. It recorded video and audio on giant reels of tape, and makes a Philips 1500 look really compact. (Picture courtesy 3M)

The topics for this month are connectors and feeders, which means they are applicable to all modes of amateur radio, not just TV, but I hope you will not stop reading just for that. All the information I pass on is based on hard-won experience and is generally the sort of thing you *won't* find in the handbooks!

BATC convention

The thoughts were inspired by the British Amateur Television Club's annual exhibition and day out. It was a success – it was well attended and there were more trade stalls than before.

Anyone searching for a camera or monitor should have come away satisfied, though the really cheap cameras sold very early (like £5 for a non-working modern Sanyo ⅔in model). It was nice to see the odd Pye Lynx or two – these seem to go on for ever – and there were several colour cameras at sub-£200 prices.

Monitors seemed to be over-priced, though, and I did not see many selling. Several of the traders had new products, such as Fortop and Wood & Douglas. Solent Scientific had a dinky little 10mW test transmitter for 24cm, which was demonstrated by its deviser G8CMQ as a creepy-peepy (the video equivalent of a handy-talky). It would also be useful for checking out your receiver after a period of inactivity.

The Worthing Repeater Group had a superb display of 'how they built their repeater' from a junked cash register (well, the logic at least)! L-Wave and LMW Electronics had some nice microwave bits and pieces and added a high-tech note to the proceedings.

To the point...

Grant Dixon, in presenting this year's Grant Dixon award, pointed out that we had a duty to pass on the knowledge we gained for the benefit of others. Mike Walters, G3JVL, did just that in a packed lecture on 23cm techniques. I certainly learned something new and was reminded of other points I had myself learned from bitter experience, so it might be worth repeating them here.

It is of course true that antennas, connectors and feeders do as much work in your system as the actual transmitter and receiver themselves. At 70cm, and even more so at 23 and 24, signals are too precious to lose in sub-standard feeders and connectors.

The choice of the right antenna is important and it is worthwhile sorting out if you want high gain whether you can live with the narrower beamwidth you will end up with. Multiple antenna systems may mean that they are not all beamed exactly on the same point on the horizon, and long aerials must be kept accurately horizontal to avoid firing above (or below) the horizon.

Cabler's choice

Just as important is the feeder. Heliax type cables obviously offer the lowest loss but they are expensive to buy and so are the special connectors! Add to this their inflexibility and size and I think you are better off with more 'normal' types of coax. G3JVL made the important point that semi air-spaced cables could act as water pipes if not properly sealed and the braiding can also act as a capillary wick for moisture. So do tape up the ends of cables with self-amalgamating tape and try to avoid installing cables on humid days – the moisture can later condense out inside the cable. Remember that BNC connectors are *not* waterproof, so use N-type exclusively outdoors.

When it comes down to a choice of coax, there isn't really a choice now. Half-inch cables are reasonable but avoid RG-8, especially the sort sold to CBers. It has a low braid density, which allows half the RF to escape before it reaches the other end of the feeder. UR-67 is adequate but H-100 is lighter in weight and has much improved low-loss characteristics. It is sold at all rallies nowadays and costs little more than new UR-67.

Contaminated cables

Avoid buying second-hand cable like the plague. It looks such a bargain but it is positively evil how coaxial cables age invisibly. I say invisibly, though a trained eye can tell old cable. The outer sheath tends to get harder and more brittle and the inner dielectric goes yellow. The braiding tarnishes to a black colour and is almost impossible to clean or solder. What has happened is that vinyl (from which they make the sheathing) is not naturally a very flexible material and so plasticisers are added to make it more workable.

Over time, however, these additives may leach out and start to contaminate the braiding and dielectric. Exposure to the elements and sunlight hastens this effect and gradually the plasticisers migrate to the central polythene, raising its dielectric constant and power factor and hence VSWR and attenuation.

Having lost its plasticiser the outer vinyl starts to go brittle and cracks, allowing in moisture which corrodes the braid. RF is inhibited from flowing through the braid, attenuating the return

current path and allowing the forward signal to radiate from the centre conductor. Less signal reaches the aerial from the transmitter and as less signal can be reflected, the 'match' as read on a VSWR meter looks better as the cable ages. But clever lads like you and me are not so easily fooled now.

Of course, cable like this is useless, even if it has been stored unused, and it often appears at rallies at bargain prices. But don't be caught.

People who have looked at H-100 cable may feel it is difficult to work with, and at first sight this is true. It is not as flexible as 'normal' coaxes, and the sheath needs a good knife to cut it. On the other hand its toughness means it resists scratching and splitting. The braiding and copper foil are fiddly to dress and the copper centre conductor is quite thick, and all these factors add up to make it awkward to prepare the cable for fitting a plug.

Connecting you now

First of all, you must use the right connectors and the Greenpar are the type to use, for two reasons. Firstly, the centre conductor will fit the centre pin without filing down (which is taboo) and secondly because the Greenpar design has a ferrule for contacting the braid, rather than relying on fanning out strands of the braiding.

Do *not* slit the plastic sheath lengthwise; just cut around the cable and remove a length of sheath. Remove the braid and foil as well, and after sliding the shell of the connector down the cable (I know, I forget this too sometimes!), force the ferrule between the foil and braiding. If it refuses to go use a hairdrier to warm up the sheath and make it more supple; the ferrule will slide down now and after things cool down they will grip the ferrule even better.

Turning to connectors (both BNC and N type) I must admit I am very fond of the type made by Greenpar and Coline. These use a ferrule to contact the braiding and hold the centre pin captive. The older designs (Mil Spec), if not properly made up, can allow the centre pin to slip back inside the plug (on BNCs). This at least causes an open circuit and may lead to a short circuit when the pin touches the braid. Having blown up a 'Blue Brick' in this way I have now thrown out all my non-captive plugs!

More expense!

Reverting to G3JVL wisdom and the way we risk our equipment by cutting corners, Mike had some instructive thoughts on relays.

Most stations tend to use some form of relay for transmit/receive switching at the bottom of the aerial feeder. Many of these use plated phospor-bronze for contacts which eventually gets pitted and oxidised.If operated by miniature push-rods these must be capable of conducting heat out of the relay contact chamber (if the relay feels warm when passing power this is a good sign)! The ideal relay also has auxiliary detector contacts, and a well designed system uses these to detect that the relay has thrown before passing RF through the relay. Switching 'live' RF is a recipe for an early death of the relay – and transmitter.

Even more worrying is the poor isolation performance of some relays. Mike said that he would like a preamp or receiver to see no more than 1mW of RF, though 10mW might not be lethal. Most relays are fine at two metres and even 70cm, but give perhaps only 22dB isolation at 24cm. If you intend to run 100W on transmit, such a relay is clearly quite inadequate.

I must admit this quite shocked me and sent me rushing for my calculator when I got home. The bottom line is that if you intend to run high power on 24 you must use one of the better Japanese or German relays. These also ground the contact not connected. Otherwise you will have to build your own, or find some aerospace surplus goodies. The only alternative is to put a second relay in series on the Rx side of the main Tx/Rx relay. Oh dear, sounds like more expense!

CORRECTIONS AND MODS

Whilst every effort is made to ensure that there are no mistakes with our diagrams, the occasional error does occur. We appreciate our readers' co-operation in notifying them to us.

VHF/UHF FREQUENCY METER (May 1984 issue)

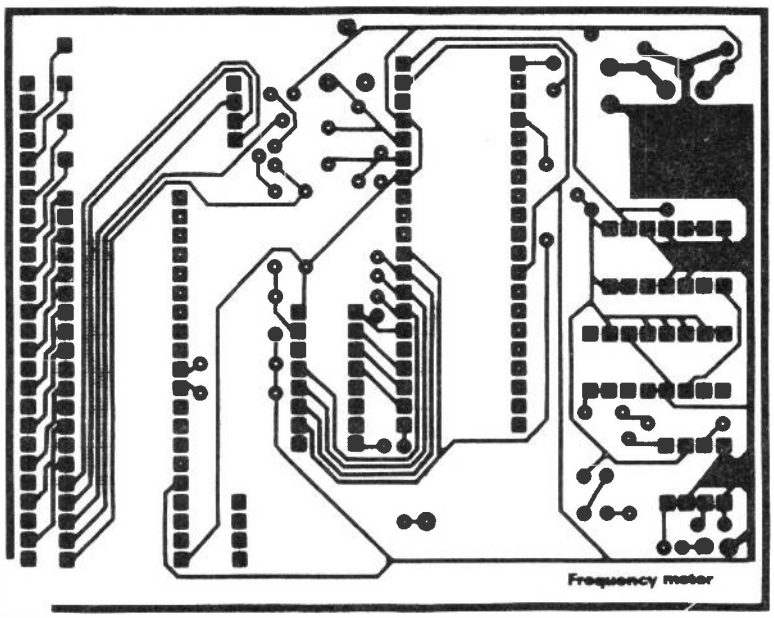
Due to an error the foil pattern was printed in mirror image in last month's issue.

It has also been noted that some of the ICs are static sensitive so care should be taken with handling.

VR1 should have read 100K and not 100R.

YAESU FC102 REVIEW (July 1984 issue)

It appears that part of the review could be misinterpreted, so we advise our readers to read their instruction manuals thoroughly before using.



DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

Sporadic-E is on the way. That was the message during April when several pre-season openings were noted at considerable strength and duration. The first of these was noted on the 8th with a football match from Spain on channels E2, E3 and E4 in the early afternoon. Other programmes followed and the opening lasted until 1530.

Another opening occurred on the 22nd with strong and consistent signals from Italy on channel IA for well over an hour from 1000 BST. The programme was a religious service and at times it appeared on channel IB. Italian signals appeared again during a lengthy opening which was first noticed at 1920 on the 28th. Fortunately there were no problems with identification. The normally small 'anti-pirate' inscription of 'RAI' was in much larger letters towards the top right-hand corner of the picture. You couldn't miss it!

Signals from the east were noted on April 23. The opening was already in progress at 1340 when the receivers were switched on. A cinemascope feature film was noted and, judging by the captions, it was of Polish origin. To confuse the issue, some captions in the Cyrillic alphabet were seen after the film on channel R1, with a newsreader or announcer in uniform appearing a little later.

A new channel R1 transmitter has opened in Poland at Siedlce close to the Russian border and one wonders if this may be a joint Polish/Russian service. Several other enthusiasts noted this transmission.

Due to tropospheric activity in Band III and at UHF towards the end of the Easter period, quite a few elusive stations were picked up. At least one enthusiast saw Polish Band III stations. Here in Derby the main highlight was RTL Luxembourg on channel E7 with the test card. Normally reception on E7 is very difficult due to the local menace (Lichfield channel B8), but fortunately the transmitter had been switched off for several days.

DX log for April

The following log should give newcomers to DX-TV an idea of just what can be received:

2/4/84:
SRG (Switzerland) on channel E3 with the '+PTT SRG 1' FuBK test card from the Uetliberg transmitter; CST (Czechoslovakia) channel R1 radiating the EZO-type test card from Ceske Budejovice.

3/4/84:
CST R1, R2 on EZO test card.

4/4/84:
TVE (Spain) E3 with the GTE colour test card; CST R2 on test pattern; MTV-1 (Hungary) with a multiburst/frequency gratings pattern on channel R1.

6/4/84:
TVE E3 on GTE test card with several sightings via meteor shower (MS); CST R2 on test card.

8/4/84:
TVE E2, E3, and E4 during the early afternoon with football followed by other programmes until 1530.

9/4/84:
TVE E3 on colour test card; NRK (Norway) on E4 with the PM5534 test card including the identification 'Norge Kongsberg'.

10/4/84:
TVE E3 on a bar test pattern with indecipherable identification: the GTE test card was also seen; TVP (Poland) R1 on the PM5544 with a dark background; CST R1 on EZO test card; ORF (Austria) on channel E2a with the PM5544 test card and 'ORF FS 1' identification. This was also noted in Band III on channel E5 via MS.

12/4/84:
Unidentified PM5544 test card on channel R2 but thought to have been of Hungarian or Czechoslovakian origin.

13/4/84:
TVE colour test card on channel E3.

22/4/84:
RAI (Italy) from 1000 BST onwards with a religious service until 1100 via Sporadic-E (SpE). This programme was also noted on channel IB; TSS (Russia) or TVP on R1 with a cinemascope feature film during the early afternoon via SpE.

24/4/84:
SR-1 (Sweden) on E2 with the 'TV 1 Sverige' PM5544; several West German stations noted via enhanced tropospheric conditions at UHF including the Hessischer Rundfunk test card and 'hr 3 FFTM' identification on their FuBK on channel E37.

25/4/84:
West German trop signals including WDR-1 (Westdeutscher Rundfunk) from the Langenberg transmitter on channel E9; mystery colour bars noted on E5 at 0825 via weak trops.

26/4/84:
RTL (Luxembourg) on E7 with the 'RTL Plus' PM5544 test card; SWF-1 (Südwestfunk) on channel E9 from Hornisgrinde in West Germany with the FuBK test card and 'SWF BADN' identification.

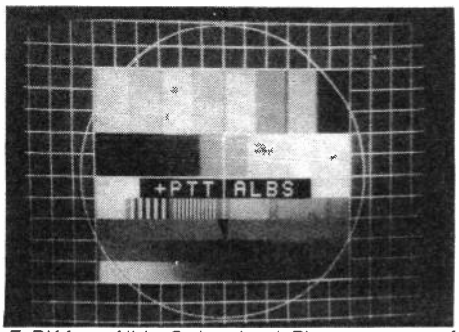
28/4/84:
RAI on channel IA with programmes from 1900 BST via Sporadic-E propagation.

30/4/84:
TVE E3 on a bar pattern which included the transmitter identification 'RTVE Gamoniteiro'. This pattern was featured in the August 1982 edition of ***R&EW***.

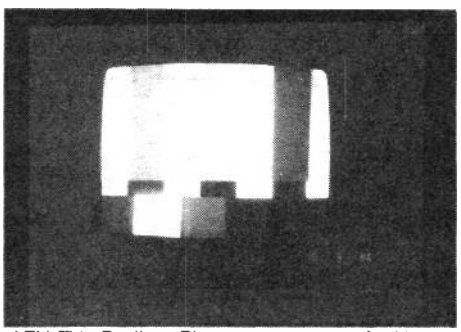
Reception reports

Kevin Jackson (Leeds) logged a few unusual transmissions towards the end of April via the improved trop conditions. The 8KW NDR (Norddeutscher Rundfunk in West Germany) outlet at Sylt on channel E41 was seen radiating a test card similar to the one shown in the July 1984 issue of ***R&EW***.

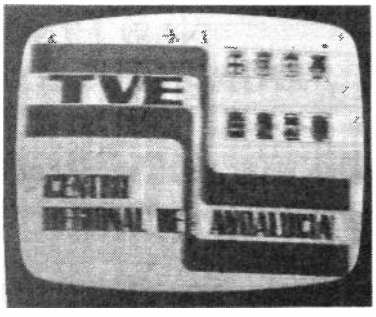
Kevin's best DX event was on the 26th when a Polish Band III station appeared



FuBK from Albis, Switzerland. Photo courtesy of Gosta van der Linden



AFN-TV Berlin. Photo courtesy of Jürgen Klassen



TVE identification from Andalucia, Spain

on a clock caption followed by an identification caption and programmes. Transmissions came from the channel R6 outlet at Olsztyn, a distance of 1438Km.

Adrian Patton of Grimsby has commented on the growing problem of interference in his area from a nearby cordless 'phone installation'. He's also experiencing problems from a home computer. This produces negative images throughout Band I. Has anyone a suggestion regarding a remedy? Incidentally, Adrian wouldn't mind a chinwag with any local DX-TV or amateur radio enthusiasts particularly at weekends. He may be contacted by dialling 0472 887950.

Wigan enthusiast Tony Cater has discovered a possible pirate radio link just below channel E21. The identification 'KFM 24 hours a day' has been heard and transmissions come from the Manchester area. An out-of-band amateur station has also been noted from the same direction.

Andy Webster (Billinge, Wigan) noted patterning over RTE (Eire) on channel IH. Further investigations revealed an electronically generated chessboard pattern not unlike the old Zimbabwe type. The signal, at approximately 210MHz, later switched to a picture showing an amateur enthusiast and some of his equipment, but there was no sign of a signal on the 70cm amateur band. Towards the end of the month, Andy noted Sporadic-E activity on channel R1 with possibly the new Polish transmitter at Siedlce.

Over the Easter holiday Clive Athowe of Blofield near Norwich refurbished his DX shack. It now resembles an executive suite with fitted carpets and armchairs. He's also forwarded an executive-style log – it's a computer print out! Band III meteor shower goodies include CST (Czechoslovakia) on channel R6 from Pardubice on April 8th radiating the test card, and TVP (Poland) from Gdansk or Krakow showing the dark PM5544 test card on channel R10.

The E2 outlet at Gwelo in Zimbabwe appeared on the 20th with programmes accompanied by Italian channel IA signals. Gwelo appeared again on the 24th but this time with the 'ZBC TV' PM5544 test card. Sporadic-E was active on several occasions. The Russian '0249' monoscopic test card came up on R1 for about thirty minutes during the morning of April 24. Signals from Spain on channel E2 were also noted via SpE during the month with a bullfight showing all the gory detail!

DX-TV on video

Adrian Patton has taken us to task over our recent claim that the Hitachi VT 11E video cassette recorder has multi-band facilities. He owns such a machine but it is UHF-only.

There are apparently several versions

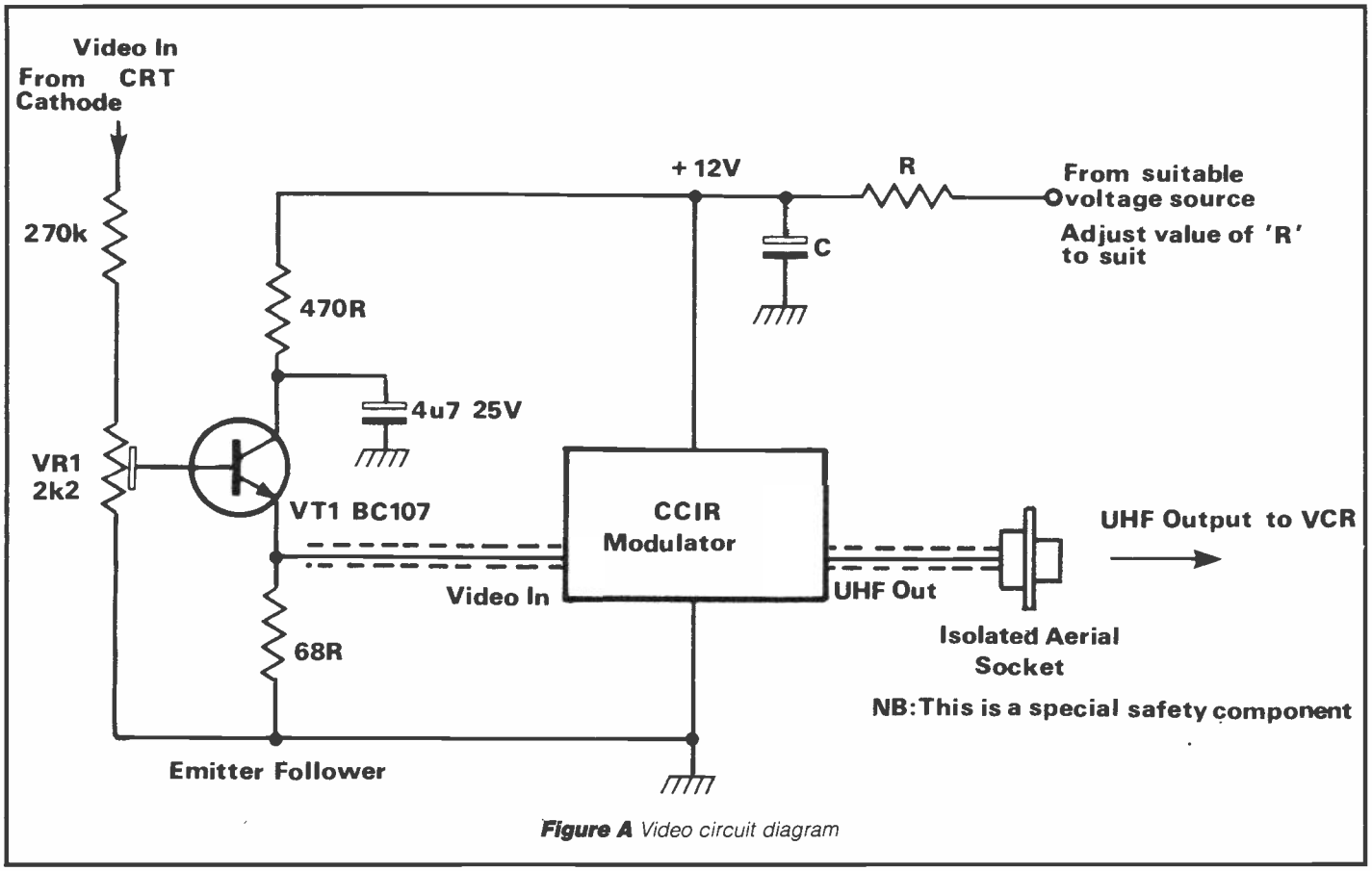
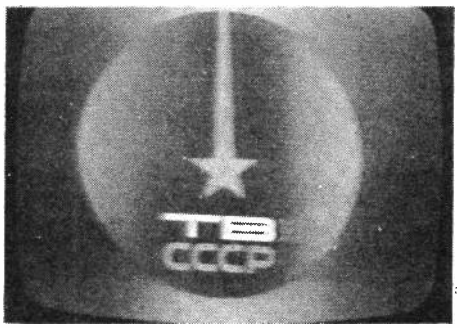
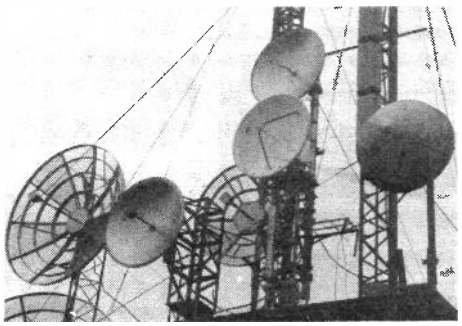


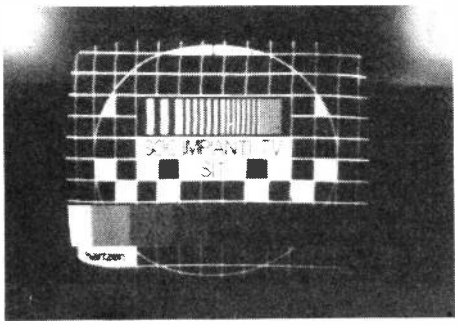
Figure A *Video circuit diagram*



Russian identification caption on channel R1



Pirate TV aerials at Bergamo Northern Italy



Test card from Italian pirate station

of this particular model. The VT 11E (DS) has multi-band facilities plus the PAL/SECAM switch which we referred to. The VT 11E (BS) however is UHF-only, although according to our service information the standard VT 11E does possess multi-band facilities. This is all very confusing and we wonder if the manufacturers know themselves!

While on the subject of video recorders, from time to time we are asked how Bands I and III DX can be recorded using a UHF-only VCR. One solution is to use a VHF to UHF converter to extract the signal at video.

The live chassis found in most receivers presents a problem but an attractive method which we have used for several years overcomes this.

It involves the use of an expensive UHF modulator with the video tapped off at the cathode of the crt. The reason for using the modulator is simple: it can be positioned inside the set with the signal leaving at UHF via an isolated UHF aerial socket. This is of the same type as found on most recent TV receivers.

The idea was originally suggested by Hugh Cocks of satellite TV fame and the simple circuit is shown in *Figure A.* The modulator is available from Sendz Components. The 12V supply may be conveniently obtained from virtually any low-voltage point within the receiver, for instance, the cathode of the sound output valve. Adjustment to VR1 should be made for optimum results with signals of various strengths.

Service Information
Netherlands:

AFN-TV officially commenced broadcasting on April 5 from the American Forces base at Soesterberg. The transmitter has an ERP of approximately 20KW and operates on channel A80, which would be equivalent to a European channel between E70 and E71.

The horizontally polarised transmitting aerial is located on a 40-metre mast. Programmes from AFN-TV Soesterberg consist of video recordings and are different from those radiated by the station in West Germany where material is received from America via satellite.

Norway:

NRK are expected to start a regional television service in September. Programmes will be produced by NRK at Sørland in Kristiansand and radiated via three main outlets. These will be Greipstad on channel E2 (60KW), Bjerkreim E6 (15KW) and Lyngdal E9 (30KW). A regional news programme will be broadcast on weekdays between 1745 and 1755 local time.

Belgium:

On February 20th, BRT TV2 programmes began from a 10KW ERP outlet in Brussels on channel E25. It replaces the E25 transmitter at Wavre which collapsed some time ago.

TELE-2 programmes on channel E49 originate from the Profondeville outlet which has an ERP of 50KW.

In the Brussels area the French satellite service known as TV5 is rebroadcast on channel E56 in PAL colour on the CCIR-H standard.

France:

Canal Plus commenced broadcasting on April 20 using the VHF Band III channel 1 (176MHz vision, 182.5MHz sound).

Scrambled programmes will be radiated between 1000 and 1200 local time with non-scrambled material from noon until 1800.

The official starting date for Canal Plus is November 1, 1984. Six hours of programmes each day are scheduled but they will be mainly scrambled with only 45 minutes per day of de-scrambled material.

Test transmissions for Canal Plus on channel 1 have started in the area around Paris. The channel corresponds to the old channel F8a.

This month's Service Information was kindly supplied from various sources via Gösta van der Linden in Rotterdam, Netherlands.

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7905/12/15/24 plastic 50p
CA3085 TO99 ..... 50p
LM723 14 dil or TO99 ..... 50p

EPROMS/MEMORIES
2764-300ns INTEL/FUJITSU £6.50
2732A-3 Ex-eqpt. £2.50
2102 500ns AMD ..... 80p 10/£6.00
MC6810P £1.05

POWER TRANSISTORS
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TIP35B £1.30 TIP35C £1.50
2N055 Motorola ..... 50p 5/£2.00
2N055 Ex eqpt tested ..... 5/£1.00
MJE3055, MJE2955 equiv ..... ea. 50p

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Varley 24v dc 4p c/o relay 80p
Fig 8 mains cassette leads ..... 3/£1.00
KYNAR wire wrapping wire 2oz reel £1.00
PTFE min. screened cable ..... 10m/£1.00
TOKIN MAINS RFI FILTER 250v 15A £3.00
TDK MAINS RFI FILTER 115v 15A £1.00
IEC CHASSIS PLUG/6A RFI FILTER £3.00
Epoxy potting compound 500g £2.00
Mercury tilt switch small £1.00
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12FR400 12A 400v small stud ..... 4/£1.50
BY127 1200v 1.2A ..... 10/£1.00
1N5401 100v 3A ..... 10/£1.00
BY254 800v 3A ..... 8/£1.00
BY255 1300v 3A ..... 6/£1.00
1A 800v bridge rectifier ..... 4/£1.00
6A 100v bridge 50p
10A 100v bridge £1.25
15A 100v bridge £1.25
25A 200v bridge ..... £2.00ea. 10/£18
25A 400v bridge £2.50

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BTX95 800v 15A £1.20
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W24/ or sim 12 watt 4 of one value for £1
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OPI2252 Opto isolator 50p
Photo diode ..... 50p 6/£2
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RPY58 LDR 50p
TO18 LDR 50p
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Bicolour red/green 5mm or rect. ..... 50p 5/£2

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1N4148 ..... 100/£1.50
1S3740 Germanium ..... 100/£2.00
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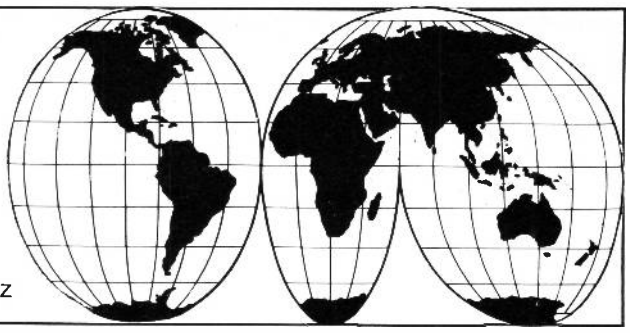

BY Frank A Baldwin

All times in GMT, **bold** figures indicate the frequency in KHz

With the 'season' in full swing for the best chance of reception in the UK of signals from Latin America, I bring to your attention the Republic of Peru and in particular some of the out-of-band stations that have recently been reported.

Peru is in west South America with the capital, Lima, being some 13Km from the chief port of Callao. The country is bounded in the west by the Pacific Ocean and divided by two ranges of the Andes with high altiplano in between.

The western range features two high volcanoes, El Misti and Huascaran, whilst in the east are the West Amazon rain forests.

The population is mostly Indian, the Inca capital being at Cuzco on the high altiplani, the Inca Atahualpa being captured and treacherously executed by Francisco Pizarro and his band of adventurers – the so-called Conquistadors, who eventually fought amongst themselves. All that sets the scene, now we deal with the DX.

The details listed here are correct according to the latest information that I possess, although I should mention that some of the frequencies are apt to vary on occasions – this habit being part of the LA DX game. Where a time is stated (not a transmission period) it indicates when heard.

Logging some of these Peruvians will prove to be far from an easy matter. Apart from their relatively low powers, there is the ever present problem of the commercial QRM which abounds around most of the channels listed. For these reasons alone the successful reception by a UK based enthusiast would represent a DX feat of no mean order.

In frequency order for ease of operating, we commence with –

Radio El Sol de Los Andes, Cuatunumi, Santa Cruz on **4254.5.** The only other details known about this one is that it announces as being on **4225** and has also been heard on **7073.5.**

Radio Frequencia Juvenil, Cajabamba, Cajamarca, on **4361,** operating a schedule from 0000 to 0400.

Radio Inca del Peru, Los Banos del Inca, Cajamarca, on **4494** – not to be confused with Radio Inca del Peru based in Lima.

Radio Los Andes is located in Tayacaya, Huancavelica, where is it scheduled around-the-clock, the frequency being **5300.**

Radio San Francisco, Ayacucho, is timed on the air from 2300 to 0330 on **5301.**

Radio Nueva Acobamba, Acobamba, Huancavelica, is on **5325** where it operates from 1100 to 0230.

Radio La Voz del Nororiente, Jaen, Cajamarca, on **5340** is scheduled from 1100 to 0200.

Radio Vision, Juanjui, San Martin, is on **5360** schedule unknown.

Radio Pucara, Jaen, Cajamarca, is on **5560** from 2300 to 0200.

Radio Yucan, Cutervo, Cajamarca, is on a reported **5617** from 1110 through until 0007.

Radio Bambamarca, Bambamarca, Cajamarca, is on **5656** from 2100 to 0300.

Radio Acunda Mariscal Morales, Chota, Cajamarca, is reported on **5657** from 2000 to 0400.

Radio San Miguel, San Miguel de Pallaques, Cajamarca, is on **5707** from 0045 to 0250.

All of the foregoing was retrieved from my computer memory bank but much of it was originally obtained from *Short Wave News,* the journal of the Danish Short Wave Clubs International with additional information from the *World Radio Handbook,* 38th Edition, to whom acknowledgements are made.

Next month I will be dealing with some more of the Peruvian transmitters.

AROUND THE DIAL

African stations are listed first and these will provide some hours – or even days – of endeavour and enjoyment for those readers interested in the short wave world.

AFRICA

Cameroon

Radio Douala on **4795** at 2052, OMs with songs in vernacular complete with drums and other local instruments – very rhythmic. R Douala is on the air from 0425 to 0800 and from 1630 to 2300 with a power of 100KW.

Yaounde on **4850** at 2055, OMs and YLs with local songs in vernacular and OM with announcements in French. The schedule is from 0430 to 0700 and from 1630 to 2400. This is the National Service in English and French.

Chad

Radio Chad, N'djamena, on a measured **4904** at 1910, OM with a talk in French, drums in typical African style. OM with station identification at 1930 in French. The schedule is thought to be from 0500 to 2100, Saturday until 2200 although I have not confirmed this period. N'djamena is probably better known as Fort Lamy; it is the capital of the Chad Republic sited at the confluence of the Shari and Logone rivers. It is the centre of the caravan trade and somewhat isolated. The power is 100KW.

Egypt

Cairo on **11665** at 0015, chimes time-check, OM with station identification and the news in Arabic in a programme of the Domestic/External Service, scheduled on this channel from 1900 to 0030.

Kenya

Nairobi on **4934** at 0334, OM with recitations from the Holy Quran in the Eastern Service programme timed from 0250 to 0630 and from 1420 to 2010 (General Service on Sunday only until 2110).

Libya

Tripoli on **11815** at 2003, OM with a talk in Arabic in a 'Voice of the Greater Arab Homeland' programme, timed on this frequency from 1800 to 2100 and from 2300 to 0330. English to North America in a Radio Jamahiriya presentation is timed on this channel from 2100 to 2250 although the timings of these programmes are apt to vary from day to day.

Nigeria

Radio Nigeria, Lagos, on a measured **4932** at 2103, OM with a newscast of both African and world events. This is the Educational Service which is on the air from 0400 to 2300.

Sao Tome

Radio Nacional on a measured **4807** at 2026, music in the fast rhythmic local style, OM with announcements in Portuguese. This one is scheduled from 0530 to 2300 (Saturday until 2400) and the power is 10KW. Sao Tome has recently come to life again after an absence of about eighteen months. Similarly, Chad mentioned above went silent in 1979 but re-emerged earlier this year.

Senegal

Dakar on **11895** at 0612, OM with a newscast in French, a short interlude of some orchestral music then OM & YL alternate with announcements during a French programme for West and Central Africa, daily from 0600 to 0800.

AMERICAS

Argentina

Radio Rivadavia, Buenos Aires, on a measured **5882** at 0150, a commentary in Spanish describing the events during an exciting, apparently, futebol (football) match between two local teams.

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R Rivadavia is on the air Monday to Friday inclusive from 2100 to 0200 but extended to 0400 on football events, Saturday from 2300 to 0400.

Brazil

Radio Emisora Rural, Santarem, on **4765** at 0048, OM with a sporting commentary in Portuguese, the signal surprisingly riding over that of the R Moscow relay in Havana. R Em Rural is on the air from 0800 to 0300 at 10KW.

Radio Nacional da Amazonia, Manaus, on **4845** at 0026, OM with a local pop song in Portuguese, OM with announcements. The schedule is from 1300 to 0800, the power 250KW.

Radio Baré, Manaus, on **4895** at 0039, YL with a ballad in Portuguese complete with guitar backing. R Baréis on the air from 0830 to 0130 with a power of 1KW.

Radio Cultura do Para, Belem on **5045** at 0053, a programme of recorded local pops, OM announcer. The schedule is from 0700 to 0300 with a power of 10KW.

Radio Nacional da Amazonia, Brasilia, on **11780** on 0125, OM announcements in Portuguese, YL with a pop song, OM with station identification at 0130. This one radiates from 0800 to 1600 and from 1800 to 0200 with a power of 250KW.

Radio Globo, Rio de Janeiro, on **11805** at 0120, OM with a sports commentary then OM with promos. R Globo operates from 0800 to 0400 with a power of 10KW.

Radio Clube de Pernambuco, Recife, on **11865** at 0125, OM a talk in Portuguese, announcements then promos. RC de Pernambuco is scheduled from 0900 to 0400 with a power of 1KW.

Colombia

Radio Guatapuri, Valledupar, on **4815** at 0320, OM with a local pop song, OM with announcements in Spanish. The schedule is from 1000 to 0500 with a power of 10KW.

Radio Sutatenza, on **5095** at 0323, OM with announcements in Spanish then a programme of recorded local pops. On the air from 0900 to 0400 at 50KW.

Ecuador

CRE Guayaquil on a measured **4656** at 0136, OMs with a discussion in Spanish and several mentions of Guayaquil. Radio Dif del Ecuador (CRE) operates from 2300 to 0400 with a power of 5KW.

Radio Luz y Vida, Loja, on a measured **4851** at 0339, OM with a local pop song in Spanish, OM announcements. Sometimes on a 24-hour schedule but normally from 1045 to a variable 0400. The power is 5KW.

Peru

Radio Ondas del Titicaca, Puno, on a measured **4922** at 0019, OM with a talk in Spanish about Peruvian affairs, several place names being mentioned. Slightly muffled speech and some echo-effect probably due to studio conditions. This one operates in Spanish or Aymara – the local Indian language – to the schedule 0945 to 0300 with a power of 1KW.

Venezuela

Radio Valera, Trujillo, on **4840** at 0315, OM with station identification, promos in Spanish then into a programme of local pops. R Valera is on the air from 1000 to 0400 with a power of 1KW.

Radio Capital, Caracas, on **4850** at 0012, OM with the station identification, announcements and local pops. The schedule is from 1000 to 0500 and the power 1KW. Recently reactivated, this one has been off the air since 1978.

Radio Barquisimeto on **4990** at 0339, OM announcements in Spanish, OM ballad – rather sorrowful at that! The schedule is from 1000 to 0400 with a power of 15KW.

ASIA

China

Radio Beijing on **9900** at 2014, YL with a talk during the Standard Chinese transmission directed to Europe and North and West Africa and timed from 2000 to 2100.

India

AIR (All India Radio) Delhi on **9665** at 1957, OM with announcements, frequencies and times of transmissions then YL with a newscast during the English programme for the UK and Western Europe, scheduled from 1845 to 2230. Also logged in parallel on **9755.**

AIR Delhi on **11620** at 1317, OM with a talk in the Sinhalese programme to Asia, timed from 1300 to 1330.

Iran

Teheran on **9770** at 2030, trumpet call, OMs with a military marching song then OM and YL alternate with a newscast in Persian (Farsi). Schedule on this channel is unknown. Also logged in parallel on **9022.**

Israel

Jerusalem on **11655** at 0120, OMs and YLs with a discussion about local politics during an English presentation to the Americas and Europe, scheduled from 0100 to 0125.

Jerusalem on **9815** at 2004, OM with news comment in the English programme to Africa, Europe and North America, schedule from 2000 to 2030 – a more reasonable time than the above for many readers perhaps.

North Korea

Pyongyang on **9360** at 1823, YL with announcements, local music and songs in the French programme to Europe, timed from 1700 to 1850.

Saudi Arabia

Riyadh on **5875** at 0254, interval signal, national anthem, OM station identification in Arabic at sign-on of the Domestic Service General Programme which is on this channel from 0255 to 0500 and from 1000 to 2300.

Sri Lanka

Colombo on **11800** at 1734, local-style music and YL with a song during the Urdu transmission to East Africa and the Middle East scheduled from 1645 to 1745.

OM with station identification and news in the English programme to the same target areas and timed from 1745 to 1815.

Turkey

Ankara on **9695** at 2120, YL with a song, local-type music during the Turkish programme for Turks abroad, featured from 1600 to 2200 on this frequency.

Yemen Arab Republic

San'a on **9780** at 2020, OM with some songs in Arabic complete with local orchestral backing during the all-Arab transmission on this channel from 0300 to 0700 (to 1000 on Friday) and from 1100 to 2110.

EUROPE

Austria

Vienna on **11660** at 1858, interval signal, OMs with the station identification in French, German and English, frequencies, then into the German transmission for Europe, North Africa, the Middle East and South and West Africa, scheduled from 1900 to 2000.

Spain

Madrid on **11880** at 2040, YL with a news comment on both local and world events in the English presentation for Africa, timed from 2030 to 2130.

Greece

Radio Macedonia on **12000** at 1004, YL with folk songs and music, YL with announcements in Greek. The schedule is from 0355 (Sunday from 0425) to 2305.

Malta

Deutsche Welle (Cologne, West Germany) relay on **11795** at 1417, YL with announcements during the German programme for Europe, the Middle East, South and South East Asia, timed from 1400 to 1600. A news comment followed.

Portugal

Lisbon on **11800** at 1506, OM with a football commentary in the Portuguese programme for India and the Middle East, scheduled from 1400 to 1600.

CLANDESTINE

National Voice of Iran on **5915** at 1932, OM with a talk in the Persian programme with several mentions of Ayatollah Khomeyni. The Persian (Farsi) language is used from 1730 to 1745, 1800 to 1815 and from 1930 to 1945. Seda-ye Melli-ye Iran is pro-Soviet (transmissions emanate from the Baku transmitters) anti-US but hostile to Khomeyni although originally they were pro-Khomeyni.

NOW HEAR THESE

Abidjan, Ivory Coast, on **11920** at 0600. Radio Amazons, Iquitos, Peru, on **5060** at 0345. At 5KW the schedule is from 1000 to 0500. Melbourne on **11790** from 1500 to 1600 and from 2000 to 2030 on this channel. Also have a try for signals from the standard frequency and time signal stations.

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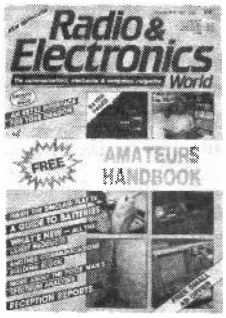
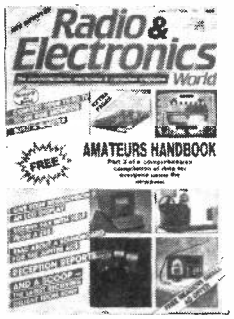
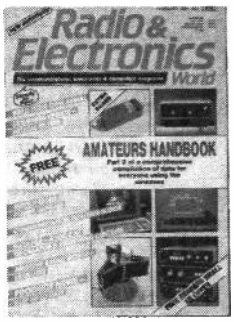


DECEMBER 1983
Designs — Poor Man's Spectrum Analyser Part 2; Communications Building Blocks Part 2; A 4001/4011 Tester; Continuity Tester. *Features* — Inside the Sinclair Flat TV, An in-depth probe; A Circuit Designers Guide to Batteries; Data File on Op-Amps Part 1; Metal Detectors in Warfare; Data Brief 1-LM1821S Video IF PLL Synchronous Detector; Data Brief 2-SL6270 Gain Controlled Audio Amplifier; An RS232C Interface for Your Dragon 32. *Reviews* — ALDEN Weather Chart Recorder Kit; Digithurst MicroSight 1.



JANUARY 1984
Designs — Communication Building Blocks (Active Antennae); FAX Receiver; RGB Interface for the Ferguson TX-90; A Couple of Voltage Detectors; LCD Capacitance Meter; Cymar Q-meter (An aid to winding coils); Zener Diode Checker; A Drinker's Delight; LCD Display Option for the Rewbichron II. *Features* — A Novel Receiver (Sony); Capacitors for Coupling, De-coupling and Filtering; Data File on Op-Amps Part 2; Farewell to Test Card 'F'; A Soundboard for the Jupiter Ace; Data Brief – MC1377 Colour Signal Encoder.



FEBRUARY 1984
Designs – Switched Mode Power Supplies; Crowbar Protection Circuit; Switched Step Attenuator; Universal NiCad Charger; Communications Building Blocks (IF Amplifiers); Real Time Calendar Clock. *Features* – Data File on Op-Amps; Six Antennas from Three Wires (Double your directions without doubling your cost); Designers Update (Helical Filters); Moving Pictures from Wax – 'Phonovision'; Computers, Communications and Applications; Data Brief – Low cost, wide range varicap diodes.

MARCH 1984
Designs — Modifying the Pye PF1 Pocketfone Receiver; Communications Building Blocks (IF Amplifiers); One Night's Work (Audio-Amp); 200W PEP Transmatch. *Features* — Sony ICF 760CD Receiver; Data File on Op-Amps; UOSAT-B; AKD Absorption Wavemeter; Data Brief — Hitachi HA 1197 AM Tuner; Oscar 10 and its Orbit Parameters; Programmable Sound Generator (the AY8910 family); Random Morse Computer Program; ICOM World Clock.

APRIL 1984
Designs — One Night's Work (IF Oscillator) ; HF Linear Amplifier; The Piano Keyer — only £5 for Perfect Morse; Peak-Reading LED RF Wattmeter; Speech and the Computer — Make the Beeb Micro Talk!; 2 Metre Tiger Antenna. *Features* — Hall Effect Devices — Exploiting Magnetisms' Effect on Conductors; Data File — CMOS Bilateral Switches and Multiplexer/Demultiplexer ICs; Data Brief-TD 2002A Linear IC

MAY 1984
Projects –One Week's Work (VHF/UHF Frequency Meter); Spectrum Analyser Update; Assembling a Logic Probe Signal Generator; 2 Metre J-Stick Aerial; SX-200 Relative S-Meter.
Features – Data File – 4046B Phase-Locked Loop CMOS IC; Hamey HM203-4 Oscilloscope review; A Beginners Guide to Meteor Scatter Propagation; High & Low Measurements – A Guide to Measuring Outside the Conventional Ranges

JUNE 1984
Projects – Microprocessor Controlled Dot Matrix Printer; One Nights Work – Replacement Plug-in Module for 2532 EPROM; A low-cost Frequency Standard; Radio Frequency Bridge; Modifying the RGB Interface for the Ferguson TX90. *Features* – High Speed Data Transmission; Trio-Kenwood TS-430S Transceiver; ZX Spectrum Data Transmission Program; Data File – National Semiconductors LM Range of Dual Audio-Preamplifier ICs; Data Brief – MC 1648 (SL 1648) Voltage Controlled Oscillator; HP41CX Calculator Review

JULY 1984
Projects — VLF converter, a unit for the very low frequency; Teleprinter Terminal Interface; Multifunction Test Instrument, a versatile piece of test equipment; Building the Fortop TVT-437; Improving Indoor Aerials, getting better reception without an aerial amplifier; Logic Probe for CMOS and TTL's.
Features; Amplicon Digital Panel Printer; Oscar 10; Yaesu FC102 Review; Data File — audio power amplifiers; Images of the World, a new publication review.

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■ Yaesu FT101E, good condition, with 600Hz filter, fan, and fist mic. £285. Yaesu YC601 digital frequency display (fits all Yaesu 101 and 401 series TRCVs) £75 (perfect condition). Maurice (G6IMV), 18 Mossvale Grove, Washwood Heath, Birmingham, B8-3QJ.

■ Yaesu FT707 and FC707 ATU. Mike bracket original boxes and manuals, extra bands K-tone fitted all mint cond £450 the lot. Pete Stevenson, 6 Netherhouse Place, Commanhead, Glasgow, G34-0DT Tel: 041-771-7611

■ Zenith R7000 £350 mint, exchange 35mm Nikon camera, video recorder, WHY. C Haynes, 13 Lionel Road, Eltham, London SE9 6DQ. Tel: 01-850-1543

■ Swop Stereo, cost £750 for transceiver. sorry no cash, on the dole. Just taken licence. Also radio controlled model aircraft cost £200 WHY. Full details. Tel: 051 489 2668

■ Eddystone 830/X Rx £30. Audioline 341 FM/CB £25. Rama ext SP £5. RD6 resistance box 152 to 1MHz £15 ono. 2x, 6μF, 500V capacitors £1.00 pair. 1400μf, 400V capacitor 50p. 1800 μF, 250V both BX Daly. 1-3500μf, 30Vdc capacitor 20p. Dual O/P 16μf, 350v capacitor. Also 6x Newmarket 404 transistors 10p ea. Pye radio telephone POA and various other bits + pieces POA. Bob Jones. Tel: 0685 74061

■ Colour printer/X-Y plotter, Type CGP-115, four-colour pen mechanism, selectable 40/80 character width printing, relative and absolute graphic modes, extras, £110 ovno. Tel: Mike GM4UKG, QTHR, Inverkeithing (0383) 416688.

■ Trio R600, mint condition, four months old, receiver used very little £230 ono. Global at 1000 ATU, good condition £20. T Corbett, Sunnyside, New Road, Coedpoeth, Wrexham, Clwyd, North Wales. Tel: Wrexham 757435 (after 6pm).

■ Scopex 14D-10 double trace CRO. Bandwidth 10 MHz. Absolutely as new condition. Cost £289, accept £150. Complete with manual and muff. Tel: Reading 883799

■ IC2E, Spkr Mic, BP4 battery case +6 Nicads, DC1, 12V adaptor, mobile charging lead, cases, all standard accessories £140. 20W PA, suits 2E, £20. Rx converter, 2m input, 10m output, £10. Wanted, FT290. Dan Glover (G6RMA QTHr). Tel: (0322) 524938 (evenings only)

■ SWL report forms designed for maximum information about your listening post. Give real meaning to your DX reports. Derek Rout, 3/137 Champion St, Christchurch, New Zealand.

■ Pye Tx/Rx 1.6/3.9 KHz, 50W, spares, manual. As new, offers. BC221 freq meter, charts, PSU vgc £40. Dane test oscillator 0.1 10000Hz, dual quad output, vgc £40. Serviscope with new spare valves £40. Airmec VTVM, Type 219, vgc £35. Marconi VTVM, TF899, vgc £20. Metrix MX202B, VOM, vgc £45. Racal SSB adaptor RA218 less crystals, as new, offers. Valves QV08/100, QF41, 723A/B, KT66, 11E3, QU37, 3C45, 5R4GY, 6CH6, CRTs DG-18-14A, RMT59. Shack clearance. Tel: 0502 715419

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■ 2m FM amplifier by Catronics Ltd, 11.5W in, 40W out plus spare new 11.5 in 40 out transistor and circuit etc £25. Hardly been used. 2m speech processor with internal 9V battery, also multi plug to fit Yaesu transmitter, as new £15. Tel: Nelson 68548

■ Realistic 5 band DX200 receiver £75 ono. A Parr, 3 Groes Lwyd, Abergele Clwyd. Tel: 0745/822176

■ Ex EMI research lab's parabolic four foot dish with tripod mount. Part motorised low windage sited in Hampshire £125. Buyer collects phone Looe (05036) 4339 G8MRB

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■ Armstrong AF208 chassis with full data and speaker. Radiomobile car radio model 1085XT with speaker. Also Bush radio type AC11. Long medium short waves. Needs dial panel. All in good working order. Offers please or exchange for small short wave radio, such as Mohican GC-14, Codar T28, or any similar type. WHY. Arthur Hyde, 54 The Causeway, Pagham, Bognor Regis, Sussex PO21 4PG. Tel: Pagham 3256

■ Pye Cambridge 5W VHF mobile transceiver. Easily modified to 2 metres £15. Carriage extra. 'Artificial Satellite Observink' by H Miles. The best book available for information on orbital predictions, telemetry, radio tracking and visual observation of satellites. Brand new, £5.50. K H Law, 11 Springhill Road, Saffron-Walden, Essex CB11 4AH. Tel: 0799 21388

■ Yaesu FRG 7700, good condition, bargain at only £210. Tel: Yeovil 29313 (evenings)

■ Yaesu FT480R as new condition, boxed with manual etc £260 ono. Nakamichi cassette deck model 350 boxed as new £60 ono. Rank, Bush, Murphy, colour monitors, Ex-BBC, working £50 each or all ten for £450. Tel: Guildford 0483-571134 (evening-weekends)

■ Labgear LG300 CW transmitter, covers amateur bands. Also Woden UM2 power supply and modulator. Neither in working order but could be made workable. Ideal for valve enthusiast, circuit diagrams also available. £70 the lot. Buyer must collect. A Mackay, 20 Broom Covert Rd, Swinfen Hall, Lichfield, Staffs. Tel: Shenstone 480909 (after 6.30pm)

■ Code Master CW/RTTY Decoder +Morse tutor, CWR 610E £120.00 (G4UVJ). Tel: Canvey Island 697978 (QTHr).

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■ Oric 48K plus Oric chess and other software £95 (or swop for Spectrum 48K). Heathkit RAI amateur bands receiver £45 ono. Tel: Loughborough 268136 (after 7pm).

■ Shack clear out. Grommets mixed sizes 100+ £1.00 bag. Washers, non-metallic, with ⅛in and ½in holes different sizes rubber/fibre/insulation 2,000 £7.00. Three tone buzzers, will work on 9V to 12V fixed to PCB, 3in x 1/w/in, beautifully made, box of 40 £2 each. Pots all 22K Lin small size, 10 for £1. Packs res/cap/tran/100+ £2.50. Polypropylene twine light, strong, 200lb breaking strain, 100 yard rolls £1. Fuzz boxes £9. D Martin, 29 St Johns Close, Leatherhead, Surrey.

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■ Hameg scope HM203-4 as new £250. Realistic scanner 2003 60 channel. Unused £190. Realistic speaker £5. Revco discone aerial unused boxed £30. Home built bench power supply 0-30V 2amp £25. Workshop clearance, wire small drill, bits and peices etc £15. All collect or plus carr. Edwards, 2 Beach Road, Burton, Bradstock, Bridport, Dorset DT6 4RF. Tel: 0308 897625

■ For sale. DX200 communications receiver, vgc. 1.8-30MHz + long wire antenna and full instructions. Good for SWL beginner £68 ono. Philips black and white portable television, excellent 20in screen vgc £68 ono. Hitachi radio portable FM/MW/LW, very smart, £13 + case + earphone. Nice present. Laurence Mendes, The White House, Chapel Lane, Mickleton, GL55 6SD. Tel: 038 677 727/798.

■ Creed 75 page printer with stand, paper winder, 6S tape reader, Creed 80-0-80 power supply, lots of paper rolls & tape, all in wkg condition. Buyer collects £25.00 the lot. Ring after 7pm week days. Tel: Mike (G8ATK) 0252 715765.

■ Computer printer for sale. TTL level input. Uses ordinary 8½in wide paper. C/W power unit, built-in interface, software (tape and printout). Modified Creed 7B. Can be seen working on my Acorn Atom. £50 buyer collects. Also four 2708 EPROMS, offers? Or will exchange for a 2716 or 2532. N J Tubb, 35 Burns Road, Pound Hill, Crawley, Sussex. RH10 3AT. Tel: Crawley 513354 (evenings).

■ Closed circuit TV camera with b/w monitor for sale. Two sets available each with 6½metres cable, £65 per set. Stereo reel-to-reel recorder (Cossor), 2 speed, track transfer, etc. Complete with stereo microphone, £40. Microphone mixer £5. Fifteen 5in floppy disks (used) £1 each. Three storage boxes for 5in disks £1.50 each. Buyer collects large items or pays carriage extra to price asked. All items must go!! Dennis Lyons. Tel: Shipton-under-Wychwood (0993) 830248 or Nuneaton (0203) 385614 (answer service).

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■ Realistic PRO2001 scanning receiver 16560 freqs. Complete with discone antenna and VHF/UHF portable antennae. £90.00 ono. Also Realistic DX200 comms. Receiver £65.00 ono. Both in mint condition complete with handbooks and original packing. Also Lowe TX40 CB TX/RX complete with SWR meter, matcher and AR2 antenna. £30.00. Tel: 0302 841530.

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■ Sony CRF-320 HF + general coverage receiver sell £325, or swap 2 metre multimode. Tel: (Glasgow) 041-551-9117 evenings.

■ Sony IFC 7600D radio. New May 1984. Controls rather small for my fingers. Cost £170 asking £140. Tel: Worthing 49978.

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■ Practical Wireless back issues. May, Nov 74; Jan to Mar 75; Sep to Dec 75; Feb to Dec 76; Apr, Oct 77; Jan, Feb 78; Mar 80. 24 copies in all. 80p each including post or offers for the lot. David Wyatt, 6 Whittington Road, Oswestry, Shropshire, SY11 1HY.

■ Cossor oscilloscope, Model 1049, circa 1950. Double beam dc to 100KHz. Probably working, with manual and circuit. £5 to strong caller (weight 75lb). Tel: 021 552 2494.

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■ Pye Pocketfones, Type PF1 Tx. Tel: Chris, Reading 661075.

■ Operators manual or circuits for Tektronix 531A oscilloscope with Type D plug in unit. Buy or borrow or photocopy. All expenses paid. Peter Makin, 6 Fairisle Close, Clifton Estate, Nottingham NG11 8GD. Tel: Nottingham 215460.

■ Circuit diagram or manual for solatron scope type D300. T Heeley G35WU, 34 Worlaby Road, Scartho Grimsby, South Humberside DN33 3JT. Tel: 751537.

■ Oscilloscope tube new or s/h for telequipment scope type D83. Complete mainframe considered. G Jackson, 17 Newnham Close, Hartford, Huntingdon, Cambs. Tel: (0480) 58065.

■ A handbook for Labgear LG300 TX (1955) and a service manual (not a handbook) for Racal 17L RX. Will gladly pay for a loan of either to photocopy. If you do not wish to sell. Phone of write. Dave GM4RKA (QTHR) 0875 610778. All letters answered. David Marshall, Beech Cottage, Main Street, Ormiston, East Lothian, EH35 5HT, Scotland.

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■ Pair of Partridge output transformers, Type WWFB or CFB for 'Williamson' amplifier. Also Garrard 301 turntable. Tel: 0892 40022 (evenings).

■ German WW2 equipment for collection. Condition not all important. Also manuals and parts wanted. Offer WS19 or cash in return (OZ8RO). R Otterstad, Uejdammen, 5 DK-28Y0, Holte, Denmark. Tel: 02-801875.

■ Teletex adapter for ordinary TV-set. Must be in good condition and able to work without any alteration of TV-set. S Sakamoto, 53 Appleford Drive, Abingdon, Oxon OX14 2BX

■ Vintage wireless equipment, early amateur gear, old American communication receivers, old domestic radios, any condition or incomplete, also old magazines, books, manuals. Tel: 0202-510400

■ Denco octal plug in coils. Green 1 and 2. Blue 1 to 5. Tel: Bristol (0272) 844584

■ Yaesu FC902 or similar also other makes of ATU considered like Trio 230 KW107 SEM etc. Also wanted Yaesu FTV902R or similar also desk mike for FT101Z. V Sayer, 10 St Davids Road, Locks Heath, Southampton. Tel: Locksheath 84340

■ Valves W81 or equiv's 7H7 W143 W148 to fix BRT 400 Rx. Also wanted manual or any info. For Gertsch FM3 freq meter. Call Ed G8FAX evenings on Rayleigh (0268) 770716

■ Realistic PRO-47 UHF/VHF (patrolman receiver) with or without crystals. Also cheap JIL SX200 or 200N. Mr J Bidgood, 255 Chamberlayne Rd, Eastleigh, Hants SO5 5HX

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Agents Wanted To Sell Computer Software for most Computers. We now have the Dialog Electronics Part 1 in stock. Also have in stock Pools Winner and Coursewinner. We can supply Business software, games and Computer ad on's. **Phone (0288) 4179** up to 9pm most nights for your free list and details about our agents.

Thanet Electronics ICOM
95 Mortimer St, Herne Bay
Tel: 02273-69464
Open: Mon, Tues, Wed 9-5
Thurs 9-1, Fri, Sat 9-5.30
All mail order & service enquiries to head office, 143 Reculver Rd, Tel: 02273-63859

LONDON

BONEX LTD
RF component specialists Toko coil & Inductors
102 Churchfield Road
London W3 6DH
Tel: 01 992 7748

NORFOLK

Eastern Communications
31 Cattle Market Street
NORWICH
(0603) 667189
MAIL ORDER
ICOM
ACCESS BARCLAYCARD
MON-FRI 9.30-5.30
SAT 9.30-5.00

Radio & Electronics World

COUNTY GUIDE

You can be assured that readers know where they can go in your area to purchase

RATES
BOXES ad sizes
20mm x 59mm single
40mm x 59mm double

Total prepayment rates	Ad space	3 issues	6 issues	12 issues
	single	£47.00	£88.00	£158.00
	double	£94.00	£176.00	£316.00

RADIO & ELECTRONICS WORLD COUNTY GUIDE ORDER FORM

TO: Radio & Electronics World · Sovereign House · Brentwood · Essex CM14 4SE · England · (0277) 219876

print your copy here .....

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NUMBER OF INSERTIONS REQUIRED

	3	6	12
Single County Guide	£47.00 ☐	£88.00 ☐	£158.00 ☐
Double County Guide	£94.00 ☐	£176.00 ☐	£316.00 ☐

PAYMENT ENCLOSED £ —

Cheques should be made payable to Radio and Electronics World. Overseas payments by International Money Order

Conditions — Payment must be sent with order form. No copy changes allowed. Ads accepted subject to our standard conditions, available on request.

Registered No 2307667 (England)

C P I

CATALOGUE OF ALLSORTS
Electronic, telephones, new BT sockets, burglar alarm equipment etc
Send 40p and SAE to:
CABELEC
14 Tillman Close, Greenleys, Milton Keynes MK12 6AQ. Dept REW.

THE VINTAGE WIRELESS COMPANY
1914 - 1960
Radios, amplifiers, service sheets, valves, vintage components, books new & used, repairs & restorations, mail order only.
Tudor House
Cossham Street, Mangotsfield,
Bristol BS17 3EN
0272-565472

RADIO CANADA
Peking, Australia, voice of America. A Vega 206 (6x SW/MW/LW). Pulls these and dozens more. £23.45. Year's guarantee. Return dispatch.
CORRIGAN RADIOWATCH,
Building 109, Prestwick Airport KA9 2RT

Turn your surplus IC's Transistors etc into CASH. Immediate settlement. We also welcome the opportunity to quote for complete factory clearance.
Contact:
Coles, Harding & Co, 103 South Brink
Wisbech, Cambs. Tel: 0945 584188

RTTY
THE EXPANDING MODE
Build your own terminal unit to interface your micro to a receiver or transceiver.

PL1 PLL T.U. . . . Kit	£13.50
built module	£18.50
FP1 Power supply & pre-filter Kit	£11.25
built module	£14.65

Software also available – please enquire
For full catalogue send s.a.s.e. to
Please add VAT to all prices
PNP Communications (REW)
62, Lawes Avenue, Newhaven
East Sussex BN9 95B
Telephone (0273) 514465

RESISTOR PACKS FOR ALL PROJECTS
¼watt carbon film resistors 5% 1 ohm to 10M E24 series. Packs of 10 each value (1690 resistors) **£10.00** Your choice of quantities/values 125 for **£1.00.** VAT and Post Free.
GORDON HALLETT
20 Bull Lane, Malden Newton,
Dorchester, Dorset DT2 0BQ.

EUROLEC VIDEO SERVICES
01-669 2611 Telex 893819 Eurolec G
Address for correspondence only:
35 Sandy Lane South,
Wallington, Surrey SM6 9RF
We have a quantity of Phillips VCR cassettes, both new and ex-library. Please write or phone for details
NTSC/PAL Transfers. Please write or phone for details

J A CREW & CO
SPINNEY LANE, ASPLEY GUISE, MILTON KEYNES
Tel: (0908) 583252
(Mail order only)
1000 resistors 1/4 1/2 watt £2.50; 100+ capacitors 95p, 50 electrolytics 95p; LED's red 50p/6, yellow/green 50p/4; 50 assorted branded transistors £1.95; 50+ diodes, SCR's & bridge rectifiers £1.60; BC108 £8/100, panel neons £2.50/10; TIP 50 £1.20/4; BY164 bridge 1.4A 25p; Opto-isolators 60p/5;Mains filter 5A (List £6+) £2.85; 40 pin low profile DIL sockets 50p/2; 6 volt BI-PIN bulbs 50p/10; 12 volt low profile relays SPCO 5 A rating £1.25. Add £1 p&p to all orders under £12. 44 page catalogue packed with thousands of other bargains, mechanical and electronic, price 50p.

4 PLASTIC BOXES £2
1. Thick black, four screw top, size 90mm by 70mm deep 26mm.
2. Thick black four screw top, size 150mm by 84mm, deep 43mm.
3. Thin white flick on top, size 81mm by 64mm, deep 26mm.
4. Thin semi-clear white top, size 81mm by 64mm, deep 64mm.

ONE OF EACH TYPE (sample) **£2.00** plus **P&P 30p.**
ELECTRONIC MAIL ORDER
62 Bridge Street, Ramsbottom, Lancs. BLO 9AG.
Tel: (070 682) 3036. – ACCESS/VISA

R & S Radio (G4OWY)
Amateur radio equipment bought, sold and exchanged. List of available items sent on request.
Telephone anytime on 0305-786930

ALPHA KEYS
Precision engineered keys for the connoisseur. Twin or Single paddle. One of the lightest and smoothest movements ever.
CAVITY WAVEMETERS
For the UHF/VHF operator, one wavemeter to cover 144 mhz to over 2500 mhz. Can measure rf as low as 50 mill watts with suitable meter
COAXIAL RELAY KITS
The cavity block is pre-machined to take either BNC or N type sockets. Two types of cavity available. Alum. type for HF, Brass for the higher frequency.
Send large SAE for more information to:
PAUL SERGENT, G4ONF
6 Gurney Close, Costessey, Norwich NR5 0HB
Tel: (0603) 747782

NEW IMPROVED
Radio & Electronics World
The communications, electronics & computers magazine

SMALL ADS

This method of advertising is available in multiples of a single column centimetres — (minimum 2cms). Copy can be changed every month.
RATES
per single column centimetre:
1 insertion £9.65, 3 — £9.15, 6 — £8.65, 12 — £7.75.

RADIO & ELECTRONICS WORLD SMALL AD ORDER FORM

TO: **Radio & Electronics World · Sovereign House**
Brentwood · Essex CM14 4SE · England · (0277) 219876

PLEASE RESERVE.....centimetres by.....columns

FOR A PERIOD OF 1 issue.....☐ 3 issues.....☐ 6 issues.....☐ 12 issues.....☐

COPY enclosed.....☐ to follow.....☐

PAYMENT ENCLOSED:..... £ — Cheques should be made payable to Radio & Electronics World Overseas payments by International Money Order

CHARGE TO MY ACCOUNT.....☐

COMPANY .....

ADDRESS .....

SIGNATURE ..... TELEPHONE.....

.....

		C	P	I									

Ant Products
All Saints Industrial Est
Baghill Lane, Pontefract West Yorkshire
Telephone (0977) 700949

TIGER LY9 70 Cms Antenna
New from Ant Products, a superb addition to the range of renowned antenna, the Tiger LY9 for 70 cms. A light weight antenna with a heavy weight signal. Offering a high 11db gain on a 58 inch boom length. Great for vertical or horizontal mounting. Supplied in matched pairs for the ultimate Oscar station complete with all hardware for mounting with elevation control. Precisely adjustable for angle in order to get the best performance. Also including matching unit for circular polarisation. Right or left hand can be chosen with equal efficiency. Last but not least our famous two year guarantee and full back up service.
Write now for full details enclosing a SAE plus 25p in stamps

This space could be yours for as little as **£23.25** per month. Call the advertising department now on 0277 219876, or complete the coupon opposite.

ADVERTISERS INDEX

Radio & Electronics World
The communications, electronics & computers magazine

ADVERTISING RATES & INFORMATION

ABC membership approved pending first audit Jan-Dec 1984

DISPLAY AD RATES

depth mm x width mm	ad space	1 issue	series rates for consecutive insertions: 3 issues	6 issues	12 issues
61 x 90	⅛page	£91.00	£86.00	£82.00	£73.00
128 x 90 or 61 x 186	¼ page	£160.00	£150.00	£145.00	£125.00
128 x 186 or 263 x 90	½ page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£590.00	£560.00	£530.00	£475.00
263 x 394	double page	£1140.00	£1070.00	£1020.00	£910.00

COLOUR AD RATES

colour rates exclude cost of separations

depth mm x width mm	ad space	1 issue	series rates for consecutive insertions: 3 issues	6 issues	12 issues
128 x 186 or 263 x 90	½ page	£420.00	£395.00	£375.00	£335.00
297 x 210	1 page	£810.00	£760.00	£730.00	£650.00

SPECIAL POSITIONS

Covers: Outside back cover 20% extra, inside covers 10% extra
Bleed: 10% extra [Bleed area = 307 x 220]
Facing Matter: 15% extra

DEADLINES

*Dates affected by public holidays

issue	colour & mono proof ad	mono no proof and small ad	mono artwork	on sale thurs
Sept 84	12 Jul 84	18 Jul 84	20 Jul 83	9 Aug 84
Oct 84	15 Aug 84*	21 Aug 84*	23 Aug 84*	13 Sept 84
Nov 84	13 Sep 84	19 Sep 84	21 Sep 84	11 Oct 84
Dec 84	11 Oct 84	17 Oct 84	19 Oct 84	8 Nov 84

CONDITIONS & INFORMATION

SERIES RATES
Series rates also apply when larger or additional space to that initially booked is taken.
An ad of at least the minimum space must appear in consecutive issues to qualify for series rates.
Previous copy will automatically be repeated if no further copy is received.
A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received.
Display Ad and Small Ad series rate contracts are not interchangeable.

If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.

COPY
Except for County Guides copy may be changed monthly.
No additional charges for typesetting or illustrations (except for colour separations).
For illustrations just send photograph or artwork.
Colour Ad rates do not include the cost of separations.

Printed — web-offset.

PAYMENT
All single insertion ads are accepted on a pre-payment basis only, unless an account is held.
Accounts will be opened for series rate advertisers subject to satisfactory credit references.
Accounts are strictly net and must be settled by publication date.

FOR FURTHER INFORMATION CONTACT
Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4SE.
(0277) 219676

Overseas payments by International Money Order. Commission to approved advertising agencies is 10%.

CONDITIONS
10% discount if advertising in both Radio & Electronics World and Amateur Radio. A voucher copy will be sent to Display and Colour advertisers only.
Ads accepted subject to our standard conditions, available on request.

£600 + for the receiver performance of a £250 portable? There's a better way!

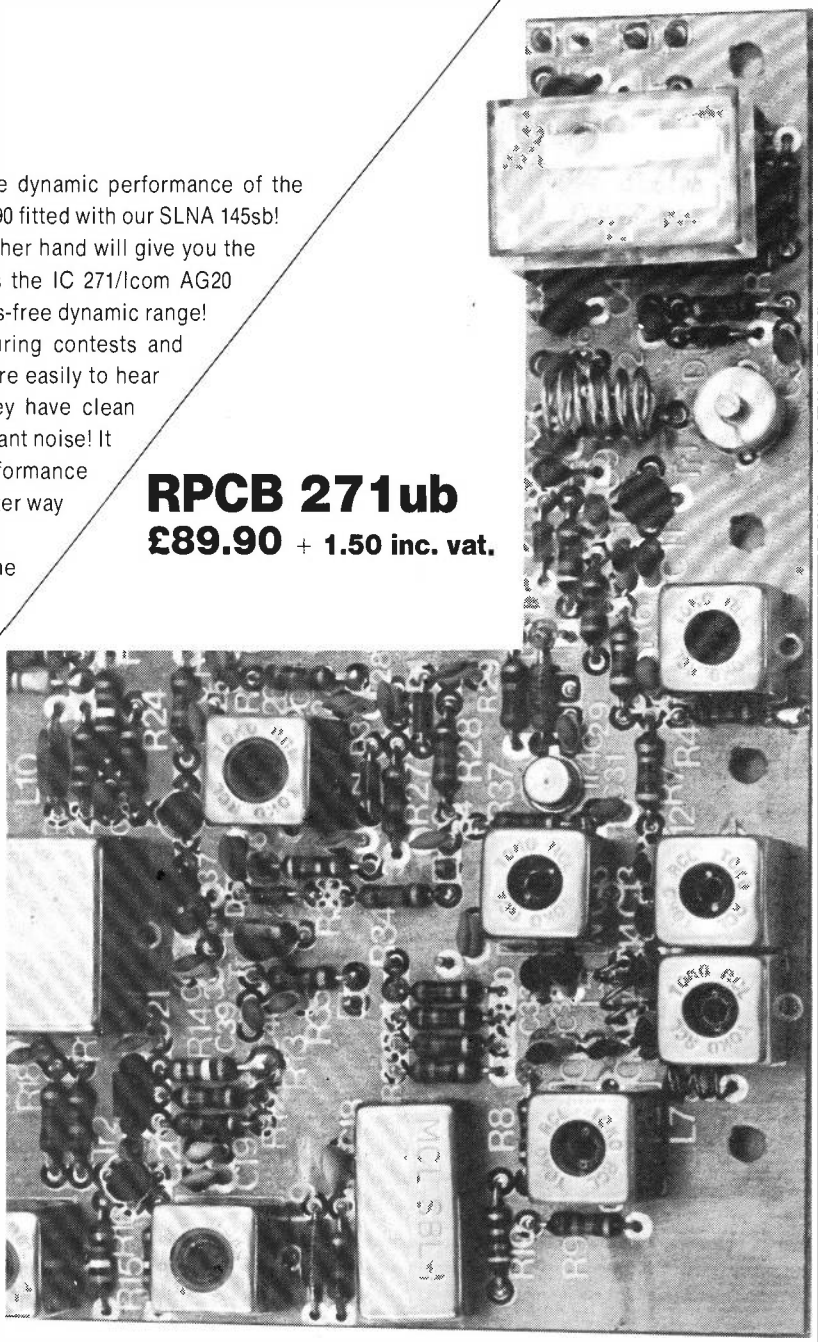
Fitting a preamplifier to Icom's IC 271 will degrade the dynamic performance of the transceiver to a level very similar to that offered by a FT290 fitted with our SLNA 145sb! Fitting our RPCB 271ub replacement front-end on the other hand will give you the same sensitivity (to within a small fraction of a dB) as the IC 271/Icom AG20 preamp combination, but with about 20dB better spurious-free dynamic range! The superiority of our approach will be best seen during contests and openings, where with our board you'll be able much more easily to hear the weak dx amongst the strong locals (assuming they have clean signals in the first place!), instead of a bandful of unpleasant noise! It does seem pointless to waste the excellent potential performance of this transceiver by fitting a preamp when there's a better way of going about it.

Incidentally, we did have a few teething problems with the interfacing of the RPCB 271ub to the IC 271. R+ was getting into Icom's mic preamp IC producing rather unpleasant ssb audio on transmit. This has now been cured, and of course where our customers have had problems we've been happy to put them right. We do care!

Stephen G4 SJP

P.S.

Our new TVHF 230c 2m to all 9 amateur hf bands transverter should be available in limited quantities at first by the time this appears in print. See it (and us) at the major rallies, or give a ring for more info.



RPCB 271ub
£89.90 + 1.50 inc. vat.

muTek limited — the rf technology company

Access VISA

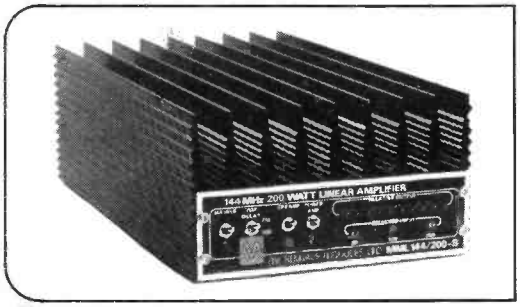
Dept RW, Bradworthy, Holsworthy, Devon EX22 7TU (040924) 543

MICROWAVE MODULES LTD

NEW!

MML 144/200-S: 144 MHz 200 WATT LINEAR AMPLIFIER

NEW!



FEATURES

- 200 watts Output Power
- Linear All Mode Operation
- Suitable for 3, 10 & 25 watt Transceivers
- Ultra Low-Noise Receive Preamp — Front Panel Selectable
- Relative Output LED Bar Display
- Equipped with RF Vox & Manual Overide
- LED Status Lights for Power, Transmit, Preamp on and input level

£245 inc VAT (p&p £4.50)

144 MHz HIGH PERFORMANCE RECEIVE CONVERTER: MMC 144/28 HP

NEW!

FEATURES

- Excellent strong signal handling characteristics
- Gasfet RF amplifier
- High level double-balanced mixer
- Harmonic-free, regulated oscillator

Input frequency range:	144-146 MHz	**Image rejection:**	60 dB
Output frequency range;	28-30 MHz	**Input/output impedance:**	50 ohm
Typical gain:	20 dB minimum	**Power requirements:**	13.8V at 75mA
Noise figure:	2 dB	**Power connector:**	5 pin DIN socket
3rd order intercept point:	+ 19 dBm (output)	**RF connectors:**	SO239 or BNC, please specify

Size: 110 x 60 x 31 mm (4⅜ x 2⅜ x 1¼")

£42.90 inc VAT (p&p £1.25)

1296 MHz GaASFET PREAMPLIFIER — MMG1296

NEW!

This GaASFET 1296 MHz preamplifier is constructed on high-quality Teflon glass-fibre pcb and includes a microstripline filter which provides excellent rejection to mixer image frequencies and out of band signals. It has a power gain of 15dB and a noise figure of 1.2dB. The power requirements are 13.8V at 35mA and the unit is fitted with 50 ohm BNC sockets.

£59.95 inc VAT (p + p £1.25)

MMC50/28S — 6M CONVERTER

This new Converter has switched oscillators to provide coverage of 50-54 MHz on a 28-30 MHz receiver. The design utilises MOSFETS in the RF amplifier and mixer stages, and the local oscillator is regulator controlled.

INPUT RANGES:	50-52 MHz 52-54 MHz	**OUTPUT RANGE:**	28-30 MHz
OVERALL GAIN:	30dB	**NOISE FIGURE:**	2.5dB

NEW!

£34.90 inc VAT (p + p £1.25)

OUR ENTIRE RANGE OF PRODUCTS WILL BE EXHIBITED AND ON SALE AT MOST OF THE 1984 MOBILE RALLIES BY OUR OWN SALES TEAM, COME AND TAKE A CLOSER LOOK

ALL MICROWAVE MODULES PRODUCTS ARE FULLY GUARANTEED FOR 12 MONTHS (INCLUDING PA TRANSISTORS)

Access
VISA
WELCOME

MICROWAVE MODULES(REW)

BROOKFIELD DRIVE, AINTREE, LIVERPOOL L9 7AN, ENGLAND
Telephone: 051-523 4011 Telex: 628608 MICRO G
CALLERS ARE WELCOME, PLEASE TELEPHONE FIRST

HOURS:
MONDAY-FRIDAY
9-12.30, 1-5.00
E. & O.E.