RADIO & ELECTRONICS WORLD

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OCTOBER 1981

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RADIO & ELECTRONICS WORLD

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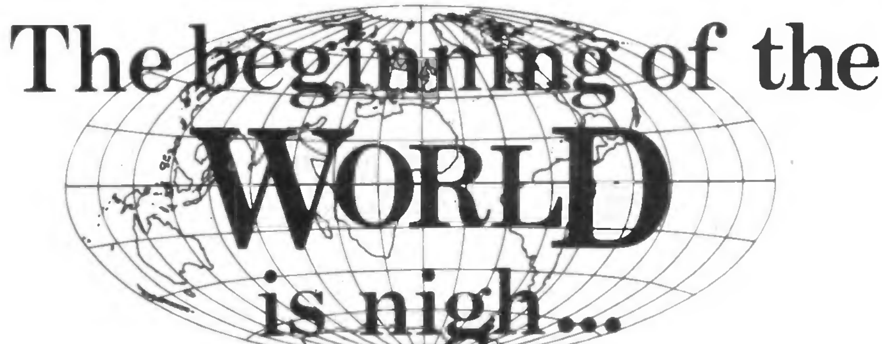
EDITORIAL



Welcome

The beginning of the world is nigh...

The occasion of the launch of a new publication such as **R&EW** is usually accompanied by much back slapping, and assertions from the publisher that the human condition is likely to benefit greatly as a direct result of the emergence of this new publication. We don't necessarily subscribe to this viewpoint, since **R&EW** is primarily a publication for the business of electronics, communications and computing - and not the business of publishing.

R&EW has put its money where its mouth and policy are - in other words, as evidence of our commitment to support the *'sharp end'* of the business, **R&EW** has easily the biggest and most broadly based investment in in-house engineering, production, and support facilities of any UK monthly magazine.

We are keen to stress that **R&EW** is a *magazine*, and not simply a series of instalments from standard textbooks or worse still, the regurgitation of obscure theses and abstruse concepts illustrated by pages of 'large sums'. We want **R&EW** to stimulate and encourage readers to *do* things.

There is a whole cornucopia of opportunity in the electronics business, waiting for bright and imaginative thought to be applied to devise new approaches to old problems, approaches to problems no one ever thought existed, and to simply use the technological facilities placed at our disposal to far better effect.

The growing obsession with engineering status within the electronics industry tends to hide one of the basic ways in which electronic science has failed to find any acceptable slot in modern society - namely the classic inability of the scientist to communicate ideas outside his own spectrum of endeavour. The mass media have two or three stock 'pundits' who get wheeled on whenever a scientific opinion is required, and unfortunately this approach usually does more harm than good to the public's image of those engaged in the 'silicone' chip revolution.

R&EW is keen to try and promote any endeavour that brings electronics closer to the 'real' world. After all, the wider the appreciation of the subject, the more copies we sell, and the more products our advertisers supply. And the greater the benefit to the community at large - who have so far been offered little more than frippery in the shape of space invaders and various forms of consumer entertainment media.

We applaud the BBC for at last having worked electronics into the School's Broadcasting system, although we are disturbed to find that the pupil support kit consists of pieces of chipboard and screws with cup washers. We would have hoped that the BBC might have invited collaboration from the industry to put together the sort of package that would relate modern electronics rather more directly to the 1980s.

An invitation

If you have anything to say on the subjects you find covered in **R&EW**, then please write and let us hear about it. If you have any ideas that you would like to offer for publication, then send them in.

If you have ideas, but do not know how to go about presenting them, then watch **R&EW** for details of how to set out feature articles for submission.

If you have viable design ideas for practical features, and would like to avail yourself of the **R&EW** feature sponsorship scheme that is available to those groups or individuals with the resolve to see such a project through to a conclusion - then write (enclosing an A5 size SAE) to the Readers' Services Department for details. This scheme may be particularly useful to schools and colleges with good ideas, but hindered by a shortage of funds to implement them using the best and most modern technology.

Radio and Electronics World is keen to support any practical endeavour, and we are pleased to offer advice and information through the medium of our **Readers Q-A** page. There is likely to be a flood of enquiries for this department, and we must point out that we cannot guarantee an answer to all enquirers. (Other than '42'). And one rule is absolutely rigid - no SAE, no answer.

Interesting and original enquiries will tend to take precedence, and although we cannot promise to be the fount of all knowledge in electronics, communications and computing - the **R&EW** book service is a most comprehensive and carefully considered 'complement' to provide the readers with 'background support'.

know their onions in MOS fabrication, 4, 8, and 16 bit MPUs, memory etc.

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We stock most of the parts for projects in this magazine.

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0-25W 200Ω—4·7MΩ Vert 10p

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Range	Val.	1-99	100+
¼W 2Ω2-4M7	E24	2p	1p
½W 2Ω2-4M7	E12	2p	1p
1W 2Ω2-10M	E12	5p	4p
2% Metal Film 10Ω-1M		8p	4p
1% Metal Film 51Ω-1M		8p	6p

100+ price applies to Resistors of each value not mixed.

TGS 812 or 813 gas and smoke detector 415p. Socket for above 30p.

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TIL211 Grn 18
TIL212 Yellow 18
·2" Red 14
2" Yellow Green 18
Square LED 29
OCP71 120
ORP12 80
ORP61 85
2N5777 45
7 Seg Displays
TIL321 C An ·5" 110
TIL322 C Cth ·5" 110
DL704 C Cth ·3" 99
DL707 C.A. ·3" 99
DL747 C.A. ·6" 180
FND357 or 500 120
MAN3640 170
·3" Green C.A. 180
TIL32 Inf. Red 52
TIL78 detector 54
Bargraph Red.
Ten segment 225p

LCD DISPLAYS
3½ Digit 599p
4 Digit 750p
6 Digit 850p

VOLTAGE REGULATORS*

		+ve		−ve	
1A	TO3				
5V		7805	145p	7905	220p
12V		7812	145p	7912	220p
15V		7815	145p	7915	220p
18V		7818	145p		
1A	TO220 Plastic Casing				
5V		7805	60p	7905	65p
12V		7812	60p	7912	65p
15V		7815	60p	7915	65p
18V		7818	60p	7918	65p
24V		7824	60p	7924	65p
100mA	TO92 Plastic Casing				
5V		78L05	30p	79L05	65p
6V		78L62	30p	—	
8V		78L82	30p	—	
12V		78L12	30p	79L12	65p
15V		78L15	30p	79L15	65p



CA3085 85 | LM326N 240 | 78H05+5V/5A 550
LM300H 170 | LM327N 270
LM305H 140 | LM723 35 | 78HG 5A +5V
LM309K 135 | TAA550 50 | to +25V 600
LM317K 350 | TBA625B 75 | 79HG 5A −2·25
LM323K 625 | TDA1412 150 | to −24V 650p

SLIDE 250V: 1A DPDT 14p; 1A DP c/off 15p; ½A DPDT 13p

SWITCHES TOGGLE 2A 250V: SPST 33p; DPDT 44p
SUB-MIN TOGGLE SP changeover 59p; SPST on/off 54p; DPDT 6 tags 75p; DPDT c/off 88p; DPDT Biased 148p

PUSH BUTTON Latching or Momentary. SPST C/Over 99p; DPDT C/Over 145p

SWITCHES Miniature Non-Locking Push to Make 15p Push to Break 20p
ROCKER: SPST on/off 10A 250V 28p
ROCKER: Illuminated DPST Lights when on: 10A 240V 85p
ROTARY: (ADJUSTABLE STOP) 1 pole/2-12 way 2p/2-6W, 3p/2-4W, 4p/2-3W. 45p
ROTARY: Mains 250V AC, 4 Amp 68p

DIL SOCKETS (Low Profile - Texas) 8 pin 8p; 14 pin 10p; 16 pin 10p; 18 pin 16p; 20 pin 22p; 24 pin 25p; 28 pin 30p; 40 pin 30p.

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Drum 54mm 58p
0-1·365pF 325p
00 2·365pF 395p
0 2 365pF with slow motion Drive 450p
00 208/176 395p
,, ,, with slow motion drive 450p
C804-5pF 10 15
25 50 pF 278p
100, 150pF 352p
'L' 3 x 310pF 725p
00·3 x 25pF 550p

DENCO COILS
'DP' VALVE TYPE Range 1 to 5 Bl., Rd., Yl. Wht. 122p
6–7 B.Y.R. 110p
1·5 Green 150p
'T' 1 to 5 Bl., Yl., Rd., Wht. 150p
B9A Valve Holder 42p
RDT2 145p
RFC5 140p
RFC 7(19mH) 160p
IFT 13; 14; 15; 16; 17 120p
IFT 18/1·6 135p
IFT 18/465 152p
TOC1 125p
MW5FR 122p
MW/LW 5FR 154p

VEROBOARDS 0·1"

	clad	plain
2½ × 3¾"	73p	52p
2½ × 5"	83p	—
3¾ × 3¾"	83p	—
3¾ × 5"	95p	79p
3¾ × 17"	326p	211p
4¾ × 17"	426p	—
Pkt. of 100 pins	50p	
Spot Face Cutter	118p	
Pin Insertion Tool	162p	

COPPER clad boards Fibreglass 6 × 6" 90p; 6 × 12" 150p; S.R.B.P. 9·5 × 8 95p
Ferric Chloride 1 lb. Anhydr. 195p
Dalo Pen 90p

DIODES
AA129 22; BA100 15; BY126 12; BY127 12; CRO33 250; OA9 40; OA47 12; OA70 12; OA79 18; OA81 16; OA85 15; OA90 8; OA91 8; OA95 8; OA200 8; OA202 8; IN914 4; IN916 8; IN4001/2 5; IN4003 6; IN4004/5 6; IN4006/7 7; IN4148 4; IS44 4; 3A/100V 15; 3A/400V 16; 3A/600V 17; 3A/1000V 30; 6A/400V 50p

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NOISE Diode 195

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DIAC ST2 25

SCRs Thyristors
1A/100V 42; 5A/400V 40; 8A/600V 48; 8A/300V 60; 8A/400V 75; 5A/600V 60; 12A/400V 95; 12A/800V 180; 15A/700V 180; 2N4444 140; 2N5062 32; 2N5064 35; BT106 150; C106D 38; TIC44 24; TIC45 29

TRIACS
3A/100V 48; 3A/400V 56; 6A/100V 60; 8A/400V 69; 8A/800V 115; 12A/100V 78; 12A/400V 82; 12A/800V 135; 16A/100V 103; 16A/400V 105; 25A/400V 185; 25A/800V 295; 25A/1000V 480; 30A/400V 525; T2800D 120

TTL 74		74141	70	LS91	80	4007	18	4561	75	LM1458	45
(TEXAS)		74142	190	LS92	36	4008	62	4518	42	LM2917	195
7400	11	74143	250	LS93	36	4009	35	4519	29	LM3900	60
7401	11	74144	250	LS95	45	4010	40	4520	78	LM3909N	70
7402	11	74145	70	LS96	120	4011	15			LM3911	125
7403	14	74147	99	LS107	43	4012	18	LINEAR IC's		LM3914	220
7404	14	74148	75	LS109	30	4013	34	702	75	LM3915	220
7405	18	74150	80	LS112	30	4014	75	709C 8 pin	35	LM3916	240
7406	28	74151	45	LS113	40	4015	66	710*	48	LM13600	135
7407	28	74153	45	LS114	35	4016	32	733	75	M252AA	625
7408	16	74154	75	LS122	44	4017	48	741 8 pin	14	M253AA	1150
7409	16	74155	75	LS123	55	4018	88	747C 14 pin	78	MC1303	88
7410	14	74156	75	LS124	105	4019	42	748C 8 pin	36	MC1304P	260
7411	20	74157	45	LS125	30	4020	61	753 8 pin	185	MC1310P	150
7412	20	74159	99	LS126	30	4021	70	810	150	MC1488	75
7413	24	74160	60	LS132	45	4022	66	2114L-300N	99	MC1489	75
7414	32	74161	60	LS136	28	4023	20	2114L-200	150	MC1494	694
7416	25	74152	62	LS138	35	4024	45	2114-450N	99	MC1495	350
7417	25	74163	64	LS139	38	4025	19	4116-200N	140	MC1496L	92
7420	16	74164	64	LS151	39	4026	130	2708	250	MC1596	225
7421	20	74165	62	LS153	39	4027	38	2716-5V	275	MC1709	90
7422	20	74166	65	LS155	39	4028	58	9400CJ	350	MC3302	150
7423	22	74167	185	LS156	39	4029	77	AY-1-0212	675	MC3340	120
7425	28	74170	168	LS157	35	4030	50	AY-1-1313A	660	MC3360	120
7426	30	74172	290	LS158	36	4031	170	AY-1-1320	225	MC3401	52
7427	27	74173	65	LS160	41	4032	125	AY-1-5050	99	MC3403	89
7428	28	74174	72	LS161	41	4034	195	AY-1-5051	160	MC3405	150
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7444	90	74185	99	LS181	130	4044	65	CA3018	68	NE560	325
7445	65	74188	290	LS183	275	4046	75	CA3019	70	NE561	395
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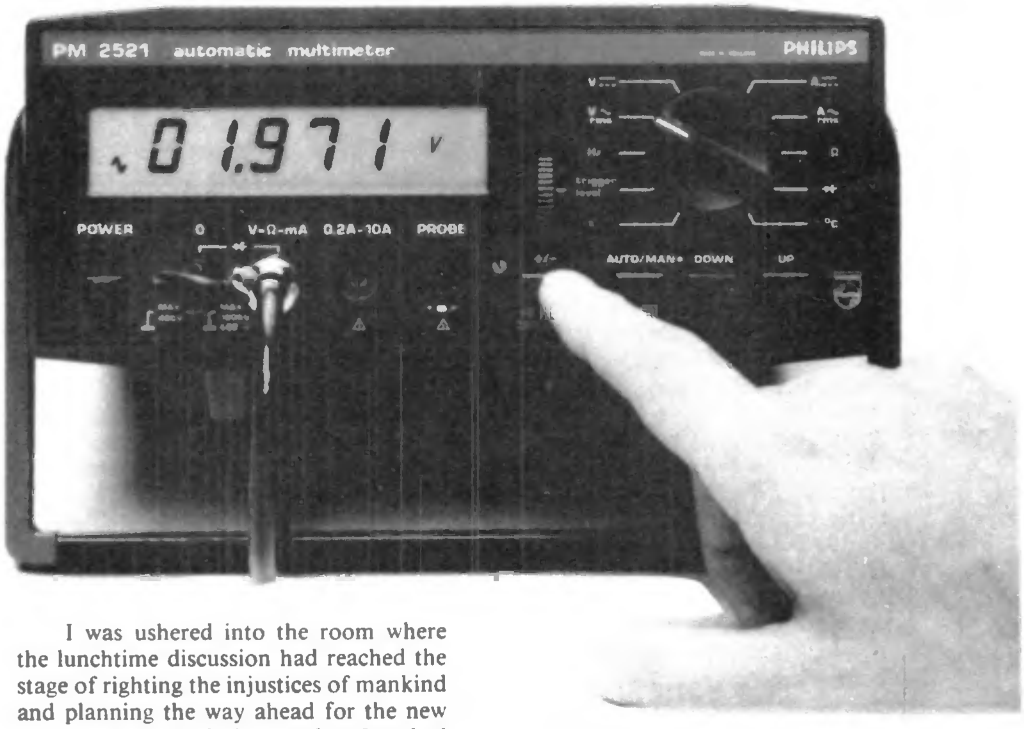
7448	50	74192	70	LS193	65	4049	30	CA3028A	80	NE565	17
7450	16	74193	65	LS194	49	4050	30	CA3035	235	NE566	180
7451	16	74194	75	LS195	40	4015	78	CA3036	115	NE567	170
7453	16	74195	65	LS196	58	4052	78	CA3043	275	NE570	450
7454	16	74196	65	LS197	85	4053	78	CA3045	365	NE571	420
7460	16	74197	65	LS200	345	4054	125	CA3046	71	RC4136D	40
7470	35			LS221	60	4055	125	CA3048	214	S566B	245
7472	30	74LS		LS240	96	4056	120	CA3059	195	SAB3209	425
7473	30	LS00	12	LS243	85	4058	480	CA3075	213	SAB3210	278
7474	25	LS01	13	LS243	85	4060	90	CA3080E	85	SG3402	295
7475	40	LS02	14	LS244	80	4063	99	CA3081	190	SN76013	170
7476	30	LS03	14	LS245	118	4066	36	CA3089E	215	SN76023N	170
7480	48	LS04	15	LS251	40	4067	399	CA3090AQ	375	SN76477	175
7481	120	LS05	15	LS253	40	4068	22	CA3123	150	SP8629	299
7482	70	LS06	15	LS257	48	4069	20	CA3130	90	TAA621	250
7483	50	LS09	15	LS258	40	4070	26	CA3140	48	TAD100	159
7484	80	LS10	15	LS259	85	4071	20	CA3160	95	TBA120	70
7485	95	LS11	15	LS261	195	4072	20	ICL7106	795	TBA550Q	330
7486	26	LS12	15	LS266	25	4073	20	ICL7107	975	TBA641	250
7489	205	LS13	30	LS273	90	4075	20	ICL8038CC	340	TBA651	190
7490	28	LS14	48	LS279	88	4076	60	ICM7205	1150	TBA800	90
7491	45	LS15	15	LS280	250	4081	26	ICM7207	475	TBA810	95
7492	30	LS20	15	LS283	45	4082	21	ICM7215	1050	TBA820	78
7493	30	LS21	15	LS290	57	4085	65	ICM7216A	1950	TDA1004	290
7494	34	LS22	15	LS293	46	4086	70	ICM7217A	790	TDA1008	310
7495	59	LS26	18	LS295	215	4089	140	ICM7224	785	TDA1022	578
7496	45	LS27	15	LS298	130	4093	43	ICM7555	80	TDA1024	105
7497	120	LS28	20	LS299	420	4094	168	LD130	452	TDA2020	320
74100	85	LS30	18	LS323	270	4095	90	LF351	48	TDA2030	300
74104	54	LS32	15	LS365	37	4096	90	LF356	85	TL061CP	40
74105	55	LS33	16	LS366	37	4097	320	LM10	395	TL064	150
74107	32	LS37	18	LS367	37	4098	88	LM301A	26	TL071CP	40
74109	35	LS38	18	LS368	90	4099	95	LM308T	95	TL074CN	140
74110	40	LS40	16	LS373	75	4161	99	LM311H	70	TL081CP	42
74111	55	LS42	35	LS374	75	4410	725	LM318	240	TL083CN	92
74112	170	LS47	40	LS375	48	4411	695	LM324	50	TL084CN	105
74116	88	LS51	15	LS377	90	4412	800	LM339	70	UAA170	170
74118	80	LS54	15	LS378	69	4433	770	LM348	90	UAA180	170
74119	90	LS55	30	LS390	140	4501	28	LM349	125	XR2206	320
74120	75	LS73	25	LS393	140	4502	10	LM358	50	Z80CPU	525
74121	30	LS74	25	LS399	230	4503	50	LM379	375	ZN414	95
74122	45	LS75	28	LS668	105	4507	40	LM380	80	ZN423	105
74123	50	LS76	20			4508	265	LM381N	145	ZN424	130
74125	42	LS78	24	CMOS		4510	68	LM382	125	ZN1034	200
74126	40	LS83	50	4000	14	4511	68	LM384	140	ZN425E	350
74128	42	LS85	70	4001	14	4512	75	LM386	99	ZN426E	300
74132	48	LS86	38	4002	14	4514	195	LM387	120	ZN1040E	685
74136	35	LS90	35	4006	66	4515	195	LM389	99		

Transistors		BC212	10	BF257/8	32	OC41/42	120	ZTX301/2	16	2N3906	17
AC125	35	BC212L	10	BF259	35	OC43	55	ZTX303	25	2N4037	46
AC126/7	25	BC213	10	BF274	42	OC44	120	ZTX304	17	2N4058	10
AC128	25	BC213L	10	BF336	40	OC45	40	ZTX314	25	2N4061/2	10
AC141/2	30	BC214	10	BF451	35	OC70/71	40	ZTX326	30	2N4427	80
AC176	28	BC214L	10	BF594	30	OC72	40	ZTX341	30	2N3859	78
ACY17/18	70	BC236	10	BF595	30	OC74/75	50	ZTX500	14	2N4871	58
ACY19/20	75	BC237	14	BFR30/40	23	OC76	50	ZTX501/502	15	2N5172	18
ACY21/22	75	BC307B	15	BFR41	23	OC81	50	ZTX503	18	2N5179	45
ACY28	75	BC308B	18	BFR79	23	OC82	130	ZTX504	25	2N5191	75
ACY39	85	BC327	15	BFR80/81	24	OC83/84	40	ZTX531	25	2N5305	24
AD149	79	BC238	14	BFR98	105	OC140	110	ZTX550	25	2N547/8	38
AD161/2	42	BC338	15	BFX29	28	OC170/1	85	2N697	23	2N5485	38
AF118	95	BC441	34	BFX84	28	OC200	85	2N698	40	2N5642	750
AF139	40	BC461	34	BFX85/86	28	TIP29	34	2N699	35	2N5777	45
AF178	75	BC477	40	BFX87/8	28	TIP29A	38	2N706A	19	2N6027	32
AF239	78	BC516/7	40	BFY50	23	TIP29B	56	2N708	19	2SA715	60
BC107	10	BC547/8	14	BFY51/52	23	TIP29C	60	2N918	33	2SC495/6	70
BC107B	12	BC549C	14	BFY56	32	TIP30	48	2N1131/2	24	2SC1096	85
BC108	10	BC557/8	15	BFY64	35	TIP30C	56	2N1303	60	2SC1173	125
BC108B	12	BC559	15	BFY81	120	TIP31A	45	2N1304/5	85	2SC1306	150
BC108C	12	BCY70/71	16	BRY39	40	TIP31C	55	2N1671B	215	2SC1307	220
BC109	10	BCY72	20	BSX20	20	TIP32A	48	2N2219A	28	2SC1449	85
BC109B	12	BD131/2	48	BSY95A	25	TIP32C	60	2N2220A	26	2SC1678	140
BC109C	12	BD133	60	BU105	170	TIP33A	65	2N2221A	25	2SC1923	50
BC140	30	BD135	45	BU205	190	TIP33C	78	2N2222A	25	2SC1945	225
BC142/3	30	BD136/7	40	BU208	200	TIP34A	74	2N2369A	17	2SC1953	90
BC147	9	BD138/9	40	E421	250	TIP34C	88	2N2646	48	2SC1957	90
BC147B	10	BD140	40	MD8001	250	TIP35A	160	2N2904/5	28	2SC1969	198
BC148	9	BD144/5	198	MJ400	150	TIP35C	185	2N2905A	26	2SC2028	85
BC148B	10	BD205	110	MJ491	175	TIP36A	170	2N2906/7	26	2SC2029	180
BC148C	10	BD214	115	MJ2955	90	TIP36C	199	2N2926G	10	2SC2078	155
BC149	9	BD245	198	MJE340	54	TIP41A	60	2N3053	26	2SC2091	85
BC149C	10	BD378	70	MJE370/71	100	TIP41B	68	2N3054	58	2SC2314	85
BC153/4	27	BD434	55	MJE2955	99	TIP42A	60	2N3055	48	2SC2166	165
BC157/8	10	BD517	75	MJE3055	70	TIP42B	75	2N3442	140	2SC1679	190
BC159	11	BD695A	85	MPF102	66	TIP120	90	2N3663	15	2SD234	75
BC160	45	BD696A	85	MPF103/104	36	TIP121	99	2N3702/3	10	3N128	112
BC167	10	BDY56	180	MPF105	36	TIP142	120	2N3704/5	10	3N140	112
BC168C	10	BF115	35	MPF106	40	TIP147	120	2N3706/7	10	40311	80
BC169C	10	BF167	29	MPSA05	25	TIP2955	60	2N308/9	10	40313	125
BC170	15	BF180	38	MPSA06	25	TIP3055	60	2N3710/1	10	40315	68
BC172/3	11	BF194/5	12	MPSA12	32	TIS43	32	2N3771	179	40316	85
BC177/8	120	BF196/7	12	MPSA55	30	TIS44/45	45	2N3772	195	40361/2	50
BC179/81	20	BF198	16	MPSA56	30	TIS88A	50	2N3773	270	40408	95
BC182/3	10	BF199	18	MPSA70	25	TIS90	30	2N3819	22	40411	280
BC184	10	BF200	30	MPSU06	55	TIS91	32	2N3820	45	40467	95
BC182L	10	BF224	24	OC26	170	ZTX107	11	2N3822/3	65	40468	60
BC183L	10	BF244/5	28	OC28	130	ZTX109	12	2N3866	90	40594/5	90
BC184L	10	BF244B	30	OC35	125	ZTX109	11	2N3903/4	1–	40603	90
BC187	26	BF256	35	OC36	120	ZTX300	13	2N3905	15	40673	95

4 for further details

NEW PRODUCTS



Philips Launch a Carefully Measured Counter Attack on the DMM Market

"A Day in the Life of an Editor" -or "You can't get the wood..."

The head of the new PM2521 was well and truly wetted at a reception given in Cambridge by the Pye Unicam Group. Your editor had the dubious distinction of turning up just as coffee was being served after lunch - since I had gone to the 'do' by car. I should have listened to the organizers, who suggested I should let the train take the strain and they would chauffeur me from the station to Kings College, Cambridge, where it was all happening.

After an hour of straining around Cambridge city centre in the car (why is there never anyone with local knowledge on GB3PI when you need help in getting out of the Cambridge maze?) being hounded by policemen and maniac traffic wardens - I eventually conceded defeat to the Cambridge Town Planning Department, and parked at the railway station. This was my first press reception with my **R&EW** editorial hat on and I was off to a Bad Start!

I took a most astonishingly disagreeable cabbie onto Kings, where I was eventually directed to the appropriate room. As I stepped through the door, it was rather eerie. Like a high technology 'Marie Celeste' - for there all around, were batteries of Philips new DMM offerings - all performing different tasks (indeed, it can do many things, of which more anon) - but not a sign of human life.

Off the shelf

I sat down and picked a biscuit from a desolate coffee tray and rooted around for the brochure that accompanies these events. After a couple of minutes' perusal, I strolled over to the display and had a 'twiddle'. The press release said the produce was available off the shelf, and these were indeed working examples of the instrument. I could mention a few other launches where the production 'box' was fed from several rackfulls of not-quite-ready-in-time prototype electronics.

So there I was, considering what to do next - after all, Kings is a big place and there was little point in trying to find the party. An adjoining door opened and a startled face appeared above a Philips tie -the festivities had been carrying on in the very next room all the time. Such is the quality of construction of those august portals. with decently seasoned timber in tightly fitting frames, that neither of us had any knowledge of the others' presence.

I was ushered into the room where the lunchtime discussion had reached the stage of righting the injustices of mankind and planning the way ahead for the new technological revolution, and so I tucked in.

Keep this up, I thought, and soon I will be vying with some very well established freeloaders of the electronics trade for the title of the "Smartest Operator". All the fun and none of the sales talk indeed!

An excellent buffet luncheon preceded a delightful raspberry syllabub. My compliments to whoever chose the wines, for on the hottest day of the year, I managed to remain 'content', but totally in control of my faculties for the remainder of the day. Upon subsequently learning that one of my 'industry colleagues' (we magazine Eds are very wary of one other, really) had failed to turn up, I was distressed to realize that I could probably have filched his unclaimed syllabub as well!

To Business.... the PM2521

I don't know if they managed to put something in the wine (you have to watch this Philips crowd, with a million pounds a day being spent on investment, you never know what they're going to get up to next) but I was sufficiently impressed by the instrument that I whipped out the cheque book and bought one - on the spot, no messing about.

The looks of delight and amazement that drifted across the faces of the assembled company were almost worth the £295 plus VAT - but with such a powerful tool as the PM2521 added to the **R&EW** armoury - the whole exercise seemed doubly worthwhile.

I suppose I could go into great and tedious detail about the significance of the device as a 'Computerized MultiMeter' (I'm sorry, I still don't like the chosen terminology of 'Digital Measurement Centre', it doesn't really say what it does very concisely) but you are better off getting a copy of the brochure and reading the spec for yourself. The salient features are shown below.

Plus many other features, extras and options. Read the real leaflet, Pye Unicam at York Street Cambridge would be delighted to send you some, I'm sure.

First impressions

This is very much the workhorse instrument of any design/test engineer. First impressions usually give way to better considered statements, so these are strictly of the nature, "I wish the knobs were a different colour" type remarks.

As it happens, I have long felt that Philips' instrument image was being restrained by the inevitable 'consumer' associations of the brand name, and that something like this should go out with a

Accuracy of around 0.03% (0.01% on DC) with 10uV maximum resolution.

Fully autoranging from 200mV to 1000v DC (600v AC)

Frequency from 0.1Hz to 10MHz (with reciprocal measuring to speed things up)

Autoranging AC Audio measurements in dB, with the 40Hz to 20kHz range +/—0.2dB, and only +/—1dB from 20kHz to 100kHz.

Autoranging AC and DC current from 2uA to 10A.

Autoranging ohms from 200 ohms to 20M ohms.

Seconds from 10uSec to 1,000,000 Sec

Relative references can be taken by simply setting a datum level.

'Pye' or another more 'scientific' label. Tektronix don't make washing machines, so there really isn't any confusion over their brand image.

The rather austere grey presentation with the not over-visible LCD fail to do full justice to the fact that this really is the DMM of the moment. The teutonic influence of the continental design team has certainly provided the Philips' instrument range with a fully coordinated style and appearance, but I confess I like my 'leading edge' technology to look a shade less reserved. With 3.5 digit DMMs becoming so commonplace, it would seem desirable to set the 4-and-a-bit digit PM2521 well apart from that stable. A vacuum fluorescent display would have brightened it all up considerably.

The lack of knobs and buttons is thanks to the 8035MPU which runs the whole show. This offers a very useful facility whereby an input reference level can be programmed into memory, and then used as a datum. The input to output gain of amplifiers and attenuators can easily be assessed in this way. The instrument can perform this trick on the dB and voltage ranges - but on the voltage ranges, this provides a useful facility of 'trend analysis', where the user can see if things are going up or down during alignment without really having to think too much about it. Perhaps this is a useful feature for the die-hard analogue meter fans, who feel that they are better under control of the situation by watching the trends on the needle. At least with this system, you don't need to try to remember the whereabouts of the needle the last time you looked.

Current measuring up to 20mA uses an active current balancing technique that balances the current flow through the meter to virtually nothing, causing a maximum of 25mV drop at the meter input.

Frequencies are measured from 0.1Hz to 10MHz - but with the speed of reciprocation (f + 1/T) to eliminate tedius gate timing periods at LF. It must be said that this facility is only 0.005% accurate (50ppm), so it is not really intended to supplant the funtion of an 'accurate' RF frequency counter with a stable gated counting system.

A data-hold probe is available to latch data, so that you can prod into the nether regions of Many Volts without taking your eyes of the probe tip and the HT leads.

Zap...

It's not totally clear from the brochure exactly what overload the device can stand - I certainly wasn't keen to try AC mains across the current input having just acquired the thing. The voltage ranges seem happy with quite a lot - 1000v on DC and 600v on the AC functions. Even resistance can handle 265v, a favourite trick of our lab where I've lost count of the number of MMs where the resistance range bears the legend "Do not use - blown out".

Conclusions

The PM2521 is being hidden away with the rest of my 'secret' tool and instrument store. I know it's pretty hard to damage the thing electrically, but there are still those amongst us who will use the first thing that comes to hand to knock nails in, rather than go and look for the hammer.

Gone are the days of searching around only to find that the multimeters have all been used to prove the astonishingly low impedance of the average Ni-Cad, or to demonstrate the spot welding process on the probes, by plugging mains across the microampere ranges.

The PM2521 deserves a lot of praise. It really seems to have the market slot to itself for the time being, and the price is right. It's a great deal more money than most private individuals could justify for persuing a hobby, but every school, college and industrial user really need an instrument of this quality simply to provide a reliable *reference*, be it from Keithly, Fluke or whoever. There are bigger, better and more comprehensive devices than this one, but the price differential is quite disproportionate.

R&EW projects will henceforth be that little bit better and more accurately documented. As they say, "You can rely on Pye". Thank you and goodnight. ■

NEWS FEATURE ~ C.B.

A prototype Rigalizer. (No, it doesn't sit there going "Nick,nick" every time a CBer goes by)

CB: Enforcing the Rules. Who said it couldn't be done?

If ever anyone needed some evidence that the 'media' and the conscientious reporting of high technology were incompatible, then the way in which CB reporting has been conducted must provide a reasonably convincing example. CB radio has been described as everything from a comfort to the old and disabled, to the most serious concession to criminal irresponsibility ever seen. These reports are invariably couched in 'simplified' laymens' terms that belies the writers' probable confusion when faced with something as technologically taxing as changing the batteries in a torch.

A Brief Background

Despite all the grandiose and altruistic rhetoric spouted by supporters of AM CB, it is very much the product of the same commercially biased thinking that led to all the other consumer electronics booms of the past few years. In other words, the application of a low cost technology to stimulate a market that owed its very existence to the availability of low price consumer electronic goods. There are certainly very many good and valid reasons why CB should be offered as a service to any citizen so disposed, but these laudable reasons are regrettably not the ones that have precipitated the UK CB movement into the confused mess now prevailing.

This is not to say that the entire market arose simply because the Far East churned out CB radios - no one sets out to make a product and then find a market - but that is almost how CB arrived in the UK. The great American CB boom that created worldwide awareness of the whole CB phenomenon was followed equally abruptly by the great CB debacle, when literally millions of unsold sets were left cluttering warehouses around the world.

The very concept of creating a market 'out of thin air' is very alluring to the manufacturer, but the way in which such a concept is implemented usually spells ruin for more than half the participants. The desire to be first and foremost is very powerful, and when there are ten manufacturers all fervently expecting to corner 25% of the market, the 150% of overproduction simply creates a glut that forces prices down out of sight.

The bootleggers...

In the US, the great CB 'bust' that followed the 'boom' created vast surplusses of equipment. When dealers discovered they couldn't actually give the wretched stuff away, certain naughty folk discovered that US CB had created interest in overseas markets where local regulations had prevented CB, but nevertheless there were sufficient loopholes in import regulations to ship the equipment into the hands of retailers, willing to sail as close to the wind as was necessary to make a profit.

There are many CB set makers who produce equipment that they know will be used illegally, since the sets produce frequencies and powers that are not permitted to be used anywhere in the world. Yet the manufacturers are very keen to supply anyone with the necessary funds prepared to chance importing them.

The tacit approval and moral support afforded to the illicit CB trade by the numerous CB enthusiast publications, has fuelled the movement onto unprecedented displays of public disobedience and self-confidence. For despite vehemently stressing that they don't actually endorse the concept of illegal CB operation, all these magazines carry equipment reviews and advertisements for very thinly veiled illicit operations, whose legality has been somewhat undermined by the subsequent attentions of the Home Office.

Many people engaged in the 'black market' CB infra structure are genuinely ignorant of the harm done by illegal CB to both existing users of the frequencies, and the future for legal CB in this country. The way in which CB has been used to participate in illegal and irresponsible activities of one sort or another has alienated most of the senior levels of the Home Office.

MPT1320

To cut a long story short, political pressure obliged the the government to conjure up a CB band where previously there had been 'no space available', and in order that this service should cause least annoyance to other users, the Home Office rather cleverly spiked all the guns of all the lobbyists by offering a service that was actually technically rather more generous than the one that they had been asking for. The document concerned is the specification reference MPT1320.

Instead of the 27MHz AM band that evolved from the USA's FCC (Federal Communication Commission) standards, we have 40 10kHz channels in the range 27.60125MHz to 27.99125MHz. It can be shown (to most observers with an open mind) that the UK specification is in fact going to result in better facilities for the

NEWS FEATURE ~ C.B.

UK CB'er. So why the uproar in the CB lobby? Perhaps it's because so many operators and traders have a vested interest in the FCC AM equipment - and the Home Office are not surprisingly unsympathetic to anyone claiming distress as a result of having made a financial gamble in an illegal trade.

One of the only serious points to raise concerns the unification of European standards. It is true that most European countries adopt the 23 channel system - but then again this is not universal by any means, neither is the power permitted, and nor is the mode of modulation. So what's one more standard amongst friends? *(Table One)*

It is arguable that in view of this hotpotch of inconsistency, the best solution is to step aside from all existing standards, and present the basis for unification which can at the same time be **enforced**. And now here comes the tricky bit...

Enforcing the rules

One of the major frustrations facing any radio regulatory body where CB has been made legal, concerns the weeding out of illegal operators. In Germany, for example, where the rather meagre 500mW and 22 channel equipment was made legal on some of the FFC frequencies, it is immedately very much more difficult for anyone to detect and prevent the use of the 'dumped' US FCC standard 40 channel 4W AM and SSB equipment. There's safety in numbers, and the illegal sets can easily lose themselves in the midst of the legal sets. After all, the average policeman is probably hard pressed to spot the difference between a car radio and a CB set if it wasn't for a microphone hanging out the front.

However, despite having resigned itself to a similar fate in the UK, the Home Office has been shown a real and viable alternative to simply acknowledging that we are going to have 40 'naughty' and 40 legal CB frequencies, in the shape of the 'Rigalizer'.

Just blow into this microphone, sir...

Simply stated, the Rigalizer demonstrated that for around £50-£100 a throw, the enforcement of CB can be accomplished by an unskilled operator, simply by asking the radio user to key the transmitter, and blow or whistle into the microphone. The frequency and mode of transmission are immediately displayed, so anyone operating outside the confines of MPT1320 can be invited to participate in further questioning. More simply, the user can be given a receipt for the rig, and asked to collect it from the local police station after it has been given a more thorough test.

The Rigalizer is based on a circuit for a bandpass tuned FM deviation meter, but with an AM detector and frequency meter added for good measure. The deviation meter aspects of this circuit are described in detail elsewhere in this issue.

The system is such that the meter will only acknowledge a legal transmission if it is correctly modulated. Simply turning the modulation off with an AM or SSB transmitter will not be good enough -quite apart from the fact that the frequency will not be correct either. The UK CB allocation has therefore (probably unwittingly) provided its own method of enforcement. This fact may not be lost on other European authorities, desperately trying to find a way out of the problems that attend illicit AM operation.

AM must go

It's been said before, but in view of the pro-AM propaganda, it is most important that any discussion of CB reminds readers why AM must be phased out.

AM causes problems as a result of the fact that almost any equipment with silicon transistor circuitry can be made to pretend it's a CB receiver if enough signal is presented to a rectifying junction. The author fondly recalls being called to switch off a burglar alarm that was triggered after midnight by a local CB operator with his booster. (The alarm has since been fitted with ferrite beads and 10nF disc ceramic capacitors at every possible point of sensitivity.)

Carefully regulated and expertly 'set-up' AM can be shown to be relatively innocuous, but since AM of transistor RF output stages is closely related to the load matching conditions, then the problems arising from a mismatched antenna begin in earnest. Harmonics can be filtered to a large extent, but when operators who know no better buy a 100 watt booster amplifier (widely available at most CB shops), then all hell breaks loose. After all, the fines for operating 4W are usually the same as for operating with 400W.

The linear amplification of AM is not trivial, and most so-called 'linears' are not very linear. But apart from problems arising from the spurii, the simply overwhelming interference experienced from 100W of AM on TV, HiFi and the hosts of microelectronic gadgets now throughout many a household, is quite devastating.

The bottom line of the whole argument surrounding CB as the AM lobby interpret the idea is that CB is a strictly local 'natter' band. It never was construed as a means of transatlantic communication, which is more reliably and less problematically achieved by the pursuit of legal amateur radio.

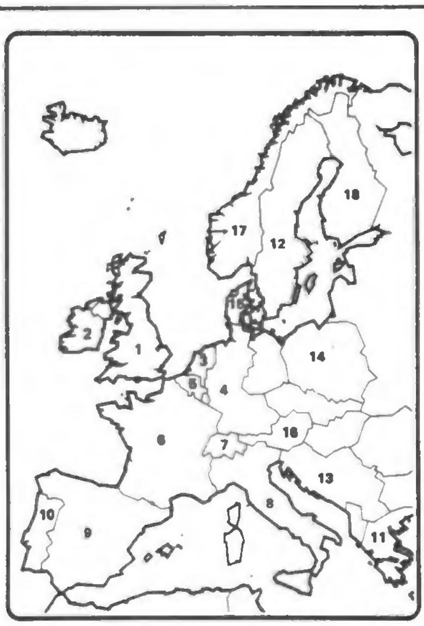
It seems a shame to concede the proverbial 'mile' and fail to enforce the legal use of the permissable 'inch' of FM CB, when the means of sorting the legal from the illegal is really rather simple. The brazen use of huge powers and interfering equipment will not serve the cause of CB very well in the eyes of the public. The outcry after ATV sacked Meg Richardson from Crossroads will pale into insignificance alongside the reaction to rampant AM CB when the public finds that Coronation Street reception is being affected by the local breaker.■

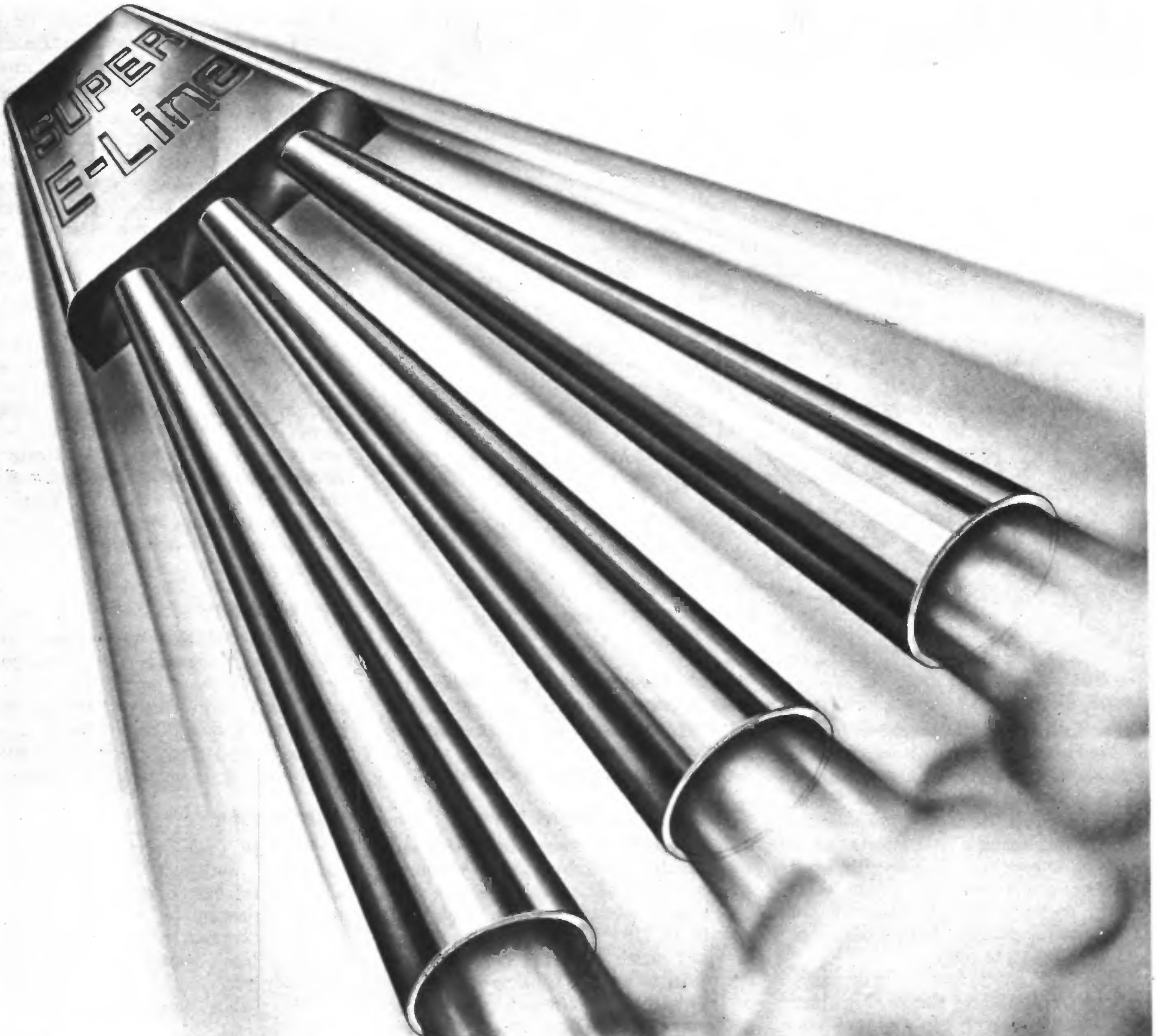
Table one: Euro 'standards' (?)

Euro-CB on 27MHz

The fact that most of Europe already uses 27MHz for CB was obviously an influential force in the UK choice- but as you will see as we unwind each country in the course of this series - actual standards vary widely......

No.	Country	Channels	Mode(s)	Output
1	UK	(?)40	FM	(?)4W
2	Eire	40	FM	4W
3	Holland	22	FM	0.5W
4	W. Germany	22	AM/FM	0.5W
5	Belgium	22	AM/FM/SSB	0.5W
6	France	22	FM	2W
7	Switzerland	12	AM	0.1W
8	Italy	23	AM	5W
9	Spain	22	AM	5W
10	Portugal	40	AM/FM/SSB	5W
11	Greece	40	AM/FM/SSB	5W
12	Sweden	25	(SSB)/AM/FM	2-5W
13	Yugoslavia	32	AM	2W
14	Poland	40	AM/SSB	4W
15	Denmark	23	AM/FM	0.5W
16	Austria	12	AM/FM	0.5W
17	Norway	23	AM/FM	0.5W
18	Finland	24	AM/FM	0.5W




SUPER
E-Line

Writing For R&EW

The Best Ideas are the Simple Ones

The first thing to establish before starting to write an article, is your resolve to finish it. 95% finished articles are of little use, and it is usually the last 5% of the feature that takes the most determination and stamina to complete. After all, the interesting experimental and prototype stages are past - and what remains is the grind of producing an accurate circuit diagram and parts list that is intelligible to any reader.

Your first entry into writing really ought to be something simple, brief and lucid. The big projects can wait until you have at least established the basic format of presentation and got some practice in exactly what 'motions' you need to be going through.

Presenting the Text

Always type or write clearly on A4 paper, using double spacing and a 2 inch left hand margin.

Write the article title and your name on each sheet of text and drawing submitted.

Keep all the diagrams on separate sheets to the text.

Number all pages consecutively.

Conventions

In order to ease communication, it is essential that all participants are going to be talking the same language - hence the need for standard circuit diagram symbols, and parts designations.

Please stick to **R&EW** style diagram symbols, and although we appreciate that we are using two styles at the present time - the symbolic representation is consistent. Circuit diagrams should be shown with part numbers *and* values whenever possible. As a matter of practicality, it is usually best to leave the part numbering until the last stage of the article - and then use a copy of the circuit diagram, striking out components as they are numbered.

Choosing the Right Parts

It is vital that features submitted should use readily available parts whenever possible. Generally speaking, if an author specificies a BC108, then we would also specify BC238 (the same transistor in a low cost plastic package) and then refer the reader to a list of suitable alternatives of standard types. We wish to avoid the problems that arise from circuits designed using parts that happen to have been residing in the author's junk box for the past ten years - and if we are in any doubt about an alternative suggested by the technical editor, then we will evaluate the prototype with the alternative ourselves - or send suitable alternatives to the author for his verification.

Prototypes

In any feature that describes construction, it is virtually essential for us to see a prototype. We will **not** require this until the article has been read and acknowledged, but we would appreciate the following guidelines being observed:

Use standard boxes/cases etc., rather than folding your own aluminium sheet, chopping down your own trees, and making your own planks.... Use cases from Arbour, Vero, etc. If you (or we) feel that your prototype needs 'dressing' before presentation in the magazine, we would be happy to supply one of the 'standard' boxes at our cost, to enable you to fit the prototype.

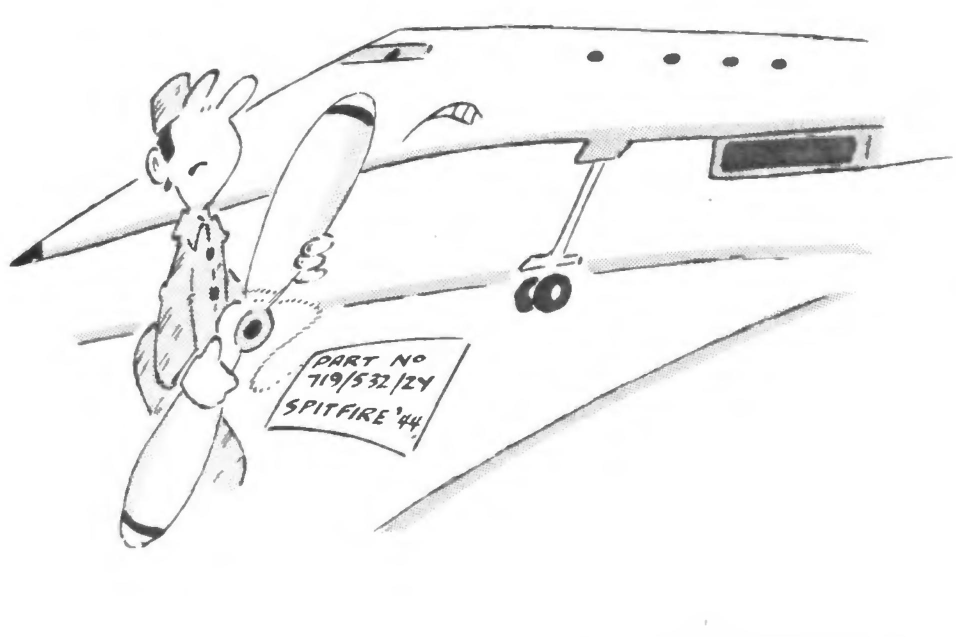
Photographs

We are pleased to receive B/W photos or negatives to accompany articles, but may prefer to take our own shots from your prototypes. Any colour work should be left to us, unless you are particularly confident. Colour work must be transparency if possible.

References

Although not presently used in many 'enthusiast' publications, courtesy references to material used in the compilation of an article will be used whenever possible. Please indicate the source of any such reference by:

Title of book/publication
Author
Publisher
Any other relevant details.



APPROVED TRIO DEALER

CATRONICS FOR TRIO

GET READY FOR THE NEW BANDS WITH A TRIO TRANSMITTER

NEW TS830S

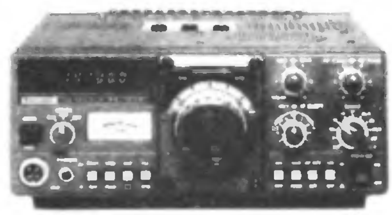
WITH NEW BANDS

TS830S Brief Specification

Frequency Range:	9 bands, 160m–10m
Modes:	CW, USB, LSB
Final Power Input:	220 watts PEP (SSB) 180 watts DC (CW)
RX Sensitivity:	0·25µV at 10dB S/N
Catronics' Price:	£726

TS130S

WITH NEW BANDS



TS130S Brief Specification

Frequency Range:	8 bands, 80m–10m
Modes:	CW, USB, LSB
Final Power Input:	~200 watts PEP (SSB) ~160 watts DC (CW)
RX Sensitivity:	0·25µV at 10dB S/N
Catronics' Price:	£547

25W PEP version also available TS130V at £450

TR2400

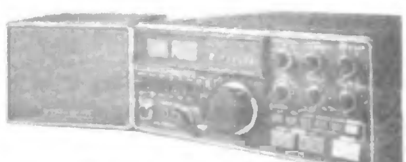
2M SYNTHESIZED PORTABLE

TR2400 Brief Specification

Frequency Range:	144–146MHz
Mode:	FM
RF Output Power:	1·5 watts min.
Sensitivity:	1·0µV for 30dB S/N
Display:	LCD
Memories:	10 built in
Scanning:	Auto in 5kHz steps
Catronics' Price:	£198

TS770

ALL MODE 2M + 70CM



TS770 Brief Specification

Frequency Range:	144–146MHz 430–440MHz
Mode:	SSB (USB, LSB), CW, FM
RF Output Power:	10 watts. Only for FM: 10W (HI)/Approx. 1W (LOW)
Sensitivity	SSB/CW 0·5µV for 10dB (S+N)/N FM 1µV for 30dB (S+N)/N
20dB quieting (FM):	Less than 0·4µV
Catronics' Price	£785

NEW TS530S

BUILDING ON SUCCESS

TS530S Brief Specification

Frequency range:	9 bands, 160m–10m
Modes:	CW, USB, LSB
Final Power Input:	220 watts PEP (SSB) 180 watts DC (CW)
Receive Sensitivity:	0·25µV at 10dB s/N
Catronics' Price:	£561

TR9000

2M COMPACT ALL MODE

TR9000 Brief Specification

Frequency Range:	144–146MHz
Modes:	USB, LSB, FM, CW
RF Output Power:	10 watts
Sensitivity:	SSB/CW 0·25µV for 10dB S/N FM 0·25µV for 12dB SINAD
Frequency Control:	Digital, phase locked VCO
Memories:	5 built in
Scanning:	Auto – 25/12·5kHz/100Hz
Catronics' Price:	£371

TR7800

2M FM SYNTHESISED

TR7800 Brief Specification

Frequency Range:	144–145·995MHz
RF Output power:	HI 25W, LO 5W (adjustable)
RX sensitivity:	0·2µV for 12dB SINAD
Autoscan:	5kHz or 25kHz
Memories:	15 inc 1 x priority
Repeater shift:	+/–600kHz & Reverse
Frequency display:	4 digit LED & Mem. No.
Catronics' Price:	£276

NEW TR8400

70cm FM SYNTHESISED MOBILE

TR8400 Brief Specification

Frequency Range:	430–439·975MHz
Channel Spacing:	25kHz
RF Output Power:	10W (HI) or 1W (LO)
RX Sensitivity:	0·4µV for 12dB SINAD
Memories:	5 (scanning)
Repeater shift:	±1·6kHz
Catronics' Price:	£329

R1000

COMMUNICATIONS RECEIVER

R1000 Brief Specification

Frequency Range:	200kHz–30MHz
Modes:	AM, USB, LSB, CW
Sensitivity	<2MHz: 5µV >2MHz: 0·5µV for 10dB S+N/N on SSB
Digital Readout:	to 1kHz
Clock:	Quartz controlled
Catronics' Price:	£305

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Conventions for Component Identification:

Where specific manufacturers are mentioned, this is usually the result of our experience of their cooperation and assistance to enable their parts and information thereon to be made easily available at competitive cost. Omission of a manufacturer does not imply that we think there is anything is wrong with their product - and we invite any manufacturers not listed to advise us if they are willing to cooperate in the way we require to ensure minimum fuss for *all* our readers.

This list may seem a little longwinded, but we are endeavouring to establish common standards, which will make the circuits easier to follow -and should make the parts easier and cheaper to obtain once the system is more widely appreciated.

Please indicate:
(*R&EW* preferred values indicated in brackets)

RESISTORS:

a) Power rating in watts (0.25/0.33W)
b) Tolerance required (5%)
c) Indicate part number by prefix 'R'
d) Use the value multiplier to replace the decimal point:
eg 4.7k ohms .. becomes .. 4K7
100 ohms .. becomes .. 100R
4.7 ohms .. becomes .. 4R7
2.2Mohms .. becomes .. 2M2
e) Preset resistor part number prefix is Vr.
f) Variable (control variable resistor, potentiometer etc.) prefix is also Vr.
g) Use E12 series types when possible. ie:
1, 1.2, 1.5, 1.8, 2.2, 2.7, 3.3, 3.9, 4.7, 5.6, 6.8, 8.2.
h) Use the following preferred lead spacings for PCB designs:
0.25/0.33W (mount flat) 10mm
0.5W (mount flat) 15mm
..........(on end) 5mm
i) Use 16mm diameter potentiometers if possible, with 6mm (3/8") dia round shafts for control knobs.

CAPACITORS

a) Type of construction: Electrolytic, ceramic, polystyrene, polyester, mylar, mica, monolithic, air spaced, film spaced etc. (NB there is no basic difference between ceramic plate and disk types of equivalent ratings).
b) Value in picofarads (pF ü 10^{-12} farad), nanofarads (nF ü 1000pF) or microfarads (uF ü 1000nF)
c) Minimum working voltage
d) Tolerance
e) Temperature co-efficient if applicable
f) Indicate the part number of fixed capacitors with prefix 'C'.
g) Indicate trimmer capacitors 'TC'.
h) Indicate variable (tuning) capacitors with 'VC'.
i) Use E12 or the nearest decimal values whenever possible.
j) Use the following preferred lead spacings for PCBs:
1-47000pF Ceramic 5mm
1-4700pF Polystyrene 5mm (radial) 10mm (radial)
over 4700pF Polystyrene (as necessary)
1n to 100n polyester or mylar 10mm
Tantalum beads 5mm
0.47 to 100uF 16v Elcos (electrolytic) 5mm
over 100uF (as necessary)
Trimmers 0-30pF 5mm or 7.5mm grid
30-100pF 10mm grid

TRANSISTORS:

Bipolar Types

a) Try and stick with standard types, and use plastic versions e.g. BC107/8/9 — ZTX107/8/9, BC237/8/9 etc.
b) Use centre emitter types for common emitter RF applications: e.g. BF594, BF274 etc.
c) Prefix part numbers with 'Q' in parts list.

FETS

a) For small signal AF and RF types, please stick with Siliconix and Hitachi e.g. 2N3819 etc — 2SK55, J309 etc.
b) Please prefix part numbers with 'Q'

MOSFETS

a) Please use Hitachi, AEG and NEC small signal RF MOSFETs e.g. 3SK45/51/60/88, BF960/1/3
b) Please use Ferranti, Siliconix and Hitachi power FETs
c) Prefix part numbers with 'Q'

Digital ICs:

a) Use LPS TTL whenever feasible, although please state if standard TTL and 74C are also applicable.
b) Use buffered CMOS types, and only specify unbuffered when necessary.
c) Due to differences in different manufacturers' CMOS, please state type used in prototype. Give the full part number you have used, although we will probably drop the manufacturer's coding in most cases.
d) Prefix all IC part numbers with 'IC'.

MPU and Memory:

a) Please specify manufacturer of versions used in the prototype.

b) Please indicate the speed range only where essential.

c) Prefix all parts numbers with 'IC'.

Linear ICs - Standard Types of Op Amp, Comparator etc.

a) 741 op amps come with a variety of prefixes and suffixes, please stick to the basic number. eg SN72741CN

b) BiFet op amps come in a variety of confusing manufacturer codings, we would prefer to stick with the National and Fairchild 'LF' types.

c) Prefix part numbers with 'IC'

Voltage Regulators

a) The 78L/78M/78 (and 79 for negative regs) series are preferred. LM340- versions are also acceptable.

b) Please use plastic (TO220) packs for the 78M/ and 78/ unless vital.

c) Please use the TO92 plastic pack versions for the 78L/ functions.

d) Please prefix part numbers by 'IC'.

Miscellaneous Function Linears

a) Where an alternative approach exists, please avoid using single-sourced devices (Mullard, Plessey and Siemens types need to be watched here).

b) Stick to the following 'standards' for audio stages when possible:
up to 1 watt: TBA820M, ULN2283B
1-5 watts: LM380N, TBA810, TDA2002
5-15 watts: TDA2006, HA1388...12v supply, HA1370...mains PSU

C) Prefix part numbers with 'IC'.

TRANSFORMERS

Mains Power Supplies

a) Mains transformers must conform to BS specifications.

b) Please state the conditions under which the VA rating is assessed.

c) Please indicate the DC current required.

d) Prefix part numbers with 'T'.

IF (Intermediate Frequency)

a) Use standard 10mm and 7mm types whenever possible.

b) The standard IFs are:
AM broadcast receivers 468kHz
FM broadcast receivers 10.7MHz
Communications equipment 455kHz, 10.7MHz, 21.4MHz, 48.055MHz, 45MHz.

c) Use a block filter (prealigned types) when possible.

d) Prefix part number with 'IFT'.

Other RF Types

a) If possible, use a stock type, rather than a 'roll your own' type.

b) Use Amidon and Micrometals dust iron toroids for resonant circuits.

c) Use Neosid types for ferrite toroids if possible.

d) Prefix the part number with 'T' if the device is a true transformer function, or 'L' otherwise.

Chokes

a) Use 'TOKO' style chokes for low current applications from 1uH to 1.5H.

b) Use 'EMI' core toroids for power chokes and interference suppression.

c) Use small ferrite beads (Neosid, Mullard etc) for RF decoupling whenever feasible.

d) Prefix the part number with 'L'.

Crystals

a) Please specify frequency

b) Nature of resonance - eg 3rd overtone, parallel, series etc.

c) Load capacity required (usually 20 or 30pF)

d) Type of holder (HC18U, HC25U above 4MHz)

e) Please prefix part number with 'X'

Crystal Filters

a) Please use monolithic types with external matching IFTs, such as the TOYO HCM, Uniden, Cathodeon, PTI, etc.

b) Please stick to 10.7 and 21.4 for receiver IFs. Avoid 9MHz if possible.

c) Please prefix part number with 'XF'

Hardware

a) Use phono connectors for low level audio connections

b) Use phono connectors for 'internal' RF connector leads up to 200MHz (they make a good 50 ohm match)

c) Use BNC bayonet connectors for all external RF connections up to 20W RF power.

d) Use PL series connectors for higher powered RF connections and all antenna connections.

e) Use IEC mains inlet sockets on chassis, and shuttered IEC outlets where applicable.

f) Use ribbon cable jumpers where appropriate

g) Prefix all socket part numbers with 'SK'.

h) Prefix all plug part numbers with 'PL'.

Cabinets

a) Stick with proprietory brand cases rather than DIY bending.

b) Check with us to see if we will arrange for one of our advertisers to supply it to you FOC.

Miscellany

Most points have been covered here but any suggestions for additions and alterations are welcomed from component suppliers and readers alike, and we will update this listing from time to time. If suggesting any changes, please supply full details of the product(s) concerned.

Can we Help You?

At *R&EW's* new editorial offices, we have a large library of technical data and information covering most types of electronic component. If you need a data sheet or assistance in locating special parts, then we can probably help. Technical assistance with circuit development must necessarily wait until such time as we have established that the project is suitable for publication, but requires a little refinement.

One way in which we would like to assist in 'tidying up' the loose ends of a feature, is to provide a fast prototype PCB service so that all projects can be supplied with PCB layouts for maximum reader appeal.

If you have access to the necessary PCB drafting aids, (and many readers probably have), then please use a metric grid - and preferably the Chartpak die-cut symbol system. Rub-down transfers are better than nothing for *artwork*, but not a lot!

Original artwork needs to be easily changed to incorporate modifications -especially those relating to the diferent sizes of components and the positions of the relative terminations etc.

R&EW will provide a prototype PCB FOC for any project where we have seen the draft article and agreed some form of acceptance. In other words, we frequently accept constructional features based on Veroboard prototypes, but would like the author to transfer to a custom PCB layout to assist in providing clarity and reader appeal - since it is about 4 times easier to follow a standard PCB than translate into Veroboard.

If you have any further questions, then please get in touch with:

The Projects Editor
Radio and Electronics World
117a High Street
Brentwood
Essex CM14 4SG

The WE Talking Clock

As if it isn't bad enough to have the time being bleeped away by the hour, you can now make this chronographic masterpiece give you a minute - by - minute account of the passage of the day.

Your very own 'speaking clock' - the lips are not supplied !

Features

1. **24 Hour Display with the time being *spoken* at the touch of a button.**
2. **Alarm Facilities:**
   a) Gong followed by time being spoken - repeated every 10 seconds (if you can take it !!)
   b) 9-minute Snooze Timer, reset by touching the touch button.
3. **Display Brilliance Control:**
   a) Display blank switch for night use - display lights up when touch button is touched, and when Alarm operates
   b) Optional brightness control - by potentiometer or automatic by Light Dependent Resistor.

This clock tells you the time for a change, and you have the option of checking the clear, bright red display. Apart from novelty value, the benefits to the visually disabled are obvious, thanks to the use of the ITT UAA 1003-3 speech synthesis IC.

The system operates by reading the numbers from the clock IC outputs, and includes a comprehensive alarm function.

Technology Update

Talking machines have been with us now for many years, and are largely taken for granted. Take, for example, the Post Office's speaking clock, where the information is stored on Optional Discs. Many machines use magnetic tape loops to hold pre-recorded messages, but being mechanical, they are large, mechanically unreliable over extended periods of use, and expensive - certainly too expensive for a project based on a talking clock.

More recently, the size has been reduced to a level where they can be incorporated into aircraft warning systems and the like, but the cost is still high. These mechanical systems all have one thing in common, which is that the voice heard is a direct recording of someone speaking, saved on a mechanical medium and played back when required. With tape loops, the access time for a given message might be very long.

With semiconductor memory now coming down in price, you might imagine that the human voice could be digitised and stored in memory for instant access to pre-recorded words or phrases. Unfortunately, the amount of storage required for even a few words is very high. For a male voice, for example, filtered to allow a maximum frequency of 3.5kHz, we might sample at 8,000 samples per second (8 kHz), and if digitised to 12 bits, this requires 96,000 bits per second. So, to speak the 20 or so different words (lasting about one second each) needed for a 24 hour clock, we need some 1,920,000 bits of memory - which will cost a great deal - at least for the next year or so !

Many schemes have been devised which can substantially reduce the memory requirement by data compression techniques. One of these is "Continuously Variable Slope Delta Modulation", where a signal tracks the voice input and only the difference since the last sample is digitised and stored. By this technique, the data rate can be dropped to 16k bits per second. National Semiconductor use Delta Modulation with two other techniques: "phase angle adjustment" and "half period zeroing", to reduce the data rate on their Digitalker range of circuits to about 1,000 bits per second, which is a much more managable value. The Digitalker is made on a PCB with many support devices, has a fixed vocabulary, and is still too expensive for a mass-market application such as a talking clock.

Synthesising Speech

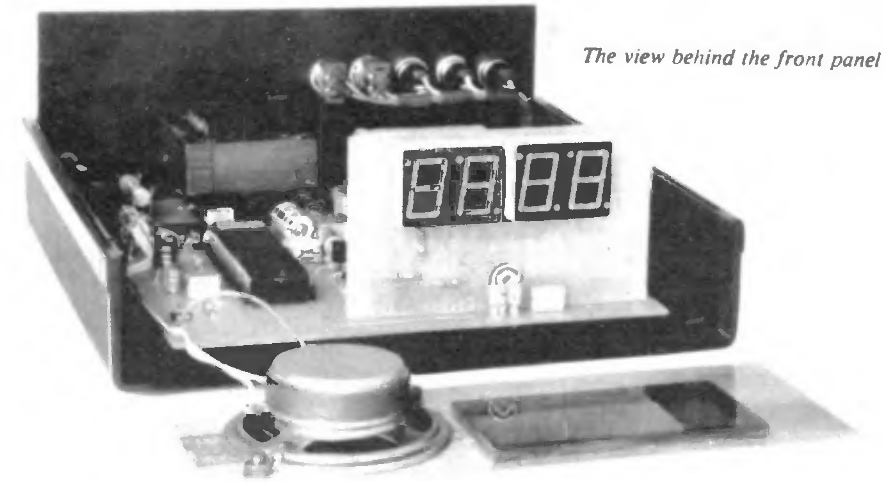
A totally different approach to making machines talk is to synthesise the speech as it is needed, using a basic set of rules. Speech can be broken down into its smallest fundamental parts, which are called PHONEMES. The English language has about 40 of these, but because the context in which a word is used varies the way it is spoken, we need variations on the Phonemes. A leading company in speech synthesis in America is VOTRAX, who use 128 of these variants, called ALLOPHONES. A typical Allophone lasts 50 to 250 milliseconds, and the vocabulary is virtually unlimited - just join up the required Allophones! Obviously, it isn't quite that simple, because associated with each Allophone is the pitch, duration, timing, amplitude and overtone quality, requiring a 12 bit word to specify the complete 'package'.

Some speech sounds are *voiced*, that is, a tone is generated by the vocal chords (e.g. "been" - all letters voiced) but others (e.g. 's' and 'p' in "sleep") are unvoiced and produced by the shape of the mouth, the position of the tongue, and air flow only.

In the synthesiser, voiced sounds are generated by tone generators, but the unvoiced ones come from filtered white noise. The PHONEMIC SYNTHESISER as it is called, is generally used where a large and changing vocabulary is required, and is not particularly cheap, again requiring many ICs. Its versatility means that it can be used in a system which reads written text from a book and speaks the text at up to 200 words per minute - a tremendous boon for the visually handicapped.

The second basic method for synthesising speech is to use the LINEAR PREDICTIVE CODING (LPC) technique. This is the system used by Texas Instruments in their Speak and Spell toys, and is based on the ability to electronically model the human vocal tract.

A multi-stage digital filter is used to mimic the major resonant modes of the vocal cavity. The name "Linear Prediction" is derived from the nature of the synthesis process. Each digital speech sample (stored in memory) is anticipated from a combination of previous samples and the input to the filter. Words are stored in a read-only memory (ROM) and are broken up into four parameters: voicing, pitch, amplitude and frequency. A complex software algorithm manipulates the sound parameters to create the synthesised speech. Using LPC, the data rate is around 1200 to 2400 bits per second, and can be manufactured on a very low number of ICs, three in Texas Instrument's case. As with the data compression techniques, the vocabulary is fixed in a custom-programmed PROM.



The view behind the front panel

The Talking Clock Chip

ITT Semiconductors took on the task of making a single chip which could interface directly to a clock chip to produce a very simple talking clock. This is the UAA 1003-3, and it uses several complex methods of data compression as well as the removal of redundancy to achieve the required memory vocabulary of about 20 words, as well as control, decoding and digital to analogue conversion, all on one MOS chip. Each word generated by the speech generator consists of a number of staircase-shaped pulses having a fixed period of 10 milliseconds. Each pulse is built up from 128 steps, and the smallest amplitude variation is 1/16th of the peak amplitude i.e. 4 bits of amplitude information.

The time information for the UAA 1003-3 is taken directly from a common cathode LED display, and it can be shown that only 15 LED's in the 24 hour 7 segment display need to be monitored to give complete 24 hour time information. When the "talk" input is activated, the time data on the 15 lines is latched, and after a pause of one second, the system begins to speak the time. Due to the limited number of words available, this is restricted to the number of hours and the number of minutes separated by a short pause. When the "alarm talk" input is activated, the initial one-second pause is filled with a tone.

In this version of the Talking Clock using the UAA 1003-3, we have incorporated features not existing in the MM5387 24-hour clock chip or the UAA 1003-3 itself. These are: the use of a Touch Switch to make the unit speak the time, and the addition of a ten second

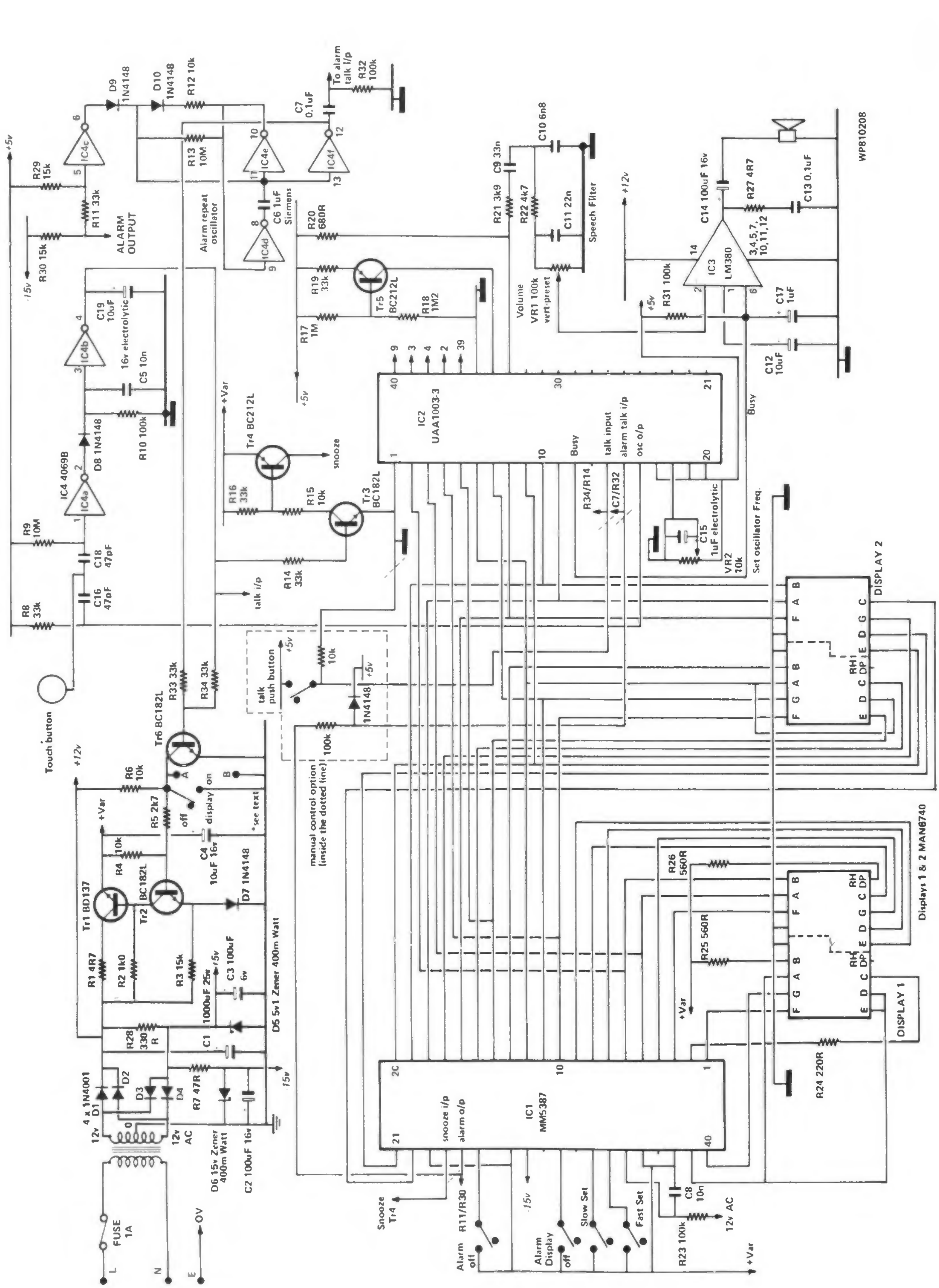


Figure one: The complete circuit diagram repeat circuit which initiates the tone and time alarm talk output every ten seconds. (We didn't think that one alarm would wake the average enthusiast who's been up till 2.00a.m. working on a project!) Also, touching the button after the alarm has gone off will cause a 9-minute snooze cycle to begin. In addition, the display may be switched off for night use, but when the touch button is touched, the display lights up, so that the UAA 1003-3 can "read" the time.

As an option, the completely "off" state may be replaced by a variable brightness one, controlled either by a potentiometer or automatically by a Light Dependent Resistor.

Circuit Operation

The MM5387 clock chip directly drives the 4-digit, 7-segment display and the time inputs of the UAA 1003-3. It requires a negative supply of 15v, which is stabilised by D6, and a positive supply of between about 2 and 7 volts, depending on the display brightness. TR1 and 2 form a simple voltage regulator with D7 as a reference, and R1 providing a measure of short circuit protection, as well as reducing the dissipation in TR1. The output voltage of the regulator is set by R4, and 5 when the "display on" switch is on, to about 6.5v. This is about optimum for a bright display without causing excessive dissipation in IC1. When in the "off" position, R6 upsets the balance of the regulator and causes the output to drop to about .5v, thus blanking the display. The UAA 1003-3 requires a 5v supply, and this is stabilised by D5. A 50Hz signal from the transformer is fed via R23 to the clock chip for its timebase.

The UAA 1003-3 has an on chip oscillator which controls the frequency and speed of the speech. Its frequency is set by means of VR2 to be the most natural sounding. The chip also requires a constant current input for the digital to analogue converter, and this is generated by TR5. The speech output from the D to A converter is filtered by R21, 22 and C9, 10, 11 to remove unwanted high frequency noise and is then fed to the volume control which is a preset potentiometer accessible through a hole in the front panel. IC3 is a good old faithful LM380 amplifier which drives a 2 inch loudspeaker. This is fed from the unstabilised supply to allow maximum undistorted output. The volume level available is plenty to wake almost anyone! IC2 has a "Busy" output which is joined to the other input of IC4 (Pin 6). This is normally biassed positive by R31, so muting the amplifier, but when IC2 is talking, the busy line goes low, thus unmuting the amplifier.

The simplest configuration for those constructors making their own PCB (or using breadboard techniques) is shown in *Figure 3*. Here, the 'talk' input of IC2 is fed directly from a push button, and the 'alarm talk' input is fed directly from the alarm output of IC1. The 100k resistor and diode prevent over-voltage on the input of IC2. A push button can also be connected to the snooze input (Pin 24) of IC1, its other end going to the +VAR supply. This arrangement has one drawback which is that the alarm only sounds once, but is otherwise perfectly satisfactory.

IC4 (a hex CMOS inverter) performs a number of functions which greatly improve the appeal of the clock. The first stage is used as the touch detector. IC4 has a 25kHz clock output, which is fed via C16 and C18 to the first stage of IC1. Normally clock pulses charge C5 via D8, holding the output of stage 2 low, but when the touch button is touched, the junction of C16 and C18 is effectively shorted to ground, which causes stage 2 to switch its output to +5v. This drives the talk input of IC2, causing the time to be spoken. It also drives TR3, TR4 and hence the snooze input of IC1, so that snooze mode is set by just touching the button. In addition, TR6 is turned on, so that, if the display switch is in the off position, touching the button causes the display to come on. This is necessary so that IC2 can read the time from the display which it obviously could not do if the display were blanked.

The alarm output of IC1 is now fed to the third stage of IC4, so that under normal conditions, its output is held high and, via D9, inhibits the astable oscillator formed by stages 4 and 5. Resistors R29 and R30 ensure that stage 3 functions even when the display is switched off, and +VAR is only about .5v. When the alarm time is reached, the alarm output goes high, stage 3 output goes low, and the oscillator is allowed to run. Due to the action of D10 and R12, C6 is discharged quickly and when the input to stage 5 drops below its threshold, the circuit flips over. D10 is now reverse-biassed and so C6 charges through R13 only, which takes about 5 to 10 seconds. When charged enough, the circuit flips back and starts again. Stage 6 is a buffer whose output is fed via C7 to cause a pulse at the alarm talk input, since a continuous +5v level on this input upsets the operation of IC2. The result of all this is that the time is spoken (preceded by the tone) at the end of each short half cycle, every 5 to 10 seconds until the snooze function is started or until the alarm is switched off.

Without D10 and R12, there would be a pause after the alarm time was reached before the alarm was sounded. R34 is included so that all the time the alarm is active, the display is illuminated.

Assembly

Assembly of the talking clock is straightforward, especially if the PCB designs and components specified are used.

The order of assembly should be the traditional one; resistors, capacitors, diodes, transistors and ICs, and finally, the transformer. IC1 and IC2 should be fitted into sockets, but IC3 and IC4 can be soldered in. Great care should be

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exercised where tracks pass through adjacent IC and display pins. (See the section on front panel regarding the volume control, VR1). When happy that both boards are correctly assembled, and free from solder blobs or dry joints, they can be married together. The solder pins through the main board should be carefully aligned with the pads on the display board and only the extreme end two soldered at first, ensuring that the boards are at right angles. When the joints have cooled, inspect the alignment of pins and pads very carefully, and if the front panel has been made already, it is worth checking alignment of the display with the cutout. If everything is satisfactory, the remaining pins can be soldered, being very careful not to blob between pins. Wire the switches and push button on 4 inch flying leads for now. The touch button used in the prototype was made on a lathe, but many other things could be used e.g. metal control knobs or large plated screws.

The only proviso is that it can be fixed to the top of the box and connected to the circuit inside! To test out, the touch input should be, say 6 inches of wire with the end bared for half an inch or so, to allow good contact. Leave the loudspeaker disconnected at first so that it is not damaged during early tests. Connect a mains lead and you are ready to test out the unit.

Testing

First, a word of warning - since there is mains voltage present on the board, the tracks and fuse should be protected to avoid contact during testing, and even then, great care must be taken. The mains should **always** be disconnected whilst working on the unit, when power is not needed.

With IC1 and IC2 removed, switch the display switch to 'on' and switch on. Check that there is a +5v across D5, -15v across D6 and that the voltage across C4 is between 6 and 7 volts. If not, it should be made so by adjusting R5. With the display switch to 'off', this voltage will drop to about .5v. Note that the top right segment of the tens of hours and the decimal point are both permanently on, and the effect of switching the display switch will be clearly seen. As a quick check on IC4, short Pin 6 to Pin 7 to disable the muting bias and the voltage on Pin 8 should be about half that on Pin 14. With the bias on, this will drop to about 2v. All voltages are measured relative to the 0v rail.

Now switch off and plug in IC1. Ensure that the display switch is on. When power is re-applied, the display should be seen to flash. Press one of the 'Set' buttons and the flashing should stop, and by using the two set buttons, the time should be settable to any time. Press the 'Alarm Time' button and the alarm setting will be seen. This should also be adjustable to any time.

Simulate operation of the touch button by shorting R9, and with the display off, check that this causes the display to come on.

And so for the big moment! Switch off, connect the loudspeaker and plug in IC2. Set the volume preset and RV2 to about mid-position and switch on. Set the time as before and touch the touch button lead. There should be a delay of about one second and then the time will be spoken. RV2 should be adjusted for the most natural sounding speech. Note that with the loudspeaker in free air, the speech will sound somewhat 'thin' and disembodied, but it will sound much more full-bodied when finally boxed up.

Next, test the alarm circuit. With the alarm switched off, set the alarm time to a couple of minutes later than the actual time on the display, and then switch the alarm on. When the time reaches the alarm time, the tone will be heard, followed by the time. This should repeat every 5 to 10 seconds. Set the snooze mode by touching the touch button lead. The time will be spoken without the tone, and the 10 second repeating will stop. After 9 minutes of snooze, the alarm will operate again, and these functions repeat until the alarm is turned off. Ensure that the alarm also functions properly with the display switched off. In this case, the display will light up when the alarm first operates and stay on during the 10 second repeating, and go off again when snooze is selected or the alarm is turned off.

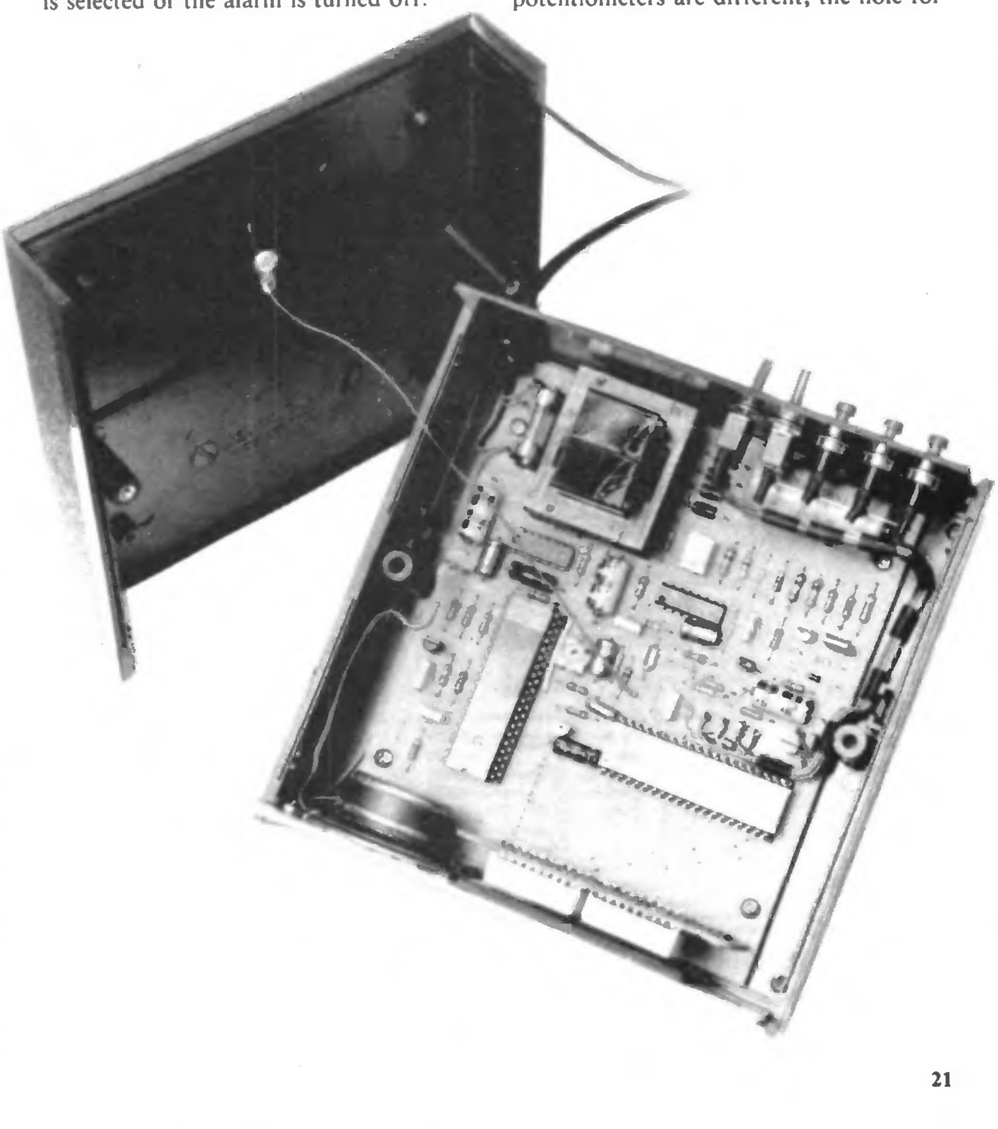
Brightness Control

It is possible to make the display brilliance variable instead of being either 'on' or 'off'. This can be either adjusted by a potentiometer, or automatically, using a light dependent resistor (LDR). In either case, it is necessary to remove **R6** and to wire the potentiometer or LDR across points A-B.

Since the LDR has a finite 'on' resistance, it will be necessary to adjust R5 to bring the voltage across C4 back up to about 6.5v, with the LDR in maximum light conditions - probably direct sunlight, if you can find any. The value of the potentiometer is open for experimentation, but about 50k ohms seems suitable. Also, the type of LDR used can vary; original experiments were done with an OPR12. If it is thought that a fixed dim display is required, then a fixed resistor may be fitted across points A-B; again, the value will depend on the brightness level required Note that under all the above circumstances, the display will always brighten up to speak the time.

Front Panel

On the prototype, a metal panel was made according to the drawing in *Figure 4*. It was prepared with wet and dry sandpaper, painted with cellulose paint (2 coats) and the legend put on using Letraset. Note that since all preset potentiometers are different, the hole for



the volume control may need to be moved. Alternatively, the preset itself may be raised.

Final Assembly

When all tests are completed satisfactorily, the unit can be fitted into its case. The switches can be fitted to the rear panel, and the mains cable passed through a hole or slot. The touch button on the top of the case should be wired to the board.

Fit a piece of red acrylic filter (2.6in. by 1.3in.) over the display aperture using a contact adhesive e.g. Evostick, and when dry, fit the loudspeaker and its grille, by means of 2 solder tags or pieces of tinned copper wire over 2 nutstand screws. For safety reasons, if a metal front panel is used, it should be connected to the mains earth. The PCB is retained into the specified case by means of 4 self-tapping screws. The case can be finally screwed together and the power applied again.

The talking clock is now ready to run. The first few interjections 'it' makes will seem quite unearthly and unnerving, but after a while, you will no doubt find yourself talking back ! ■

Components List

Resistors

1 x R 1	4R7 .5w
1 x R 2	1k
3 x R 3	15k
4 x R 4	10k
1 x R 5	2k7 (See text)
4 x R 6	10k
1 x R 7	47R
7 x R 8	33k
2 x R 9	10M
4 x R10	100k
7 x R11	33k
4 x R12	10k
2 x R13	10M
7 x R14	33k
4 x R15	10k
7 x R16	33k
1 x R17	1M
1 x R18	1M2
7 x R19	33k
1 x R20	680R
1 x R21	3k9
1 x R22	4k7
4 x R23	100k
1 x R24	220R
2 x R25	560R
2 x R26	560R
1 x R27	4R7
1 x R28	330R
3 x R29	15k
3 x R30	15k
4 x R31	100k
4 x R32	100k
7 x R33	33k
7 x R34	33k
1 x VR1	100k vert-preset
1 x VR2	10k horiz-preset

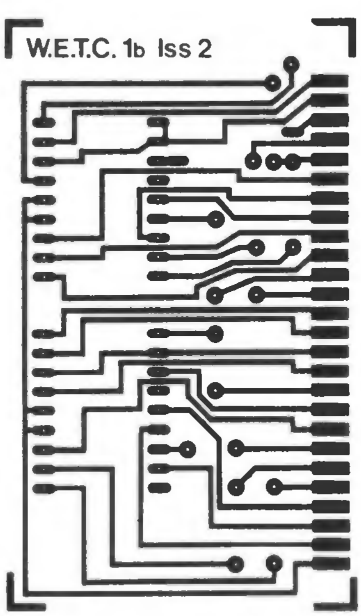
Capacitors

1 x C 1	1000mfd 25v electrolytic
2 x C 2	100mfd 16v electrolytic
1 x C 3	100mfd 6v electrolytic
3 x C 4	10mfd 16v electrolytic
2 x C 5	10n Siemens
1 x C 6	1mfd Siemens
2 x C 7	0.1mfd Siemens
2 x C 8	10n Siemens
1 x C 9	33n Siemens
1 x C10	6n8 Siemens
1 x C11	22n Siemens
3 x C12	10mfd electrolytic
2 x C13	0.1mfd Siemens
2 x C14	100mfd 16v electrolytic
2 x C15	1mfd electrolytic
2 x C16	47pF polystyrene
2 x C17	1mfd electrolytic
2 x C18	47pF polystyrene
3 x C19	10mfd 16v electrolytic

Semiconductors

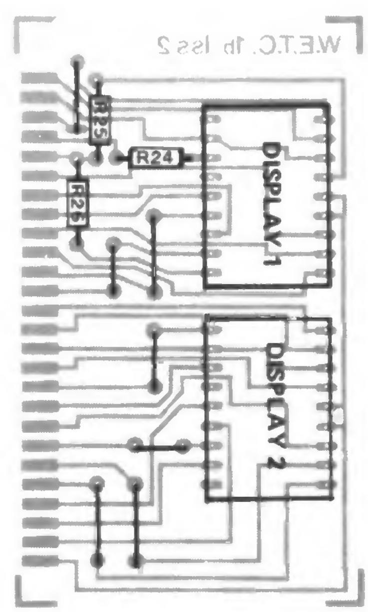
4 x D 1	1N4001
4 x D 2	1N4001
4 x D 3	1N4001
4 x D 4	1N4001
1 x D 5	5v1 Zener 400m watt
1 x D 6	15v Zener 400m watt
4 x D 7	1N4148
4 x D 8	1N4148
4 x D 9	1N4148
4 x D10	1N4148
1 x TR1	BD137
3 x TR2	BC182L
3 x TR3	BC182L
2 x TR4	BC212L
2 x TR5	BC212L
3 x TR6	BC182L
1 x IC1	MM5387
1 x IC2	UAA 1003-3
1 x IC3	LM380
1 x IC4	4069B

2 x Displays 1 & 2 MAN 6740



Display PCB foil side

Figure 4:



Component side

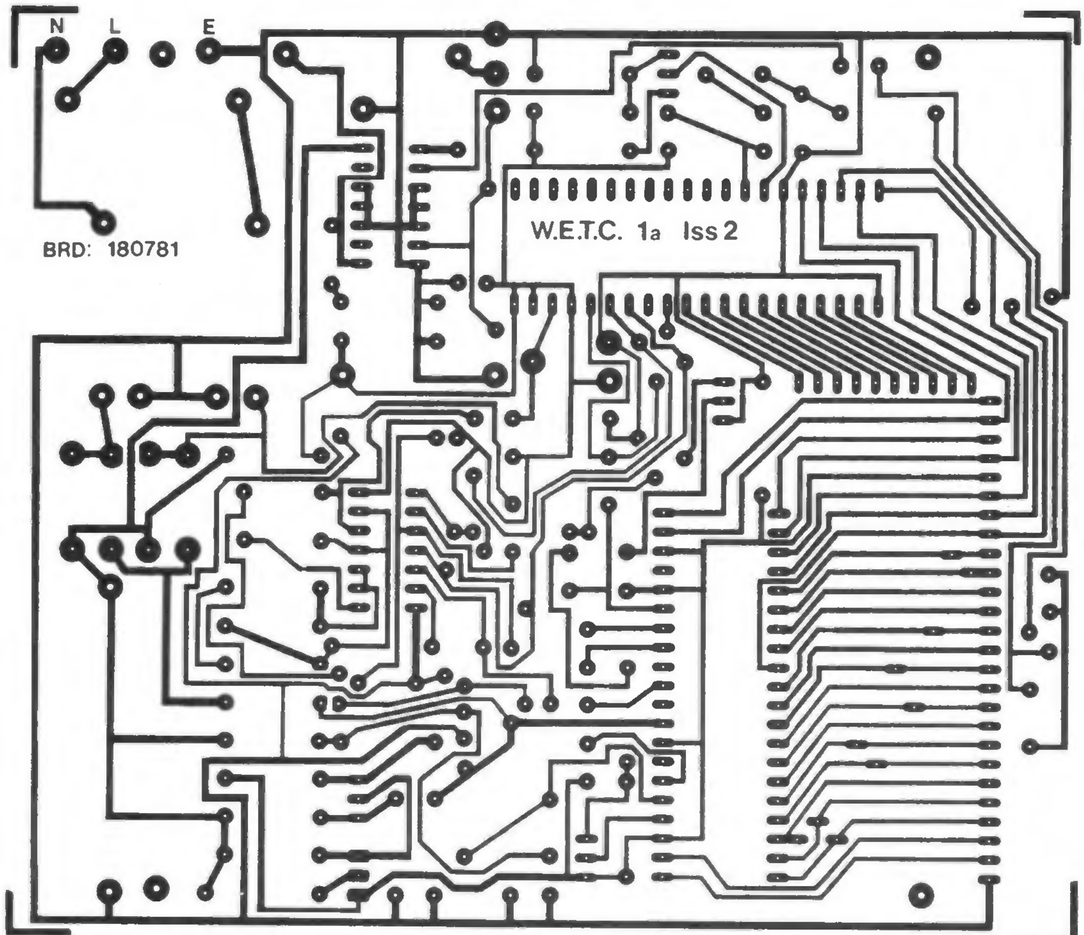
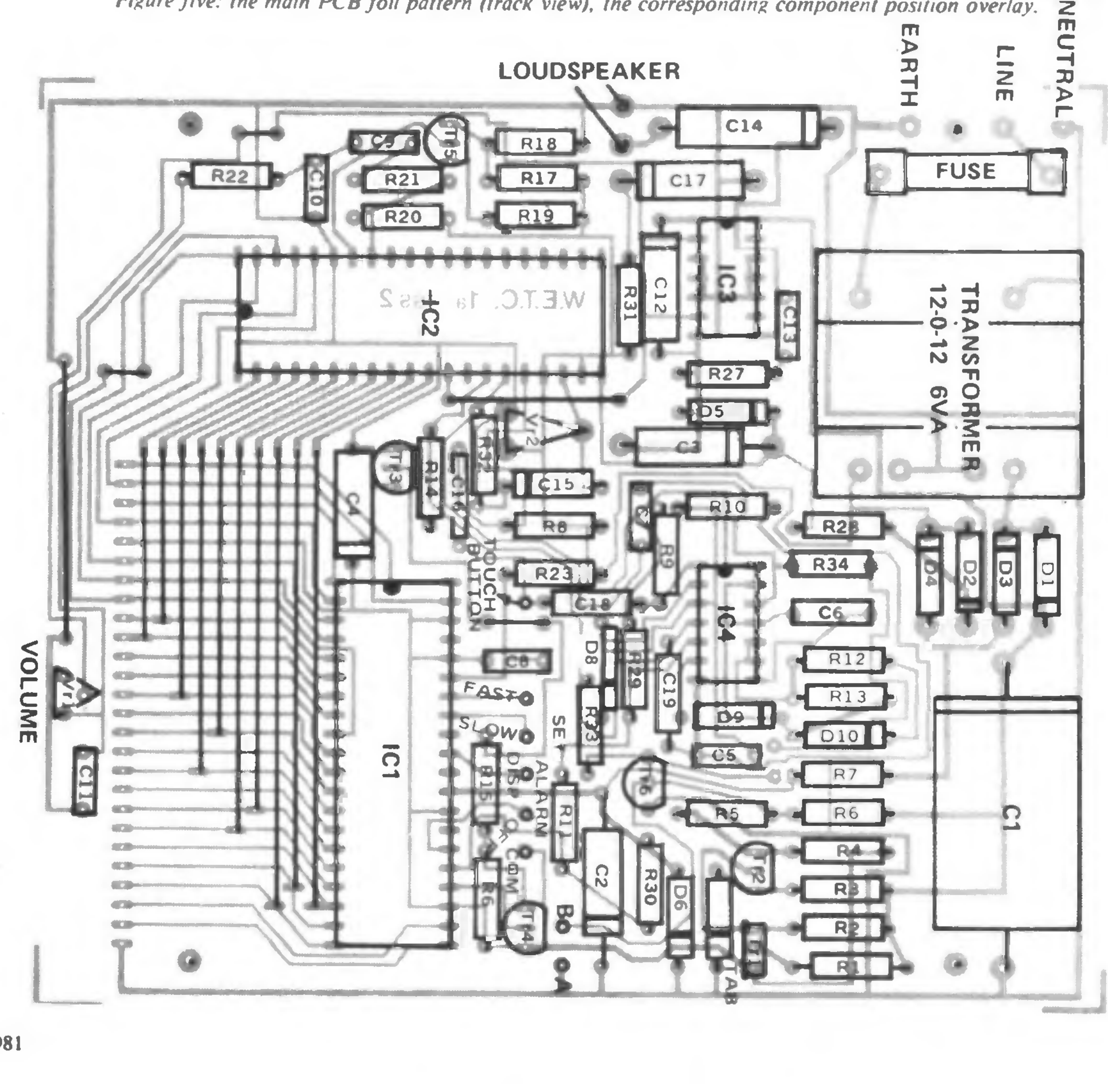


Figure five: the main PCB foil pattern (track view), the corresponding component position overlay.



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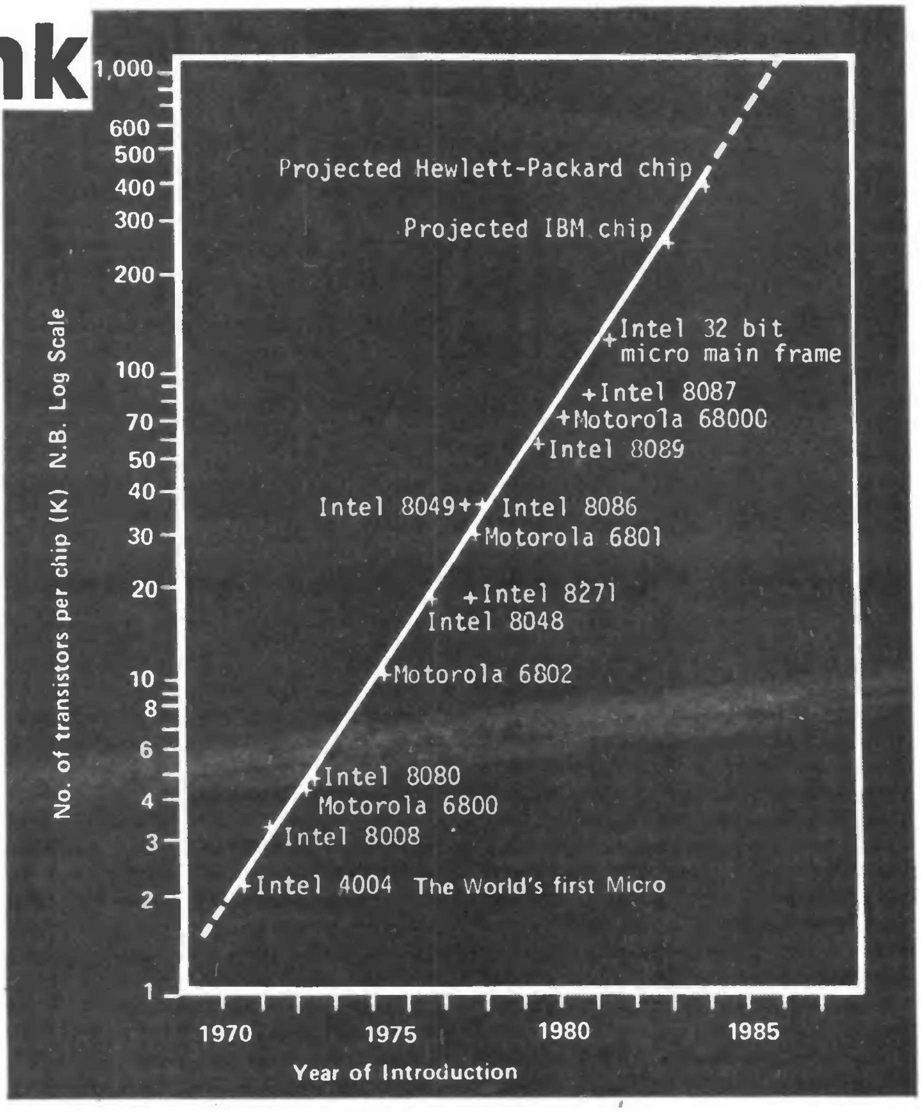
Compulink



Never before has the technology of computing been so readily available to the home constructor. This year has seen the introduction of a personal computer with built-in BASIC and TV display logic, for around £50. Five years ago, a similar system would have cost more like £5,000.

Of course, this tremendous reduction in the cost of a 'system' merely echoes dramatic reductions in the cost of the electronics, or *hardware*, needed to build a small computer. This reduction in cost was brought about primarily by the introduction of the microprocessor.

Many readers will own or have access to a personal computer. Once the skills of programming have been acquired and the novelty of playing space invaders has worn off, the electronics enthusiast will inevitably come to realise that despite owning a piece of equipment which would have been unimaginable ten years ago, it is actually quite difficult to make it 'do something useful'. Also, those cynical *friends* who were temporarily stunned into silence when they asked, "Yes, but what does it do?" and were proudly demonstrated the latest cheque book balancing programme, will soon recover their powers of speech and begin to ask more embarrassing questions such as, "Can't you make it control the lights?" or, "Why did you buy a new central heating controller when you own a computer?"

Enter COMPULINK.....

Here, at **R&EW**, we are not very impressed by computers, or to be more specific, *microcomputers,* playing space invaders. Instead we want to see them 'interfaced' to the outside world. We will be describing truly practical applications of microprocessors and home computers; how to use them as intelligent controllers, test equipment, waveform generators, etc. Perhaps the most exciting field is the interaction between communications and computing.

Communications can be used to link computers and peripherals together and computers can be used to control communications synthesisers, such as those available from Motorola, National Semiconductor et alia. This enables the hobbyist to construct a fully synthesised, microprocessor controlled radio that can vie with commercial alternatives for features, ideas and outright gimmicry. This is a field we shall be exploring a great deal in the future.

A new era begins

Advances made in integrated circuit design during the mid seventies meant that instead of only being able to incorporate several hundreds of active devices on a single integrated circuit die (the chip) manufacturers were able to build devices using tens of thousands of active devices. This technology which became known as Large Scale Integration, meant that products previously constructed from numerous Small Scale Integration parts (such as many of the standard 74xx series logic parts) could now be produced on a single custom Integrated Circuit.

This ability to shrink the size of an application from a bench-full of devices to one single integrated circuit, meant that many products which would have previously been impossible to manufacture due to the high cost of assembly or even the sheer bulk of the electronics, were now quite feasible.

The new technology was quickly put to work producing high volume consumer applications such as digital clocks/ watches and simple personal calculators. However, the initial cost of development was extremely high and could only be successfully amortised if the final application was to be tremendous volume. Moreover, the resulting integrated circuit was so specific that it could only be used in that one particular application, therefore it was very susceptible to being overtaken by a new and better device from a competitor.

What was needed was a truly universal "logic" element which could be produced in high volume and then characterised or programmed for the customer's final application, thus the idea of a microprocessor was born.

The first microprocessor was produced by Intel as the basis of a scientific calculator they had been asked to design. Two design solutions were pursued, one based on the production of yet another custom integrated circuit, and the other based on the production of a universal programmable controller or *microprocessor,* the processor solution was finally adopted and the first commercial use of microprocessors had begun.

At that time, the full implications of this new device had not been fully realised -and Intel were quickly overwhelmed by people wanting to use microprocessors as the basis of a new product. This tremendous commercial pressure ensured the rapid development of new and better offerings by all semiconductor 'Giants', and has accounted for the phenomenal rate at which advances have been made in the availability and application of microprocessors.

It is worthwhile noting that when the 8080 was first introduced, the small quantity price was some £200 compared to today's cost of £5 or £6. The first microprocessors were intended solely as intelligent control devices. However,

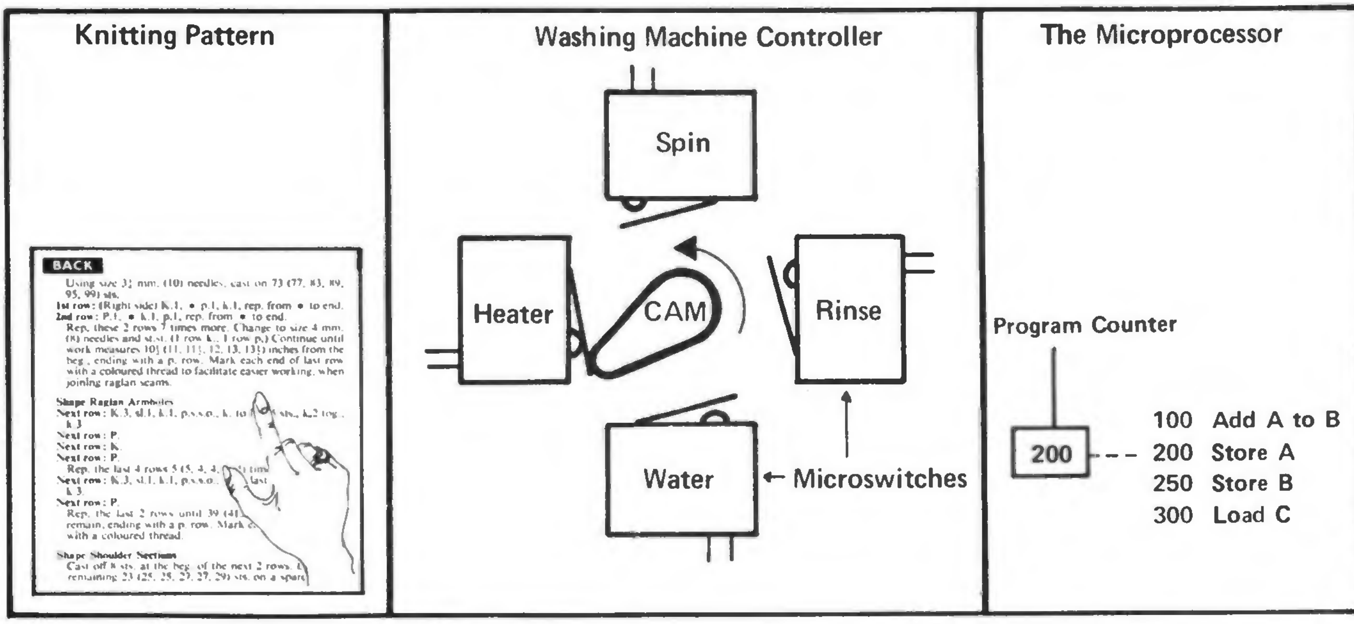


Figure 2: familiar analogues of the microprocessor

similarities between the workings of a microprocessor and the internal architecture of a computer, coupled with the versatility that is inherent in a *programmable* machine, soon lead to their incorporation into personal computers. Soon, new and more powerful microprocessors were being introduced intended specifically for use in the new field of personal computing. *Figure 1* shows the tremendous rate of introduction of these devices coupled with the increase in complexity with each new machine.

The key to understanding how to use microprocessors is to understand how to program them, the electrical interconnection and system design is much easier to comprehend and is largely constrained by factors beyond the designer's control.

What is a programme?

A programme is a set of ordered instructions stored in a readable form which may be read and acted upon by a controlling device.

This broad definition includes knitting patterns, washing machine controllers and computer programmes. It is fundamental to the concept of programming that a difficult and complex task can be subdivided into a number of sequential and simple steps - whether it be.

"Knit 1, purl 1..."

"Turn the water on, turn the heaters on...."

"Multiply A by B".

This ability to express complex ideas by limited numbers of fixed statements is something with which we are all familiar. The English language has only 26 such statements (the alphabet), and yet possesses a limitless ability to express concepts and ideas.

Microprocessors usually have between 100 and 400 simple built-in statements referred to as the "Microprocessors Instruction Set". All the programmes are then constructed from these basic instructions, in the same manner that words are constructed from the letters of the alphabet.

How programmes are stored and read

For a knitting pattern, the method of programme storage is one of decipherable marks upon paper. The programme is read by the moving finger of the human who is acting as the controller.

Having read one instruction and acted upon it, the finger moves on to the next instruction. In computing, the finger which marks the current position of the controller in the programme is referred to as the "Instruction Pointer", or "Programme Pointer". In effect, the Instruction Pointer indicates where the controller must retrieve the next programme step from, having finished the current one. In the case of the washing machine controller, the programme is stored as a series of bumps and dents on the cam surfaces which operate microswitches connected to the motor, water solenoid and heater. In this example the micro-switches are the instruction set, the cams are the programme, and the programme pointer is the angular displacement of the cam shaft.

In a computer or microprocessor the programme is stored within a semiconductor device known as a 'memory chip'. The memory chip contains a number of discrete locations which may be selected by the instruction or address counter of the microprocessor. Each of these memory locations can be set to a value which will cause the microprocessor reading it to execute one of the instructions from its instruction set. The value stored in the memory location thus tells the microprocessor which of the instructions to execute.

The memory chip and its locations are filled with pointers to the instructions in the microprocessors' instruction set, and is analogous to the paper and marks of the knitting pattern, where the instruction pointer of the microprocessor is the moving finger. (See *Figure 2*)

Programming Languages and their relationships

Microprocessors are only capable of executing programmes written in terms of their built-in instruction sets, much as an English person cannot inherently read something written in Russian. All the programmes must therefore ultimately be translated into the processors native instruction set.

The steps of the instruction sets are very simple, and of the nature "add A to B", "read from a memory location" and "write to a memory location".

A programme presented entirely in the form of instructions from the processor's instruction set is known as a "machine code programme". Unfortunately, it is extremely tedious for humans to write in machine code, since it is rather like having to work out how to spell each word as you want to use it.

Nevertheless, many applications of simple computers rely on machine code programming, so a thorough understanding of it is fundamental to a complete understanding of computers - and computing in general.

To assist the machine code programmer, nearly all the computer systems contain a small machine code programme stored in a memory device known as the "Monitor Programme". When the microprocessor is made to execute (read) the monitor program, instructions within it enable the human to locate and *access* memory *locations* within the computers' memory, and write a value into the memory representing the machine code step which the programmer wants the micro to execute.

This *accessing* is carried out via some sort of computer *terminal* - and the monitor contains programme steps which allows the micro to write data to the terminal, and read data entered into the terminal by the programmer.

When the programmer has finished entering his programme into memory, he can instruct the microprocessor to go and 'read' (execute) his newly entered programme via the monitor programme. This method of programme construction and entering is really only feasible for very short programmes, such as those programmes of less than a thousand discrete steps.

In order that the programmer can be freed from the tedium of writing machine code programmes, there are programmes which help to write programmes. These programmes are known as *programming languages*.

A programming language helps the operator to write programmes by supplying a language which can be used to communicate with the computer using stock words, phrases and even sentences. Thus the effort changes from constructing one's own words (and writing a dictionary as you go along), to that of stringing together the supplied words and phrases in the correct order.

The programming language creates a pseudo *instruction set*. This pseudo instruction set is a lot more powerful than the simple inherent instruction set that is supplied with the microprocessor. Instead of instructions such as *read from memory location, add A to B* - the programming language offers instructions such as:

"Print on the terminal A x B"

and

"Input from the terminal the value of A".

Examples of programming languages are BASIC, FORTRAN and COBOL. It should be remembered that these languages are themselves programmes, and are of course written in machine code.

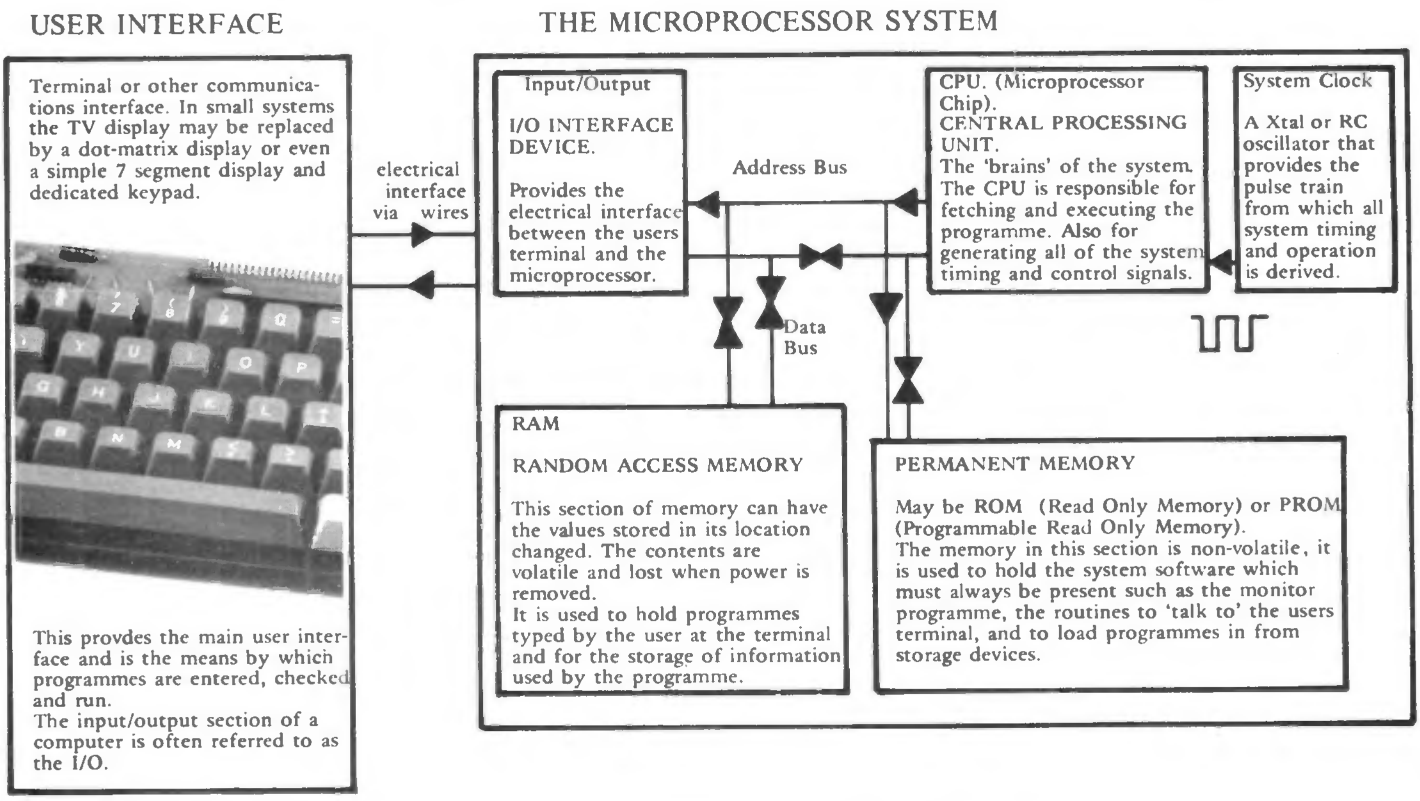
Ultimately, these programmes convert the programmer's programme to machine code, much as a translator converts Russian into English, and then breaks the words down to the alphabet, or the basic *instruction set*.

There is therefore a hierarchical relationship amongst programming languages, and the further from machine code a language is - the more power the pseudo instruction set has - allowing complete concepts to be expressed by a single *pseudo instruction,* or a small group of them.

As you can imagine, the more powerful the pseudo instruction set of a language, the greater the *overhead* of converting a programme written in that language to machine code becomes. Thus a programme written in an advanced programming language runs more slowly than the same programme written directly in machine code, unless special techniques are employed, e.g. few bilingual English people read Russian as quickly as their own native tongue.

Next month we will begin to look at what machine code is, and how programmes can be structured using it.

ANATOMY OF A SMALL COMPUTER SYSTEM



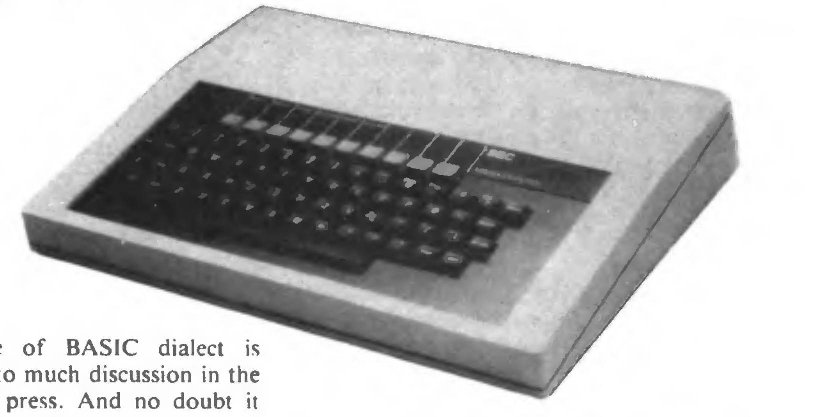
ADDRESS BUS

This is often used by the CPU to address or select the other devices in the system. Each device in the system apart from the CPU, is wired up to respond only to one particular address or set of addresses. Thus for instance the instructions of a programme are fetched by the value of the programme counter being placed upon the address bus causing a unique memory location to be selected or addressed.

DATA BUS

This is used by the CPU to read or write to the addressed location. Thus to 'store A' in memory the processor first selects a storage location (under programme control) and writes to value of A onto the data bus.
The direction of data flow on the bus is controlled by the CPU.

First Impressions of the BBC Microcomputer
- by Philip Anthony



Due for production in September this year, the BBC Microcomputer is destined to become one of the most talked-about small computers available. It is sold not on rock-bottom price, (like Uncle Clive's ZX series), but on a comprehensive performance for a moderate price. It is important to be absolutely clear what is being offered. Compiled from three sources, the information laid out in the diagram and discussed below reflects what 'they' want us to know about the system at this early stage of its evolution.

In many ways, the standard model resembles the highly popular TRS-80*, but it has more features and facilities, and uses the 6502 microprocessor chip found in the PET* and APPLE* rather than the Z.80 more beloved by the larger bus-orientated machines. (* Trade Marks.) The box contains an integral power supply, keyboard and speaker, plus, (we must assume), a fair collection of outside-world connectors for the myriad plug-in options.

The video output, for example, is available as UHF for a domestic television receiver, composite video for a video monitor, *and* RGB sync for equipment such as the *Videoprint* hardcopy device recently 'discovered' by TV Times ('Videoprint': UK Agent Sintrom Electronics Ltd, Reading). Also included is a cassette interface for both programmes and data, an elapsed time clock and 32k of firmware ROM.

At the moment, it is not clear if a light-pen input is provided.

The video interface operates in one of eight modes - including colour and high resolution graphics. 16k of dynamic RAM is included, but as four of the eight video modes use 16k or more of RAM just for the screen display, this does not seem enough.

The enhanced model includes an extra 16k of RAM plus interfaces to analogue input (12 bit, 4 channel), RS232, Centronics printer and the curiously named, 'TUBE' connector. Most matrix or daisywheel printers will connect to either the RS232 (serial) or Centronics (parallel) interfaces and a number of specialist hardware devices such as plotters and digitisers could be attached.

Further hardware extras are planned, including the disk interface, network interface and teletext interface; all plugging into the original enhanced processor. Other computer languages and microprocessors will be available via the second processor expansion option (TUBE connector), leaving the original processor to handle solely input/output.

The choice of BASIC dialect is already subject to much discussion in the computer trade press. And no doubt it will continue to provoke controversy for a long time to come. Whatever was chosen was bound to become a standard of sorts.

What they have chosen is adequate to exercise the hardware, and provides more facilities than most of the larger machines, onto which the would-be programmer might graduate. In particular, the provision of structured features including multi-line procedures and functions, and unrestricted variable naming should allow the user to avoid the less elegant constrictions of simpler BASICS. Positive encouragement of software development, and the telesoftware facility, will result in a very wide range of available programmes. The only problem will be grading their quality.

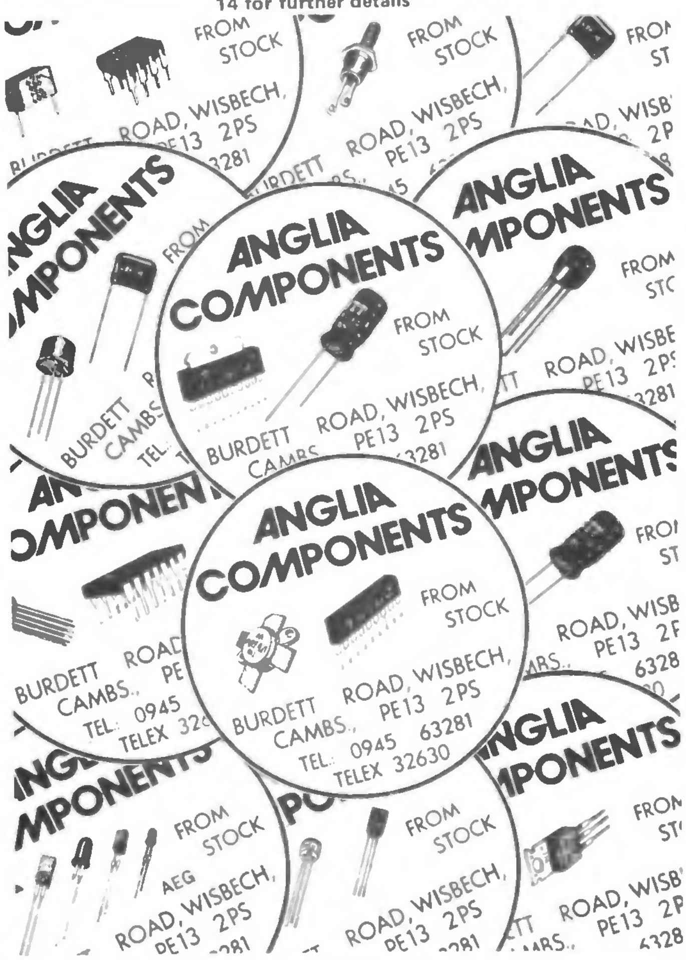
Most microcomputer projects, (both in the UK and USA), with which the author has been familiar have slipped their quantity-production schedules by about a year. Although early models have been available in sample quantities, they seem to differ almost daily as engineering modifications filter through to the factory floor. Any bold attempt to manufacture thousands to an original design merely results in thousands of boards covered with cut tracks and 'spaghetti' wiring. History is littered with stories of production schedules shattered by unexpected demand, and even with more carefully researched machines equally behind schedule. Reluctantly it might be expected that very little 'quantity' is likely to appear before next Easter. The political and programme-planning consequencies of this have been discussed at great length elsewhere. It must also be said that with the hardware for the network and disk interface not anticipated for delivery until Autumn 1982, the likelihood of incorporating debugged, or indeed *any*, firmware to drive these functions in the original machines seems slim. Let's hope this is proved wrong, for the concept and its implementation deserve every support and encouragement.

In conclusion, it appears that the standard machine is a well thought-out and comprehensive design, for a reasonable price. The enhanced model, additional interfaces and language processors appear less good value by comparison, although the system rally seems to have very little direct competition (by definition).

Whatever the price and performance of the hardware, the unprecedented training and support which will be generated to accompany the machine should ensure that it does for home computing what the Model T did for motoring. And it really is about time that some form of enforced standard was introduced before the market diverges much further. ■

Graphics Resolution	Colour	Text	Size
640 x 256	2	80 x 30	20k
320 x 256	4	40 x 32	20k
160 x 256	16	20 x 32	20k
	2	80 x 25	16k
320 x 256	2	40 x 32	10k
160 x 256	4	20 x 32	10k
40 x 25	2	40 x 25	8k
		40 x 25 Teletext compatible	1k

14 for further details



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SX20	100	Assorted Polyester/Polystyrene Capacitors	£1
SX21	60	Mixed C280 type capacitors metal foil	£1
SX22	100	Electrolytics, all sorts	£1
SX23	50	Quality Electrolytics 50-100mfd.	£1
SX24	20	Tantalum Beads, mixed	£1

*Quantities approximate, count by weight.

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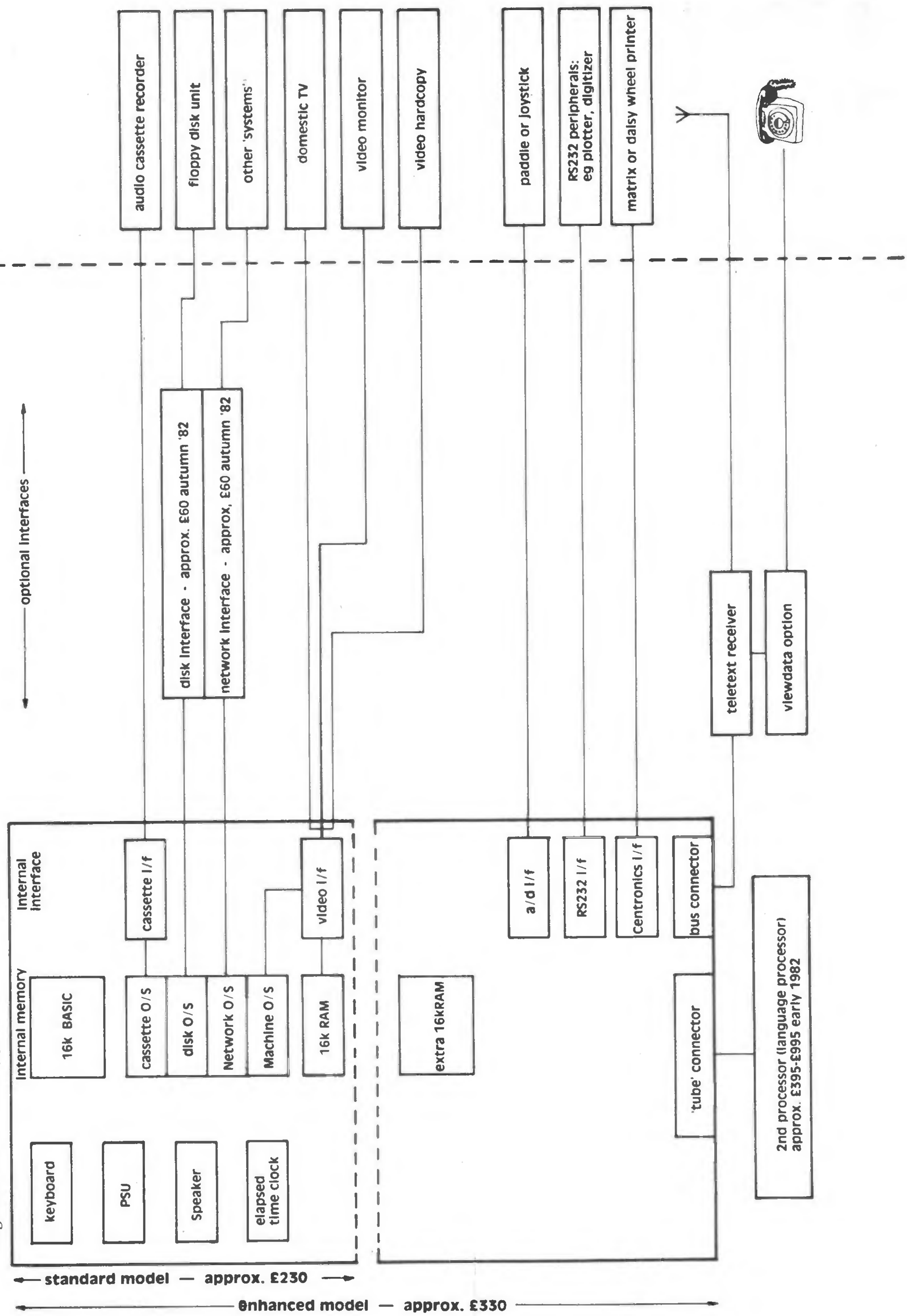
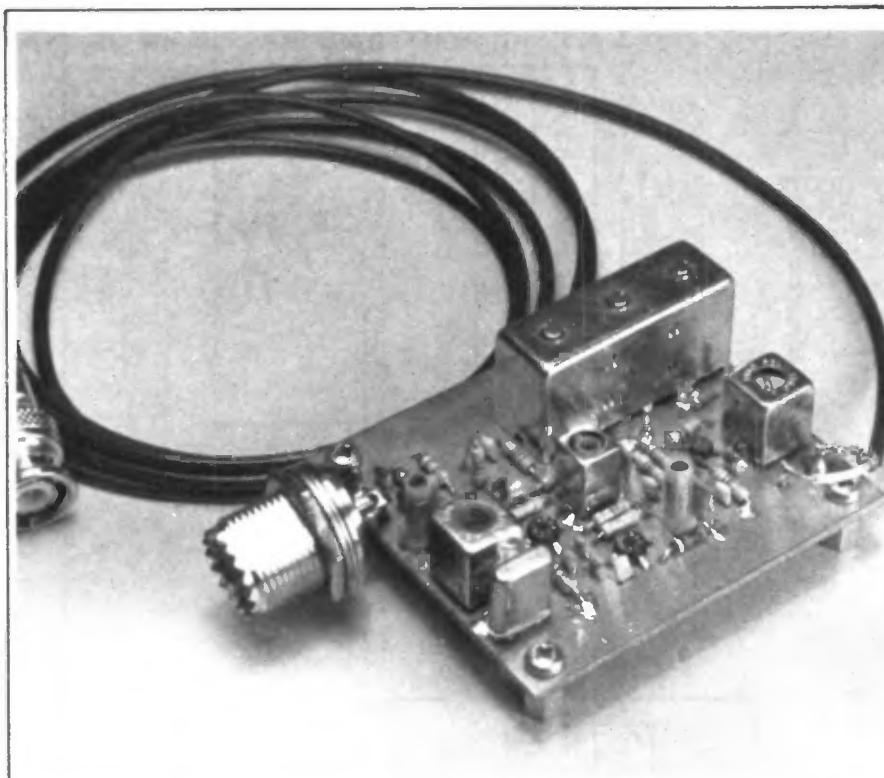


Figure 1: Hardware Configuration

a state-of-the-art vhf converter

timothy edwards

Probably the most advanced design ever to appear in a UK electronics magazine, giving an insight into commercial techniques and design philosphy — yet easily made by a relatively inexperienced enthusiast



Despite the plethora of ready made equipment for the 2 metre (144-146MHz) amateur communication band, most radio enthusiasts like to try and salve their consciences as participants in the once exclusively 'practical' art of amateur radio, by making at least one or two items of equipment that can justifiably be described as 'home grown'.

Most of the commercial transceivers for the VHF bands are primarily FM systems for simply 'nattering', and some of the hobby's traditionalists might suggest that the use of 2m NBFM bears more than a passing resemblance to the principles behind CB radio - but that's an entirely more contentious subject......

The exclusive use of NBFM tends to overlook the more interesting aspects of CW and SSB communications (morse code and single sideband to the uninitiated). But since most enthusiasts have an HF communications receiver (or two) at their disposal, it is an easy enough task to make a thoroughly professional converter for 144-146MHz, with an IF output to be tuned on the 28-30MHz section of the HF receiver. The radio enthusiast may thus fulfil the repressed constructional instinct, as well as being able to have a serious look at the CW and SSB aspects of the 2 metre band before launching into a few hundred pounds worth of oriental temptation.

The converter is basically a linear device within the expected range of input signal levels, and so any mode (AM, FM and SSB) can be converted to the required HF output. Some HF receivers are available with NBFM demodulators, but to do the job properly, the correct bandwidth IF filter needs to be used with a purpose made NBFM IF system. In the absence of this facility, slope detection of NBFM is better than nothing. (Slope detection relies on the IF filter passband edge to translate the frequency modulation information into an amplitude variation for detection as simple AM).

However, failing all this, you can build the **R&EW** NBFM tuneable IF, or the **R&EW** add-on NBFM adapter - both of which are scheduled to appear in an early issue.

Judging by the numbers of 'nearly new' SSB transceivers advertised for sale, it is no doubt better to investigate your long term interest in this aspect of communication without first contributing to the wrong side of the balance of payments. This converter provides reception of repeaters, NBFM simplex, and demanding long range communications using CW or SSB.

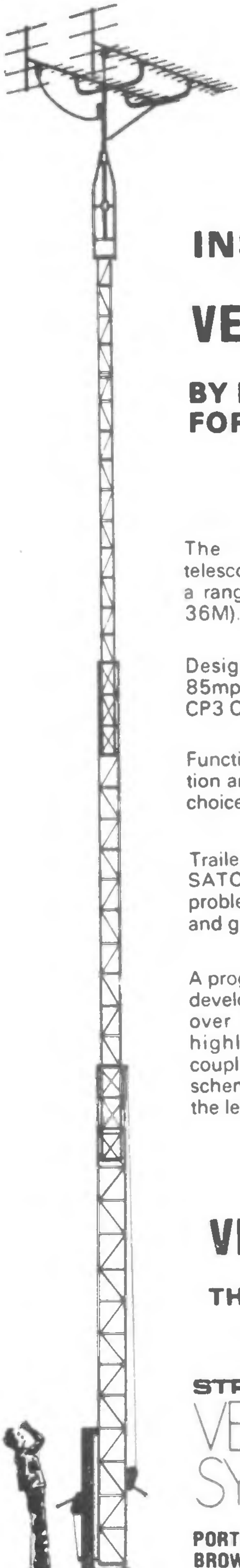
The R&EW 2 metre converter

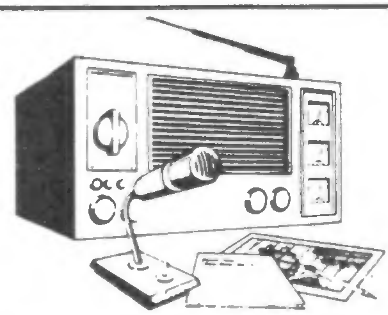
This converter was originally designed to compliment the RX80 receiver described in *"Radio Communication"*, although it will obviously operate with such receivers as the FRG7, R1000, DX160 etc. It has been designed with the latest state-of-the-art components, noteably the *NEC* 3SK88 MOSFET (note one), which has been chosen for its repeatably low noise figure and low cost. The TOKO CBT series helical filter provides an outstanding bandpass and stopband response, but most significantly of all from the point of view of those of you wishing to duplicate this converter, it is supplied prealigned, and requires virtually no trimming to optimize alignment.

Although a VHF converter usually requires considerable expertise, and recourse to a selection of signal generators and other analytical equipment, the **R&EW** converter can be built by anyone with 'kit building experience' and a multimeter.

Circuit Description

Fig. 1 shows the complete circuit diagram. C1,C2 and L1 provide the optimum noise match between the 50 ohm antenna input and the RF amplifier - this is a carefully derived selection of values, and not simply a haphazard choice from the junkbox. Gate 2 of Q1 is biased at 5v (externally derived - ie from the main receiver or tuneable IF - negative going AGC may be applied at this point by those with adequate confidence and experience). The source of the RF amplifier Q1 is then taken directly to ground to ensure minimum impedance.





The drain of Q1 is taken to the supply through R3, which provides the correct terminating impedance to the helical resonator L2, which has an input and output impedance of approximately 450 ohms. The output of L2 is connected straight to the gate of the mixer Q2, R5 providing the necessary extra load in parallel with gate one of Q2 for a correct 450 ohm matching load.

The appearance in the market of low cost helical filter blocks *(photo one)* will probably change the approach to VHF designs, since yet another circuit 'variable' has now been substituted by a 'building block' that takes out most of the problems for the less experienced designer and user. More than 75% of the problems associated with VHF radio designs are simply those associated with getting lost in the MHz as a result of the uncertainties of DIY coil designs.

Helical filters will not salvage designs that fall into the all too familiar abyss of 'dry' joints, and a shortage of basic experience in handling components and a soldering iron - but these filters will help allay the fears of the more experienced audio constructor whose neat RF projects have always been relegated to the 'pending' tray, since the problems of alignment associated with the 'green' fingers of the RF engineer, sometimes seem insurmountable.

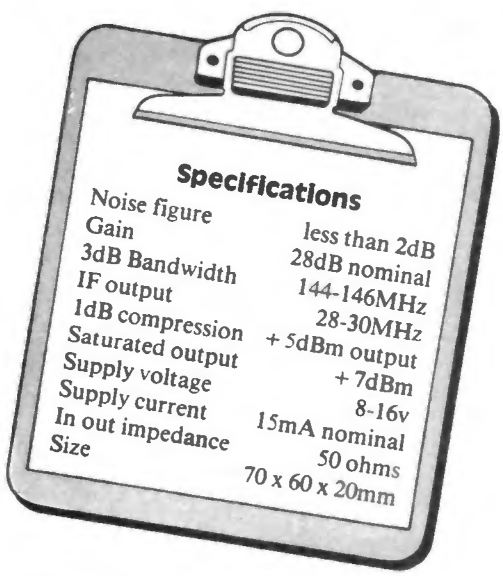
The circuit below illustrates some of the typical test voltages (nom 12v input)

Unlike the RF amplifier, the mixer does not use any DC bias on either of its gates. This is because the amplitude of the local oscillator injection voltage is designed to be sufficient to switch Q2 *directly* at 116MHz, thereby improving the intermodulation performance of the converter. This technique is used in some professional receivers, and is similar in concept to the esoteric Schottky diode double balanced mixer -except, of course, this system is single ended. It is possibly the first time that this approach has been used in an enthusiasts constructional feature. Unless you know better....

At the drain of Q2, the wanted mixer product (28-30MHz) is selected in the tuned circuit formed by L3 and C8, and matched at the secondary to 50 ohms to feed the main receiver. It is this output network that mainly constitutes the 3dB bandwidth of the converter. This means that the gain is approximately 25dB at 144MHz, 28dB at 145MHz and 25dB at 146MHz. This reduction of gain is of no consequence as the design has plenty in hand at all times.

It should be noted that the ultimate sensitivity of any receiving system is defined by its noise figure, and *not* its gain. This means that the sensitivity will be the same over at least 144-146MHz, although the 'S'meter might read slightly less at the band edges.

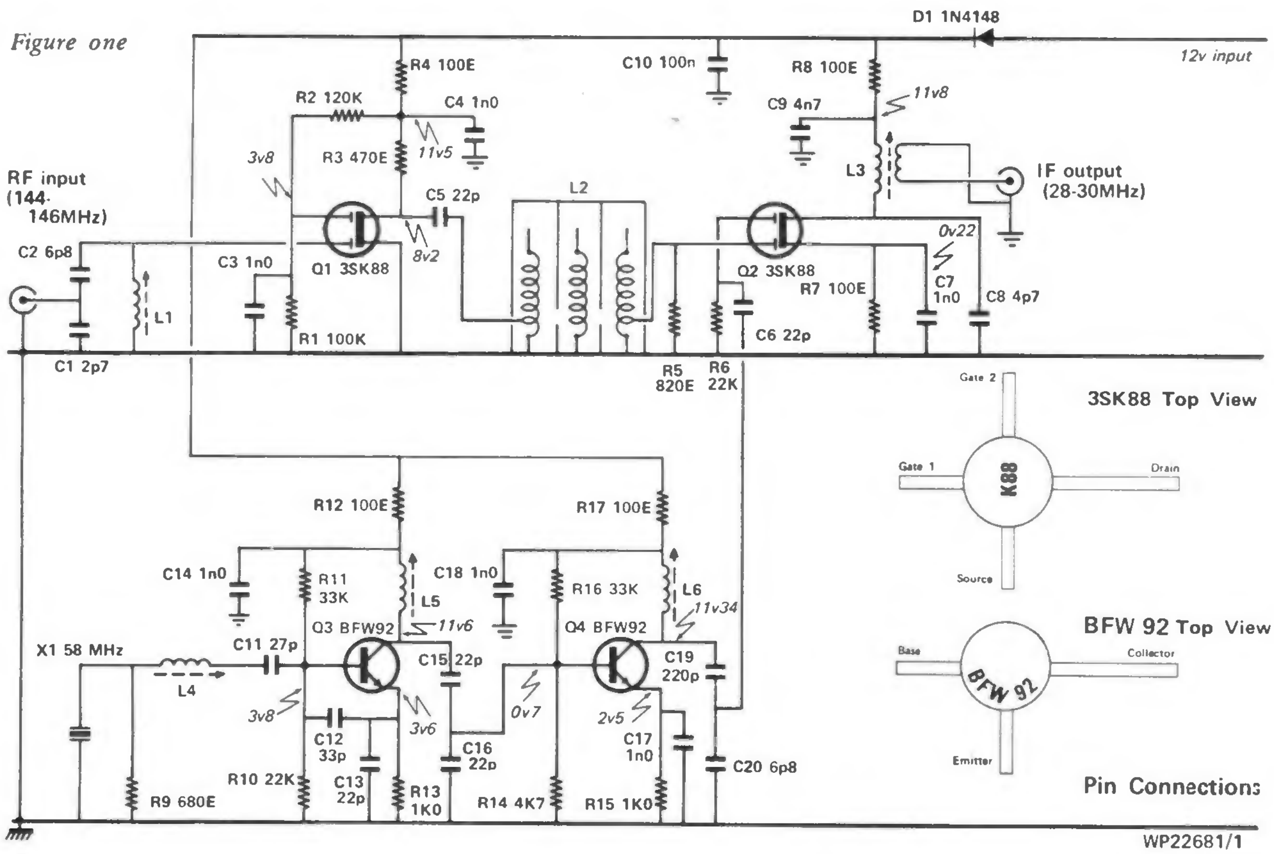
The oscillator chain uses a 58MHz crystal, rather than the more usual 116MHz type. Transistor Q3 serves the function of both oscillator, and the

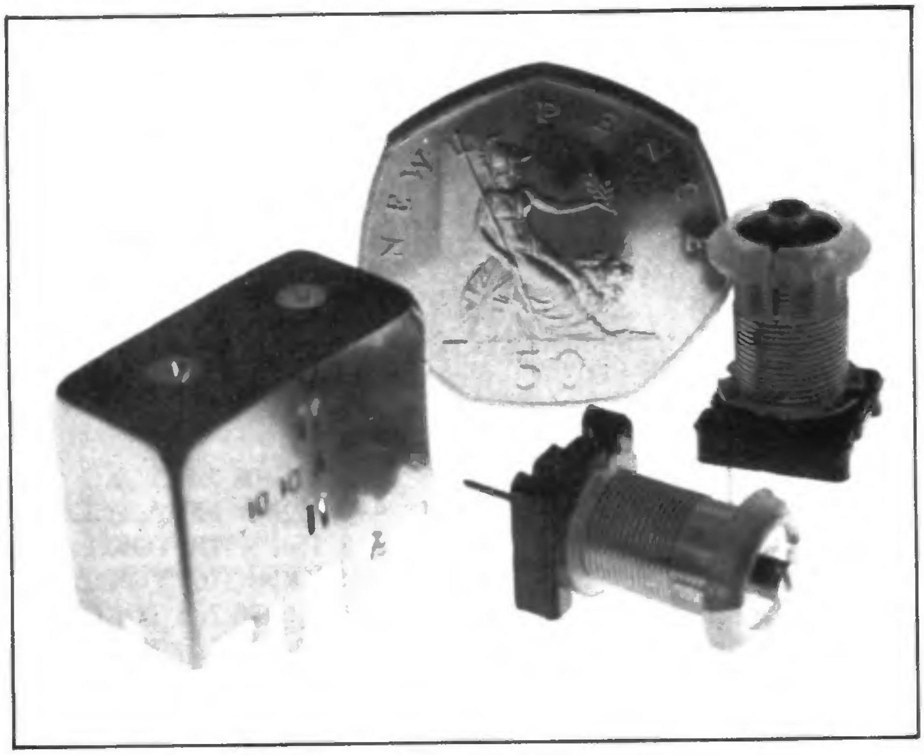


frequency doubler. L4 tunes out the capacitive reactance presented to the third overtone crystal and allows fine adjustment of its operating frequency. L5, C15 and C16 select the second harmonic from the oscillator at 116MHz and matches it into Q4 where it is amplified to an adequate level to switch the mixer, Q2. The capacitive divider, C19 and C20, provide the necessary level and impedance adjustment to feed the oscillator injection of approximately 2mW to gate 2 of Q2.

On a general point about decoupling, note the way in which the earthy end of the tuned circuit are decoupled with capacitance and inductance. Taking the example of L3 (R8/C9), R8 is apparently superfluous.

Figure one





An 'undone' view of the 2 pole version of the helical filter

This presumes that there is zero AC impedance to the RF ground on the positive supply rail which - for reasons of the effects of lead inductance and the unpredictability of 'stray' coupling at VHF - is certainly not always the case. Thus the low pass filter formed by the RC combination provides a far more positive and reliable method for keeping the RF off the supply line. The danger of creating a positive feedback loop somewhere in the physical (as opposed to theoretical) circuit layout is thereby greatly reduced.

D1 provides reverse polarity protection, which most readers with practical experience will have discovered is essential when connecting things up in a hurry. Strangely enough, this simple and effective precaution is omitted from many designs. Perhaps more components get sold that way.

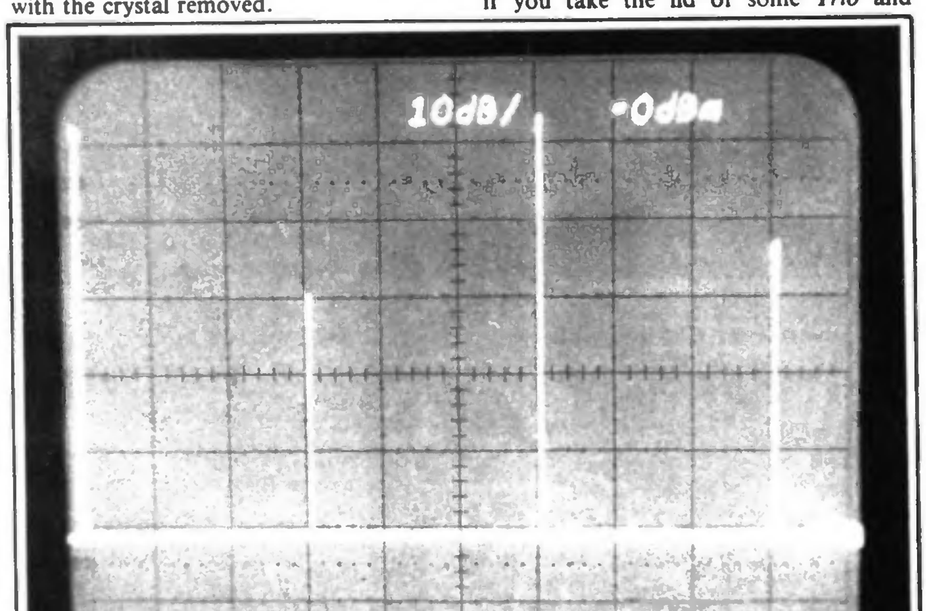
Construction and alignment

Using the PCB and components placement guide, *(figure three),* assemble the converter. Do not forget to solder the earthy legs of R1, R5, R6, R7, R9, R13, R14 and R15 - and also the can legs of L2, L3, L4 and L5. There are no critical or easily damaged components, although due to their size it is adviseable to leave the coils and helical filters until last.

After construction is completed, remove any solder splashes, check for 'dry' joints and remove the flux residue. Connect to a 12v regulated power supply and check that the current consumption is about 10mA without the crystal fitted.

Preset coils L1, L5 and L6 so that their cores are flush with the top of their formers. At this stage, do not touch L2, L3 and L4.

Connect a volt meter between Q3 emitter and ground, the voltage should be approximately 3.2v. Plug in the crystal, and the voltage should rise to about 3.5v, slightly adjust L4 for maximum reading. Transfer the meter to Q4 emitter, and adjust L5 for maximum reading - which will be about 3.5v. If the crystal is removed, the voltage will fall to approximately 0.48v. Transfer the meter to the source of Q2 and adjust L6 for maximum reading. This will be about 0.15v to 0.3v, depending on the IDSS of Q2, there will be less than 0.1v present with the crystal removed.



The spectrum of the LO at the multiplier output 10dB/div., 20MHz 'X' axis per div

Connect a 50 ohm aerial to the 2 metre input and a suitable receiver to the output via a 50 ohm coax lead. Don't bother to tuck it all away neatly into a case/box just yet, since there is a reasonable chance that you will need to do some work to the unit to get everything working perfectly.

Tune to a weak signal around 145MHz (the output will tune to 29MHz) and adjust L3 for maximum output using the receiver's own 'S' meter. Adjust L1 for maximum signal to noise by ear, and do *not* use the 'S' meter if optimum results are required. Maximum gain does *not* coincide with minimum noise figure. For a detailed explanation, refer to the 2 metre preamplifier design by the same author. *(Shortly to be described in an issue of* Radio and Electronics World *-editor.)*

Unless you have the necessary equipment to sweep the 2 meter band with a spectrum analyser and signal generator, do not adjust L2. There is little point anyway, as the helical resonator has been very accurately set up during the course of its manufacture and test, and no improvement could be effected on the samples tested. This is not unexpected, as TOKO offer an unparalleled repeatability in their ranges of high quality RF and IF coils. Experience has shown them to be suitable for most demanding applications, and indeed, there are hardly any high quality receivers that do not use some.

The bandpass characteristic over 144-146MHz shows a perfect text-book response *(photo two).* The helical filters were originally designed for use by manufacturers of Oriental 'black boxes' mentioned at the outset of this article, and if you take the lid of some *Trio* and

Standard equipment, you will probably find one of these devices lurking near the receiver front end.

The remaining adjustment is to put the converter onto the correct frequency, but this is not important unless the receiver itself has an accurate frequency readout. If it has, then tune to a known frequency such as a beacon signal or a repeater, and adjust L4 so that output frequency corresponds to the known input signal. eg:

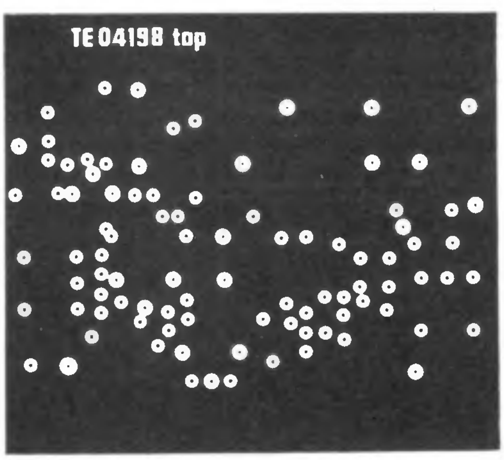
A repeater on R6 (145.75MHz) reads 29.75MHz on the main receiver display. This completes the alignment, and it is gratifying to be able to comment that no problems have occurred with stability in any examples tested so far - doubtless due to the carefully designed double sided printed circuit board.

Conclusions

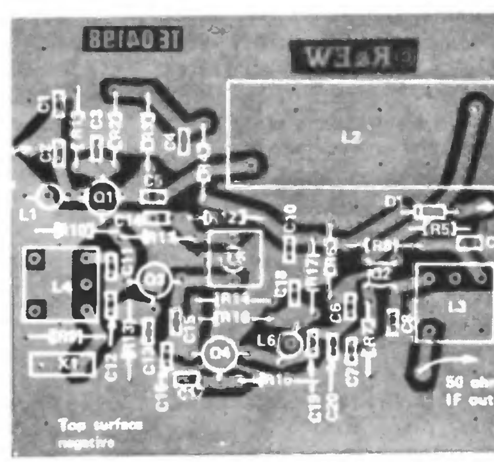
Once you are confident that all is well, fit the completed PCB into an appropriate container, and fit some form of RF connector such a PL259, or 'BNC'. If you do not already possess a standard of your own, then the 'BNC' system is probably the best choice. Fitting a BNC connector to a cable is not the easiest task for the uninitiated, but it is worth persevering and aquiring the necessary skills, since the BNC system is probably the best general purpose RF connector available.

Components List

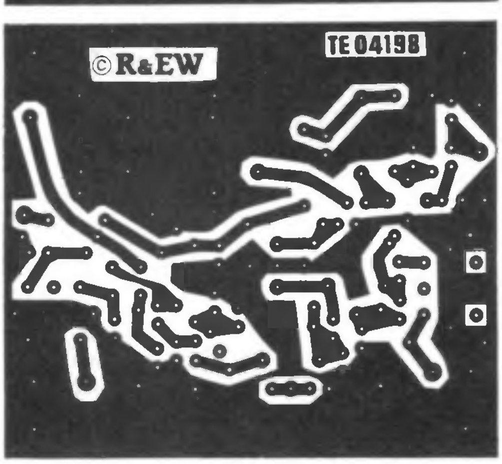
C 1	2p7 miniature plate ceramic
C 2	6p8
C 3	1n
C 4	1n
C 5	22p
C 6	22p
C 7	1n
C 8	4p7
C 9	4n7
C10	100n
C11	27p
C12	33p
C13	22p
C14	1n
C15	22p
C16	22p
C17	1n
C18	1n
C19	220p
C20	6p8
R 1	100k 1/4W Carbon film
R 2	120k
R 3	470
R 4	100
R 5	820
R 6	22k
R 7	100
R 8	100
R 9	680
R10	22k
R11	33k
R12	100
R13	1k
R14	4k7
R15	1k
R16	33k
R17	100
L 1	MC108 7.5t TOKO
L 2	272MT 1006A TOKO
L 3	154FN6439 TOKO
L 4	KXNK3766 TOKO
L 5	MC108 7.5t TOKO
L 6	MC108 7.5t TOKO
Q 1	3SK88
Q 2	3SK88
Q 3	BFW92
Q 4	BFW92
D 1	1N4148
X 1	58.000MHz HC18U
1	7mm Coil Can
1	PCB



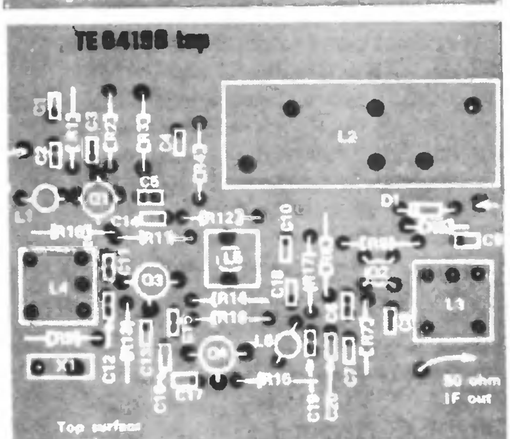
SS print of PCB earth plane layout



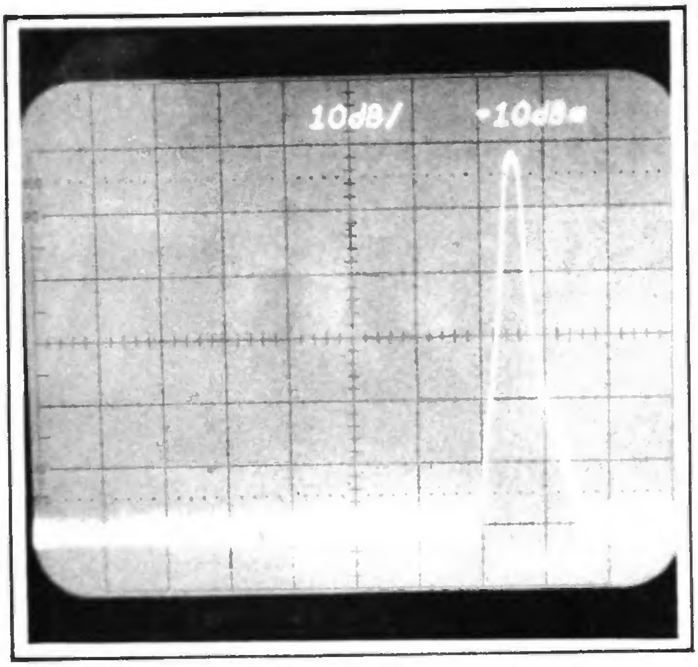
View through the top of the board of the track interconnections.



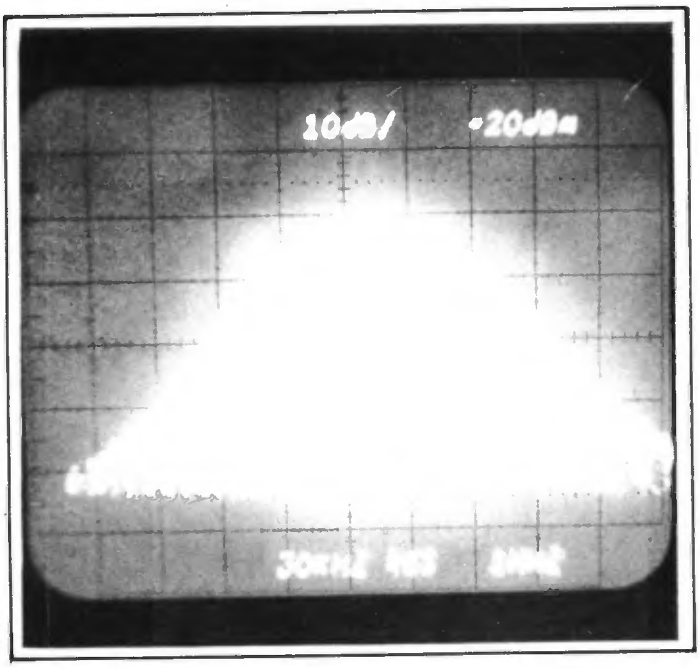
SS print of the PCB track layout



View from component side on top screen layout



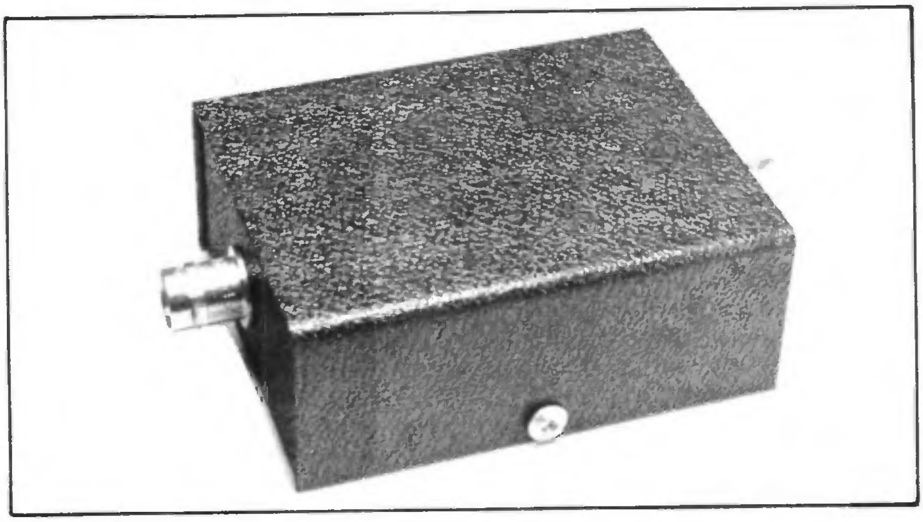
The RF bandpass at the mixer input (10dB/10MHz)



The converter bandpass (2dB/1MHz/145MHz) (note 3)

The spectrum analyser photographs were taken using Tektronix and Hewlett Packard test equipment. Because the input and output frequencies are not the same it was not possible to use the conventional technique of sweeping a tracking generator with the spectrum analyser. Instead a Hewlett Packard 8640B signal generator was swept by hand over 130-160MHz whilst the spectrum analyser was tuned to a centre frequency of 29MHz. The resulting display was stored in the analyser and photographed with a polaroid camera. The results speak for themselves and best of all, are entirely repeatable.

The **R&EW** lab alignment service is available for the soundly constructed board that cannot be accurately aligned due to absence of signal source, or simple fear of RF. The charge will be about £5. Any drastic repairs will be charged extra, since smouldering MOSFETs are not encompassed in the basic scope of this service.



The completed converter in its case

NOTES

1. Nippon Electric Co. Data sheet C1321A
2. Full data available from **R&EW** Readers' Services Dept. Please enclose an SAE.

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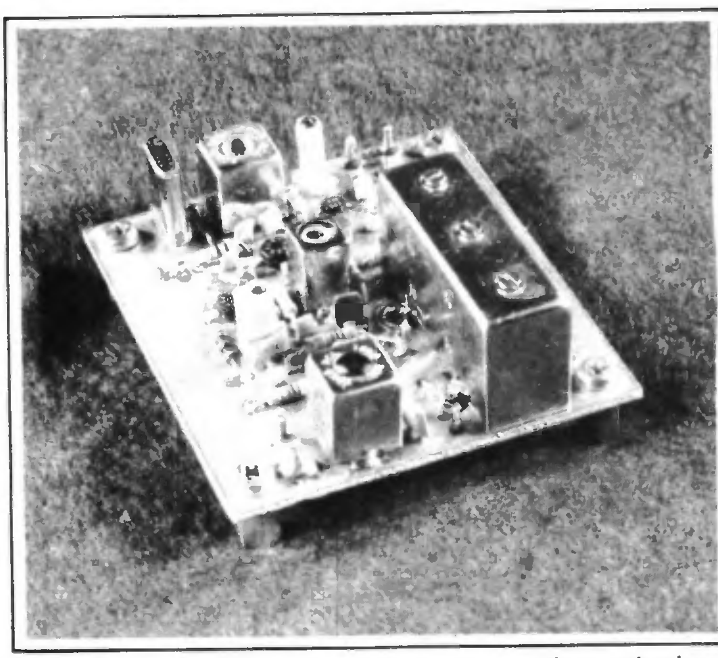
Excellent - will make one	201
Interested - might make one	202
Seen better (*tell us where*)	203
What's 2m??	204



The completed converter PCB

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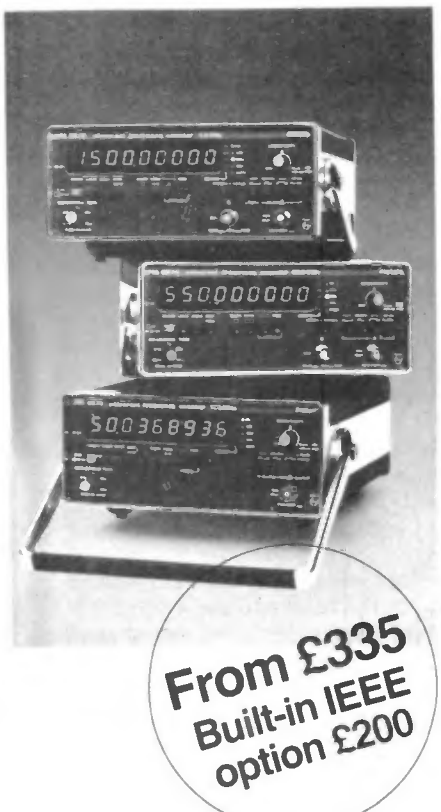

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	Inquiry No.
PM 2521 digital measurement centre	**220**
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Pye Unicam Ltd,
Philips Electronic Instruments Dept,
York Street, Cambridge CB1 2PX
Tel (0223) 358866 Telex 817331

PHILIPS

NEWS BACKGROUND

News background

This feature is basically recognition that a monthly publication would be presumptious to expect to pretend that it can outstrip a good weekly when it comes to hot-off-the-press stuff. So this section is being assembled as a 'background commentary' or news magazine.

R&EW wants to explore some of the topics in the news a little more thoroughly, and prompt a little reflection and thought amongst the readers. We would like to think that we can generate a feeling of involvement and concern in our readership, since simple apathy is one of the main afflictions of the UK electronics scene.

News background

The opinions expressed herein are an amalgamation of many ideas, discussions and debates amongst the editorial team, educationalists, industrialists and other assorted contributors. We invite your views in the hope that our letters page will become engaged in lively and useful debate on matters affecting every aspect of electronics, computing and communications. With luck, we might not get bogged down in too much obscure technical trivia with "*Names*" using the page as a platform to score points.

If we outrage, or if we strike a chord with our readers - or if this just gets read at all, then our purpose will have been fulfilled.

Education: Three Cheers for Auntie!

Electronics education took a tentative step forward with the announcement that the BBC is going to run a series on the Radio 4 Schools' Broadcasting network entitled 'Electronics and Microelectronics'. At a Press reception held on July 30th, the series producers - Arthur Vialls and Julian Coleman - outlined the series' philosophy to a gathering comprising journalists from the National Press and a number of electronics publications.

The series is accompanied by 5 film strips that link in with the broadcast commentary to provide a grounding in the basics for 14-16 year old pupils of CSE mid/low grade ability.

Whilst the series is in itself a significant and laudable effort, several very interesting points emerged from subsequent discussions at the news conference, and perhaps these broader aspects deserve a closer analysis in **R&EW** - since we rather doubt if our readership encompasses too many from the programme's intended catchment area.

How others see us

It is always interesting to see how *outsiders* view a subject we take for granted. The image of electronics and its participants in this country has been the subject of much debate within the business - especially those gripes about engineering status. The fact that the government recently announced that it was setting up centres for work experience schemes in the fields of electronic and computer assembly for the *underprivileged* tends to underline the way in which most academics view the practical end of this science.

Similarly, the BBC has been obliged to aim at a rather unambitious level of awareness, supporting the enterprise with a £6.60 pupil kit comprising pieces of wood, screws with cup washers for point to point wiring, and paper clips for switches. Those of us sitting amidst £n,000 worth of technology may find all this rather lowly - but it is disturbing to note that even this level of spending in our secondary schools is considered rather daring. Certainly the BBC didn't expect one kit per pupil, but more likely one amongst 3-4 users.

Do or die

The series producers emanated a refreshing enthusiasm - they too had discovered from following the practical experiment that electronics is actually a rather contagious and absorbing pastime. (We hope to be publishing a much longer interview with some/all of those involved in this project in a future issue.) However, one bespectacled gentleman who was involved at the periphery of this series - you know who you are, sir - displayed rather too much of the jaunty *I can't mend a fuse - what a Silly Billy I am* syndrome which pervades too many attitudes concerning science in educational circles.

If the BBC offered the same exposure to electronics as it does to our four legged horsey friends, we would probably be rather the better for it. Maybe the Japanese will accept video tapes of the Horse of the Year Show when we finally run out of foreign exchange.

Where next?

Computing has achieved an air of respectability in academic circles. In the land of the blind, the one-eyed man is king - and so it is easier to impress these hapless folk for whom electronics technology holds no interest with an erudite flash across the keyboard that results in *something impressive* happening.

All schools are destined to have a microcomputer in the next year or so - and many have already had them for a couple of years.

One of the most interesting aspects of the discussion of the programme, concerned the emergence of an inquisitive follow-up by existing school's computer users. For once the fun of variations on Space Invaders and 'big' calculators has worn off, more and more pupils and teachers are seeking to find out how to interface to the outside world.

Computing is pretty much a mathematical science, and most computer operators know precious little about the 'silicon chip' (a prize for anyone who can force the Media to use alternatives to *microchip, silicon chip*) - so perhaps we are witnessing the start of a very real desire to come to terms with the 'real world' computer interface techniques that we have decided should be **R&EW's** stance on the subject.

What we're up against

Michael Trotter, one of the main contributors to the course and a man with a great deal of enthusiasm and concern for the state of education, expressed a certain amount of frustration at the way in which schools had entertained the idea of these ten 20-minute broadcasts. Many schools had suggested they might consider the material for lunchtime clubs, since it was still Hooks Law (the one about springs and tension, remember?) that ruled the syllabus, and that it would be 1984 before any serious attempt could be made to fit this topic into the syllabus. No one dared suggest that a few sacred cows could be led to the abattoir to make room for this heretical subject that presumes not to possess a lineage traceable back to Isaac Newton and Humprey Davey.

A chink in the gloom

The producers and writers are to be congratulated. They are trying to fight their way out of the academic wet blanket that seems to get heaped on this type of scientific project in the best way they can. The course kit may draw a few derisive comments from the electronic industry - but after initial misgivings, even **R&EW** had to agree that in the context of this project and the current state of electronics education, blockboard and wood screws did seem to have a relevance - albeit a rather unnerving admission.

The producer reckoned on around 1,000 schools (from a possible total of 7,500) would be taking part - although to date only 400 pupil kits have been sold to around 100 establishments. It hardly needs to be said that a pupil project kit represents less than the national average family's weekly expenditure on ciggies, drink and other assorted 'fripperies' (please don't write and tell us if you don't smoke or drink!).

We would ask any readers with any interest in this subject - including parents with children 14-16 years old to put as much pressure on local schools as possible to see that this series is adopted nationally. Hang the fact the syllabus may not have room, Great Britain Limited and secondary school pupils really have precious little need for many of the irrelevances apparent in our educational system.

Young minds need to be fed facts and information from which they can formulate opinions and thence ideas. Some time can easily be found if some of the more dubious and subjective topics on the average syllabus were to be relegated to after hours discussion groups. This may not be very popular with those teachers who see their profession as one means of instilling a little of their personal philosophy on the impressionable generation, but anarchy, national decline and the collapse of the economy isn't very popular with the rest of us.

Rather than preparing pupils to come to terms with lifelong unemployment and burgeoning 'leisure' time, let's spend a little effort seeing that our schools try and escape the ivory tower before it collapses completely. Electronics companies might be good enough to sponsor local schools in this series - we will gladly give a free congratulation to endeavours in this area.

R&EW is already on record as promising to support and sponsor electronics projects that are carried in such a way that the information attained can be disseminated to others. All suggestions for the furtherance of electronics education are gratefully received - and we offer a prize of £500 to the best secondary school course submitted to us (by a school teacher or pupil) to provide a suitable follow-up for this initial BBC series. Watch **R&EW** for developments.

Taking a pounding

From the biggest multinational, to the smallest firms, most electronics 'industrialists' are feeling increasingly disgusted at the way in which the government is failing to provide any real basis for sound planning and expansion. Regrettably, and undeniably, the UK electronics business revolves around imported goods - and the way in which the exchange rate has slid so dramatically against the two 'electronic' trading currencies - the US$ and the Japanese Yen - is beginning to have serious repercussions.

It wasn't so long ago that the government ministers were talking about export 'competitiveness' suffering from the high £/$ exchange rate - probably in an attempt to soften us all up for the start of the slide. But now there are voices complaining that the cost of raw materials and components are suffering as a result of an effective 20% devaluation. The bottom line being that component costs usually multiply between 4 to 5 times during the progress of a manufactured product to the point of sale.

Is there intelligent life out there?

Perhaps the most exasperating aspect of the many ways in which government and civil service conspire to make our lives awkward concerns the almost unbelievably arbitrary ways in which import duties are levied. We could dip into the Customs Tariff and pull out countless absurd and contradictory classifications, but the problem to which we will address ourselves concerns the differential rates between components and finished goods.

Clive Sinclair made the point most 'publicly' a few years ago when he complained that the rate on imported calculators was typically 10% less than on the components he was using to make calculators in England. Everyone nodded and tutted, but we still pay 17% duty on most ICs - and around 6% on completed electronic products. It seems much of the tariff has been determined by historical factors - and due to the inertia of the system, no one has been able to make any serious improvement.

In fact, the whole situation resembles those farcical and medieval bye-laws about grazing rights for your cow on the local high street verges.

The original aim of customs duty was to provide another rather neat and politically easy method of wringing money out of the 'system'. Probably to provide for new strings for the King's bowmen. Any tax that can be slapped on without the general public (voters) being too directly aware of what's happening is a good thing from a politician's standpoint.

But customs duty quickly acquired another facet - namely that of providing artificial trade barriers to allow preferential treatment of home and 'Empire' - thereby currying favour (excuse the unintentional allusion to the Empire) with the industrial and commercial Barons of the 19th century, and latterly the Trade Unions.

Rubbing salt in

The combination of the effects of the exchange rate and customs duty mean that the government's slice of the action (they call it 'Revenue' - a most dignified and restrained expression) is proportionately increased, and if that were not bad enough, there is even duty to be paid on carriage and freight charges - *at the same rate as applied to the goods.* It seems rather like the post office charging postage based on the value of the goods being carried.

When questioned on the rationale of the situation, a spokesman simply made reference to the historical associations of the procedures, and the fact that they always did things that way. No doubt the same reasoning applies to the fact that VAT is supposed to be levied on any carriage charges at the same rate as applied to the goods concerned.

Let's do something about it

This gruesome and unseemly little business does not attract the attention of the Media in the same way as threatening to paint telephone boxes yellow. Basically for the very same reasons that have encouraged politicians to use these back door taxation methods with such liberal abandon over the past couple of centuries.

It's hard to drum up much political force on a subject which seems so apparently removed from the everyday concerns of the voting public - but as participants in the electronics industry, we invite your comments, and suggest that you bring pressure to bear on your MPs for a speedy and intelligent review of the medieval practices hampering the industry.

We are fortunate that our business is at last acquiring some political attention (it's only 10 years too late) and that Mrs Thatcher has appointed Kenneth Baker as the minister for *information technology* (which we suppose means computers and communications). Whilst Mr Baker is rather better qualified than the average politician put in charge of high technology as regards his technical background (he can do more than mend fuses and change torch batteries), we feel he needs every encouragement to make himself felt, in case his job turns into an obligatory sop to the technical voting public.

USA/JAPAN NEWS

What's it like to be second rate?

Just in case the recent euphoria of the Royal Wedding has left us Brits feeling rather smug and self-satisfied, we reproduce the following directly from the pages of Hayden publishing's monthly journal 'Microwaves' (June 1981). It requires little comment from us. The United States has always taken a rather less sympathetic view towards the sort of rampant import 'mania' that has bled UK Ltd very nearly to death. We are only sorry that the UK's world image is in such a parlous condition.

UK Pushes Radar, Defence Products to US Market

Needing, in effect, any money it can get its hands on, the United Kingdom is hoping that the Reagan administration will lend a sympathetic wallet in the purchase of various types of defence hardware that the UK claims, will meet US needs. According to Geoffrey Pattie, parliamentary undersecretary for defence (RAF), Britain's Nimrod airborne early warning synthetic aperture radar will fit a US Navy P-3; other equipment includes aircraft like Hawk and AV-8B Advanced Harrier.

Demonstrated recently in Nimrod flights from Andrews AFB in Maryland, the radar has proved in over two years of testing that it can identify surface ship silhouettes up to 200 miles, a distance which Pattie thinks will improve the range and accuracy of P-3 target acquisition and identification. This identification, as distinct from merely detecting a possibly hostile target, is felt by the British to be the most important facet of the radar system.

Meanwhile, the US attitude of 'buy American' intensifies putting a damper on British enthusiasm; congressional critics of the Defence Department (US) may be expected to point out that in the face of surging Japanese imports, such as automobiles, the US does not need any more foreign products - especially those that compete with US aerospace producers.

Satellite broadcast boom

If there's one thing any good American citizen enjoys more than a good helping of TV junk, it's fifty helpings of the stuff. The recent burgeoning of satellite broadcasting has given a complete nervous breakdown to those poor souls who tried flicking between three or four local TV channels to follow the respective programmes.

And if there's something they enjoy even more than that, it's all-American free enterprise. So the boom in satellite TV broadcasting has managed to feed several national cravings in one go. The use of one of the many 'private' satellite downlink systems enables any citizen with around $1500 to enjoy 24 hour news, current films and much more. Less fortunate subscribers have to pay to be wired up to the local cable TV network.

Yet more satellites (affectionately referred to as 'birds') are being raised aloft - and the Comstar D-4 will have added another 24 channels to the possible total by the time you read this.

One of the latest offerings from the Warner-Amex Satellite Entertainment Company is a 24 hour all musical entertainment channel, largely supported by material recorded for the video disc market. Each hour will be punctuated with around 8 minutes of commercials to pay the rent.

We have yet to see how the European market will respond, but judging by past attempts at the harmonisation of anything - let alone something as complex as colour TV broadcast standards and multilingual soundtracks - the emergence of a uniform European satellite standard seem rather remote.

The World's First Digital Synthesised UHF-FM handheld?

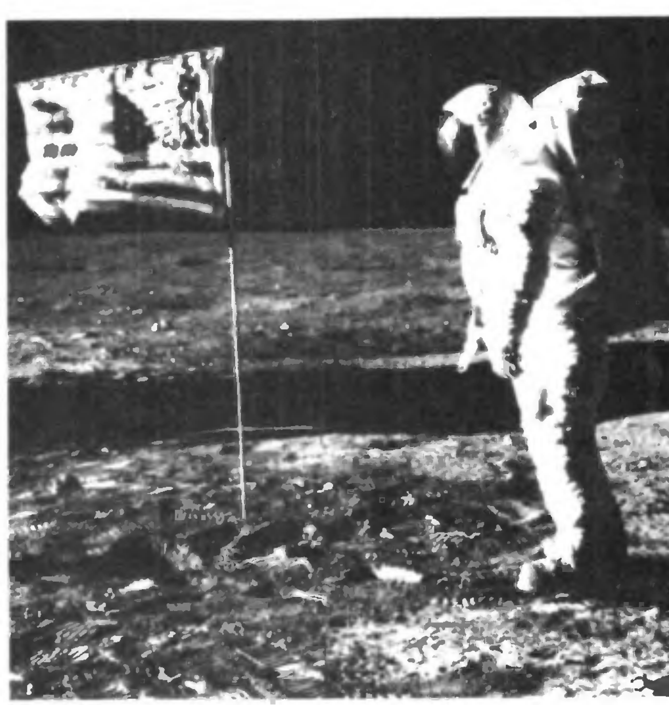
So says Repco of the commercial communication grade RP 1010. Up to 16 channels can be programmed into the memory, eliminating the need for crystals and delivery delays.

800MHz is alive and well

Despite the raspberry blown at the prospects for 934MHz CB, products are pouring out onto the US market for the not so far away 800MHz land mobile band. Use of automatic phone patching (direct dial into the telephone network from private mobile radio) and a generally more liberal and enlightened use of VHF and UHF mobile radio has caused enough congestion to drive users onto the new 800MHz band.

Interestingly enough, many observers of the US scene put much of the appreciation of the value of communication down to the wide appreciation and understanding brought about by CB radio. Although the US CB system is now fairly worthless as a serious communication medium, the benefits to the private mobile radio industry continue unabated.

Grand Space Invaders Caption Contest.
Can you do better? All entries on postcards only to the R&EW office. Judging by September 30th 1981.



"Can I stop blowing the flag now, Al ?"

USA/JAPAN NEWS

TOKO production 'flat out'

The burst of activity in VCR production has wound up production of TOKO coils to the staggering rate of 100 million coils per month spread throughout its worldwide manufacturing locations.

Despite predictions of a declining market for 'wound' components with the advent of devices such as the SAW in TV VIF applications, ceramic IF filters for FM radios and chip inductors - the video boom has reaffirmed the place of the coil in modern video processing technology.

The historical markets for coils from Japanese producers such as TOKO have been gradually ebbing away to low cost Taiwan and Korean manufacturers, whilst the higher standards demanded for VCR production have meant that this change of emphasis at TOKO has come at just the right time.

Fuji Electric looking for ways out

Fuji Electric announced expansion overseas in the form of a three year policy plan that would have most UK and European electronics company executives turn green with envy. Six overseas production and marketing centres have been planned to provide growth from the present export sales $286 million to $476 million 1983.

Expected 1981 total sales are around $1,400 million.

OKI invest $120 million

Most non-Japanese executives would probably have a hard time trying to grasp the enormity of Japanese economic power. OKI Electric have set aside $120 million for investment this year. $71 million has been earmarked for semiconductor production facilities, no doubt some of this for the projected 256k dynamic RAM.

After all the fuss in the UK over the 64k DRAM, and the investment in our very own NEB inspired INMOS, it is interesting to note that Japanese 64k DRAMs have left the rest of the world on the starting blocks. OKI is producing over 250,000 150nSec 64k DRAMs each month for sale at about £5 each in volume.

Japanese battery manufacture in Wales

Yuasa Battery of Japan are to start manufacturing sealed lead-acid batteries in Wales, at the rate of 80,000 per month next spring. No doubt this toe-hold in the EEC will provide a useful base from which to attack local manufacturing bases in a product area which must historically have been protected by the shipping weight of the end product.

Hitachi get 64k EPROMs moving

The announcement by ceramic capacitor and filter maker, Murata Inc., of the their 1981 £48 million investment in 'production facilities' did not rate more than 10 lines in the Japanese trade press.

Matsushita to produce 11 million lithium batteries a month

Continuing our disregard for the credibility of the beleagured UK electronics company, we bring you the news that Matsushita's battery division has cranked production from 5 million to 11 million units per month on the watch/calculator lithium battery line.

At the same time, Sanyo announced increased production of 4 million batteries a month. If each battery was laid end to end, the resulting potential might provide a big enough shock to remind the Department of Trade and Industry that the sad industrial performance of the UK is not likely to be much improved by the pathetic investment capabilities of our own technology based industries.

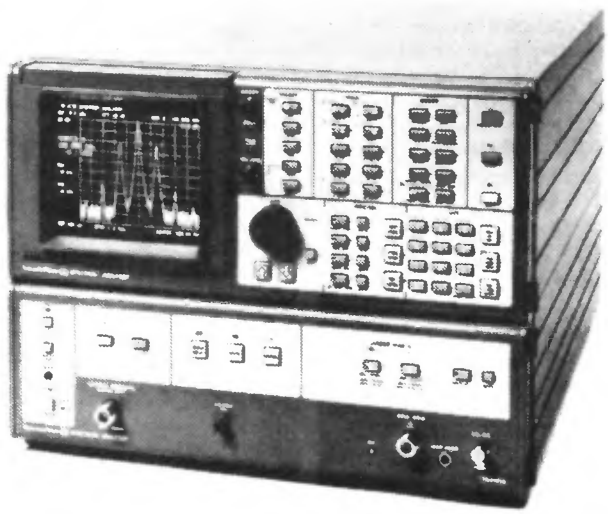
Murata investing $48 million

If a UK company invested £24 million in production facilities, the media wouldn't stop talking about it for weeks. The Prime Minister would doubtless be asked questions, and the Queen would probably be obliged to put in an appearance somewhere along the line. Friday night's News at Ten would probably be extended by 30 minutes.

The announcement by ceramic capacitor and filter, Murata Inc., of their 1981 $48 million investment in 'production facilities' did not rate more than 10 lines in the Japanese trade press.

Hitachi produce a 256k ROM

Hitachi have now produced a 256k (a quarter Megabit) mask programmed ROM (HN61256) primarily for use in electronic translating devices. The configuration is either 32k x 8, or 64k x 4. Power consumption from a single 5v rail is a meagre 1.5mA, with 50uA standby. The relatively slow 7.5uSec cycle time can easily be accommodated in this type of application.



A combined spectrum/network analyser

Takeda Riken appear to have produced the tool that most RF development engineers have been asking about for the past few years. The combined spectrum analyser and network analyser covering the range 50Hz to 1.8GHz has a 90dB input dynamic range, and will doubtless spur American competition into some form of reaction.

Takeda's TR4172 measures transmission to 0.1dB/-division, group delay to 0.1nSec/division and provides on-screen indication with digital processing and image storage. A GP-IB interface completes the whole show.

Can we have one or two to review, please?

50 design ideas for use with.....

The Cover Gift

To celebrate our first issue of **Radio and Electronics World,** we have attached four free transistors to our first front cover - these have been selected from the following mix of popular Ferranti E-line devices:-
ZTX108, MPS2222A, ZN3903, ZN3905.

We regret we cannot be responsible for any shortages or errors in the ways this gift is supplied - we hope that the temptation of our free offer has not led to too many felonies on the newsagents' bookshelves.

Back in July, when we discussed the possibility and the nature of out first cover-mounted gift, we wanted to choose something a little different from the free piece of 'perf-board', or resistance colour code chart. We wanted a gift that would help us to encourage *you,* the active electronics *user*, to dust off the soldering iron and actively pursue the subject of electronic design.

We would have liked to give away a complete kit - but the packaging problems proved insurmountable (when we do solve them, **R&EW** may well be the first magazine to cover mount all the parts for a constructional article), in the meantime we present you with four free transistors, fifty circuit ideas in which to use them -and a worthwhile challenge, in the shape of a competition to find some more 'innovative' uses for them.

The R&EW Design Competition

Starting with issue Number 3 Volume Number 1, we will be publishing the three best designs received from readers based around this month's free transistors. The competition will run for six months, and each month we shall be awarding a 'first' and two 'runner-up' prizes. In addition, the entrant who in our opinion submits the best overall design will receive a further prize.

The designs submitted can be relevant to any field of electronics, providing they comply with statute law (no FM wireless microphones please). Furthermore, we hope the competition will convince some of you that you have the ability to generate articles, and earn a few pounds into the bargain!

Competition Rules

1) All entrants must submit a proper circuit design clearly drawn with all component values marked. Each circuit should be accompanied with a short written explanation of the circuits used and method of operation.
2) Entrants must be prepared to loan **R&EW** a prototype of their circuit if required.
3) Each entrant can submit as many designs as they want, but each must start on a fresh sheet of paper.
4) Circuits must be original (as far as possible), unpublished and comply with statute law.
5) Circuits may contain between 1 and 10 of the give-away devices as 'active components' any other semiconductors should be limited to diodes, thyristors, triacs etc. One ZTX108 on the end of a Z-80 microprocessor is definitely not the right spirit! (A Z-80 clock circuit would be though.)
6) The publishers reserve the right to publish any entry.
7) The competition will run for six months starting with issue 3 volume 1.

Prizes

Each month a first prize and two runner up prizes will be awarded:

First Prize: A £25 voucher to spend on electronics, in the **World of Radio and Electronics** catalogue.

Runner Up: A £10 voucher to spend on electronics, in the **World of Radio and Electronics** catalogue.

The overall competition winner will receive a further £50 voucher plus a life subscription to **R&EW.**

If you require further transistors then these can be obtained for 10p each from **R&EW** (Extra Transistors), 117A High Street, Brentwood, Essex.

Transistor Data

The four free types are:
ZTX108, General purpose NPN; MPS2222A, Fast general purpose NPN switch, oscillator etc; ZN3903 PNP & ZN3904 NPN, complementary pair fast switching.

DATA

Parameter	Symbol	ZTX108	MPS2222A	ZN3903	ZN3905	Units
Collector-base voltage	Vcbo	45	75	60	—40	volts
Collector-emitter	Vceo	30	40	40	-40	volts
Emitter-base voltage	Vebo	5	6	6	—5	volts
Continuous collector current	Ic	100	800	200	200	mA
Base current	Ib	20	-	-	-	mA
Power Dissipation temp + 25°C	Ptot	300	500	500	500	mW
Operating and Storage temperature		—55 +175	—55 +175	—55 +175	—55 +175	degrees C
Collector base cut-off current	Icbo	0.015	0.01	0.05	0.05	nA
Emitter base cut-off current	Iebo	0.015	0.01	0.05	0.05	nA
Emitter base voltage	Vbe	0.7	0.6-1	0.65-0.095	0.65-0.95	V
Collector emitter saturation voltage	Vce (sat)	150	300-1000	200-300	250-400	mV
Static forward transfer ratio	hFE	40-300	35-300	20-150	30-150	
Transistor frequency	fT	115-300	-	250	200	MHz
Output capacitance	Cobo	4.5	8	4	4.5	pF
Noise figure	N	10	4	6	5	dB
Input capacitance	Ceb	-	25	4.5	4.5	
Input impedance	hie	4.8	4	5.5	7	k ohm
Voltage feedback ratio	hre	4.1	6	4	5	x10-4
Small signal current transfer ratio	hfe	125-500	50-375	100-400	100-400	
Output Admittance	hoe	30	100	20	25	uSec or umho
Delay time	td	-	10	35	35	nSec
Rise time	tr	-	25	35	35	nSec
Fall time	tf	-	60	50	60	nSec
Storage time	ts	-	225	200	200	nSec

All competition entries should be clearly addressed to **R&EW** (Transistor Design Competition), 117A High Street, Brentwood, Essex.

To start you off, the following pages contain data on the four devices, plus 50 circuit ideas, so that even if you are not going to enter the **R&EW** competition at least there is no excuse for not using those free transistors.

Next Month

See page 62 for more details of next month's R&EW

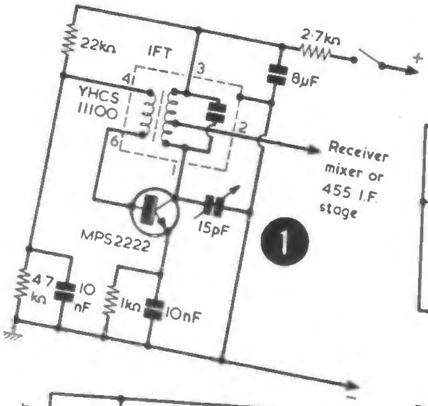
Next month's star feature

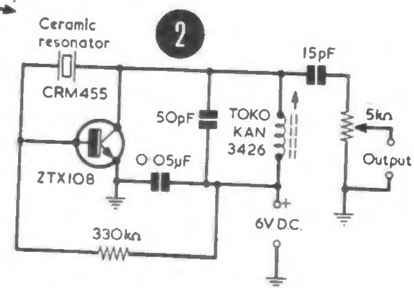
The DFCM500 - a 500MHz frequency counter, with built in capacitance measuring circuit. Mains/nicad operation with an internal charger circuit.
The unit uses an 8 digit LED display with leading zero blanking, and is supported by the usual R&EW documentation.

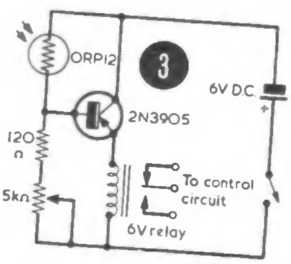
The November issue will be on sale October 1st, so place a regular order with your newsagent ***now!!***

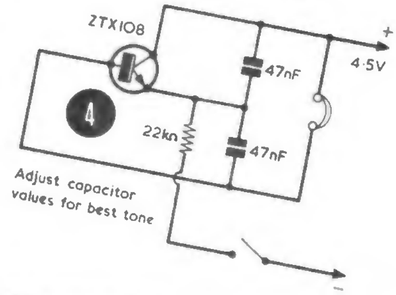
1 Carrier injection/beat frequency oscillator.
2 455kHz signal generator.
3 Light operated switch.
4 Ultra simple morse oscillator.
5 Sensitive touch switch.
6 Ramp generator with Parabola correction (linear ramp).
7 Amplified field strength meter.
8 LED pulser.
9 100kHz frequency standard/dial marker.
10 Ultra low power indicator.
11 Supersensitive field strength meter (3 to 30MHz)
12 3-transistor audio amplifier.
13 Constant current nicad charger.
14 Wide-range variable-speed multivibrator
15 Low cost VHF signal generator.
16 Very slow pulser circuit
17 1 transistor intercom.
18 Airing cupboard/incubator. temperature controller.
19 Harmonics generator.
20 Low voltage 'non-destructive' continuity checker.
21 Short wave receiver
22 Bass booster for ceramic pick-up.
23 Multivibrators 126Hz and 3.25kHz.
24 High input impedance pre-amplifier.

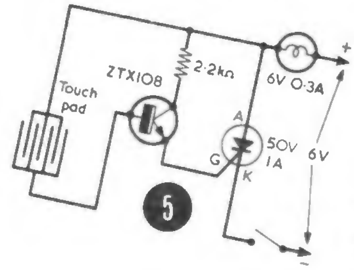
25 Low-impedance microphone pre-amplifier.
26 Straightforward transistor tester.
27 Nocturnal car finder.
28 150mW audio amplifier
29 Flood/damp detector.
30 Hi-lo. Battery voltage monitor.
31 Audio tracer.
32 Simple transistor amplifier.
33 Fuzzy sound pre-amplifier.
34 Basic pre-amplifier.
35 2-input audio mixer.
36 Crystal frequency proximity marker.
37 10Hz-1MHz analogue display pulse counter.
38 Scope timebase calibrator.
39 Magnetic microphone for carbon microphone replacer.
40 Loudspeaker into microphone converter.
41 Tachometer.
42 Siren.
43 Car voltage monitor.
44 Boosted crystal set.
45 Soil moisture detector.
46 Shirt-pocket 3-transistor radio.
47 Medium wave booster.
48 27MHz transmitter/bleeper
49 Broadcasting metal locator.
50 Simple circuit tester.

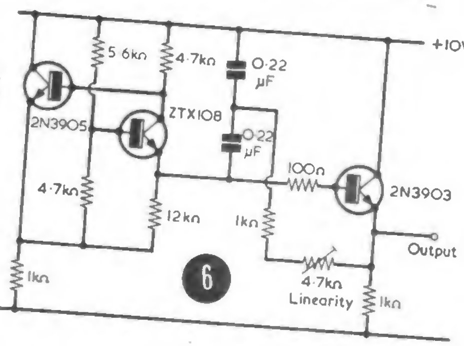


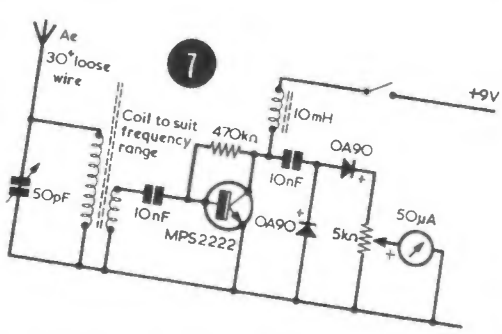


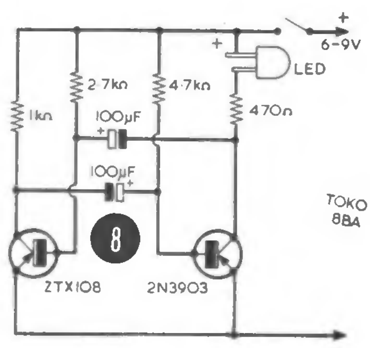


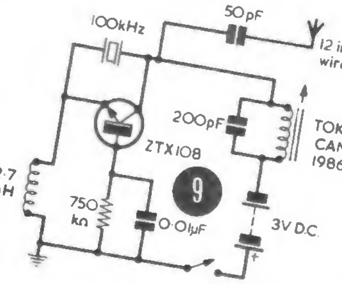


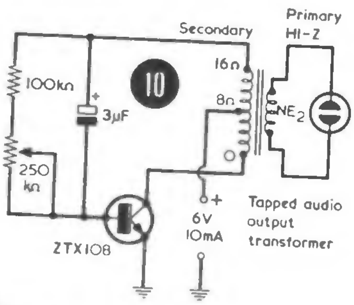


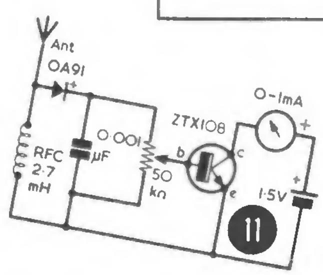


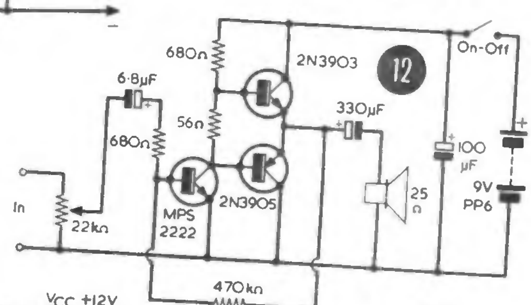


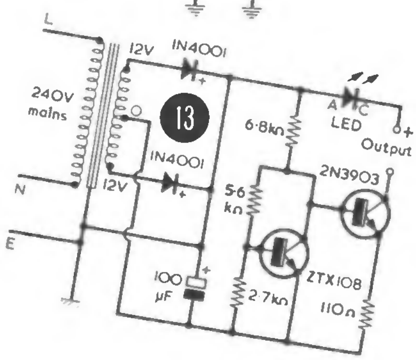


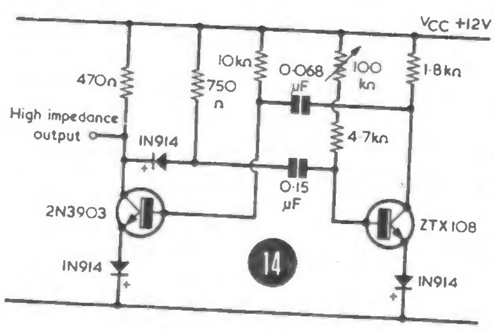


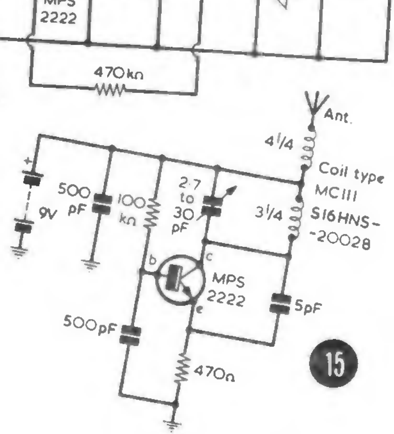












AMATEUR
RADIO
EXHIBITION
81

WHAT?

The NEW Leicester Amateur Radio Exhibition. That's what.

WHERE?

The Granby Halls, "as usual," but with improved facilities including new catering arrangements, easier car parking and quicker admission. That's where.

WHEN?

Friday, Saturday, Sunday, 23, 24, 25 October 1981, 10am-6pm Fri/Sat, 10am-5pm Sun. That's when.

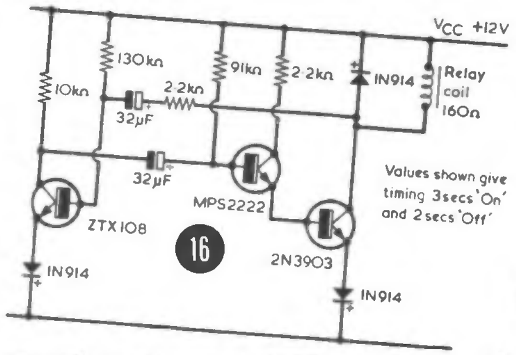
WHO?

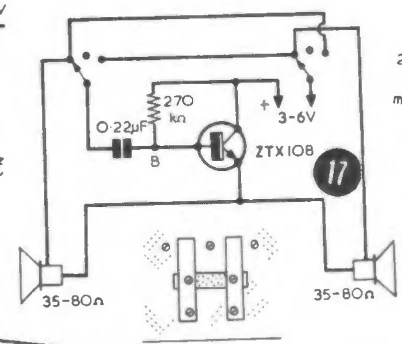
At this independent show you will find some of the best-known retailers in the country. You will also find many specialist traders not previously invited to participate at Leicester. This way you'll have a real chance of finding the rig you want – at a keen price too – and also some of those awkward bits and pieces you're always looking for and can never track down. That's who you'll see there.

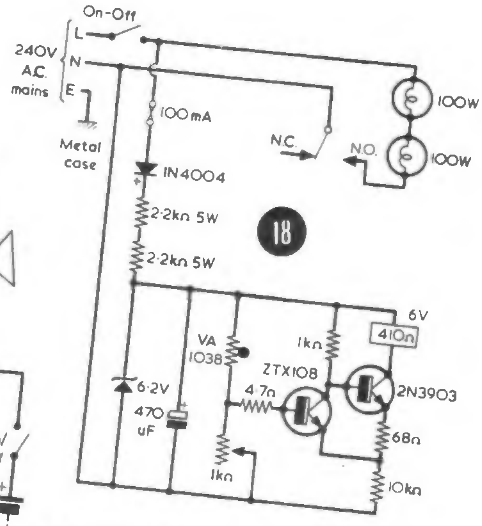
WILL THEY SEE YOU?
With talk-in on 2m and 70cm you can't lose your way!

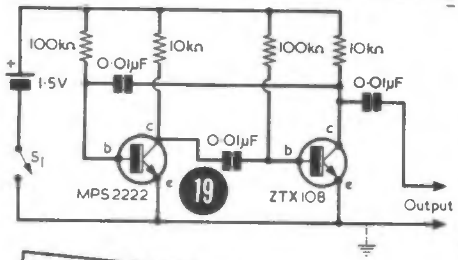
SPECIAL ATTRACTION
BRING AND BUY TO BE RUN BY THE LEICESTER AMATEUR RADIO CLUB.

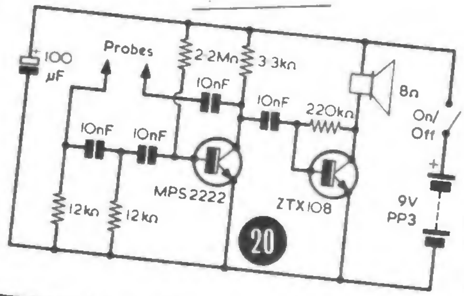
22 for further details

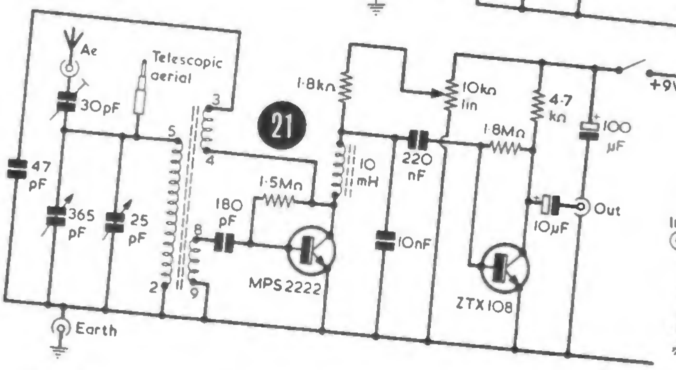

VCC +12V
130kΩ
91kΩ
2·2kΩ
IN914
Relay coil 160Ω
10kΩ
32µF
2·2kΩ
32µF
MPS2222
ZTX108
2N3903
IN914
IN914
Values shown give timing 3secs 'On' and 2secs 'Off'
16

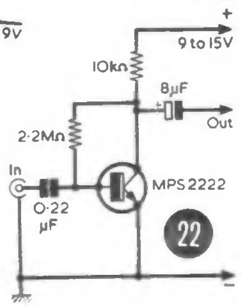

270 kΩ
0·22µF
B
+ 3-6V
ZTX108
17
35-80Ω
35-80Ω

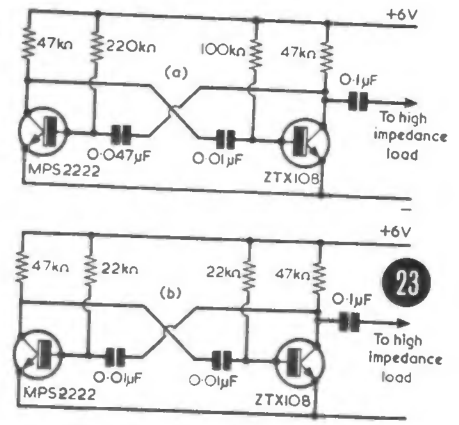

On-Off
240V A.C. mains
L
N
E
Metal case
100mA
N.C.
N.O.
100W
100W
IN4004
2·2kΩ 5W
2·2kΩ 5W
18
6·2V
470 uF
VA 1038
1kΩ
4·7Ω
ZTX108
1kΩ
2N3903
6V 410Ω
68Ω
10kΩ

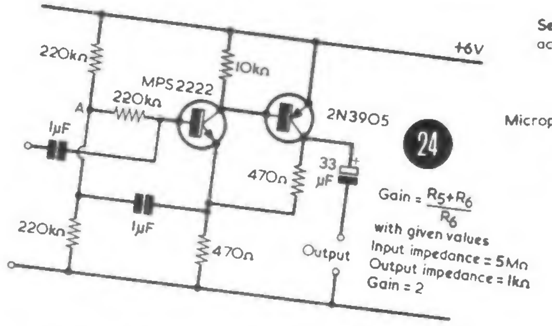

100kΩ
0·01µF
10kΩ
100kΩ
10kΩ
0·01µF
1·5V
S1
b
c
e
MPS2222
0·01µF
19
b
c
e
ZTX108
Output

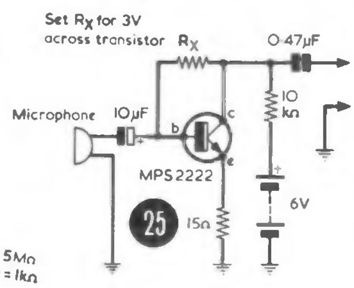

100 µF
Probes
2·2MΩ
3·3kΩ
10nF
10nF
220kΩ
8Ω
On/Off
10nF
10nF
MPS2222
ZTX108
12kΩ
12kΩ
9V PP3
20

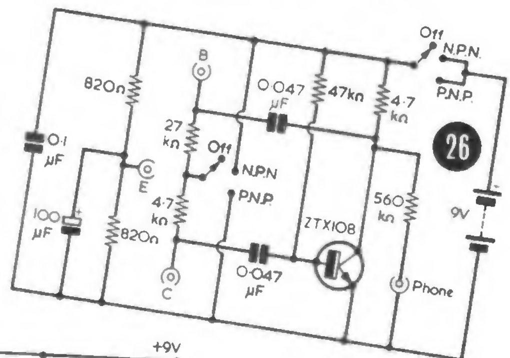

Ae
Telescopic aerial
30pF
47 pF
365 pF
25 pF
5
3
4
8
2
11
9
21
1·8kΩ
10kΩ lin
4·7 kΩ
+9V
100 µF
1·5MΩ
10 mH
220 nF
1·8MΩ
180 pF
10nF
10µF
Out
MPS2222
ZTX108
Earth

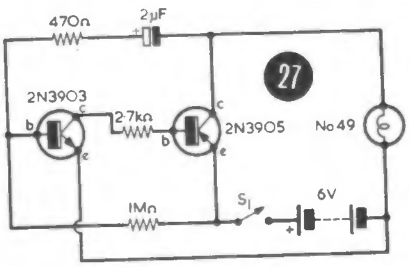

+
9 to 15V
10kΩ
8µF
Out
2·2MΩ
In
0·22 µF
MPS2222
22

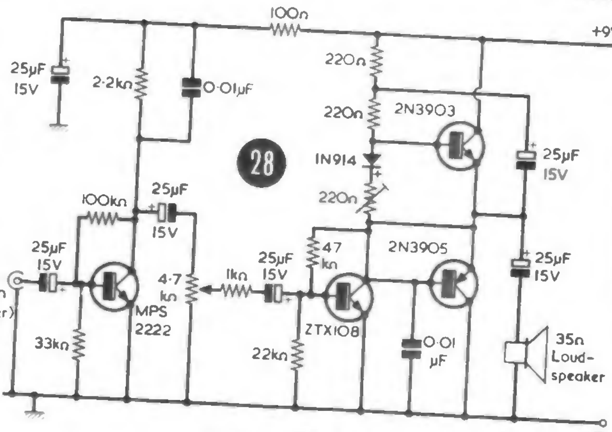

+6V
47kΩ
220kΩ
(a)
100kΩ
47kΩ
0·1µF
To high impedance load
MPS2222
0·047µF
0·01µF
ZTX108
+6V
47kΩ
22kΩ
(b)
22kΩ
47kΩ
23
0·1µF
To high impedance load
MPS2222
0·01µF
0·01µF
ZTX108

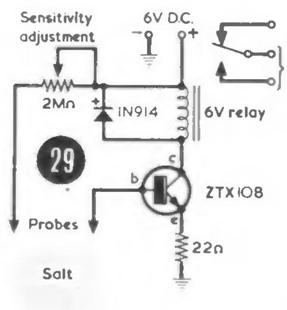

220kΩ
+6V
MPS2222
10kΩ
A
220kΩ
2N3905
1µF
24
470Ω
33 µF
220kΩ
1µF
470Ω
Output
Gain = (R5+R6)/R6
with given values
Input impedance = 5MΩ
Output impedance = 1kΩ
Gain = 2

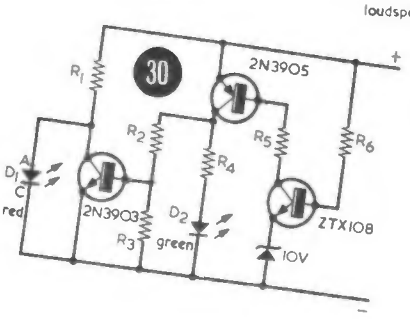

Set RX for 3V across transistor
RX
0·47µF
Microphone
10µF
b
c
e
MPS2222
10 kΩ
6V
25
15Ω

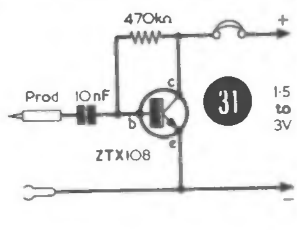

Off
N.P.N.
P.N.P.
B
820Ω
0·047 µF
47kΩ
4·7 kΩ
26
0·1 µF
27 kΩ
Off
N.P.N.
E
P.N.P.
4·7 kΩ
100 µF
820Ω
ZTX108
560 kΩ
9V
C
0·047 µF
Phone

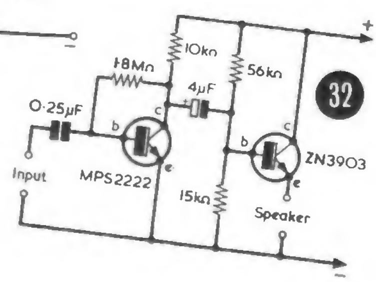

470Ω
2µF
27
2N3903
c
b
e
2·7kΩ
b
c
e
2N3905
No 49
1MΩ
S1
6V

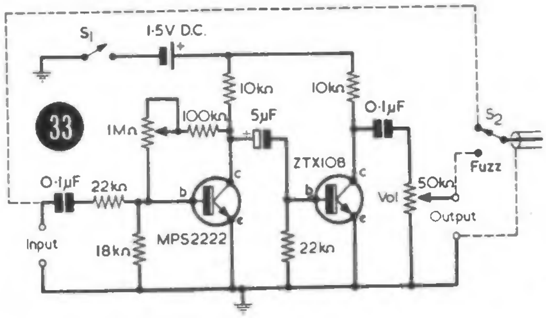

100Ω
+9V
25µF 15V
2·2kΩ
0·01µF
220Ω
220Ω
2N3903
IN914
28
25µF 15V
220Ω
100kΩ
25µF 15V
47 kΩ
2N3905
25µF 15V
Input (can be 35Ω loudspeaker)
25µF 15V
4·7 kΩ
1kΩ
25µF 15V
MPS 2222
ZTX108
33kΩ
22kΩ
0·01 µF
35Ω Loud-speaker

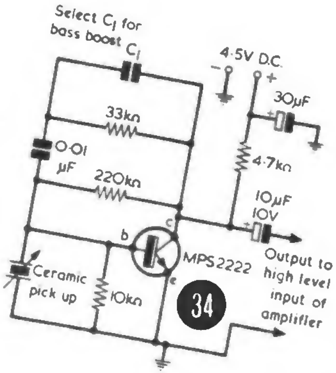

Sensitivity adjustment
6V D.C.
To alarm bell
2MΩ
IN914
6V relay
29
c
b
e
ZTX108
Probes
Salt
22Ω

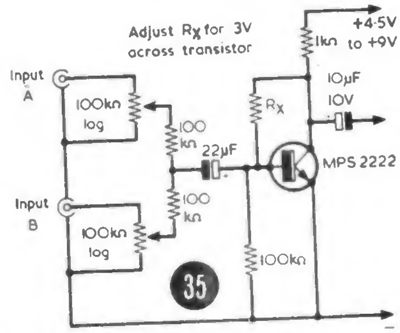

R1
30
2N3905
R2
R4
R5
R6
D1
C
red
2N3903
R3
D2
green
ZTX108
10V

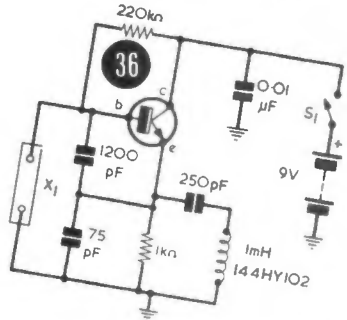

470kΩ
Prod
10nF
b
c
e
31
1·5 to 3V
ZTX108


10kΩ
1·8MΩ
4µF
56kΩ
32
0·25µF
b
c
e
b
c
e
Input
MPS2222
15kΩ
ZN3903
Speaker

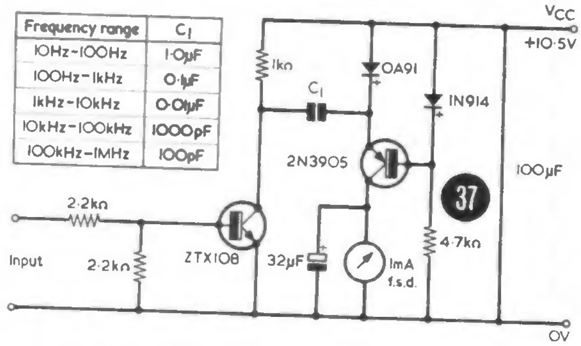


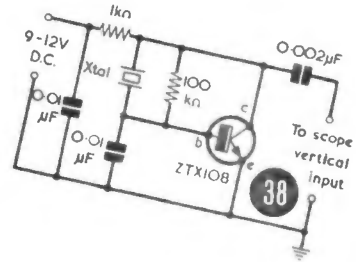


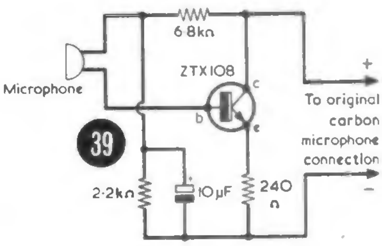


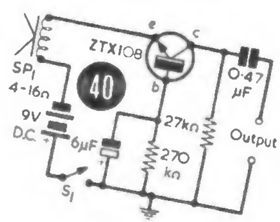


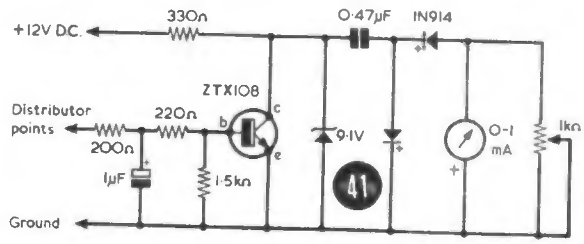
Frequency range	C_1
10Hz-100Hz	1·0μF
100Hz-1kHz	0·1μF
1kHz-10kHz	0·01μF
10kHz-100kHz	1000pF
100kHz-1MHz	100pF

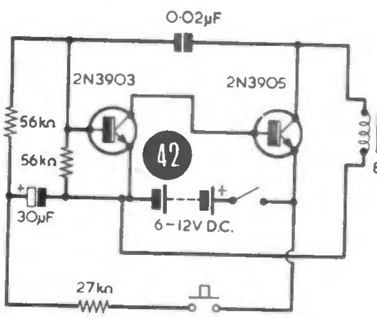


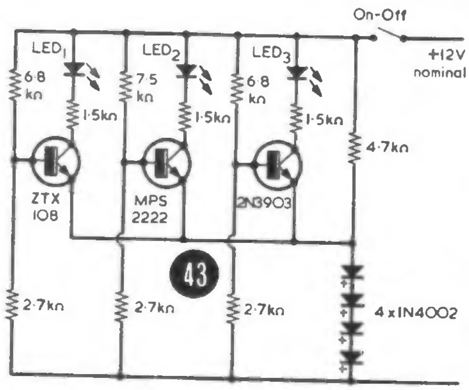


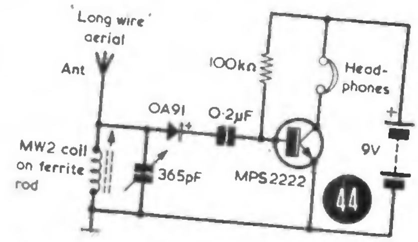


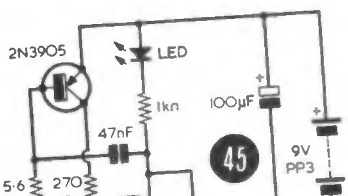


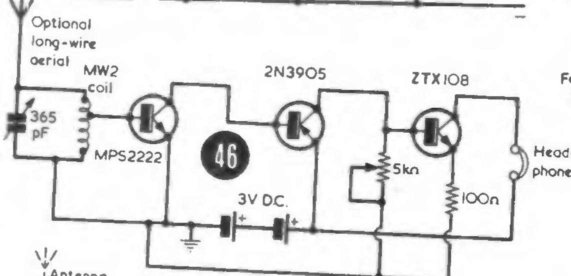


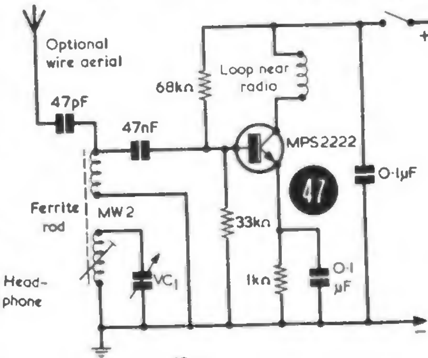


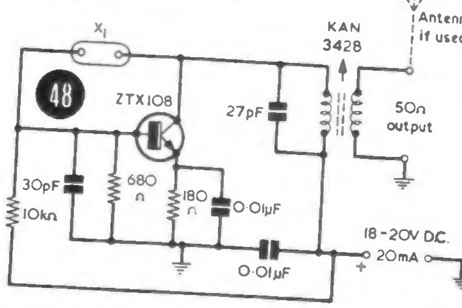


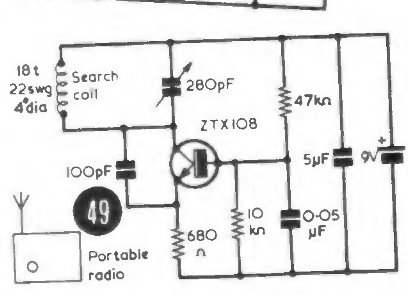


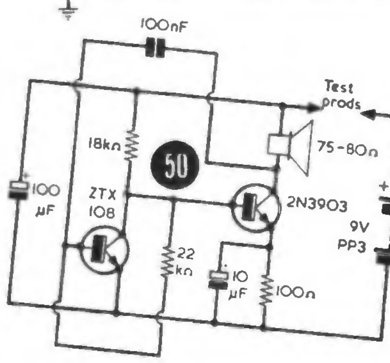






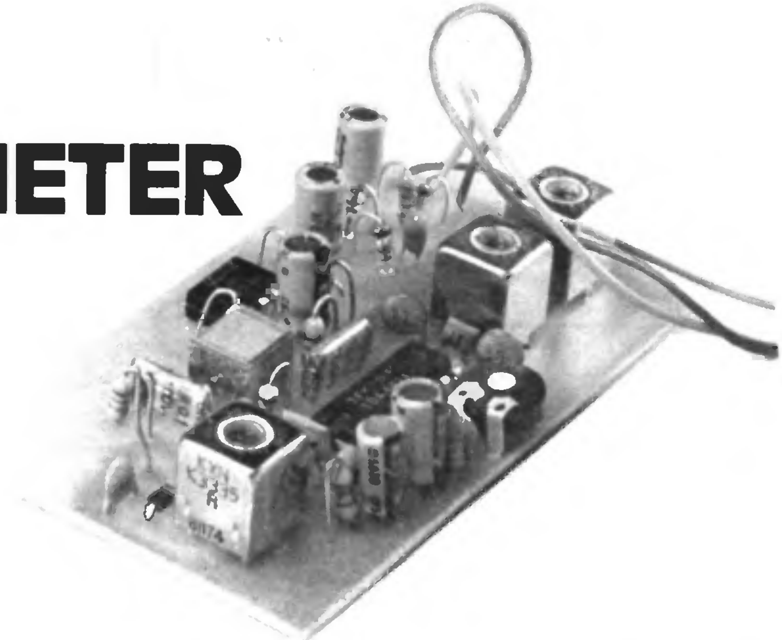






27MHz FM DEVIATION METER

ROGER RAY



Breakers..... with the impending legalisation of CB be sure you have the optimum transmitting signal with this unique piece of test equipment.

With the introduction of Citizens Band Radio using narrow band frequency modulation (NBFM) into the UK, comes the requirement for test equipment to cover this band. An abundance of test equipment is available for AM CB, such as SWR bridges, power meters and AM modulation meters.

This article describes an FM deviation meter for the frequency range 27.6MHz to 28.0MHz, which covers all channels of the UK CB allocation. This unit can either be used alone, or incorporated in a complete 'Test Centre' -and may even be retrofitted into such equipment that was originally intended for AM CB.

When a low level signal is picked up nearby a transmitter, the meter will read the frequency deviation (in kHz) when the transmitter is modulated. A transmitter that 'under' deviates will have poor range, while one that 'over' deviates will cause distortion to the received signal, since the IF filters of the receiver are not designed for more than a 2.5kHz peak deviation level. Using this instrument, it is possible to check that a CB transmitter is modulating correctly, and the deviation properly set. In other words, when used in conjunction with an SWR or power meter, that the operator is 'getting out'.

The classic problem with deviation measurement usually centres on the need for some form of frequency agile tuning system to heterodyne the signal down to an IF frequency where limiting and demodulation can take place. The process is well-known and understood *(Figure 1)* - but since such deviation meters currently cost a great deal more than the price of a CB, it isn't very likely that the average CB operator would want to add it to their collection of accessories.

In fact, it isn't likely to be found in many CB repair and installation facilities either. What is needed is a low cost, repeatable, easy to set up device which tells the user exactly what's going on. Tuneable deviation meters are simple enough (any NBFM receiver with a meter reading the audio level is basically a deviation level indicator), but then every time the channel is changed, the meter needs to be retuned to follow.

This deviation meter differs from the norm in that it is wideband so that no tuning is required (other than the initial setting up of the instrument). Therefore we have a simple unit that is very easy to use.

Circuit Description

The heart of the system is the TDA4421 IC *(Figure 2)*, which is a combined AM/FM demodulator with a high gain HF IF strip. In fact it is a very versatile IC originally intended for TV applications in the vision IF, just after the video IF filter stage.

In this circuit *(Figure 3)* it is used as a wideband 27MHz IF and FM demodulator. IFT T1 is centred on the middle of the band (27.8MHz), and couples signals into the IC from the outside world. At the far end of the IC, transformer T3 centres the AGC output (the AM demodulator) at the same frequency. The threshold of AGC action is controlled by VR1.

AGC is delayed by capacitor C6, and is used to drive a PIN diode D1 across the input winding of transformer T1. This

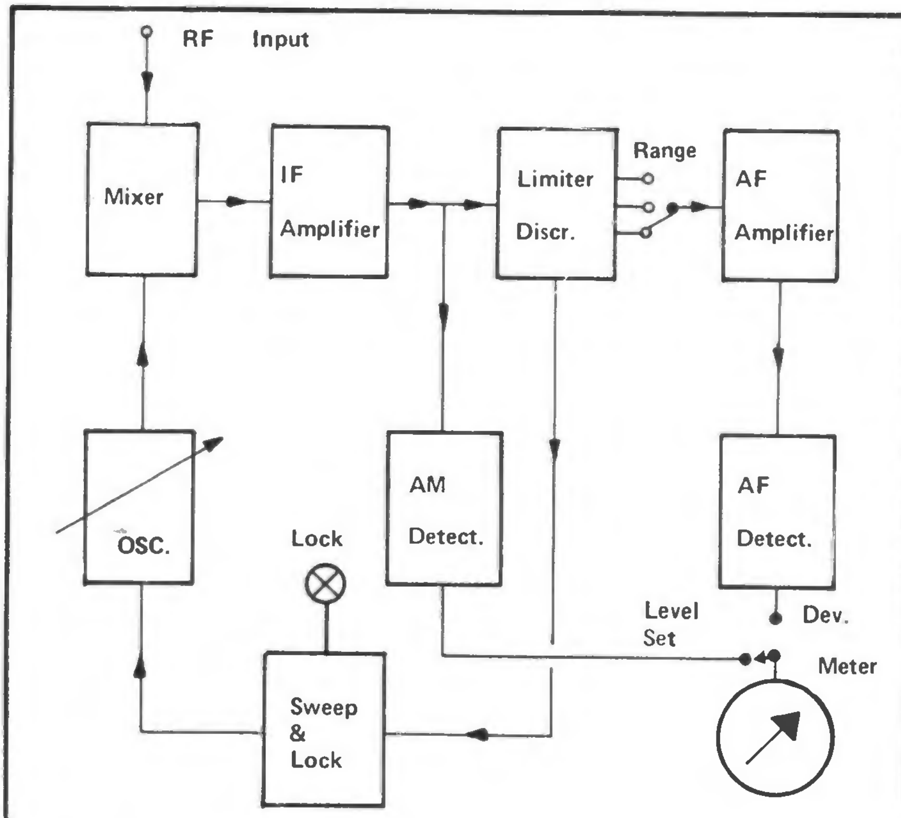


Figure 1: Simplified Block Diagram of Automatic Deviation Meter.

Figure 2:
Internal Block Diagram

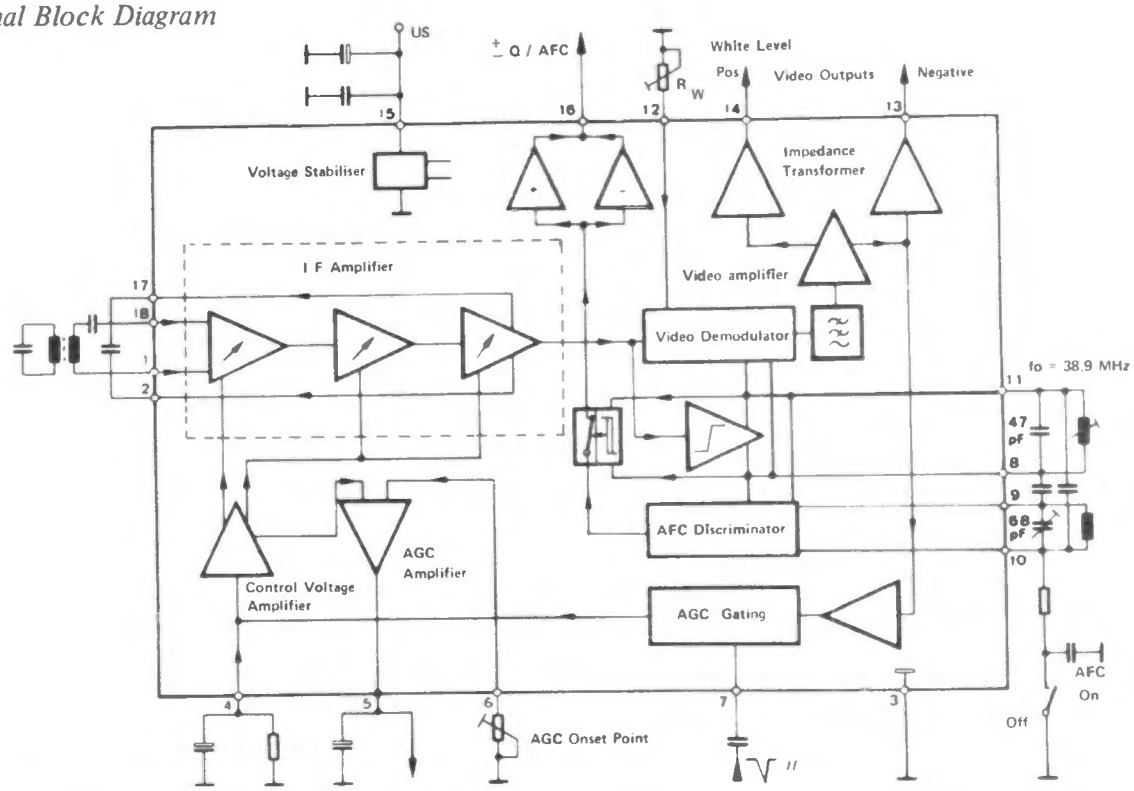
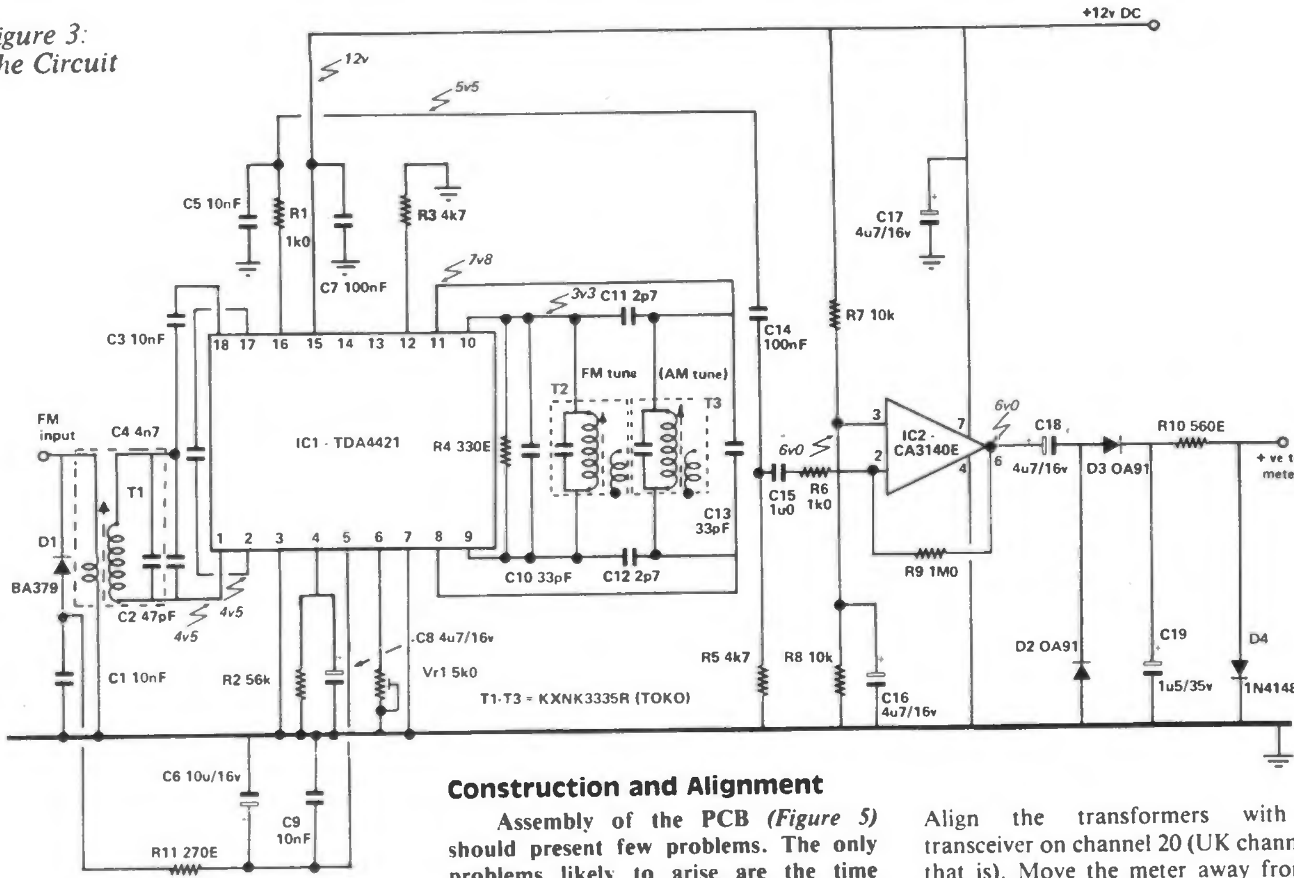


Figure 3: The Circuit



increases the dynamic range that the circuit will work over by some 30-40dB. Transformer T2 centres the FM demodulation 'S' curve on 27.8MHz *(Figure 4)*.

The audio output for the average 1.5kHz deviation permitted by the UK specification (remember, 2.5kHz is the peak level) is very low, as the demodulator is wideband. The slope of the detector curve is only a few mv per kHz, so 60dB of audio amplification is provided by IC2. The resulting output drives a voltage doubler comprised of germanium diodes D2 and D3.

The DC output is proportional to the audio level - and hence deviation may be read directly. The audio frequency response is tailored by the values of C5, C14, R5 and C15 to give a flat response from 300Hz to 3kHz. The value of R10 is chosen to give full scale deflection on a 100 micro-amp meter for a 2.5kHz deviation. D4 limits the maximum voltage across the meter to 0.7v to restrain bent needles and prevent damaged movements, since when no input signal is present, the meter will read maximum due to the characteristic noise from the FM demodulator.

The current consumption of the unit is about 60mA, so operation from dry batteries should be restricted by a 'push to read' switch. Keen operators may wish to devise a timer circuit that sense RF and switches the meter on for 5 seconds at the beginning of a transmission, just to confirm that the mike is still plugged in tight!

Construction and Alignment

Assembly of the PCB *(Figure 5)* should present few problems. The only problems likely to arise are the time honoured ones of marginal soldering, and inserting the ICs in back to front (it happens to the best of us).

Connect a 12v DC supply to the board and check that the current is around 60mA. The IC dissipation is about 600mW, so will be warm to touch after a few minutes.

To set up the deviation meter, either a calibrated FM signal generator or a known 'good' CB transceiver is required. If a signal generator is available, set the frequency to 27.8MHz and connect it to the input of the unit. Set VR1 fully clockwise, and measure the AGC voltage on PIN 5 of IC1. Increase the output of the signal generator until the AGC voltage just starts to increase. Now tune transformer T1 and T3 for maximum reading reducing the signal generator output as necessary to keep the voltage in the range 1-4v.

Now measure the voltage on PIN 16 of IC1 and tune transformer T2 for a reading of 5.5v. Check this voltage approximately follows the 'S' curve of *Figure 4* when the generator is tuned from 27.6MHz to 28.0MHz. Switch on the FM modulation set to 2.5kHz deviation 1kHz modulation frequency. The meter should read near full scale deflection (FSD). Switch off the modulation, and the meter reading should be close to zero. The calibration should be approximately linear i.e. 1.5kHz corresponding to 0.6 FSD.

An FM CB transceiver connected to a dummy load can be used in the same way as a signal generator. Attach a short wire to the input of the deviation meter and proceed as with the signal generator. Align the transformers with the transceiver on channel 20 (UK channel 20, that is). Move the meter away from the transceiver to reduce the signal level when adjusting for AGC voltage. Whistle into the microphone and note the position on the meter, this should correspond to 1.5kHz deviation. Shouting really loudly will limit the modulator at approximately 2.5kHz deviation.

When alignment is complete the cores of the transformers (T1-3) should be locked in position. This is easily accomplished by putting a small chip of wax on top of the transformer and melting it with a soldering iron.

Using the Meter

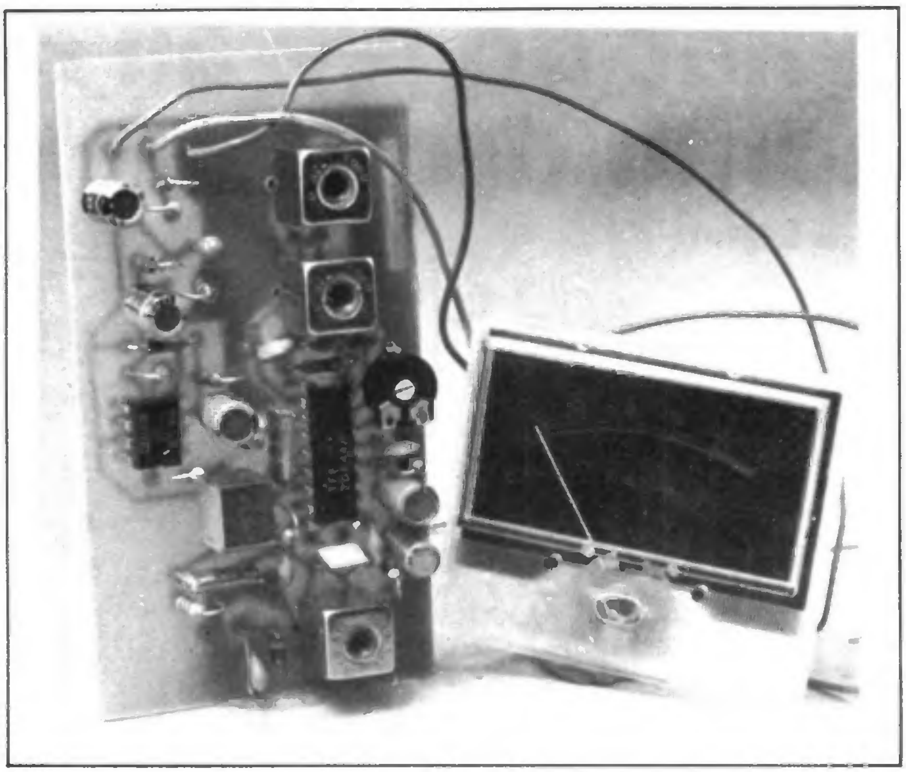
When a CB transceiver is connected to an aerial, sufficient signal will be picked up on a few inches of wire connected to the input of the deviation meter and simply placed near the transmitter feeder - in fact it will work many metres away.

Care should be taken not to put too high a level into the deviation meter. A short aerial a few inches long should be all that is required. Direct connection to the output of a CB transceiver will definitely destroy it.

As already mentioned the deviation meter may be fitted into a 'test centre' of the type designed for AM CB use. In this case the end of the input wire is placed close to the aerial socket. A two pole push switch may be used to change the meter positive connection, from the existing AM modulation circuitry, to the meter output from the board. The same switch may be used to connect the DC supply, thus giving a push to read function.

r Developments

simple elegance of this approach a extended into a complete auto deviation meter system - covering 20MHz to 500MHz. Details of this rather more complicated system will follow on in a subsequent issue, but the overall device will still cost less than £30 to make.



Components List

Integrated Circuits

IC 1	TDA4421
IC 2	CA3140

Capacitors

C 1	10nF ceramic
C 2	47pF ceramic
C 3	10nF ceramic
C 4	4.7nF ceramic
C 5	10nF ceramic
C 6	10uF 16v electrolytic
C 7	0.1uF
C 8	4.7uF 16v electrolytic
C 9	10nF ceramic
C10	33pF ceramic
C11	2.7pF ceramic
C12	2.7pF ceramic
C13	33pF ceramic
C14	0.1uF
C15	1.0uF polystyrene
C16	4.7uF 16v electrolytic
C17	4.7uF 16v electrolytic
C18	4.7uF 16v electrolytic
C19	1.5uF tantalum bead 35v

Resistors - all .25w 5% types

R 1	1k0
R 2	56k
R 3	4k7
R 4	330R
R 5	4k7
R 6	1k0
R 7	10k
R 8	10k
R 9	1M0
R10	560R
R11	270R
VR1	5k preset

Diodes

D 1	BA379
D 2	0A91
D 3	0A91
D 4	1N4148

Inductors

T 1	TOKO KXNK3335
T 2	TOKO KXNK3335
T 3	TOKO KXNK3335

NOTES

1. This circuit may be used as a wideband FM CB monitor receiver, by simply connecting an audio stage at the junction of C14 and C15. A few feet of wire as an antenna will provide signals from up to 5 km.
   AM may be received in the same way by capacitively coupling to pins 13 or 14 of the IF IC.

2. Full data on the TDA4421 is available from **R&EW** Readers' Services Dept. Please enclose an SAE and 20p.

Interest rating

Please enter the appropriate response on the Reader Response Page (p.95).

Excellent - will make one	231
Interested - might make one	232
Seen better (*tell us where*)	233
What's CB??	234

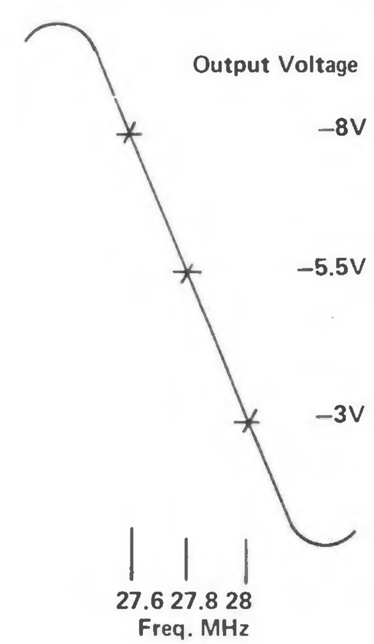
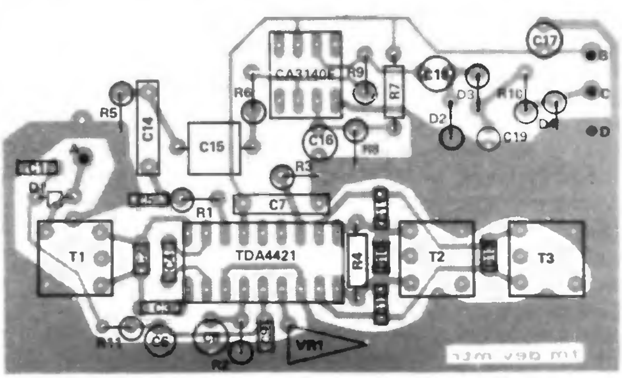
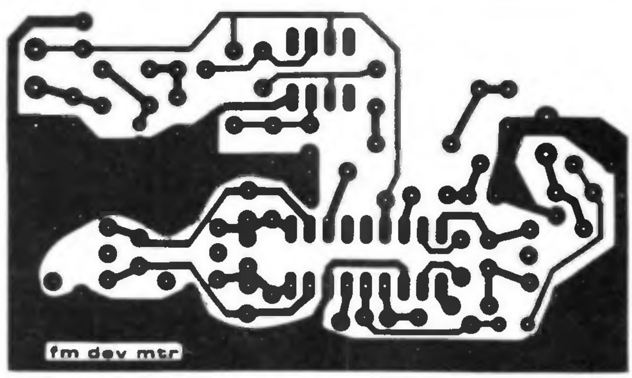


Figure 4: FM Demodulator 'S' Curve





What do we all do if the bomb drops...?

by J. Camm

It is not often a magazine publishes a series with the fervent hope that is is a complete waste of time for the readers. We don't want to frighten our readers, but we felt we ought to acknowledge the possibility of the 'worst' happening, especially since the Warsaw pact countries place a disturbingly greater emphasis on awareness of what to do in the event of nuclear conflict, than the rather reserved and reticent British.

Pacifism and capitulation are not part of the national mentality, so if the red hordes are seen clambering up the beach at Dover, the chances are that we are all in for a spot of bother.

As we are all aware, the chances of nuclear 'accidents' are likely to increase with the decline in alternative energy sources - both when the reactors 'hiccup' (remember Three Mile Island?), and when the transportation of waste springs an unfortunate leak....

Introduction

Last year the Home Secretary agreed that information about civil defence and the likely effects of a future war involving the UK should be made generally available in peacetime. Paradoxically, the GLC has since brought its civil defence programme to a halt - and in other parts of the country, similar work has been cut back due to ubiquitous public spending restrictions.

In the event of a nuclear war - and let's hope it never happens - the British population would be left largely to fend for themselves. Do not underestimate the consequences the casualties from an estimated 200 megatons of explosive being dropped on mainland Britain would be enormous.

Devastation of buildings and countryside would be on an unimaginable scale. Yet there would be survivors, probably 30-50% of the population, depending on what protective measures are taken. Large parts of the UK will be untouched by the initial attack, but fallout can be carried by weather conditions to almost anywhere (remember the world-wide effects of the eruption of the Mt. St. Helen volcano in Washington state??). The distance fallout travels and the direction it goes in, depends on something as uncertain as prevailing wind conditions. Although predominantly from the West in the UK, this is by no means reliable.

The problems facing survivors would be many and varied. These would include:-finding water and food; being able to check if it is contaminated; knowing where 'forbidden areas' are, where radiation levels are excessive, and keeping in touch with other groups of survivors.

The government intends to give warning when an attack is imminent, when fallout is coming, and when it is safe to emerge from your shelter. How is this warning going to be given? Over your 'tranny' radio of course. Well that's fine then. Hold on a minute what about EMP?

EMP

EMP stands for 'ElectroMagnetic Pulse' - which in this context is the electrical pulse given off when a nuclear device is exploded. This pulse is so severe and enormous that it makes a lightening pulse look like DC. It is incredibly fast, producing an EMP of mega-volts per metre. When a nuclear explosion occurs near the ground the range of this pulse will be limited, but explode a nuclear bomb many miles up in the atmosphere and you will destroy solid state circuitry over hundreds of square miles!

Both 'sides' know this of course, and the most likely opening nuclear move of any senario will be just that. Most military communications go to some lengths to recognize this possibility, and the Warsaw pact countries still make widespread use of valved equipment, which is far more likely to be capable of handling an EMP transient.

The object of the first shot in the conflict being to disrupt as much of the opposition's communications as possible *(would it be too extreme to use this technique on a holiday beach where Radio One vies with the oil patches for the accolade of most significant pollutant? -Ed.)*

This means that your 'tranny' would give its last 'plonk' at that moment. The enormous pulse developed on the ferrite rod would certainly blow out the RF stage, and probably the rest of the set too. Even communication equipment that is switched off is likely to be affected. In fact any solid state circuitry with more than a few inches of wire attached will be destroyed by the magnitude of the EMP. Which doesn't leave much of the technological infrastructure of society in one piece, does it?

So, back to the original question -what can be done?

Firstly, measures can be taken to protect your communication equipment from the effects of EMP. Secondly you can provide your own means of telling when fallout is coming and when it is safe

'Survivor' Setting Up And Testing Radiation Monitoring Equipment.

to come out of your shelter, by using a radiation detecting device. EMP protection can be provided by placing unused equipment inside an electro-magnetic and electrostatic enclosure, connected to earth. One of the laws of electrostatics states that, there will be no lines of force inside a charged conductor containing no internal charged bodies. Basically this means if you place your equipment in an earthed tin box, it will be protected from the initial EMP.

The box acts as a Faraday Cage which effectively provides electrical isolation for anything in it. This is fine, except that you can't use your 'tranny' if it is in a sealed metal box. Bring it out too soon, and the next EMP pulse will 'get' it. Now if your transistor radio had been designed with EMP in mind in the first case, it could be a different matter. Special surge arrestors are available, that can even 'catch' EMP pulses. Start replacing sensitive components with 'power' devices and you are beginning to go the right way.

It goes without saying that all aerials must be disconnected and input leads firmly earthed. Unfortunately this means anyone in a shelter 10 feet down in the garden would not be receiving very much anyway.

Propagation

Now assuming you have protected your MW 'tranny' and your CB rig is still operative, you can listen to government broadcasts and communicate with other survival groups - possibly. The effects of blowing vast holes in the ionosphere are largely unknown, even to the armed forces. We can speculate that HF communications will be greatly disrupted. VHF and UHF could well give more reliable communications. Although you may well find your VHF signals being reflected into Southern Europe by large clouds of ionized gas, whilst local signals disappear. Similar effects have been seen on Band II this year due to sporadic E propagation arising from 'natural' causes.

Radiation Detection

Whether you have communication facilities or not, some means of being able to sense radiation is highly desirable. Radiation detectors come in two basic forms: Dosimeters and Radiation Monitors. Each of these devices do different jobs.

Dosimeters provide a means of recording the total quantity of radiation received by the wearer. They come in the shape of large fountain pens or badges. The dosimeter contains a gold leaf electroscope. This electroscope is initially charged to a couple of hundred volts. As it receives ionizing radiation it discharges.

Oh dear, another electrostatic law! Two drawbacks of the dosimeter are:

1) By the time your dosimeter tells you that you have received a fatal dose of radiation it is a bit too late (i.e. you may be glowing in the dark) and,

2) Once used, the dosimeter requires recharging.

The other form of radiation detector is the Radiation Monitor, usually in the form of a Geiger Counter. This instrument gives you an instantaneous reading of the rate of radiation. If your monitor indicates the level of radiation is excessive you can quickly move to a safer position. Using this instrument you have a personal warning of when to take cover from fallout, when it is safe to come out, and what areas are highly contaminated.

If you have run out of food in your shelter, it would be essential to know how long could be spent outside to collect some more. Testing food for contamination is rather more tricky as the background radiation after a nuclear war is going to be very high. Never-the-less with care, the monitor is likely to be useful for this too.

In future issues of **R&EW** we will be giving constructional details of a radiation monitor, and giving some more thought to EMP-proof communications equipment. Let's hope it's all a waste of time. ☐

We feel that the ludicrous way in which electronic goods are rated for duty is doing us all a considerable disservice. Not only are the rates utterly inequitable since there are no commercially viable alternative products from the UK or EEC for many of the items being imported, but the rates lurch around from nothing to 17% in a wholly illogical and unpredictable manner. Marginal classifications are frequently altered from one form to the next.

A fair alternative is to introduce a unified rate on easily understood classifications of electronic goods, and to call the levy and import *tax*. Let's not beat about the bush with euphemisms, and then the whole business can be more clearly understood by all concerned - including the voters. For heavens sake, tax finished goods at twice the rate of components, if we have any hope of encouraging UK manufacturing enterprise.

CB synthesisers from Plessey?

Plessey Semiconductors are still plugging away with their synthesiser devices for CB, despite now being divested of their erstwhile applications manager, the colourful and helpful James Bryant, president of the UK Citizens Band Association. An application note has been issued concerning the use of the NJ8812 and SP8693 pair in a configuration with 50 external components.

These devices are claimed to offer a viable solution, although the £6 price tag for the ICs alone is rather more than the sum set aside by many Japanese set makers for the entire CB transmitter line up.

In any case, **R&EW** readers know about a rather more straightforward and cheaper solution with the CMOS MC145151 series of synthesisers. And when Motorola get these devices onto 5 inch wafers at East Kilbridge, they too will be able to wave a 'Made in Britain' flag. Perhaps it would be better for Plessey to concentrate on achieving wider acceptance of their very excellent range of communications signal processing devices, and relegate these power hungry NMOS/ECL ideas to the 'not quite made it in time' cabinet.

Motorola CMOS synthesis parts are available..... at last!

After a couple of false starts, Motorola's MC145140 series of synthesiser ICs are being delivered. In fact, Motorola seems to have got its act well together at last - a fact which will certainly put ripples on the ponds of manufacturers of competitive parts.

The first device in the series, the MC145151 *(Figure 1)*, has been in the hands of the **R&EW** lab and contributors, and initial reaction is universally enthusiastic. With a maximum operating frequency of typically over 50MHz with a 5v supply, and a quiescent current of less than 1mA, these devices seem to point the way ahead for the next generations of radio synthesiser design.

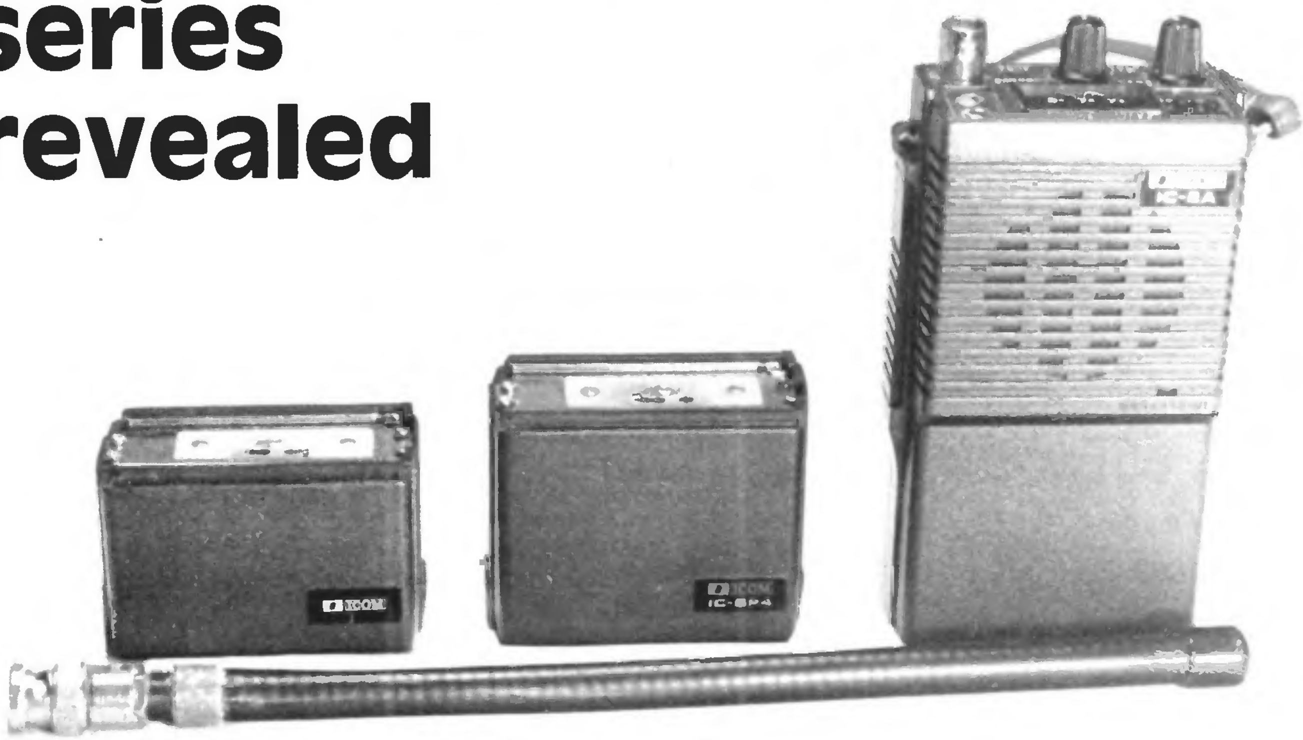
The family comprises:

Device	Control	Prescaler	Phase Detector
MC145151	Parallel binary input	single modulus	tristate/2 output
MC145152	Parallel binary	dual modulus	2 output
MC145155	Serial 3 wire bus	single modulus	tristate/2 output
MC145156	Serial 3 wire bus	dual modulus	tristate/2 output
MC145144	4 bit data	single modulus	tristate
MC145145	4 bit data	single modulus	tristate/2 output
MC145146	4 bit data	dual modulus	tristate/2 output

Applications of this universal range include everything from audio frequency synthesis to UHF communications, CATV etc. The ultra low power consumption keeps RFI to a minimum, enabling designs using these devices rather more flexibility with layout and decoupling considerations, than has previously been possible with thirsty and 'noisy' ECL designs.

Review: The IC2 series revealed

ICOM's IC2 is an excellent example of a product that has been designed as a carefully integrated system, and not just a 'one-off' offering.



Introduction

The IC2E has established a very avid following amongst amateur radio enthusiasts operating on the 2 metre (144-146 MHz) band. It is the neatest and tidiest of all current 2m handhelds - and it is probably the only one that really fits neatly into a jacket pocket.

The transceiver covers the entire 144-146MHz in 10kHz steps, using small thumbwheel programming switches, with a 5kHz offset available on a small slide switch mounting alongside the thumbwheels. The output power depends on the battery pack selected, but generally speaking, it lies between 1W and 2W on high power transmit, with the low power transmit facility providing a 10dB drop in output, although current consumption is only just about halved.

The basic battery pack supplied with the unit provides 8.4v with a capacity of 220mAh, which gives an RF output of 1.5w. The BP3 battery pack comes complete with DC jack, for use with mains or optional 12v charger that comes fitted with a car cigarette lighter plug.

Other types of power source are available providing between 6v and 12v. One of the most beguiling aspects of the transceiver is the way the battery pack seems to last all day in general use. In my experience, too many handheld transceivers seem to consume exhorbitant amounts of current on standby receive -the IC2E consumes about 20mA. This isn't particularly low in view of the saving available if the circuit could find room for a 5:1 'economizer', but the IC2 user tends to be altogether less concerned about current consumption, thanks to the simplicity of 'recharging' via the excellent slide-in battery pack options.

All the user needs to do to change the battery is slide it out from the base, and slide a freshly charged one in its place. The BP-4 pack *(illustrated in the middle of the 'family' group)* can take either 6 "AA" nicads with 500mAh capacity, or can be fed with MnAl types for 1500mAh capacity in emergencies when chargers are not to hand.

With the 500mAh capacity, the BP4 can be used to run the transceiver with a moderate transmit/receive ratio all day. Since 6 nicad cells + 7.2v, the actual transmit power is marginally less than with the BP3, consequently current consuption is also less. Battery condition is indicated by a red LED next to the antenna, which ceases to light on 'transmit' when the battery is exhausted.

The set comes complete with a rubber duck helical antenna, which although not as effective as a simple 19 inch quarter wave whip, is a good deal more convenient. The best SWR we could obtain was 2.5:1 - but notwithstanding this, the whole unit manages to give a performance that belies all objective nit-pickings such as the SWR.

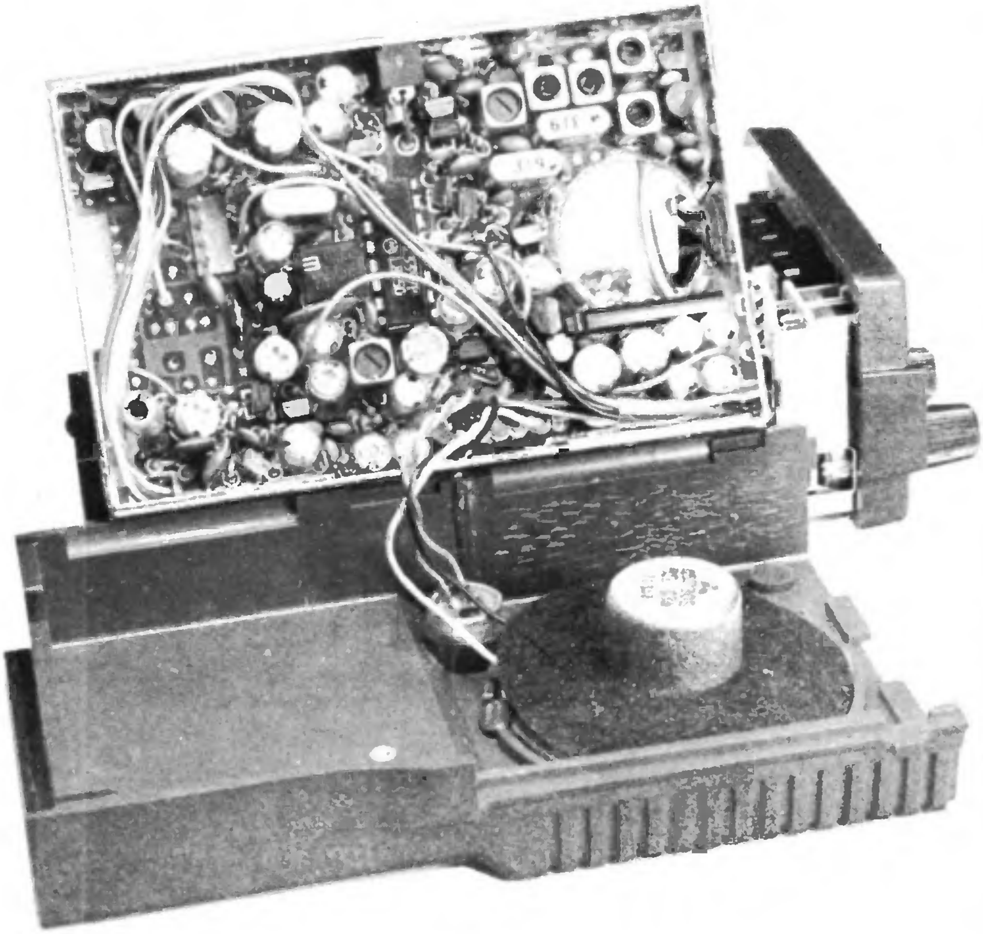
Getting inside

You don't have to be mad to try and dismantle this marvel of cunning Oriental miniaturization - but it does help. Apart from invalidating the warranty and perhaps forgetting how to get it all back together, you may make a mental totting up of the parts therein, and discover that the £150 odd you have spent on the device boils down to about £25 worth of components.

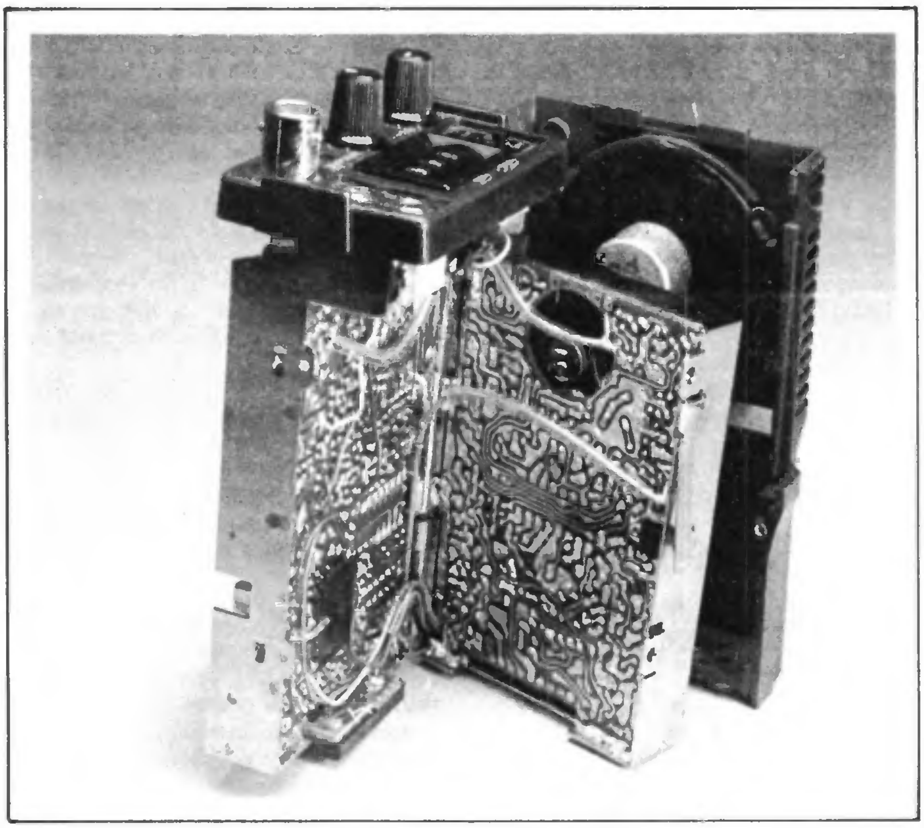
But don't be misled, imagine the tooling costs of such a neat and well conceived device (starting at about £30,000). I for one wouldn't want to have a sit and try to assemble the things, let alone try and sort it all out on "switch on" and test.

For those of you who collect such information, the RF coils are from TOKO's 5A series, and the IF coils from the 5M series. Both of which are available in this country to the enthusiast and manufacturer - and come to that so is the rest of the componentry therein, with the exception of the Toko Dengu ICs prefixed 'AN'. (See the circuit diagram.)

In fact, like most Japanese manufacturers, ICOM supply just about enough information by way of circuit diagrams and layout information for the enterprising to make a complete *verbatim* copy. Then why, I hear you ask, doesn't **R&EW** do just that.



The unbinged receiver



"Well...I undid this screw, and it sort of came apart in my hand..."

Well, apart from any question of the ethics of such blatant plagiarisation, like all equipment that finds its way onto our market, it was designed three or four years ago, and can thus be improved by the application of the *state of the art*. This comment is not intended to denigrate this transceiver, since it is one of the best and most convenient of its **genre**, old technology or not.

Letting it all hang out...

The various sections making up the main transceiver unit fit together in a typically immaculate fashion. One small pozidrive and 8 screws later, the main 'works' are revealed (with the loudspeaker still attached). Despite the enormously high density of components, the PCB is not as tightly crammed as some devices of its type. *(left)*

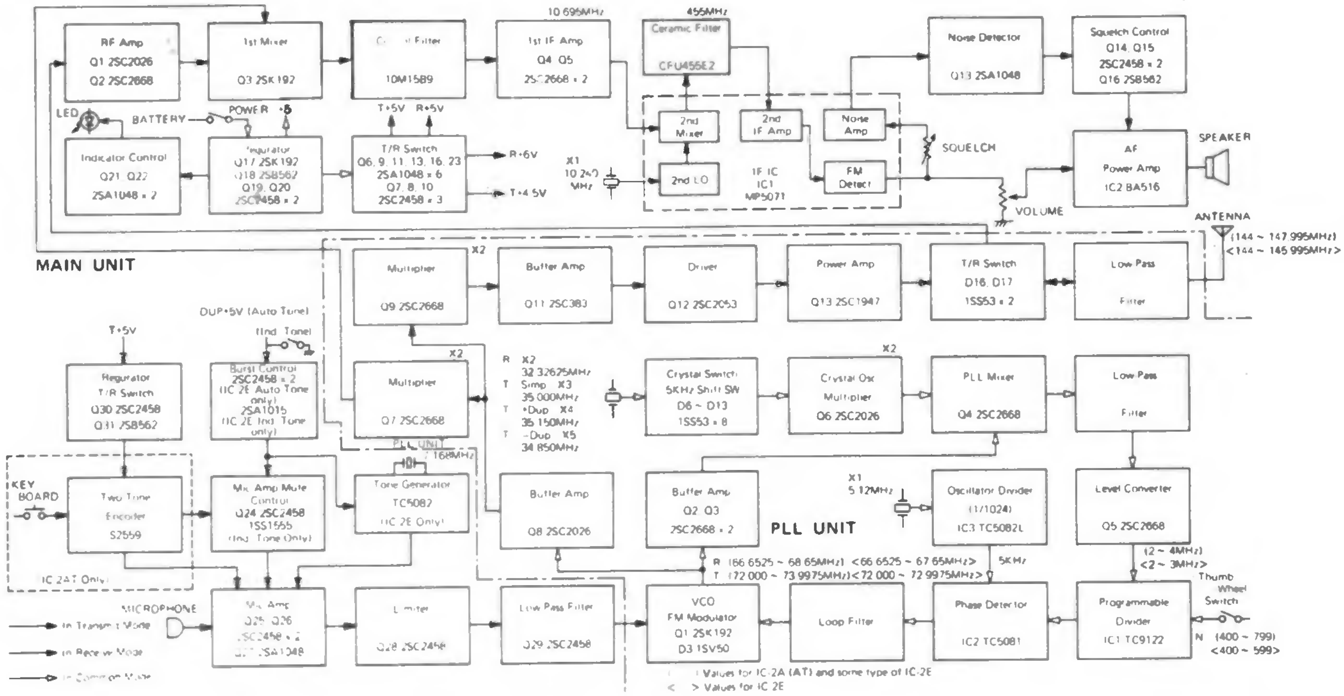
One small critisism concerns the seemingly insubstantial slide switches used for the repeater functions, the high/low power, and the 5kHz offset. It's very easy to accidentally knock the repeater shift or high/low power switch when a hand is wrapped around the unit. Many is the time that the writer hasn't been quite where he though he was as a result of an inadvertant 600kHz shift.

The way the transmitter and receiver oppose each other on a hinged assembly is a thing of joy for the communications designer to behold.

Photo *(left)* reveals the top end of the transmitter, with the aforementioned switches in the middle. You will see the output transistor soldered to the case at the bottom of the picture. The advent of emitter-to-case RF drivers is one of the great boons for the RF output design engineer. The device used by Icom appears to be Mitsubishi 2SC1947. Like too many Japanese components found inside imported Japanese completed equipment, it seems virtually impossible to obtain this device from the manufacturer without going through the most tiresome hoops. Whilst the Japanese seem keen enough to torpedo our balance of payments with complete equipment, trying to get parts like the one just mentioned can be like trying to get the rear offside wing for a 1952 Humber Hawk.

Doubtless the importers of Icom have spares, but that really isn't the point, since if we are to assume a condition of relatively free trade exists, then British manufacturers should be entitled to expect to get some service from the Japanese component manufacturers, rather than simply have to rely on those more profitable ranges of parts which it happens to suit Messrs. Oriental to deign to let us buy.

Fear not, however, TRW have several suitable alternatives for those of you wishing to design your own unit, all of which are available with relative ease. The whole question of the Japanese approach to supplying electronic goods is a subject which needs a more thorough airing than



can be offered in the middle of a piece like this. So on with the IC2....

The Circuit *(figure two)*

It's debatable whether the circuit or the block diagram is more easily understood. For the benefit of a thorough understanding of the IC2 (since this particular example provides a good grounding in this type of electronic product as a whole), the complete unexpurgated block diagram is reproduced herewith, complete with those quaint examples of the Japanese not bothering to get their English translation proof read by someone who actually speaks the native tongue. Regurators indeed !!

Starting with the more straightforward bits, the signal enters the antenna, proceeds through the low pass filter to the diode switch, and thence to the receiver RF amplifier. *(Figure two)*

The mixer stage provides an IF output at 10.695MHz (as opposed to the more conventional 10.7MHz) which goes through a reasonable 4 pole crystal filter. Since the IC2 is frequently to be found on the end of big antennas in cars and base stations, it is essential that the design takes into account the need for reasonable selectivity at the first IF.

The IF stage uses a low noise cascode configuration, in much the same way as the 10.695MHz IF preamplifier. The RF stage noise figure is the factor ultimately affecting the performance of the unit, but the IF stage provides a lot of additional gain which will tend to mask the tendency of the MC3357 dual conversion IF IC to suffer from interference from signals around the very densely occupied 10.695MHz section of the HF spectrum.

The MC3357 provides the second conversion down to the main selectivity of the Murata CFU455E at 455kHz. The noise mute is detected externally, rather than using the MC3357's own internal schmitt detector system. In this way, the mute signal controls the supply to the audio amplifier, and keeps the quiescent current as low as possible. When the mute is shut, no current flows in the audio stage.

This feature also provides a suitable switch point for muting the audio when the transmitter is on. The time has now come to consider the synthesiser system -and despite its apparent complexity, it is really a quite straightforward nettle to grasp.

The receiver receives an LO injection 10.7MHz LF of the desired RF frequency - and the transmitter obviously wants the exact RF output frequency. It is possible to perform this offset system through purely digital techniques, but the current consumed in the logic and prescalers necessary would put this approach outside the scope of the IC2 handheld concept.

The system adopted uses a CMOS PLL at only 2-3MHZ, brought about by mixing the VCO (at half the desired LO/RF frequency) with a crystal according to the nature of the offset. The transmit offsets include both plus and minus 600kHz for repeater operation.

The VCO and crystal (which is doubled) mix to produce the difference of 2-3MHz - which when doubled again, represents the 4-6MHz coverage of the 2m band. The other mixing product is sufficiently far away as to be completely out of contention at the input to the PLL.

The practice of doubling the synthesiser output before commencing power amplification can help keep instability at bay in such a confined space, but it seems primarily intended to provide for better selectivity at the lower frequency where all the nasty mixing products of the synthesiser can be more effectively filtered.

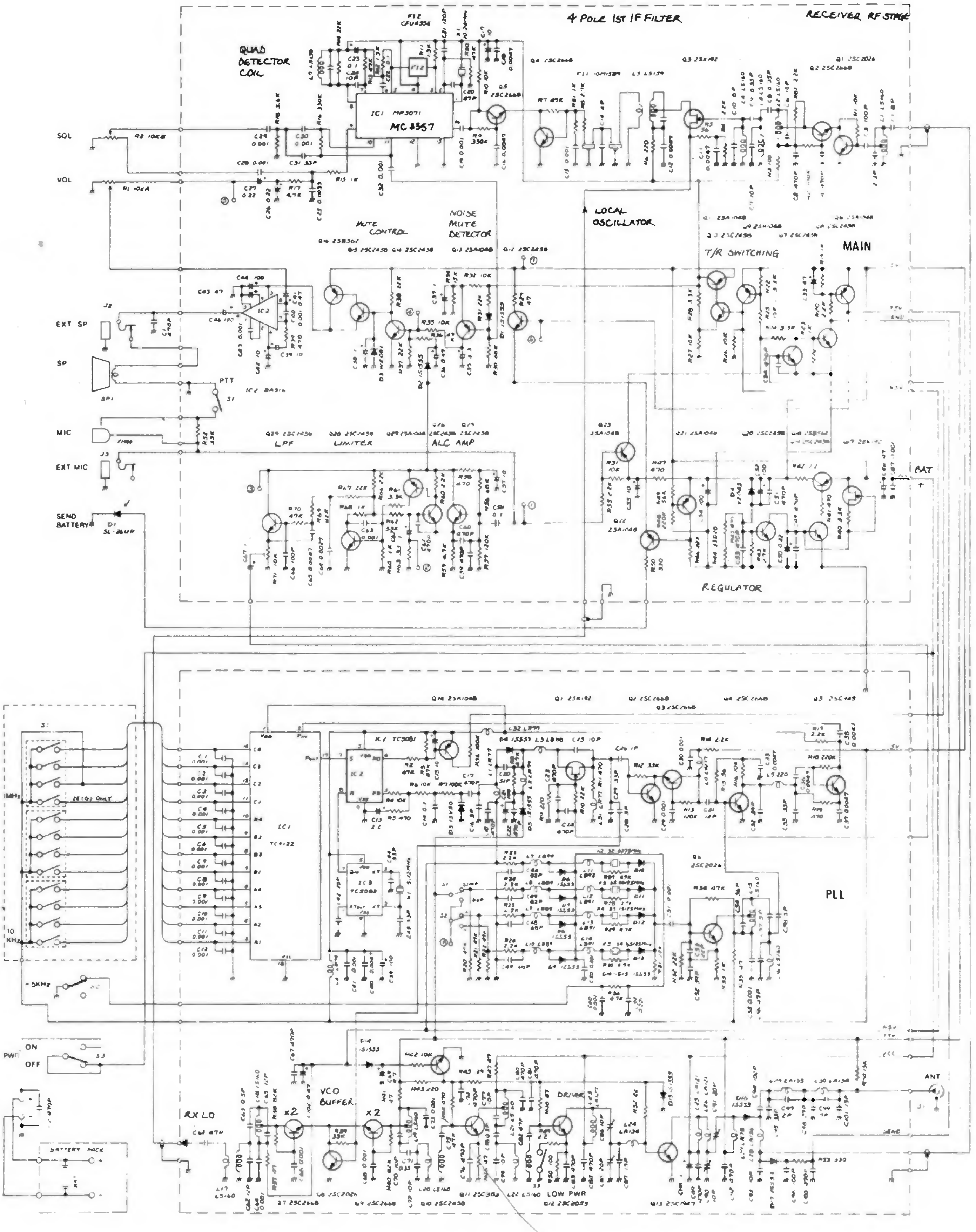
The last mortal remains of the various mixing processes can be seen at the output of the transmitter on the spectrum analyser photos. Although these are not as good as the commercial 'land mobile' specifications would require, the low power of the IC2 does not cause problems. If you hang more than about 10-15dB of output boost on the IC2, then you might like to bear in mind that the output is not the very cleanest of signals.

The 5kHz comparison reference of the PLL is doubled up to 10kHz steps when the VCO is doubled, so the interpolation of the +5kHz switch is provided by a system of electronically switched 2.5kHz 'tweaks' across the crystals used to provide the loop mixing signal. Although this is not strictly a 'digital' process, it serves its purpose well enough.

The transmitter proper *(figure three)* is a relatively simple string of grounded emitter stages, with a good deal of care provided to ensure that the half output signal does not get past the doubler stage. The output low pass filter around L29 and L30 provides good attenuation of harmonics.

The remaining part of the circuit concerns a fairly conventional low pass filter and speech amplifier. The interesting FET modulator technique is very good, as witnessed by the quality of audio experienced by anyone listening to an IC2 user. Transmit/receive switching is taken care of by a surprisingly complex array of transistors and diodes.

The tone burst is accomplished by another crystal divided down to 1750Hz, and so should be perfectly aligned at all times.


4 POLE 1st IF FILTER
RECEIVER RF STAGE
QUAD DETECTOR COIL
IC1 MP3071
MC3357
LOCAL OSCILLATOR
MUTE CONTROL
NOISE MUTE DETECTOR
T/R SWITCHING
MAIN
SQL
VOL
EXT SP
SP
PTT
MIC
EXT MIC
SEND BATTERY
LPF
LIMITER
ALC AMP
BAT
REGULATOR
PLL
MHz
10 KHz
+5KHz
PWR
ON
OFF
BATTERY PACK
RX LO
VCO BUFFER
x2
x2
DRIVER
LOW PWR
ANT

NEXT MONTH

AMONGST *OUR USUAL FEATURES ....*

Win a Philips DMM

November's competition stars the Philips PM2521 MPU controlled 'Digital Measurement Centre' – both as first prize and 'subject'.

Pye Unicam's Chris Pointer with the feted instrument

The Acorn Atom

Our man-about-computers continues to discover the hidden talents of micro-computers that think big.

Conducting the PROMs...

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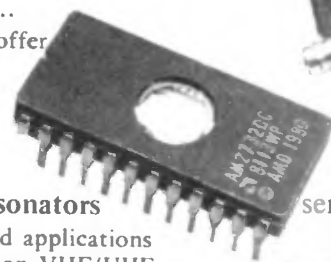
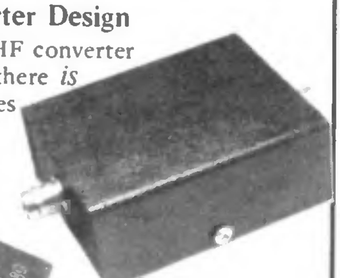


UHF Receiver Converter Design

Timothy Edwards' UHF converter proves conclusively that there *is* really life after two metres



HiFi – continuing the series on the ultimate DIY audio system

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....inside the FT290R

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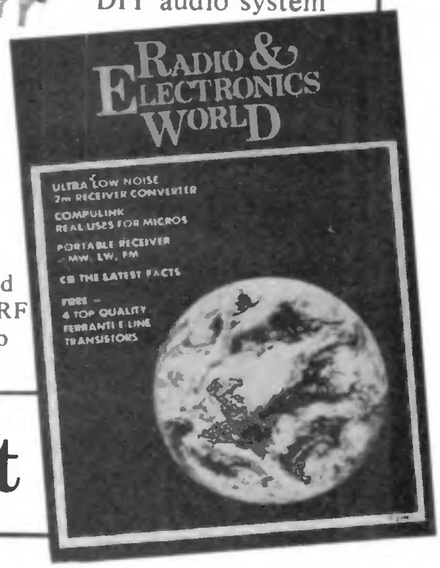

RADIO & ELECTRONICS WORLD

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The LS1000 loudspeaker protection system.
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Price £12.99
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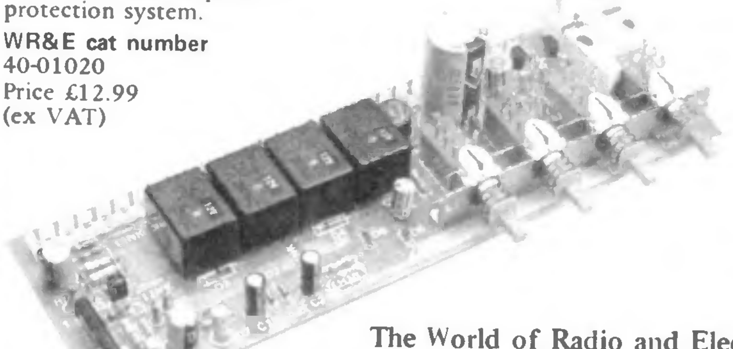

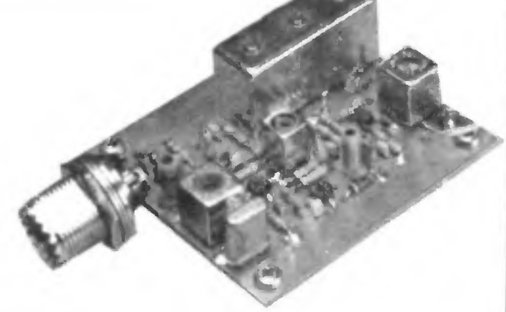

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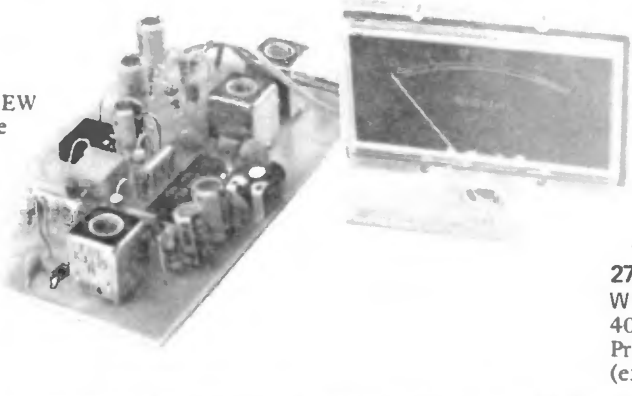
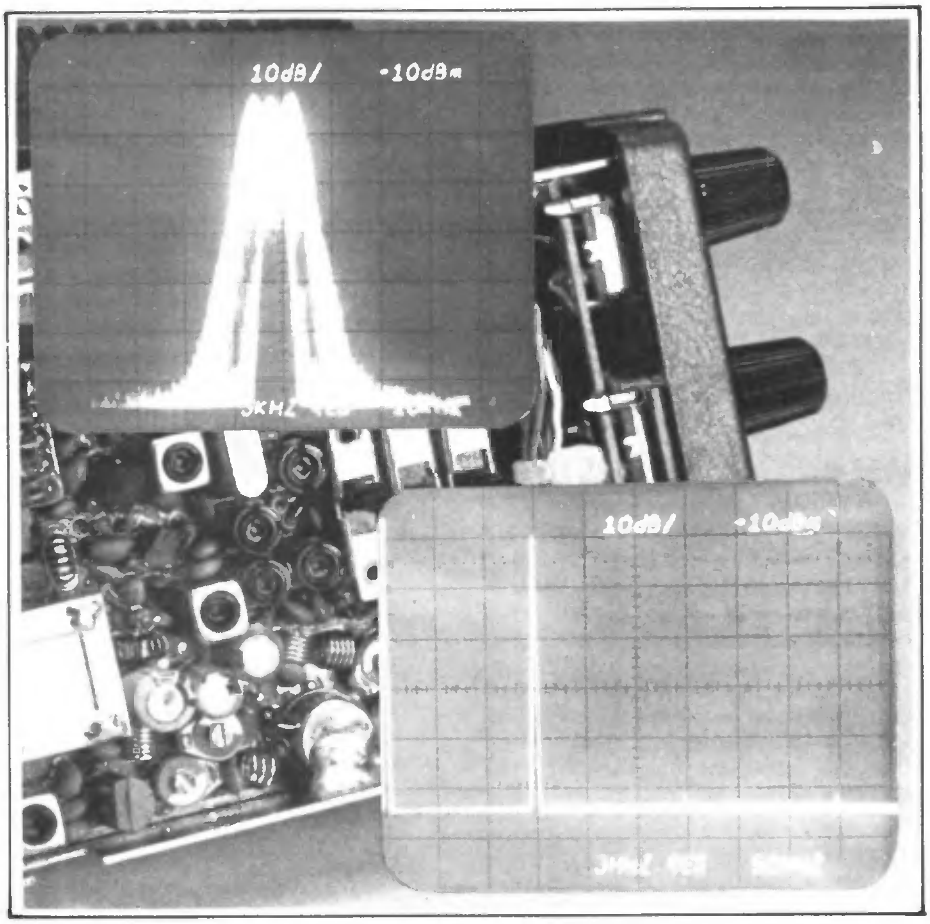


27MHz FM deviation meter
WR&E cat. number
40-01040
Price £7.49 (ex case)
(ex VAT)

31 for further details



A view of the output spectrum

Conclusions

The IC2 represents an extremely versatile and compact transceiver, with evidence of thoroughness and thoughtfulness throughout. The use of thumbwheels may seem tiresome to some users, but any other method would have penalties in current consumption and the size of the unit. There is little one can say to criticise the approach to the circuit design, although there would seem to be rather a large number of components performing the ancillary functions such as the modulator, stabilizer and switching.

In terms of RF capability, the only way to improve is to increase the number of modes. Control-wise, there is plenty of scope for using CMOS MPUs to provide more facilities (memories) and easier tuning. But then again, the price will suffer. ■

NOTES

1. Further details of the IC2 are available from several **R&EW** advertisers.

Interest rating

Please enter the appropriate response on the Reader Response Page (p.95).

Would like one	241
Interested - might buy one	242
Seen better (*tell us what*)	243
Already have one	244

READERS Q·A

Dear Sirs,

I have purchased a pulse induction metal locator - but now find that it appears to be susceptible to 'ground' interference - and I am very disappointed, since the immunity to ground effect problems was my main reason for choosing this type of machine.

Are you aware of any modifications that can be employed to eliminate these problems?

JS
Glamorgan

R&EW:

The short answer is that the pulse induction system cannot (by definition) suffer from 'ground effects' in the most frequently used sense of the term. 'Ground effect' is usually associated with tuned search head detectors that rely on the detuning effects of eddy currents induced in the 'target' metal.

But 'tuned' circuits are tuned by a combination of inductance and capacitance, and the 'ground' effect is the capacitive interference (damp ground is usually the cause) with the inductive aspects of the detection process.

In a pulse induction system (PI), the search head is untuned, being simply an inductor used to transmit a pulse of electromagnetic energy at no particular 'resonant' frequency.

The effect you are getting is most likely due to ferrous mineralization of the soil, which is a fairly widespread phenomenon in this country. The PI system is particularly susceptible to iron, due to the magnetization characteristics and the hysteresis of the metal 'storing' the pulse charge particularly effectively and then retransmitting it back to the detector head.

***R&EW** will be running a series of articles describing the theory and practise of metal detection in unique detail, and we suggest that you watch for further coverage.*

Dear Sir,

I need a replacement for a 2N5915 or BLY53A. Please advise.

BR
Hants

R&EW:

*The BLY53A is basically a 470MHz, 7w output 13.2v FM RF device. As it happens, Ambit International presently offer this at £5.02 at one off, although an alternative is the Motorola 2N5946. We can't offer you an off-the-cuff price for this part, however, since Motorola RF devices are not easily available in one off in the UK (would Motorola care to help us out at **R&EW** with pricing and better availability of their excellent range of RF devices via the World of Radio and Electronics catalogue??)*

The 2 watt version (2N5944) of the family is listed at over £9 each, so prepare for a shock...

Dear Sir,

I recently decided to upgrade my PA system (used by a local rock group), and was pleasantly surprised to find the simple and elegant AMBIT PA101 used in conjunction with D.C. Read's active loudspeaker article in April's *Wireless World*.

I am not sure if it is possible to beef the design up by paralleling more FET's. I am after 150w/8 ohms, or 250w/4 ohms. Can you comment on feasibility and potential problems?

MK
Czechoslovakia

R&EW:

A good question. One of the most endearing aspects of the power MOSFET is the ease with which it can be paralleled, and the indestructibility of high powered systems built with them. So the short answer is 'yes'.

The 140v devices used on the PA101 will drop around 10v - leaving, say, a swing of 110v pp across the load -around 180w into 8 ohms. A lot of care should be taken over the PSU design, since the use of a PSU with 5% load regulation as opposed to the more frequently encountered 10-20% regulation transformers will help keep power up, and avoid problems from modulation of the power rail.

The PA101 has recently been superceded by the PA105, which is specifically designed for parallel output devices, and is available with a heatsink bracket designed accordingly. The track layout of any high powered PA is a great deal more critical than most unsuspecting constructors take into account, and can easily make the difference between 0.005% and 1% distortion. Or worse still, complete instability.

***R&EW** will be charting a course through such design concepts and problems with our series on 'The Last Word in DIY Audio' - the first part of which describes the **R&EW** MOSFET PA, featuring an 80-160w MOSFET power amplifier, with bridging (for over 400w) and a very comprehensive overload and speaker protection circuit. Watch out around the November issue for the start of the series.*

Dear Sir,

Can you help me with a couple of items I am interested in building?

The first is a transmitter/receiver in a form of radio headphone assembly for use on a small yacht for teaching purposes. About 1w RF for short range (line of sight to shore) but with an add on 25w booster for 'navigational' use.

The second is a 27MHz FM CB transceiver with a relatively low power requirement, say 5 watts.

WJF
Hants

R&EW:

Hold on there, Mr F. Your secret is safe with us, but you had better take note of the Wireless Telegraphy Act which says many things about the devices you ask about. Most of them boil down to the £400 fine, confiscation and possible prison sentence for such illicit equipment as you have requested - doubtless in all innocence.

*The first item is an ideal case for a 934MHz CB transceiver. Since the licensing is simple, and the actual device not as daunting as some would have you believe. And, you've guessed it, **R&EW** will be covering just this type of application of CB which will probably be getting overlooked by the avaricious Oriental hordes in their anxiety to plunder our balance of payments with a plethora of car mobiles and hand-helds.*

The specification of the 27MHz CB radio is quite plain, and since 4w RF is the maximum, then 5w is relatively high in terms of output. You can pick up a set for around £50 when it all 'happens', although there will be many useful accessories and gadgets to be made to complement your gear.

Dear Sir,

Can you please advise me of a suitable alternative for the J305 FET as used in the Aztec UM1181 FM varicap tunerhead -since I am unable to locate a source.

J.J. Essex

R&EW:

The J305 is a low noise N-channel FET, made by Siliconix. If you cannot get this from any Siliconix source, then you can substitute this by a Hitachi 2SK55, which has a similar noise figure, but remember to watch the base connections.

Please address correspondance to:
Readers Letters
Radio and Electronics World
117a High Street
Brentwood
Essex. CM14 4SG

REVIEW ~ ZX ~ 81

- by Charles Wales

Summary of the BASIC commands offered by the ZX-81

ABS	SQR	LIST
ACS	STR$	LLIST
AND	TAN	LOADf
ASN	USR	LPRINT
ATN	VAL	NEW
CHR$	CLEAR	NEXT
CODE	CLS	PAUSEn
COS	CONT	PLOTm,n
EXP	COPY	POKEm,n
INKEY$	DIMx	PRINT
LEN	DIMx$	RAND
LN	FAST	REM
NOT	FOR TO	RETURN
OR	FOR TO STEP	RUN
PEEK	GOSUBn	SAVEf
PI	GOTOn	SCROLL
RND	IFxTHENs	SLOW
SGN	INPUTv	STOP
SIN	LEFTv = e	UNPLOTm,n

Style and Presentation

Our ready-made ZX-81 arrived complete with all the necessary leads and the mains adaptor - so it was simply a case of plugging in (to the mains and the aerial socket as of UHF TV) and turning on. Everything worked first time - and on the small black and white portable used as a monitor, the picture quality was excellent. Style-wise the ZX-81 has much cleaner lines than the earlier ZX-80, appearing visually to be more substantial and rather more elegant *all round.*

Most readers will have seen reviews of the earlier ZX-80, and the '81 retains most of the features; commands and programme lines being 'entered' at the bottom of the screen, checked for syntax, and if correct -added to the rest of the programme. This pre-checking of programme lines means that when RUN is eventually typed, there is a much greater chance of the programme executing and not 'crashing' due to silly errors in the structure of the programme lines.

The two main areas where the '81 is greatly improved compared to the '80 are in terms of the BASIC and the generated display. The '81 offers two speeds of computing, fast and slow; if slow is selected then the processor maintains a steady display and only executes programmes during line and frame flyback time. This is a great improvement - but be warned - *slow* means slow, about four times slower than *fast.*

If fast is selected, then programmes run a lot quicker, but the display is lost every key push and also during programme execution (except during print and input lines). As both *slow* and *fast* can be used as programme statements, a lot of flexibility can be maintained as regards display quality versus programme speed.

As far as the BASIC goes there are five main extensions:

1) Numeric variables may be named rather than just simple single letters of the alphabet, e.g. 10 LET COST = QUANTITY x UNITCOST is a rated line.
2) Numbers can be floating point and can range from very small to very large.
3) The addition of numeric arrays and strings plus some powerful string handling functions.
4) The addition of trigonometric and transcendental functions.
5) The addition of commands to control and list the soon to be announced, ZX-81 printer.

Personal impressions

Until this review model I had never played with a Sinclair machine, at first I tried to compare the ZX-81 with other machines. The ZX-81 is very powerful, equal to many other implementations - and yet I was disappointed by both the speed of execution and the small keyboard. However, I then realised that the 'comparison' machines cost from 2 to 5 times the basic price of the '81, therefore in conclusion it must be said that the basic ZX-81 (without the RAM extension), offers an unequalled (at the moment) price/performance ratio. The '81 would form an excellent introduction to someone who wanted to find out what its all about. And even if the newly converted computer 'freak' then feels constrained to 'upgrade' within a week, the '81 will have served its purpose well.

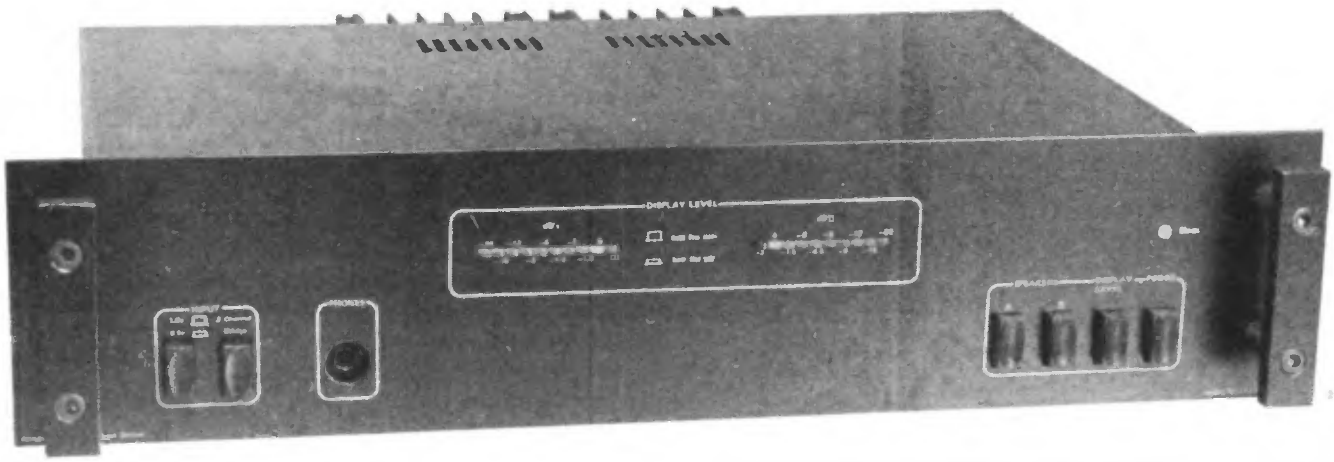
ZX-81 Specification

Price: Kit £49.95, built £69.95
CPU: Z-80
Memory: 1k static
Keyboard: 'Wipe clean' membrane style
Screen: UHF signal for connection to domestic TV. Character size 24 lines x 32 character lines 23 + 24 reserved for system use. PIXEL GRAPHICS MODE 44 x 64 PIXELS
Cassette: Uses domestic audio cassette, software allows saving and restoring of named files.
Bus: 44 line edge connector provided
Software: 8k ROM containing BASIC, Editor and Operating System
Peripherals: 16k add on RAM PACK £49.95. ZX-81 printer not yet released, approx £50.00.

Higher Fidelity Part one

Mike Creek

the LS1000 amplifier/speaker protection system



The much-refined 150w RMS per channel HMOS power amplifier

the protection racket

The next few issues of this magazine will be describing all aspects of the design, construction and test of a 'state of the art' HiFi system with up to 700 watts per channel (using two bridged versions of the basic 150w per channel HMOSFET power amplifier) - including a power and pre-amplifier followed by a matching synthesised tuner. It will be divided down into modular form, starting in this first issue with the DC sensing speaker protection circuit, LS1000.

Metalwork of a 19" rack mounting format has been designed specially to give both high quality professional appearance, with a mechanical strength and conservatively rated design that is rarely found amongst commercially available HiFi equipment. The result is a professional looking system of rack or stacking HiFi with a performance second to none, offering facilities without compromise to the sound quality, that many manufacturers in this country cannot or will not make available to the large number of enthusiasts for fear of 'overdoing it' and incurring the misguided wrath of some HiFi journalists, and thereby thwarting their sales prospects. It remains to be seen if the doctrine of 'sound quality is inversely proportional to knob count' that has been so frequently and vehemently repeated, that even those readers with an objective approach to things, find the plethora of features and facilities to be overwhelming.

It must be stressed though that the complication of the pre-amp may be beyond the capabilities of the first time constructor. So beware, and take it in easy steps.

LS1000 DC Offset Sensing Circuit

Features include:

1. DC offset sensing (plus and minus) featuring the HA12002 Custom IC.
2. Switch on/off thump elimination.
3. Local and remote AB speaker selection.
4. Pulse and preset overload protection.
5. Thermal protection.
6. Bi-colour LED mode indicator.
7. 4 separate 10A relays for each speaker path.
8. On board rectification and smoothing.
9. Switchable range bargraph driving circuitry.
10. 5 amp mains on/off switch.
11. Size 183mm x 58mm including 25 connectors and 4 SUE switches and 4 10A relays.

The LS1000 DC Sensing PCB

Why is an offset sensing circuit required in a modern HiFi amplifier ?

In general, most modern audio power amplifiers use split rail (+/—) power supplies. This has many advantages over the single ended supply (+ only), not least for its ability to be DC coupled from input to output, therefore eliminating such dubious things as the speaker capacitors. One obvious disadvantage is that if a fault occurs with the amp, or the power supply, it is possible to get half supply volts across the loudspeaker terminals, and with no capacitor to block it, this would have a disastrous effect on your loudspeaker voice coil.

How does the LS1000 fulfil this function ?

This is where the DC sensing circuit comes into its own, for it constantly monitors the DC output voltage of the amplifier and if it sees more than a volt of DC, either positive or negative, it will interrupt the loudspeaker path by switching off the relay which is in series with it.

What other functions does it provide ?

If this voltage offset is only a temporary fault then after a few seconds the relay will be engaged and connect the loudspeaker to the amplifier once again.

During initial switch-on the power supply will take a second or more to settle to a reasonable level of DC offset, so this circuit allows approximately 4 seconds delay before allowing the speakers to be switched on. To monitor the mode of operation a bi-colour LED is used. It will indicate red for a fault or switch on delay, and green for 'go'.

When operating the amplifier, if you exceed the maximum output power i.e. the amplifier's output 'clips' by trying to exceed the available power supply voltage, or if a sudden and potentially damaging pulse or transient is produced, then the speakers will be turned off for a few seconds to see if the fault or overload condition will go away.

If required, a negative temperature coefficient thermal sensor can be connected to this board to operate the thermal trip by checking the temperature rise of the output devices' heatsink (more useful in Bi-polar transistor designs which can suffer from an attack of thermal runaway). If this is not used the

connections should be grounded.

For fast 'switch-off' when the mains supply is disconnected (i.e. before the dying DC power supply on the amplifier causes the amplifier to go through the 'death throes' of squeaks, crackles and bangs that are frequently all too apparent on many amplifier designs), the LS1000 board is supplied with 18v AC for its power source which is rectified and smoothed (though with a relatively small capacitor to ensure the supply decay is rapid) and also used for the fast switch off AC sensing circuit on the HA12002.

For use with bargraph meter circuitry like that available with the U257 and 267 LED bargraph driver devices from AEG, the attenuation switching, rectification and smoothing is supplied on this board.

If you wish to switch the mains on and off from the front panel, a 5 amp mains on/off switch is provided along with A, B speaker switching. These switches are used to select the relays to be used - and not to switch the speaker path, hence it is possible to remotely control the speakers by grounding the speaker switching lines.

Assembly

Most of the construction can be done by following the components list and inserting the components into the PCB, which is printed with legend information

Connections

1.	Ground to input central earth point		
2.	Ground		to headphone socket
3.	Right		
4.	Left		
5.	Left		from speaker outputs of PA101/105
6.	Right		
7.	Thermal sensing		Note: short 7 to 8 with link if thermal
8.	Ground		
9.	Left	'A'	to rear panel output terminals
10.	Right	'A'	
11.	Left	'B'	
12.	Right	'B'	
13.	9v AC		to 9.0.9 winding on right hand channel mains transformer
14.	9v AC		
15.	Ground to junction between 10,000uF 80v caps 0v of RH Power Supply		
16.	Ground	to remote speaker switching socket on rear panel	
17.	'B'		(+25v for LED indicator in RC switch)
18.	'A'		
19.	+25v		
20.	+25v		to bargraph display boards
21.	Right		
22.	Left		
23.	Red		to front panel mode indicator
24.	Ground		
25.	Green		

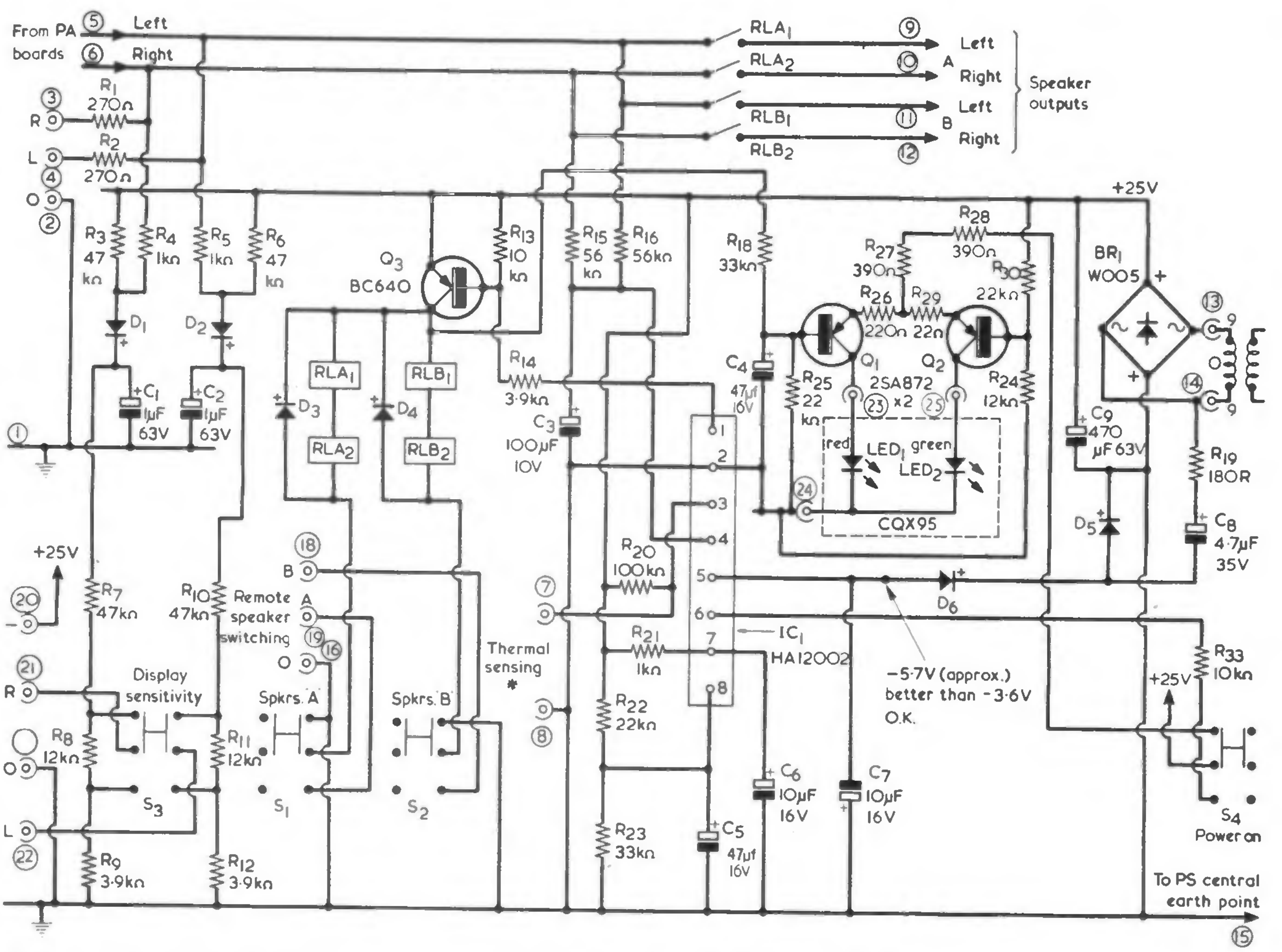


Figure one: the circuit of the LS1000

* N.B. When thermal sensing is not required, then 'sense' pin must be shorted to ground (pin next to it)

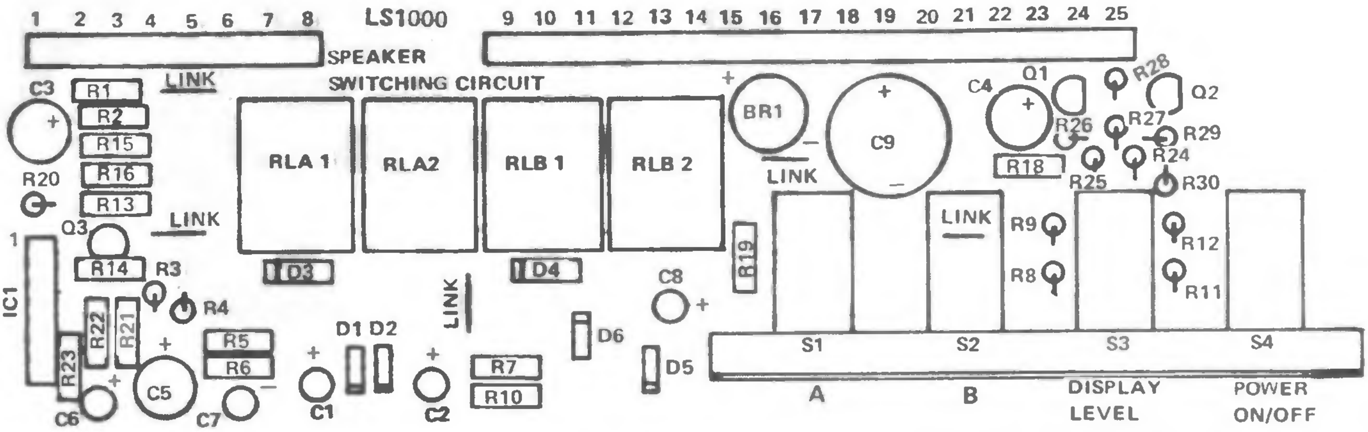


Figure three: The component overlay, superimposed on the PCB viewed from the component side.

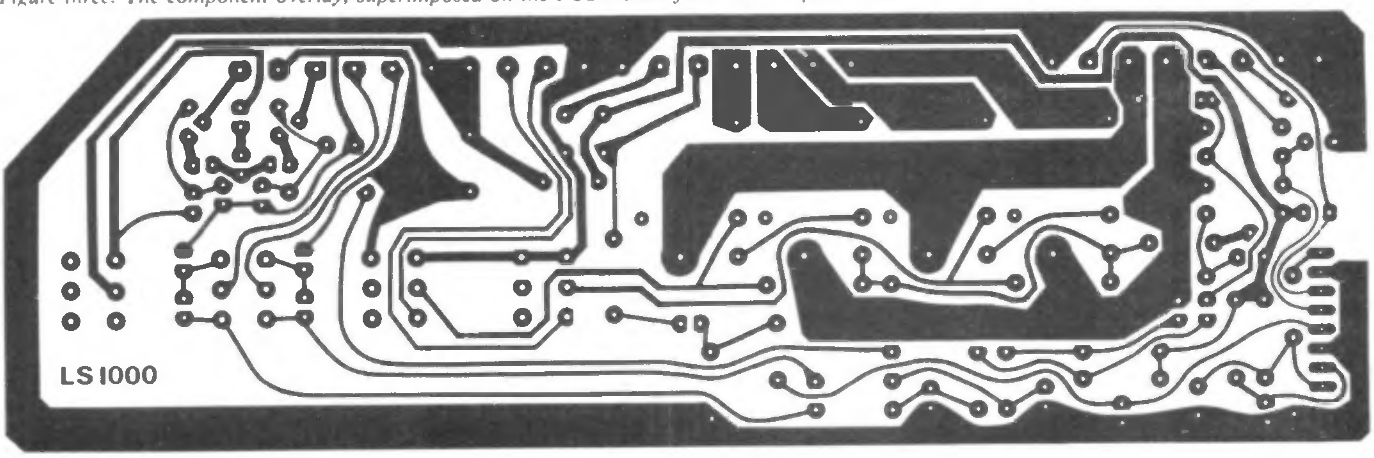
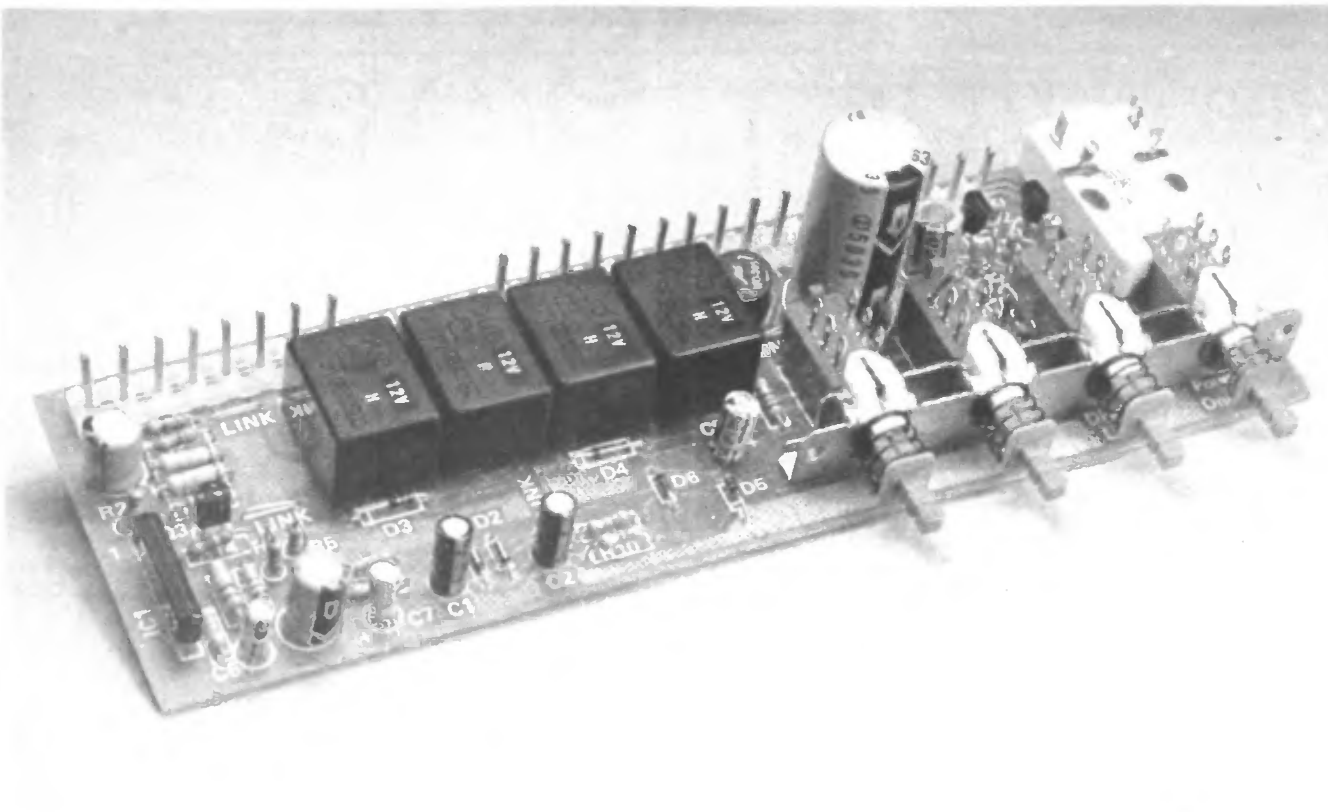


Figure two: Same size view of PCB foil side layout



The completed LS1000 unit

to assist, making sure that capacitors, diodes, ICs, transistors and bridge rectifiers are correctly polarised.

NB. Make sure speaker B selecting switch is linked on the rear terminals +25v.

Test

Connect up 18v AC across pin 13 and 14, and ground pin 15 (See *Figure 1*) with the mode LED connected correctly. When the power is applied the red LED should stay on permanently showing a fault condition. Therefore ground pin 7 (thermal sensor) to test, and refer both pins 5 and 6, loudspeaker outputs to ground with 100k resistors. This will enable you to test the offset sensing with a battery of 1.5v or more across these terminals and earth to pull them up from ground. (See *Figure 1*). The offset should trigger the relays, and the LED mode indicator should go red for the period that the battery is connected and for a few seconds after it is removed. If you select either or both of the speakers from the front panel switches or the remote ones, then the relays should both click in and out whilst the LED is changing colour. The thermal trip will operate if pin 7 is taken above ground potential, i.e. remove the link to test.

If the board does not function properly then check that you have all the components in the right places and, or, the right way round and that there are no shorting links underneath. Make sure you have +25v DC and that you have a ground reference.

Components

Resistors - all values .25w 5% carbon film.

R 1	270R
R 2	270R
R 3	47k
R 4	1k
R 5	1k
R 6	47k
R 7	47k
R 8	12k
R 9	3k9
R10	47k
R11	12k
R12	3k9
R13	10k
R14	3k9
R15	56k
R16	56k
R18	33k
R19	180R
R20	100k
R21	1k2
R22	220k
R23	33k
R24	12k
R25	22k
R26	220R
R27	390R
R28	390R
R29	22R
R30	22k

Capacitors

C 1	1uF 63v
C 2	1uF 63v
C 3	100uF 10v
C 4	47uF 16v
C 5	47uF 10v
C 6	10uF 16v
C 7	10uF 16v
C 8	4u7 35v
C 9	470uF 63v

Semiconductors

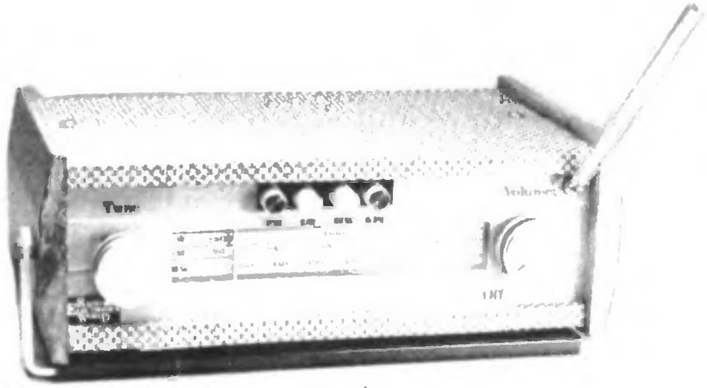
D1-6	1N4148
Q1-2	2SA 872
Q3	BC640
BR1	W005
IC1	HA12002

LED 12 CQX95 Dual
Relays OUDH 12v
Switch 4-way 2-pole SUE
PCB LS1000
Connectors 25 x .200 series

NOTE: Central earth for 0v point of power supply is via LS1000 PCB, Pin 15-Pin 1. No other connection from power supply to chassis is needed, nor should be used.

Next month....HMOS PA design. There's more to it than simply ripping off the Hitachi data sheet.

R&EW Watervole AM/FM Radio



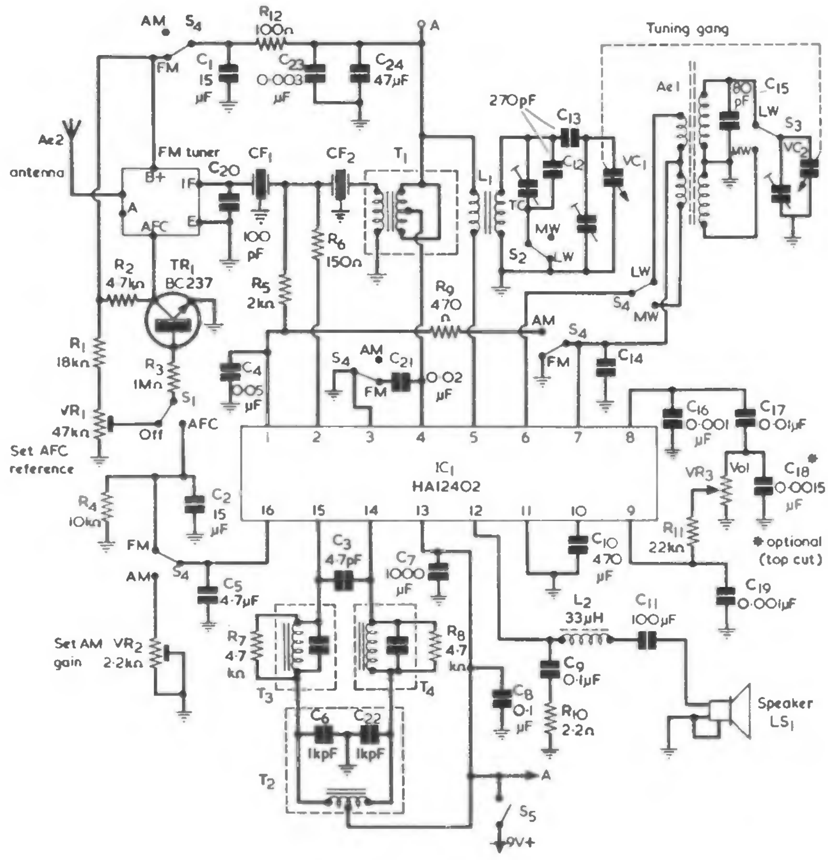
Richard Collins

*Why the "**Watervole**" ?? Well, we thought we should try and establsh some 'theme' for the constructional series, and after dismissing titles based on local place names such as the "**R&EW Harlow**", or the R&EW "**Barking Creek**", there really wasn't a lot of choice left. So we have opted for small British mammals, until someone comes up with anything better........*

This feature describes an AM/FM portable radio receiver in which all signal processing from aerial to loudspeaker (with the exception of the FM RF amplifier and mixer) is accomplished in a single integrated circuit. A typical output power of 600mW is achieved using a 9 volt battery.

It is no secret that an AM FM portable radio can be bought from many shops for about the same price as the parts for this particular constructional feature, but then again, many electronic constructional projects fall into this category. One of the major considerations of such features is the educational and instructional value, and in view of the total abdication of portable broadcast radio production to the Far East by English manufacturing industry, it seems reasonable to offer some means of basic instruction to those interested in the workings of such things through the medium of this type of article. As it happens, the performance of this particular receiver (and in particular its sound quality) is particularly good, as the result of the use of a ceramic FM IF filter, and a mechanical filter for the AM IF. In home construction projects, the parts cost is a considerably greater proportion of the total cost than in a manufacturing operation. Consequently it is far less painful to incorporate more expensive basic technology as a home constructor, than as a manufacturer of commercial consumer equipment. Thus the performance of this radio equals that of many far more expensive commercial receivers, bearing in mind that this particular project can be made for less than £20 if the parts are purchased with reasonable care.

This particular receiver would make an extremely good example for educational purposes, since as well as providing many instructional points concerning the construction of broadcast radio receivers, the student has a worthy reward for his labours.



The Circuit

Figure 1 shows the complete schematic diagram for the receiver. The AM signal is processed from the aerial through to the detector output via traditional circuit blocks of mixer, IF and detector enclosed in a reverse AGC loop. The AM mixer is of the fully balanced type and affords rejection of both the oscillator and input signal as observed at the output.

In addition, the balanced operation of the mixer provides typically 25dB of IF rejection at the input, with similar rejection of the associated noise passband. Since the circuit is linear in operation, good freedom from intermodulation product responses is assured.

IF gain is provided for both AM and FM by a common IF amplifier. In FM operation the gain is set at approximately 76dB, providing a typical limiting threshold of 40uV. For AM, the gain is reduced by lowering the current in the amplifier by means of the preset resistor Vr2.

The detector circuit is also combined for AM and FM. FM audio is recovered by phase discrimination, and AM audio by peak detection. To complete the circuit, the AM stages require AGC, and this is accomplished in the IC by setting the internal IF supply voltage equal to the voltage at the detector audio output. As a carrier appears, a corresponding reduction in the DC voltage at the audio output occurs, where an external capacitor (C5) by-passes the audio and

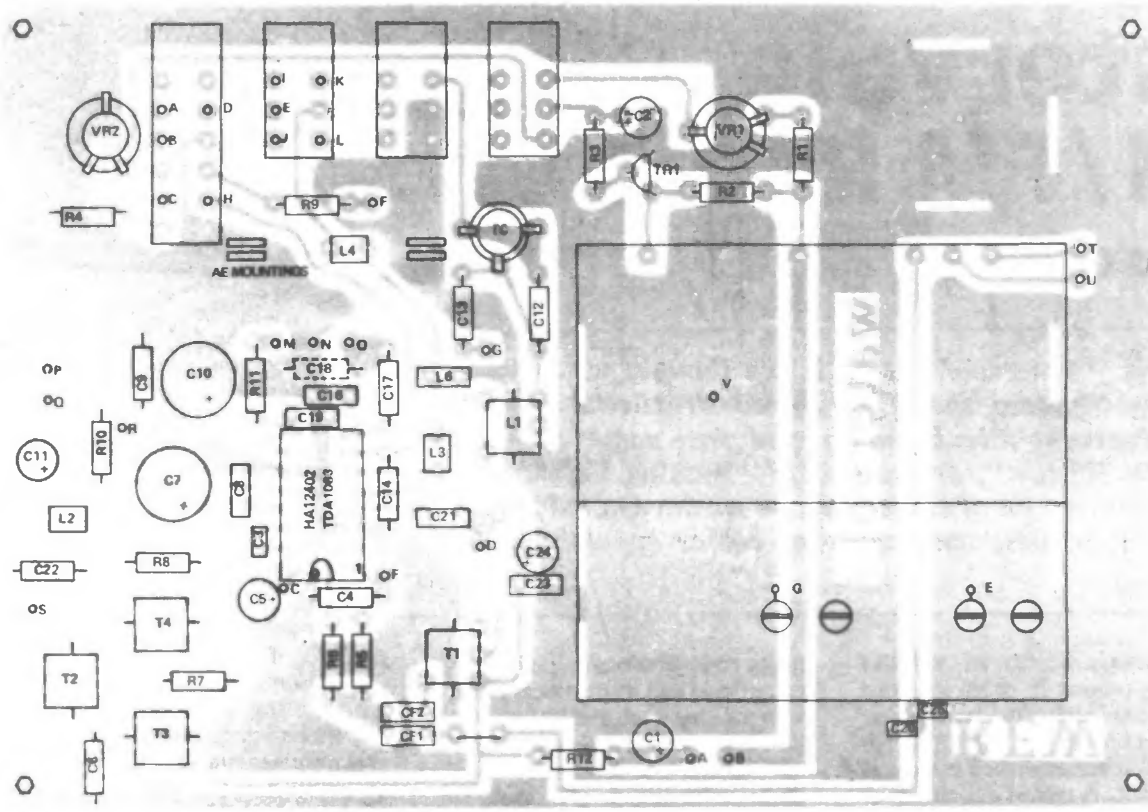


Figure 3:
PC over component positions

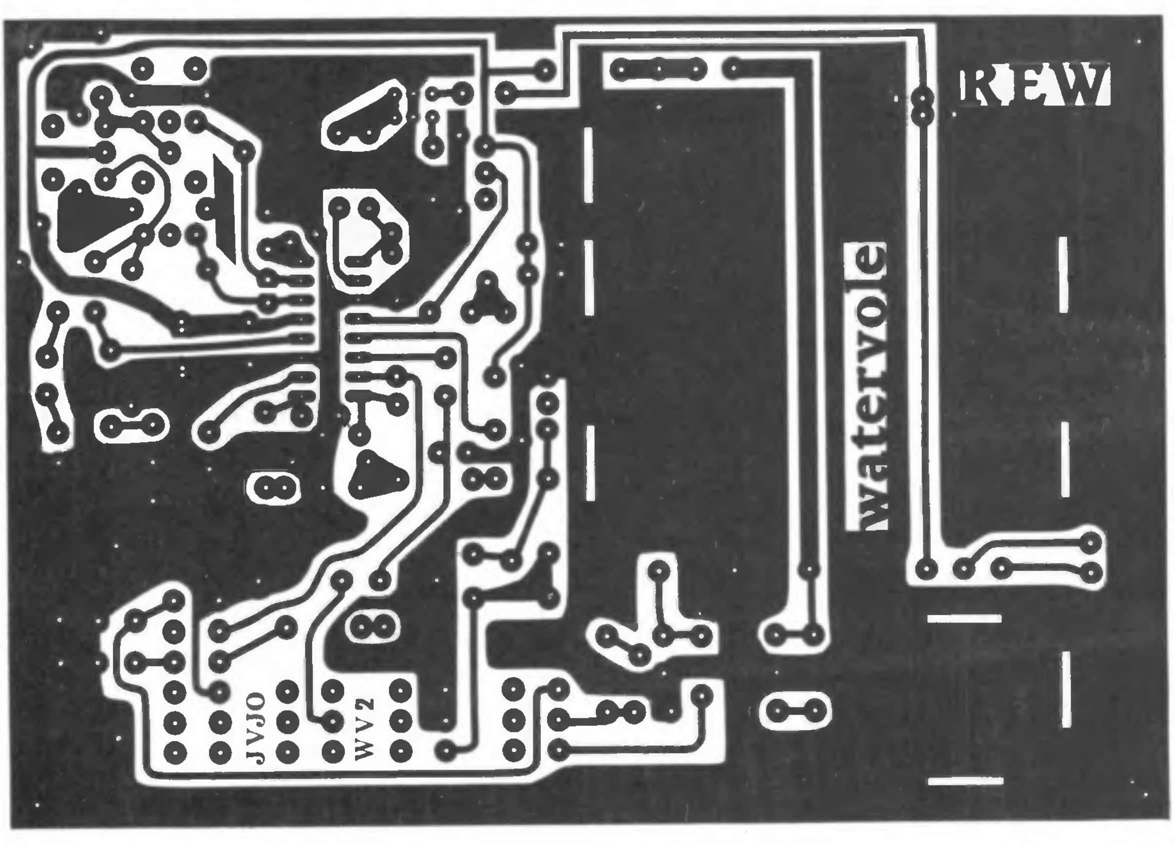


Figure 4:
PC foil layout same size

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CHOKES: TOKO 8RB series.....

5mm pin spacing fixed inductors, with a full choice of values from 100uH to 33mH - most E12 values ex-stock.

Prices:

1-25: 19p/ 25-99: 13p/ 100+: 11p

TOKO UK Ltd: tel (07535) 54057; tlx 848095

Stocked and distributed in the UK by:

Ambit int: tel (0277)230909 tlx 995194 ambit g

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TOKO, INC.

CHOKES : now 1uH to 1.5H !!

Not a mistake, TOKO's new 10RBH series extends the range to one and a half HENRIES. Only 10.5mm dia by 14mm tall. And only 26p in 100off.

TOKO UK Ltd: tel (07535) 54057; tlx 848095

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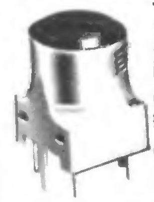

TUNABLE LF INDUCTORS

AMBIT's stock ranges of TOKO coils includes a range of LF adjustable coils that span the range 4mH to 55mH. (Each coil tunes approx. 30% of its nominal value.) Custom types available if required.

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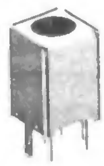
TOKO, INC.

COILS : RF, IF, OSC etc.

TOKO quality and reliability simply cannot be beaten - and with the only stocking distribution service in the world for signal coils/chokes — nor can the price, availability and stock range .

Coils for 1kHz to 300MHz.



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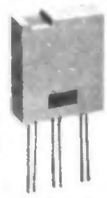

CERAMECHANICAL FILTERS :

TOKO's CFM2 series of filters combine the tight passband shaping of ceramic IF filters - coupled by a carefully selected mechanical element that keeps spurii to a very low level. Stock types 455/468kHz. Various bandwidths.

TOKO UK Ltd: tel (07535) 54057; tlx 848095

Stocked and distributed in the UK by:

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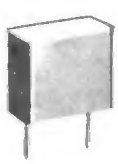

CHOKES: TOKO 7BA series.......

5mm pin spacing fixed inductors, with a full choice of values from 1uH to 1mH. E12 series available ex-stock in the UK, with the lowest prices:

1-25: 16p/ 25-99: 10p/ 100+: 8p

TOKO UK Ltd: tel (07535) 54057; tlx 848095

Stocked and distributed in the UK by:

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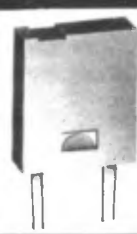

CERAMIC RESONATORS : MPU, REMOTE CONTROL, DVMs etc

TOKO's new CRM (parallel) and CFE (Series) ceramic resonators offer 10ppm stability at a fraction of the cost of crystal. Available at 200-500kHz (stock type 455kHz)

1-24: 32p/ 25-99: 24p/ 100+:19p

TOKO UK Ltd: tel (07535) 54057; tlx 848095

Stocked and distributed in the UK by:

Ambit int: tel (0277)230909 tlx 995194 ambit g

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MAIL ORDER PROTECTION SCHEME

The publishers of this magazine have given to the Director General of Fair Trading an undertaking to refund money sent by readers in response to mail order advertisements placed in this magazine by mail order traders who have become the subject of liquidation or bankruptcy proceedings and who fail to supply goods or refund money. These refunds are made voluntarily and are subject to proof that payment was made to the advertiser for goods ordered through an advertisement in this magazine. The arrangement does not apply to any failure to supply goods advertised in a catalogue or direct mail solicitation.

If a mail order trader fails, readers are advised to lodge a claim with the Advertisement Manager of this magazine within three months of the appearance of the advertisement.

For the purpose of this scheme mail order advertising is defined as:

"Direct response advertisements, display or postal bargains where cash has to be sent in advance of goods being delivered".

Classified and catalogue mail order advertising are excluded.

sets the required time constant.

The audio stages provide typically 43dB gain and can deliver up to 750mW into the loudspeaker depending on speaker impedance and supply voltage.

The only active components external to the IC are associated with the FM tuner. Use of a pre-assembled and pre-aligned tuner greatly simplifies construction of the radio and ensures good FM reception. Due to a disparity between the tuner AFC characteristics and the IC AFC output polarity, a single transistor is needed to invert the AFC signal, and couple it to the tuner.

Construction

An AM/FM radio is a comprehensive piece of equipment and requires a degree of expertise in its assembly. The use of single PCB ensures correct layout, and readers are stongly advised to purchase the ready made version, available from Ambit International. Alternatively, more advanced readers may etch their own PCB by making a tracing of the full size layout shown in *Figures 2 & 3* and using same to correctly locate all component holes on a suitable size board. Interconnections may then be inked in with either an etch resist pen or cellulose paint and a fine brush. The holes associated with the IC and the waveband switch need extra care to obtain accurate alignment. After etching the board in Ferric Chloride (strong) solution, the holes may be drilled out and the mounting slots for the tuner and the volume control bracket filed out. The etch resist should be cleaned off and the copper board is then ready for assembly.

Assembly

The major components are mounted onto the PCB first, starting with the FM tuner*, wavechange switch, coil cans*, integrated circuit socket and electrolytic capacitors. Ensure these are mounted correctly polarised as per the layout diagram *(Figure 3)*. Next fit the capacitors and resistors, the trimmer, preset resistors and the AFC inverter transistor. The ferrite aerial mounting brackets may be fitted now, but leave the aerial rod and coils until later. Do not wire the volume control and switch yet either. The PCB should now be placed aside whilst the volume control mounting bracket and the dial assembly are made up *(Figures 5 and 7)*.

***NB** 1) Coil T2 type YLE4A888 must have the tuning capacitor removed - this is easily accomplished by breaking up the body with a sharp point (being careful not to prod into the coil former) and then cutting off the two lead wires where they join the coil pins.

2) The Tuner must have the mounting tag shown in *Figure 4* cut off.□

Continued next month

Component List

R1	18k
R2	4k7
R3	1M0
R4	10k
R5	2k2
R6	150E
R7	4k7
R8	4k7
R9	470E
R10	2E2
R11	22k
R12	100E
Vr1	47k preset
Vr2	2k2 preset
Vr3	100k log pot.
IC1	HA12402/ULN2204A/TDA1083
Tr1	ZTX108/BC238/ZTX107/BC237 etc
CF1	TOKO CFSE - 10.7MHz
CF2	TOKO CFM2455B - 455kHz
Tc	5-60pf trimmer type TC6
Vc1	On Tuner
Vc2	On Tuner
C1	15uf 10v Tant. (or RUBYCON TWL ELCO)
C2	15uf 10v Tant. (or RUBYCON TWL ELCO)
C3	4.7pF ceramic
C4	0.05uF 100v
C5	4.7uF 10v Tant.
C6	1kpF Polystyrene
C7	1000uF 10v Elco
C8	0.1uF 10v Tant.
C9	0.1uF Polyester
C10	470uF 10v Elco
C11	100uF 35v Elco
C12	270pF Polystyrene
C13	270pF Polystyrene
C14	0.05uF Polyester
C15	80pF ceramic
C16	0.001uF Polyester
C17	0.01uF Polyester
C18	0.0015uF Polyester
C19	0.001uF Polyester
C20	100pF Polystyrene
C21	0.02uF Polyester
C22	1000pF Polystyrene
C23	47uF 10v Elco.
C24	0.0033uF ceramic
L1	YMRS80046N Osc Coil (TOKO)
L2	33uH choke
T1	YHCS1A590 AM IF1 (TOKO)
T2	YLE4A888 AM IF2 (TOKO)
T3	KAC9339PFV FM IF1 (TOKO)
T4	KAC9339PFV FM IF2 (TOKO)
AE1	ET476 F14 Ferrite Rod (AMBIT)
AE2	5.5in. Telescopic Rod (AMBIT)
S1-S4	inc. ALPS Assembly (AMBIT)
LS1	8-16R (see text) 4.5in. x 2.5in. LS (AMBIT LS 8/2)

Tuner TOKO AT 3302UG.
16 pin DIL socket
Aerial Mountings.
Hook up wire.
Perspex for Dial Plate Scale.
Wood for case, aluminium sheet.
Vinyl cloth.
L/S grille.
1.25in. dia Drum Drive.
Drive cord.
3off 0.5in. dia. dial cord wheels.
Hardware etc, etc.

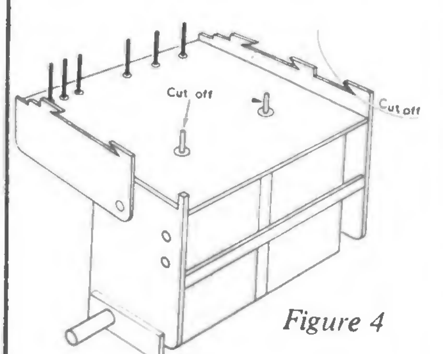


Figure 4

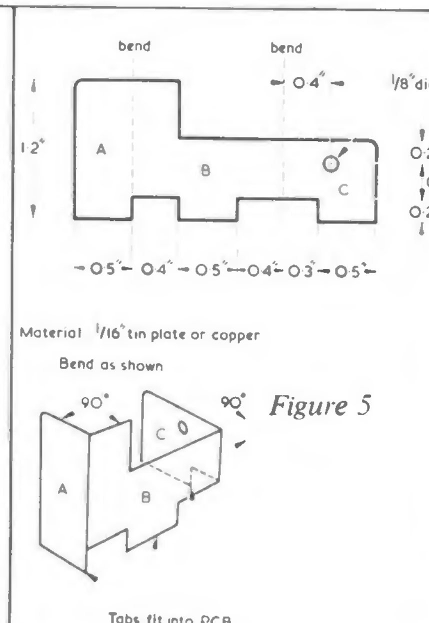


Figure 5

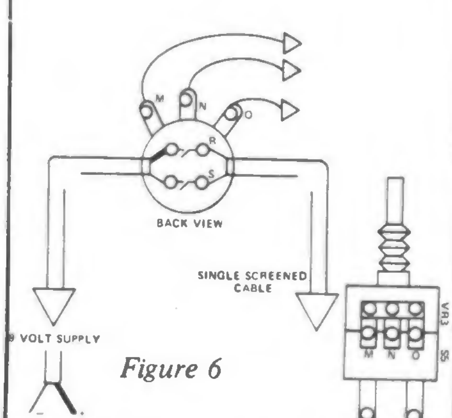


Figure 6

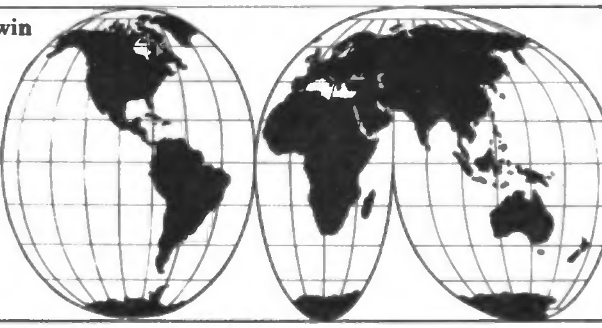
Figure 4: Modifications to the tunerhead

Figure 5: Support Bracket

Figure 6: Connections to the on/off switch

SHORT WAVE NEWS FOR DX LISTENERS

Frank A. Baldwin



All times in GMT, **bold figures** indicate the frequency in kHz.

As a hobby, short wave listening is, by its very nature, a lonely occupation. Most of us spend many hours per month ensconced in our dens, shacks, sheds or bedrooms, twiddling the receiver control knobs and hoping to log those elusive signals from far away places with strange sounding names. So lonely is the occupation of Dxing that many must give up the hobby on this score alone. Certainly many well-known Dxers have left the hobby soon after marriage - no doubt the bliss has been marred by the exit of hubby on his way to the shack for another long session of Dxing - hardly conducive to living happily ever after!

Those of us that survive the female onslaught seek some solace in joining one of the several short wave clubs that exist today. In doing so, one becomes once again a member of the human race.

I sometimes receive requests for information about short wave clubs and a recent enquiry has reminded me to pen these few lines.

For broadcast band listeners probably one of the very best clubs is the Danish Short Wave Club International. Their monthly journal *Short Wave News* must be seen to be believed, it is packed from cover to cover with items of interest to the short wave listener and Dxer alike. It is almost entirely in English (99% I should think - most of the members reside here in the UK), it arrives regularly and on time. The Editorial Staff and Club Board are themselves Dxers.

The current membership fee is £7.00 and the UK address is c/o N.R. Green, 14 Marsden Road, Blackpool, Lancs. FY4 3BZ.

Around the Dial

In which are listed firstly stations of interest to the short wave listener and secondly those transmissions which attract the attentions of the Dxer. All details are correct at the time of writing.

Switzerland

Berne on **6165** at 1837, a programme all about the clock and watch industry in the English transmission to Africa and Europe, scheduled from 1815 to 1845.

Berne on **21570** at 1935, a newscast in the French programme for Africa and Europe, schedule from 1930 to 2000.

Austria

Vienna on **6155** at 1841, at which time was heard a talk about the intake of foreign labour and the problems that followed, all in the English programme for Europe, the Middle East, South and East Africa, scheduled from 1830 to 1900.

France

Paris on **2195** at 1428, childrens choir and music in the French programme (a relay of the Domestic Service 'France Inter') beamed to North America and the Caribbean, scheduled from 1200 to 1715 on this channel.

West Germany

Cologne on **21500** at 1110, pop music in the English programme for Central and East Africa, scheduled from 1045 to 1115.

Cologne on **21650** at 1655, male and female announcers with the Persian programme for the Near East and North Africa, scheduled from 1630 to 1720.

Qatar

Doha on **11730** at 1715, OM with station identification in Arabic, local-style songs and music, identification in English at 1719 together with address for reports. Testing on this channel from 1600 to 2000 at the present time.

United Arab Emirates

Dubai on **21655** at 1724, Arabic songs and music in a relay of the Domestic Service scheduled on this frequency from 1430 to 2050.

Turkey

Turkiye Polis Radyosu (Turkish Police Radio) on **6340** at 1809, OM in Turkish, the schedule being from 0500 to 1100, 1200 to 1600 and from 1730 to 1900.

Clandestine

The Voice of Lebanon on **6550** at 1813, dance music Euro-style, YL with station identification and announcements in English at 1816. This is the transmitter of the Christian controlled Lebanese National Movement.

Australia

Melbourne on **21680** at 0610, a football commentary in the English programme for Africa, scheduled from 0400 to 0630, then to Europe only until 0930 on this frequency.

Canada

Montreal on **21630** at 1928, interval signal, OM with station identification and the English programme for Europe, scheduled from 1900 to 1930 (1900 to 2000 on Saturdays and Sundays).

New Zealand

Wellington on **17860** at 0345, musical comedy songs and music, OM announcements in English. The schedule on this channel is from 2115 through to 0640 mostly in English, being a relay of the Domestic National Programme to the Pacific Islands.

Society Islands

Tahiti on **15170** at 0340, Polynesian songs and melodies in typical style followed by announcements. The schedule is from 1600 to 0800.

South Korea

Seoul on **7550** at 1955, OM with a newscast in the Arabic programme for the Middle East, scheduled from 1930 to 2000.

China

Radio Peking on **11600** at 1631, OM with the news in the English programme for East and South Africa, scheduled from 1600 to 1700.

South Africa

Johannesburg on **21535** at 1615, OM with a news commentary in Swahili - complete with recorded statements in English by local politicians - to Kenya, Uganda and Tanzania, scheduled from 1600 to 1700.

Saudi Arabia

Riyadh on **21505** at 1940, drama in Arabic, OM with station identification in Arabic at 1947, songs and local music.

Netherlands Antilles

Bonaire on 21640 at 1705, OM with a newscast in the Arabic programme for the Middle East, North Africa and Europe, scheduled from 1630 to 1720.

Bonaire on 21685 at 1935, YL with a review of world news in the Dutch programme for central and North West Africa and Europe, scheduled from 1930 to 2020. Both of these transmissions are relays from the Lopik (Netherlands) transmitter.

Mexico

XERMX Mexico City on 15430 at 0300. YL with station identification in Spanish. OM with announcements, local-style music. YL with full identification again at 0316, sign-off at 0335. The schedule of the External Service is from 2000 to 0330 on this channel.

Ecuador

HCJB Quito on 21480 at 1942, YL with the English programme for Europe, scheduled from 1900 to 2000. Mostly letters from listeners and prayers.

La Voz de los Caras, Bahia de Caraques, on 4795 at 0108, rousing choral song by a male voice choir, military music, OM and YL with announcements in Spanish. This one operates from 1100 to 0430 (Sundays until 0200, Fridays until 0500) and the power is 3kW.

Radio Popular, Cuenca, on a measured 4801 at 0435, OM pop song in Spanish, OM announcements. The schedule is from 1000 to 0530 and the power is 2kW. The frequency can vary from 4800 to 4802 and this one is best heard after Radio Lara (Venezuela) on 4800 signs off at 0400.

Colombia

La Voz del Cinaruco, Arauca, on 4865 at 0119, OM with announcements and station identification, frequent mentions of Colombia. The schedule is from 0900 to 0330 and the power is 1kW.

Ondas del Meta, Villavicencio, on 4885 at 0121, OM with a commentry in Spanish about a local sporting event - all exciting stuff! The schedule is from 1000 to 0500 but the closing time is variable and can be as early as 0415. The power is 1kW

Brazil

Radio Borborema, Campina Grande, on 5025 at 0132, a programme of local pops, OM announcer in Portuguese. The schedule is from 0800 to 0300 and the power is 1kW.

Radio Aparecida, Aparecida, on 5035 at 0135, OM with a ballad about being lovelorn, poor chap! The schedule is from 0900 to 0300 and the power is 2.5kW.

Radio Cultural do Para, Belem, on 5045 at 0137, OM with a sporting commentary in Portuguese. The schedule is from 0900 to 0300 (variable closing time) and the power is 10kW.

more fun than a vcr ?

R&EW 'persons' have been fans of the Sony ICF 2001 synthesised portable receiver ever since one of us brought one of the first examples made back from Hong Kong in April 1980. We are saving a review of this amazing radio until we have cleared up a couple of technical points with Sony - and the sets become more readily available in the shops - but on the whole, the four sets we have been using have shown just how easy it can be to join the ranks of short wave listeners.

Just tap in the numbers, and press the execute button. Purists may lament the passing of the delicate art of translating the peculiarities of the calibration of the dial, and fondly tracking the tuning as the local oscillator drifts aimlessly around....

We shall be carrying out a lengthy review of this very significant receiver, (together with a circuit analysis), in a future issue. Meantime, we recommend that £160'ish that it costs is remarkable value for money.

Paraguay

Radio Nacional, Asuncion, on 6025 at 0157, OM with an exciting sporting commentary in Spanish but later almost blotted out by Budapest opening in English to North America at 0200. The schedule is from 1000 to 1800 and from 2100 to 0300. The power is 5kW

Honduras

La Voz Evangelica, Tegucigalpa, on 4820 at 0410, OM with a talk in English about religious affairs, choir with hymns. The schedule in Spanish is from 1100 to 0300, the English schedule being from 0300 to 0500. The power is 5kW.

Peru

Radio Chinchaycocha, Junin, on 4860 at 0412, OM with pop songs in Spanish, guitar music, OM station identification at 0417 and again at 0419. The schedule is around the clock but on Tuesdays sometimes from 0800 to 0600. The frequency of this one is variable and goes up to 4865 at times. The power is 0.5kW.

Sao Tome

Radio Nacional de Sao Tome on 4807 at 1947, songs and music in typical style. The schedule is from 0530 to 2300 and the power is 10kW.

Tanzania

Dar-es-Salaam on 4785 at 1855, OM and YL alternate in Swahili in the National Service, scheduled on this channel from 0300 to 0700 and from 1430 to 2105. There is a programme in English from 1600 to 1845, all other programmes being in Swahili. The power is 50kW.

Angola

Luanda on 4820 at 1905, OM with a talk in Portuguese. Radio Nacional is on the air from 0430 to 0630 and from 1500 to 2400. The power is 10kW.

Gabon

Franceville on 4830 at 2118, OM with a talk in French. The schedule is from 0430 to 0630 and from 1630 to 2300. The power is 20kW

Mauritania

Nouakchott on 4845 at 2124, OM with a song in Arabic. The schedule is from 0600 (Sundays from 0800) to 0900 and from 1758 (Sundays from 1700) to 2400. The power is 100kW.

Nigeria

Kaduna on 4770 at 0410, OM with announcements in English, drums then a programme of local pop on records in response to requests from listeners. This is the Home Service operating here from 1600 to 2320 (reportedly). The power is 50kW.

Benin

Cotonou on 4870 at 0421, local-style music, songs in vernacular in the Home Service, scheduled from 0415 (Saturdays from 0550) to 0800 and from 1300 to 2400 (Sundays from 0415 through to 2400). The power is 30kW and the 2400 closing times are variable.

VHF

The FT29OR
Warning: reading this brief review may seriously damage your Access statement.

The floodgates on the new generations of multimode portable transceivers are just about cranked wide open. Having achieved a healthy coverage with FM only equipment, the cunning Oriental hordes have now come up with the most irresitible offer yet laid before the avaricious gaze of the VHF amateur radio operator.

The FT29OR from Sommerkamp is the last word in 'to see it is to desire it' for the already innately acquisitive nature of the amateur radio enthusiast. And at £229.00 including VAT. Those of the **R&EW** staff who confess to being followers of the ham radio persuasion turned visibly green as the FT29OR was wheeled in briefly for the photo session.

In fact, the FT29OR was not allowed to go out the door, and the dealer who had originally called in with the object was persuaded into an on-the-spot deal. It's not true we blocked his car in the car park and refused to let him out, although if he wants the keys back, we want to see another FT29OR...

Revival Time

Despite its obvious popularity, the 144-146 MHz amateur band has been suffering from a surfeit of boredom just lately. It's not really surprising how rapidly the 2m enthusiast loses interest in operation on that band when faced with the CB-like concept of channellised 2m FM-only equipment. Channellised conversations and the 'cliques' of repeater users are a further deterrent to a long lasting affair with the band. Some of the HF bands can provide consistently new and invigorating experiences for the operators thereon, and thus never seem to lose their charm.

So the appearance of the FT29OR and its ilk are likely to breathe life in the band, and since it dashes all over the place in 100Hz increments (if required) in all modes of operation, the anarchic may be wishing it will chop up the regimental FM channelling system and return 2m to its former glory and interest. Those long last halcyon days before the 'turkeys' (a quaint expression favoured by our transatlantic cousins for operators with an IQ that vies with a Meson or Neutrino for the accolade of the smallest known particle in the universe) came to roost on the repeater stations. Do you remember when crystal controlled operators had to tune from 'high to low' to see what or who else was around?

There is little doubt that 2m FM has done the amateur radio retail trade a power of good (the same can't be said for our trade balance). The arrival of a local 2 metre repeater certainly tends to spur the amateur into getting tooled up for the job of 'nattering', so it is not surprising to note the contributions made to equipping the local repeater groups by the local equipment suppliers. But unless the operator has access to some other modes as well, then most of the fun of amateur radio is overlooked. Boredom is only a few QSOs (contacts) away.

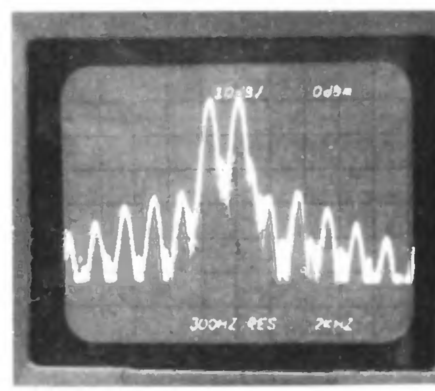
The FT29OR

From the LCD frequency readout, to the 10 channel memory, the FT29OR sets new standards for £229 rigs. It can handle any duplex frequency split, it has the obligatory 1750Hz toneburst for repeater access, and the C size NiCads (around 2 amp hour devices) provide a useful life span between charges. At 70mA on receive (which still seems rather a lot - **R&EW**'s 2m prototype receiver project only consumes 10-20mA) the batteries last a long time. Even with the occasional 800mA transmit burst.

The catches are not too severe. The mobile bracket is extra, the batteries are extra, the charger is extra - all to be expected, we suppose. A 10w mobile amp is available (the **R&EW** 2m amplifier in the next issue is also suitable, and gave around 20w when tried with this unit) and the self-conscious amateur might like to satisfy his constructive urge with a DIY version.

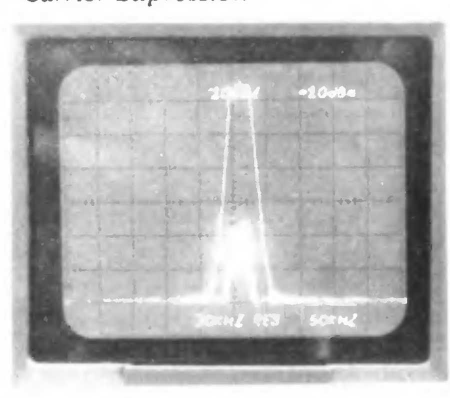
Such is the rush to get hold of these things, no English language manuals were available at the time of writing, although I am assured that they will be available when this piece appears. We expect to run a full review of this device in next month's issue, together with a detailed analysis of operation in the usual **R&EW** style.

Finally, as the editor knows all too well, mobile only equipment is rapidly becoming very uninteresting with the increasing number of thefts from cars. We even heard of one being removed from a car in a private garage the other week!! This easily transported style of equipment will certainly cause anyone to think twice before 'bolting' in bait for the local CB enthusiasts.



3rd order IMD with two tone input.

Carrier Supression



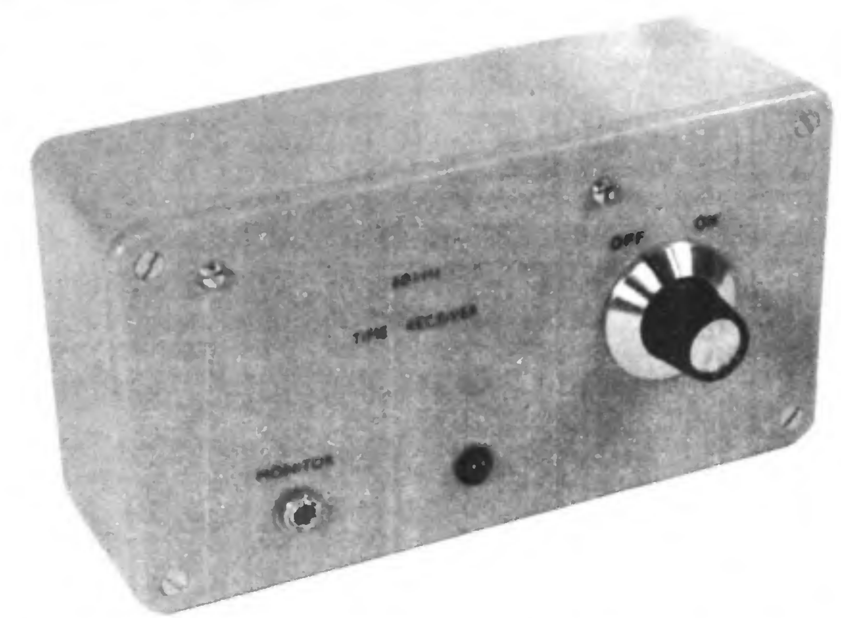
Our thanks to Peter Clarke of Arrow Electronics for being brave enough to venture into the building with this under his arm, and heroically accepting a TR7800 in exchange. If you want the car keys back Peter, you know what the deal is....

W.P.

60kHz Time Receiver

R. A. Penfold

The 'front end' of an MSF time code receiver system.



1. The 60kHz Time Receiver built into a plastic box, showing the audio and visual monitors and the on-off switch.

As many readers will know, there exists a number of highly accurate frequency and time standard transmissions, a well known example being the BBC's LW Radio 4 transmission. This has an extremely accurate carrier frequency which, at the time of writing is 200kHz.

Probably the most useful time standard transmission in Britain is the one transmitted at the very low frequency (VLF) of 60kHz from the Rugby MSF trans mitter. It is this signal that the receiver described here is designed to receive. Although the set was mainly built out of curiosity and for its interest value, it can be useful for checking the accuracy of clocks and watches.

The basic time signals are modulated onto the 60kHz carrier in the form of short breaks in the signal. The seconds are marked by 100mS (0.1 second) breaks in the carrier, and the minutes are indicated by 500mS (0.5 second) gaps. There are actually other signals modulated onto the signal, as will be explained in detail later. It is the beginning of the break in signal that indicates the precise time in both cases, incidentally.

The Circuit

Figure 1 provides the complete circuit diagram of the unit, which is a TRF (tuned radio frequency) type giving both an audio and visual output signal. A superhet circuit has no advantages in this application where only a single station at low frequency is to be received, and it would almost certainly need far more complcated circuitry and alignment to achieve the same level of performance.

Although ferrite aerials achieve far from optimum results at very low radio frequencies, such an aerial seems to give perfectly adequate pick-up of the 60kHz Rugby signal. L1 is in fact an ordinary LW ferrite aerial which is brought to resonance at the appropriate frequency by the higher than normal tuning capacitance provided by C1 and TC1. The latter is used to tune the receiver onto precisely the correct frequency.

The signal provided by the aerial is directly coupled to a Jfet common source amplifier using Tr1. The gate of Tr1 is biased to the negative supply rail by L1, while R2 and C2 are the source bias resistor and decoupling capacitor respectively.

The amplified signal developed across load resistor R1 is coupled by C4 to the input of a conventional high gain common emitter amplifier using Tr2. Due to the relatively low frequency of the input signal it is not necessary to use tuned circuit loads for Tr1 and Tr2 in order to obtain adequate gain from the unit. The low loading of the aerial tuned circuit by Tr1 and the low reception frequency also permit good selectivity to be achieved without having to use additional tuned circuits.

Stray feedback from Tr2 collector to Tr1 gate causes the circuit to oscillate (the feedback can be increased by the constructor in order to produce oscillation if the innate feedback is insufficient). The output from Tr2 is fed to an ordinary detector circuit comprised of C6, D1, D2, C9, and R6. This gives a heterodyne note equal to the difference in the frequencies of the incoming signal and that at which the circuit is oscillating. In practice the receiver is adjusted to give an output tone of a few hundred Hertz.

This audio tone is coupled to an audio amplifier by way of an RF filter using R5 and C5, and DC blocking capacitor C7. The additional RF filtering is necessary as violent instability could easily occur if an RF signal of significant strength were to break through to the output of the audio stage.

The audio stage is a conventional common emitter amplifier using pnp transistor Tr3. C8 rolls off the high frequency response of this stage so as to further reduce the risk of instability ocurring. Some of the output from Tr3 collector is taken to a 3.5mm jack socket (SK1), and the audio signal can be monitored by connecting a crystal earphone to this socket. Note that a magnetic earphone or headphones cannot be used with this set. Of course, the breaks in the signal caused by the modulation can be heard as gaps in the output tone of the appropriate lengths.

Part of the output from Tr3 collector is coupled to a rectifier and smoothing circuit consisting of C10, R10, D3, D4, and C11. When the output tone is present a strong positive bias is developed across C11. This switches on Tr4, causing its collector voltage to fall to a very low level. This results in Tr5 being cut off, and LED indicator C5 cannot light up, as Tr5 passes no significant collector current.

During the breaks in the carrier wave when there is no output tone from Tr3, the bias across C11 very quickly decays and Tr4 switches off. Tr5 is then biased on by the base current it receives through R11 and R12, causing D5 to switch on. The timer marker signals are therefore indicated by a break in the tone from the earphone, and a flash from the LED indicator.

S1 is the only control in the circuit, and is the on/off switch. The current consumption is about 3mA, rising to about 9mA during the periods when D5 is switched on. This gives good battery life from even a small type such as a PP3.

Construction

A 150 x 80 x 50mm plastic box makes a good casing for the unit, although any non-metallic case of about this size should also accommodate the unit satisfactorily. Metal cases are unsuitable as they would screen the ferrite aerial and prevent the radio signal from being picked-up. The simple layout used on the prototype can be seen from the photographs, and the precise layout is not especially critical.

Most of the components are wired onto a stripboard panel, the only exceptions being S1, SK1, D5 and the battery. A 0.1in. matrix board is used, and it has 18 copper strips by 36 holes. The component layout is shown in *Figure 2.* Start by cutting out a board of the required size using a hacksaw and then drill the two 6BA clearance mounting holes, as well as the mounting hole for the ferrite aerial which is also drilled for 6BA clearance (3.3mm diameter). The six breaks in the copper strips are then made, after which the components can be soldered into position.

The ferrite aerial is mounted in a special clip which is fixed to the board by means of a 6.3mm 6BA screw and fixing nut. There are actually two windings on the aerial coil, the tuned winding and a low impedance coupling coil. The coupling coil is not needed in this application and is ignored. There is a red dot on the aerial coil and the tuned (used) winding connects to the tags either side of this dot. The coil is slipped about 40 to 50mm onto the ferrite rod and then either glued or taped into place. TC1 is mounted directly onto the aerial coil, and should be mounted with its adjusting screw uppermost so that it can readily be adjusted.

Once the component panel has been completed it can be fitted into the case, although the small amount of point to point wiring must be completed before it is finally installed.

Adjustment

After giving the unit a thorough check for mistakes, connect a crystal earphone to SK1 and switch on. By adjusting TC1 there should be no difficulty in locating the Rugby MSF transmission, as there are few stations within the tuning range of the unit. Other stations are completely different from the MSF time transmission and are not easily confused with it.

If the RF circuitry fails to oscillate, an audio tone will not be heard as the set is tuned to the Rugby transmission, and there will simply be a change in the background noise level as the carrier switches on and off. Placing the non-earthy lead (which connects L1 and TC1 to the component panel next to the casing of Tr2 should increase the feedback to the point at which oscillation occurs and the heterodyne tone is produced.

With TC1 adjusted to bring the frequency of oscillation to 60kHz, there will be no difference between the frequencies of the two signals, and thus no audio output tone. Adjusting TC1 slightly either side of this setting should produce the tone and give reliable operation of the LED indicator.

A middle audio frequency of about 200 to 800Hz gives best results, as a lower tone can give unreliable operation due to the RF circuitry tending to lock onto the incoming carrier's frequency. Higher frequencies give a reduced audio signal level and may therefore be inadequate to operate the LED driver circuitry.

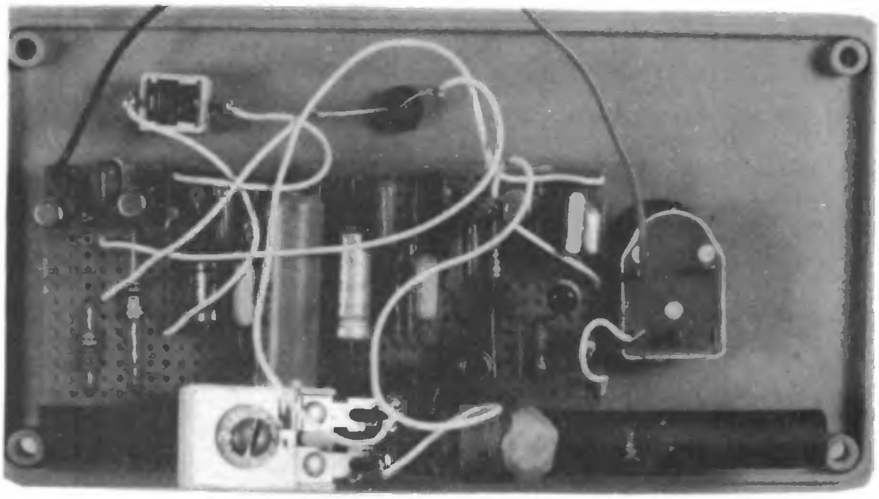
Time Signals

As mentioned earlier, the carrier is not only modulated with the minute and seconds marker signals, there are other modulating signals which can be a little confusing at first. One of these consists of a code which gives minute and hours identification, this accompanies each minute marker signal. This will be heard and seen as a rapid series of modulating pulses. These can be used to operate a digital clock circuit, but are of no significance here as the code cannot be decoded aurally or visually.

Sometimes the first few seconds markers after each minute marker will consist of a double pulse. This indicates the difference between the atomic time scale (which is the most accurate time scale and the one transmitted by the Rugby MSF station) and the time scale obtained using the rotation of the earth as the reference. This discrepancy occurs due to very small and unpredictable changes in the speed of rotation of the earth.

The double seconds marker signals immediately after the minute marker signals, indicate that the atomic time scale is behind the earth rotation time scale by an amount equal to 100mS (0.1 second) for each set of double pulses. For example, at the time of writing, the first two seconds markers after the minute markers, have an additional pulse indicating that the atomic time scale lags the earth time scale by 0.2 seconds. The time lag will never exceed 0.7 seconds.

If the atomic time scale is ahead of the earth time scale, the double seconds marker signals occur on the ninth, tenth, eleventh, etc. seconds markers after the minute markers. Again, each double pulse indicates a discrepancy of 0.1 seconds, and will be no more than 0.7 seconds. ■



2. Internal view of the authors' Time Receiver. The circuit could be built into any non-metallic enclosure.

Components

Resistors.
All are miniature .25 watt 5% (10% over 1 Meg.)

R1	3.3k
R2	3.3k
R3	3.3k
R4	1.2Meg.
R5	18k
R6	12k
R7	390 ohms
R8	1.8Meg.
R9	4.7k
R10	5.6k
R11	100k
R12	100k
R13	1k

Capacitors.

C1	1nF polystyrene
C2	47nF type C280
C3	100mfd 10V
C4	10nF type C280
C5	22nF type C280
C6	47nF type C280
C7	47nF type C280
C8	470pF ceramic plate
C9	10nF typeC280
C10	4.7mfd 10V
C11	100nF type C280
C12	470mfd 10V
TC1	500pF mica compression trimmer

Semiconductors

Tr1	BF244B
Tr2	BC239, BC109
Tr3	BC309, BC179
Tr4	BC239, BC109
Tr5	BC239, BC109
D1	0A91
D2	0A91
D3	0A91
D4	0A91
D5	TIL209 or CQY40L

Switch
S1 SPST rotary, slider, or toggle type

Inductor
L1 LW antenna coil type LWC1 on 9.5mm FRA ferrite rod about 140mm long with mounting clip (Ambit)

Miscellaneous
Plastic case measuring about 150x80x50mm
3.5mm jack socket (SK1)
Stripboard panel.
Panel holder for D5.
Crystal earphone with 3.5mm plug.
Control knob.
PP3 battery and connector to suit.
Wire, solder, etc.

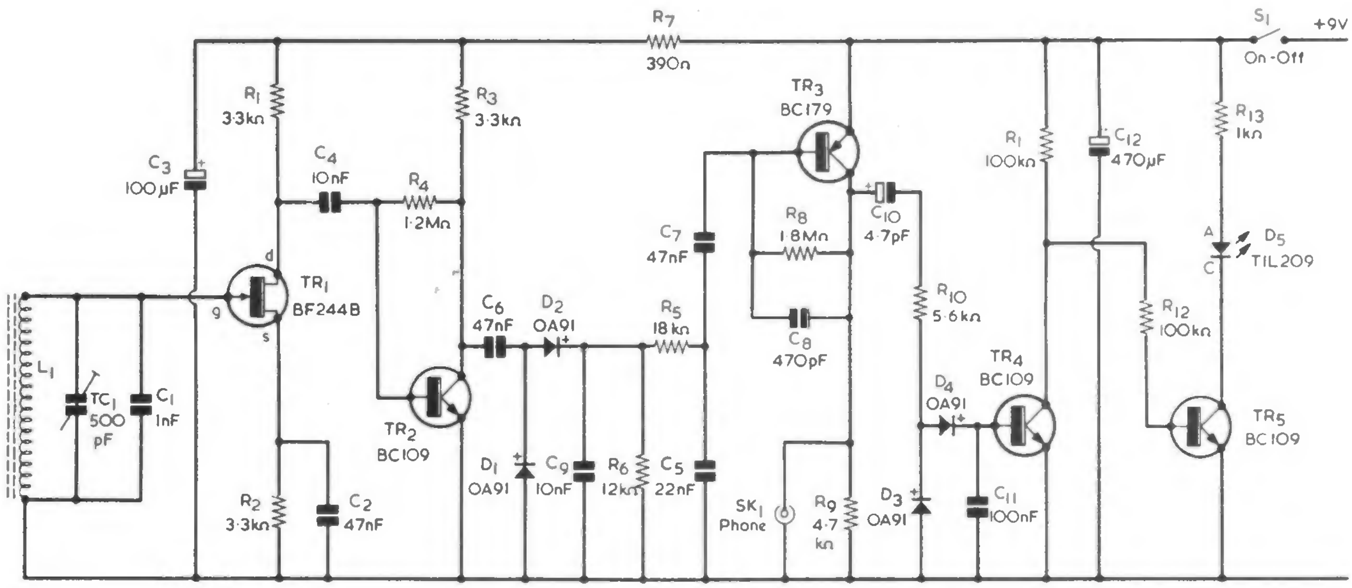
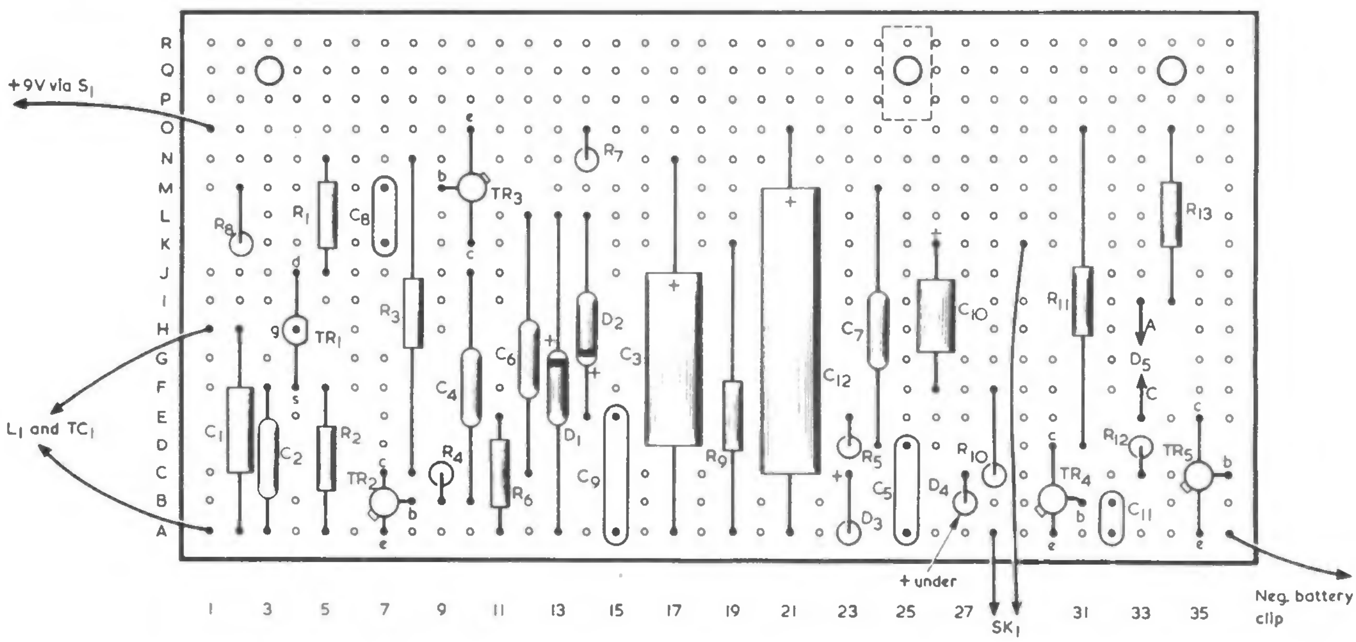

R7
390Ω
S1
+9V
On-Off
R1
3·3kΩ
R3
3·3kΩ
TR3
BC179
R13
1kΩ
R1
100kΩ
C12
470μF
C3
100μF
C4
10nF
R4
1·2MΩ
R8
1·8MΩ
C10
4·7pF
C7
47nF
A
D5
TIL209
C
TR1
BF244B
C6
47nF
D2
OA91
R5
18kΩ
C8
470pF
R10
5·6kΩ
R12
100kΩ
L1
TC1
500
pF
C1
1nF
TR2
BC109
D1
OA91
C9
10nF
R6
12kΩ
C5
22nF
D4
OA91
TR4
BC109
TR5
BC109
R2
3·3kΩ
C2
47nF
SK1
Phone
R9
4·7
kΩ
D3
OA91
C11
100nF

Figure one:


+9V via S1
L1 and TC1
Neg. battery
clip
+ under
SK1
R7
TR3
R8
R1
C8
R3
TR1
C4
C6
D2
C3
C12
C7
C10
R11
D5
C1
C2
R2
TR2
R4
D1
R6
C9
R9
R5
C5
D4
R10
D3
TR4
R12
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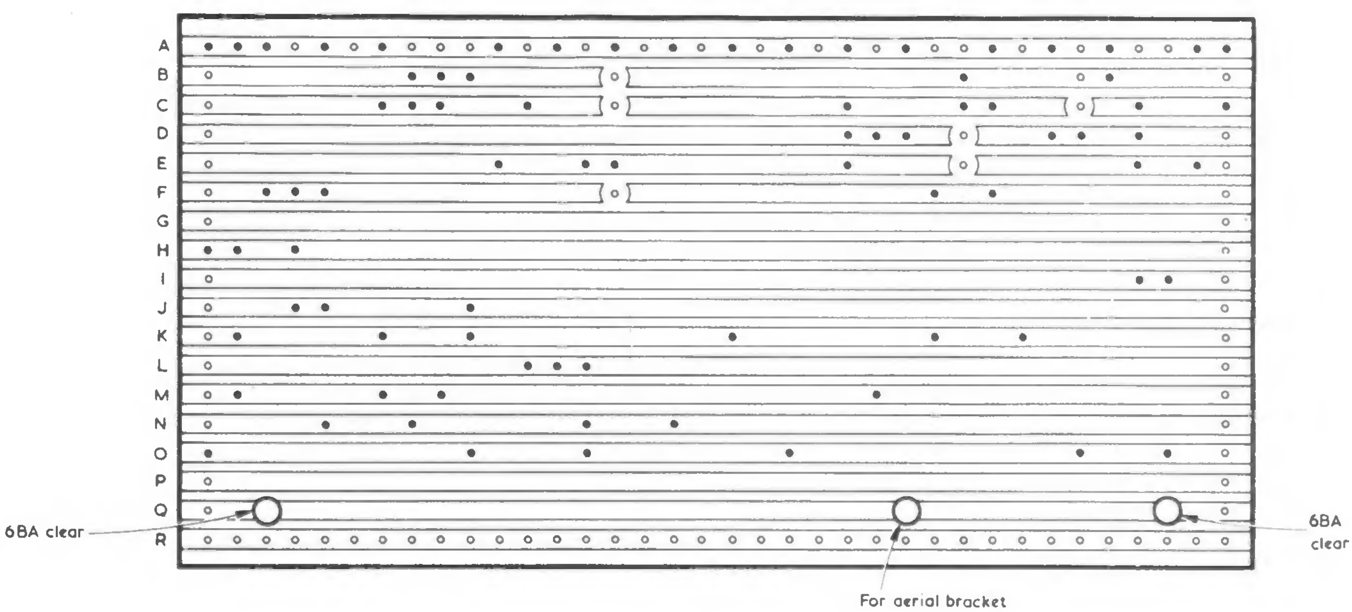
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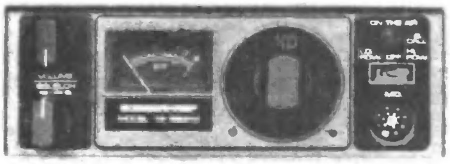

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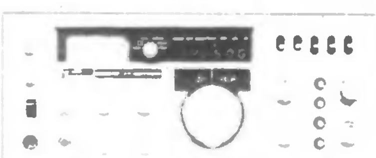

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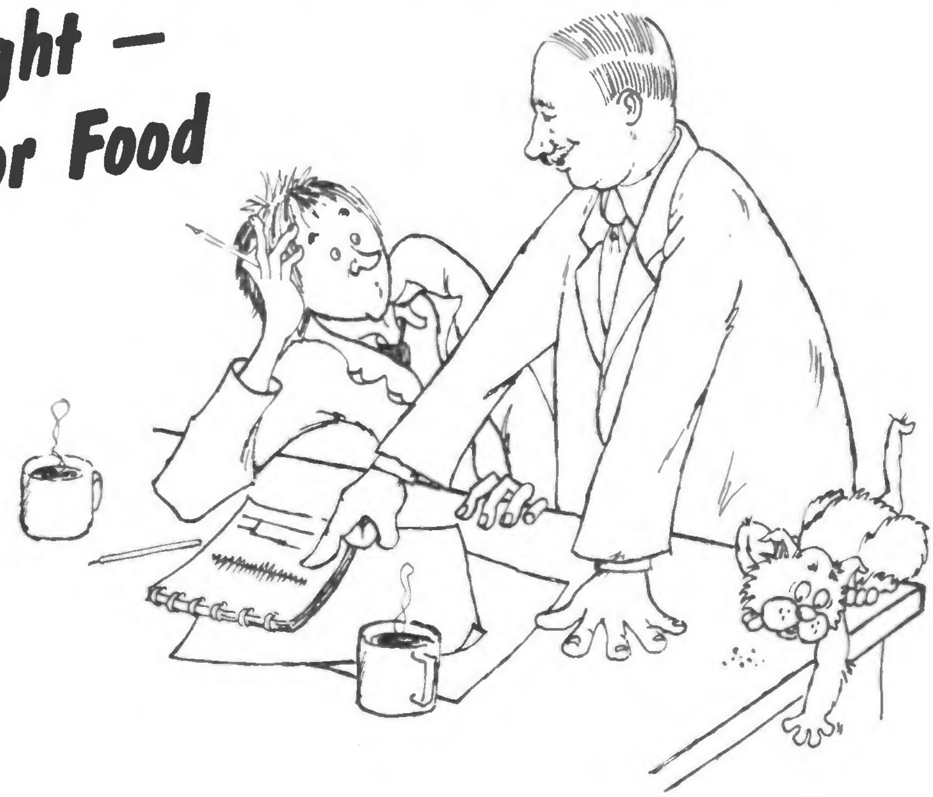


The Workshop door crashed open, "Hi Smithy, I'm back," announced Dick.

"Mind the wet paint behind the door," called Smithy from behind a gleaming new steel rack.

Dick froze in amazement at the sight of the newly refurbished Workshop.

"What happened — who — why did you do this to the old place?" stammered Dick.

"Oh, just thought it was about time we had a bit of a facelift." said Smithy with a nonchalance he found hard to maintain as he emerged from behind the new rack. In fact Smithy couldn't suppress a proud smile. He had wondered how Dick would react to the complete new revamp of the layout.

"I thought I'd take the opportunity to put up a lick of paint while you were on holiday," he said. "By the way, how was your holiday? Paignton again was it?"

But Smithy's attempt at a conversational diversion was missed by Dick who was slowly taking in all the changes in the Workshop.

Fresh paintwork, new racks, plastic floor covering over the old time-worn concrete - even the benches had been revarnished.

"Well I'll go to the foot of our stairs" muttered Dick. "You've even cleaned the windows." Dick collapsed onto the new stool beside his bench.

"And don't break that one!" exclaimed Smithy pointing to the stool.

"A chap I know broke three office chairs in two weeks," muttered Dick absent mindedly. He was still taking in the changes and improvements made by Smithy.

"How long did this take, and how many thousands did it cost?" he asked, with his usual tendency to over-statement. There was even a new multimeter on his bench with a *straight* pointer.

"Well it didn't exactly cost a pools win," said Smithy. "But I hope I won't have to spend out on new stools again for a while," he added pointedly. "Still the Workshop needed a spruce up," Smithy paused and added his other bit of news. "And it did the trick, we've got the service contract I was after — and they want us to try our hand with some of their more general electronics repairs."

"All this and that new contract" chuckled Dick and with an exagerated sweep of his arm to encompass the refurbished workshop he said grandly, "The Beginning of the World..."

"Where is that quote from?" laughed Smithy pleased at Dick's enthusiasm.

"I dunno," muttered Dick, "I think I saw it in an advert." He shrugged off his old anorak and dumped it behind the door.

"Not there!" cried Smithy quickly. "Use one of the hooks I've put up." He pointed to two new coathooks on the wall alongside one of the new racks. "The cat will have to find something else to sleep on," Smithy added wryly.

Dick paused beside the empty rack. "Where's the 'Repairs In' stuff?" he asked.

"I cleared it up before starting to re-decorate," explained Smithy. "Don't worry there's plenty to do today.

Dick looked around the bright workshop again. "Well who'da thought it," he murmured. And then he saw the new teapot. "Cripes! What's that?" he exclaimed pointing to the bright new addition to the tea things.

"It's an electric teapot" replied Smithy.

"A what?"

"It's an electric teapot," repeated Smithy. "It's meant for offices and small firms. You boil the water in it and when it switches off you put in the tea to brew."

Dick peered suspiciously at the wide-necked chromium plated utensil.

"You kidding?" he queried.

"No," chuckled Smithy. "I saw it in a colour supplement among the gimmicky waffle makers and electric tooth brush offers, and when the teapot fell off the handle..."

"Eh?" laughed Dick, "Don't you mean..."

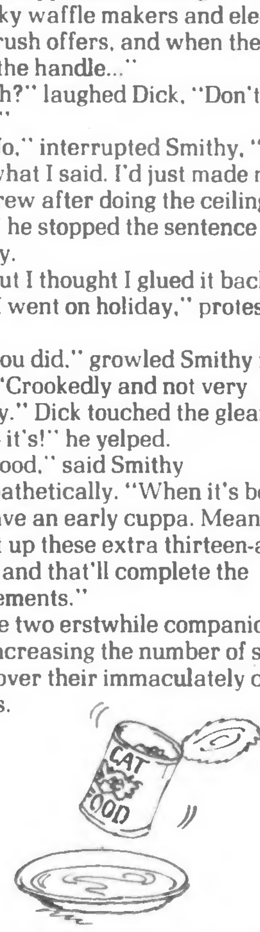
"No," interrupted Smithy, "I meant what I said. I'd just made myself a fresh brew after doing the ceiling, when crash!" he stopped the sentence abruptly.

"But I thought I glued it back on before I went on holiday," protested Dick.

"You did," growled Smithy in mock anger, "Crookedly and not very securely." Dick touched the gleaming pot "Ouch - it's!" he yelped.

"Good," said Smithy unsympathetically. "When it's boiled we'll have an early cuppa. Meanwhile let's put up these extra thirteen-amp sockets and that'll complete the improvements."

The two erstwhile companions set about increasing the number of socket outlets over their immaculately clean benches.



Then with eight sockets over each bench, cups of tea in their hands and the kitten's saucer filled with milk nearly to overflowing by the over-enthusiastic Dick, they stood back to admire their bright new domain, each lost in his own thoughts.

"Plenty of tea in that thing," remarked Dick approvingly.

"It was either that or a 'Baby Burco'," answered Smithy. "But I can't imagine anyone making tea from one of those!"

"S'pose not," grunted Dick.

Silence fell for a few moments, while they watched Tracker the Kitten sniff the milk and then slowly turn and walk away from it.

Then, "Going to evening classes tonight?" asked Smithy.

"S'pose so," grunted Dick.

"You don't sound too keen," remarked Smithy. "Where's the enthusiasm of last year?"

To Tracker's obvious interest and approval Smithy started to open a tin of cat food.

"It's all getting too hard," Dick said morosely. "I don't think its my scene any more."

Not being one to accept Dick's moods too easily, Smithy challenged him. "Perhaps you're simply fed up having just returned from holiday?"

"No," said Dick. "Old Johnson says the first topic this year will be modulation. Probably start with amplitude modulation. I could follow the maths - I think," he added, "but I can't see how the modulator actually *does* it."

"You mean produce an amplitude modulated carrier wave?" queried Smithy, and added "Well let's try going back to first principles."

Smithy stopped winding the tin opener, took a pencil from his top pocket and picked up the notepad. "If you put a signal into a simple two resistor circuit, you get a fraction of the signal out of one of them."

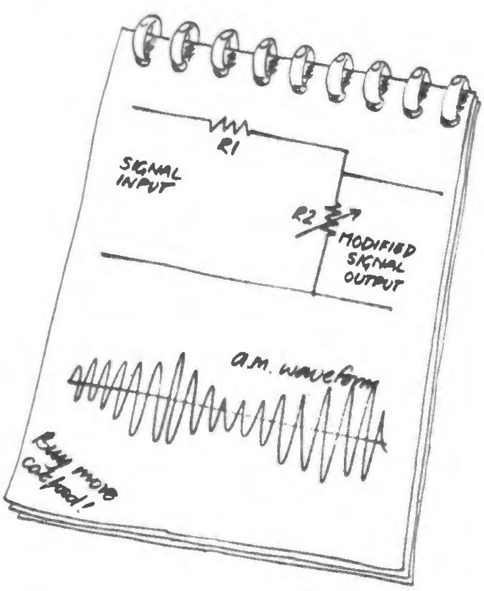
Smithy sketched on the pad to illustrate his point.

"The output is proportional to the resistor values."

"Now what happens if you vary R2 -say if it was a 'pot'?"

"The output will vary," answered Dick.

"Right," continued Smithy. "So the output will increase and decrease with the changing resistor value - like this." Smith sketched a squiggle to represent a signal getting larger and smaller. "And that's an amplitude modulated waveform," he finished with a flourish.



"But no," protested Dick disbelievingly, "Surely you need non-linear mixers or something."

"Non-linear mixers *will* produce am," said Smithy, "but any circuit which produced a 'product' term could act as a modulator. In a simple resistor circuit the voltage is the product of the current and resistance, you know, E equals IR. So if a carrier frequency current is passed through the resistor and the resistance is varied at the modulating frequency, then the resulting voltage is varied in amplitude -and that's amplitude modulation."

Dick frowned. "OK, so you can waggle a pot up and down but how could you change the resistance quickly?" he mused.

"A light dependent resistor might follow low frequencies," answered Smithy thoughtfully.

"How about a carbon microphone!" exclaimed Dick suddenly.

"Excellent" chuckled Smithy. "That would do it perfectly."

"Dick grinned broadly, pleased with his flash of inspiration. But then his brow furrowed as he thought for a moment and queried, "But doesn't an am wave have 'new frequencies' or something? And anyway what is all this business about non-linear mixers?"

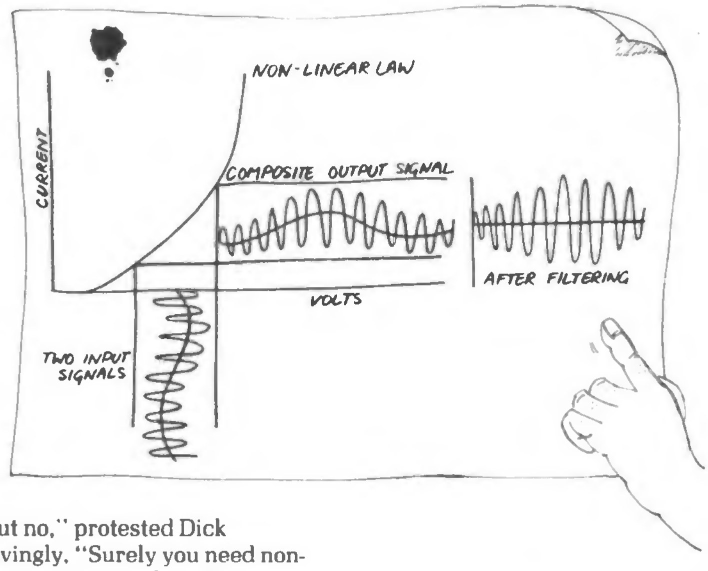
"OK" said Smithy resignedly, "Let's take a look at the usual mixer technique." Smithy paused and pointed to his first sketch.

"All we need to do is effectively to vary a resistance."

"Now," and Smithy paused to add significance to his words, "The effective resistance of a non-linear device depends on the instantaneous voltage across it, or the current through it."

"Ah yes," said Dick slowly, dimly remembering a recent session with Smithy about non-linear resistors.

Smithy was quickly drawing a sketch on a sheet of paper, "We're not talking about resistors as such" said



Smithy quickly. "They're too slow for our purpose. No - look at this current and voltage relationship for a simple diode. It shows how the resistance varies depending on the applied voltage or current."

"Blimey," muttered Dick. "What price ohms law?"

"That's just the point" persisted Smithy. "It *does* obey ohms law at any instant, and at any point on the graph. It's just that it's resistance varies all the way along the curve. As the voltage increases here," and Smithy pointed to the X axis, "So the current increases as you'd expect - but it increases quicker -or further - than if the resistance were constant."

"So its non-linear," said a bemused Dick, "But what use is that?"

"Well if you pass two currents through a normal resistor they act almost independently, so the instantaneous voltage is simply related to the instantaneous sum of the two currents, but here," and Smithy pointed to his sketch "You can think of it as one signal causing the instantaneous resistance value to vary..."

"Just like the sound varies the

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Size approx. 4'x 2' x 2'6" high. These were made for hard work, the top being formica covered. Suitable for housing instruments or for use as office desks. Beautifully made, these cost over £100 each, our price only £11.50 each, however, you must arrange to collect.

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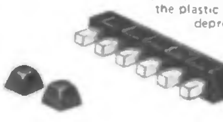
Very strongly made (ply-wood sides with hard board top and bottom). This is black grained effect, vinyl covered, very pleasing appearance. Internal dimensions 12½" long, 4" wide, 6" deep. Ideal for carrying your multi range meter and small tools and for keeping them in a safe place. **£2.30.** Post paid if ordered with other goods, otherwise £1.00.

ROPE LIGHT

4 sets of coloured lamps in translucent plastic tube arranged to give the appearance of a running or travelling light. With variable speed control box, ideal for disco or shop window display. Complete, made up, ready to plug into mains. £36.00 + £2 post.

COMPUTER KEY SWITCHES (make your own keyboard)

These are for making up on a p.c.b. and consist of a vertical mounting computer type reed switch, which makes circuit when a magnet passes over it. The magnet is located in the plastic plunger which in turn is depressed by a push rod, to which the legended top is fixed. These are made up in banks of 6, price £2.30 per bank of 6 (including tops)

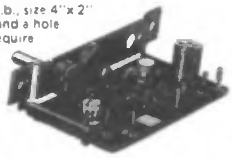


OUR CAR STARTER AND CHARGER KIT has no doubt saved many motorists from embarrassment in an emergency you can start car off mains or bring your battery up to full charge in a couple of hours. The kit comprises: 250w mains transformer, two 10 amp bridge rectifiers, start/charge switch and full instructions. You can assemble this in the evening, box it up or leave it on the shelf in the garage, whichever suits you best. Price £11.50 + £2.50 post.

GPO HIGH GAIN AMP/SIGNAL TRACER. In case measuring only 5¼in x 3¼in x 1¼in is an extremely high gain (70dB) solid state amplifier designed for use as a signal tracer on GPO cables, etc. With a radio it functions very well as a signal tracer. By connecting a simple coil to the input socket a useful mains cable tracer can be made. Runs on standard 4½v battery and has input, output sockets and on-off volume control, mounted flush on the top. Many other uses include general purpose amp, cueing amp, etc. **An absolute bargain at only £1.85.** Suitable 80ohm earpiece 69p.

MINI MONO AMP on p.c.b., size 4"x 2"

approx. Fitted volume control and a hole for a tone control should you require it. The amplifier has three transistors and we estimate the output to be 3W rms. More technical data will be included with the amplifier. Brand new, perfect condition, offered at the very low price of **£1.15 each, or 10 for £10.00.**



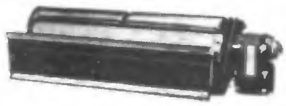
12V FLUORESCENT LIGHTING

For camping – car repairing – emergency lighting from a 12v battery you can't beat fluorescent lighting. It will offer plenty of well distributed light and is economical. We offer an inverter for 21" 13 watt miniature fluorescent tube. £3.45. (tube not supplied)

SUPER HI-FI SPEAKER CABINETS

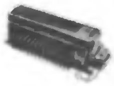
Made for an expensive Hi-Fi outfit – will suit any decor. Resonance free cut-outs for 8" woofer and 4" tweeter. The front material is carved Dacron, which is thick and does not need to be stuck in and the completed unit is most pleasing. Colour black. Supplied in pairs, price £6.90 per pair (this is probably less than the original cost of one cabinet) carriage £3.50 the pair.

TANGENTIAL BLOW HEATER



2.5 Kw quiet, efficient instant heating from 230/240 volt mains. Kit consists of blower as illustrated, 2.5 Kw element, control switch and data all for **£4.95**, post £1.50.

MOTORISED DISCO SWITCH



With 10 amp changeover switches. Multi-adjustable switches all rated at 10 amps, this would provide a magnificent display. For mains operated 8 switch model **£6.25**, 10 switch model £6.75, 12 switch model £7.25.

3 CHANNEL SOUND TO LIGHT KIT

Complete kit of parts for a three-channel sound to light unit controlling over 2000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two-tone metal case and has controls for each channel, and a master on/off. The audio input and output are by ¼" sockets and three panel mounting fuse holders provide thyristor protection. A four-pin plug and socket facilitate ease of connecting lamps. Special snip price is **£14.95** in kit form or **£19.95** assembled and tested.

THIS MONTH'S SNIP

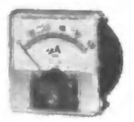
COMPUTER PRINTER FOR ONLY £4.95

Japanese made Epson 310 – has a self starting, brushless, transistorised d.c. motor to drive the print hammers, print drum – tape forward/reverse and paper feed.
Complete in module form with electronics including Printer Synchro Signal Amplifier & Printer Reset Signal Amplifier. Brand new and with technical and practical data. £4.95 post £1.25.
Data separately for £1.00.

EXTRACTOR FANS – Mains Voltage

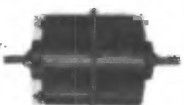
Ex-computer, made by Woods of Colchester, ideal as blower; central heating systems, fume extraction etc. Easy fixing through panel, very powerful 2,500 rpm but quiet running. Choice of 2 sizes, 5" £5.50, 6" £6.50, post £1 per fan.

100uA PANEL METER



Japanese made (Shinohara Electrical) so very good quality, these have a full vision front, are approx. 2" square and come complete with mounting studs and nuts. A thoroughly reliable instrument usually retailed at over £4, offered at a snip price this month of £2.85 or 10 for £25.00.

12v MOTOR BY SMITHS



Made for use in cars, these are series wound and they become more powerful as load increases. Size 3½" long by 3" dia. These have a good length of ¼" spindle – price £3.45.
Ditto, but double ended £4.25.

EXTRA POWERFUL 12v MOTOR

Made to work battery lawnmower, this probably develops up to ¼ h.p., so it could be used to power a go-kart or to drive a compressor, etc. etc. £6.90 + £1.50 post.

MINI-MULTI TESTER

Deluxe pocket size precision moving coil instrument, Jewelled bearings - 2000 o.p.v. mirrored scale.
11 instant range measures: DC volts 10, 50, 250, 1000.
AC volts 10, 50, 250, 1000.
DC amps 0 – 100 mA.

Continuity and resistance 0 - 1 meg ohms in two ranges. Complete with test prods and instruction book showing how to measure capacity and inductance as well. Unbelievable value at only £6.75 + 50p post and insurance.

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FREE OUR CURRENT BARGAIN LIST WILL BE ENCLOSED WITH ALL ORDERS.

TRANSMITTER SURVEILLANCE
Tiny, easily hidden but which will enable conversation to be picked up with FM radio. Can be made in a matchbox – all electronic parts and circuit. £2.30. (Not licenceable in the U.K.).

RADIO MIKE
Ideal for discos and garden parties, allows complete freedom of movement. Play through FM radio or tuner amp. **£6.90** comp. kit. (Not licenceable in the U.K.)

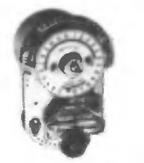
FM RECEIVER

Made up and working, complete with scale and pointer needs only a speaker, ideal for use with our surveillance transmitter or radio mike. £5.85.

CB RADIO –

Listen in with our 40-channel monitor. Unique design ensures that you do not miss sender or caller. Complete kit with case, speaker and instructions only £5.99.

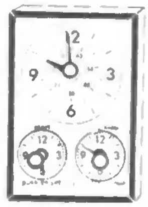
VENNER TIME SWITCH



Mains operated with 20 amp switch, one on and one off per 24 hrs. repeats daily automatically correcting for the lengthening or shortening day. An expensive time switch but you can have it for only **£2.95.** These are new but without case, but we can supply plastic cases (base and cover) **£1.75** or metal case with window **£2.95.** Also available is adaptor kit to convert this into a normal 24hr. time switch but with the added advantage of up to 12 on/offs per 24hrs. This makes an ideal controller for the immersion heater. Price of adaptor kit is £2.30.

STEREO HEADPHONES

Japanese made so very good quality. 8 ohm impedance, padded, terminating with standard ¼" jack-plug. **£2.99** Post 60p.



TIME SWITCH BARGAIN
Large clear mains frequency controlled clock, which will always show you the correct time + start and stop switches with the dials. Comes complete with knobs. **£2.50.**

SAFE BLOCK
Mains quick connector will save you valuable time. Features include quick spring connectors, heavy plastic case and auto on and off switch. Complete kit. **£1.95.**

6 WAVEBAND SHORTWAVE RADIO KIT
Bandspread covering 13.5 to 32 metres. Based on circuit which appeared in a recent issue of Radio Constructor. Complete kit includes case materials, six transistors, and diodes, condensers, resistors, inductors, switches, etc. Nothing else to buy if you have an amplifier to connect it to or a pair of high resistance headphones. **Price £11.95.**

SHORT WAVE CRYSTAL RADIO
All the parts to make up the beginner's model. Price **£2.30.** Crystal earpiece 65p. High resistance headphones (gives best results) **£3.75.** Kit includes chassis and front but not case.

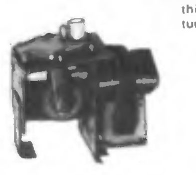
RADIO STETHOSCOPE
Easy to fault find – start at the arial and work towards the speaker – when signal stops you have found the fault. **Complete kit £4.95.**

INTERRUPTED BEAM
This kit enables you to make a switch that will trigger when a steady beam of infra-red or ordinary light is broken. Main components – relay, photo transistor, resistors and caps etc. Circuit diagram but no case. **Price £2.30**

MUGGER DETERRENT
A high-note bleeper, push latching switch, plastic case and battery connector. Will scare away any villain and bring help. £2.50 complete kit.

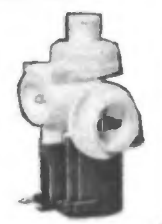
UNUSUAL MOTORISED PUMP

The motor is a normal ½" stack induction motor, mains operated. To the spindle is fitted a nylon worm drive, this considerably reduces speed and turns a nylon cog wheel to which is coupled a link operating a small bellows pump. The outlet and inlet to and from this pump are nylon pipes to which flexible tubing can be connected. Obviously, there will not be a big flow of air from this pump but quite considerable pressures can be developed.
Price £4.60 + 50p.



SOLENOID AIR VALVE

made to work with the above pump. This mains operated valve will stop the flow of air or gas when mains is applied to it. 220v - 230v model £3.45. 100v model £2.30.



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resistance of my carbon microphone," cried Dick excitedly," and that makes the current due to the *second* signal go all over the place!"

Smithy winced at Dick's phraseology but accepted that his companion understood the essence of the point he was making.

"OK," he said, "Look, while I tidy up this sketch, you pour out some more tea - there's plenty in that giant new pot thing."

While Dick replenished their mugs, Smithy hindered by the playful Tracker who had jumped up onto the bench to join them, redrew his curved graph with the addition of some signals.

"See this input signal," said Smithy. "It's what you get if you simply add two AC voltages, one high and one low frequency."

"Like waves on the sea," said Dick thinking briefly of Paignton.

"Right," said Smithy oblivious to Dick's reverie. "The instantaneous value is the sum of the instantaneous values of the two signals. But look what happens when this composite signal passes through our non-linear 'diode-law' circuit."

Dick bent forward to peer at the strange waveform emerging from the curved diode characteristic, and Smithy added, "The overall amplitude of the output is increasing and decreasing because the instantaneous resistance is increasing and decreasing according to the instantaneous value of the composite input signal."

"Oo-er - what a mix-up," chuckled Dick

"Exactly," finished Smithy. "And the mix-up includes a carrier signal which varies in amplitude. You can easily filter it out."

"Where do these 'new' frequencies come into it?" asked Dick suddenly.

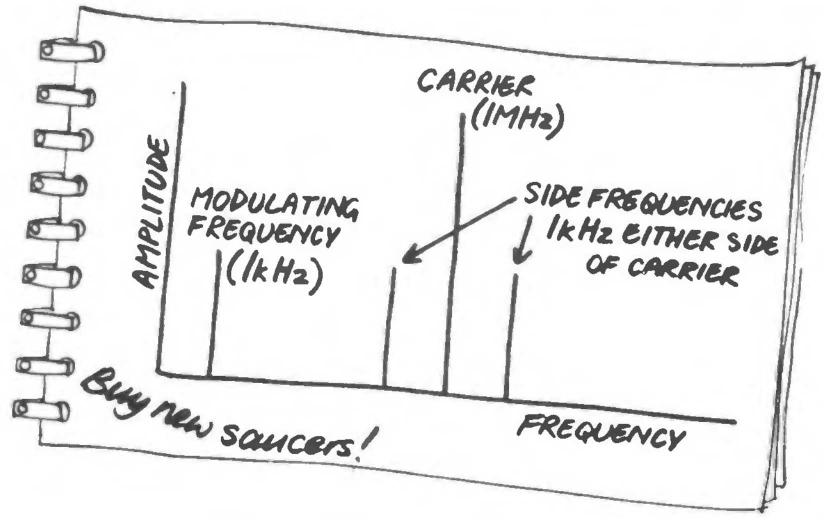
"What new... oh you mean the side frequencies," said Smithy.

"Well if you distort a sinewave you could say it is then made up of two or more sinewave signals."

"Ye-es," said Dick slowly as the name 'Fourier' floated slowly, but without any real meaning, from his memory.

"Well," said Smithy hurriedly to avoid further questions, "That is what we have here. We've changed the original signals with a regular or periodic distortion so we've created new frequency components in the output. If we hadn't then the output would be the same waveform as the input."

Dick nodded dumbly, and Smithy continued quickly, "If you had all these separate signals and simply added them together in a linear circuit you could produce this output," and Smithy pointed to the last part of his latest sketch.



"How many new frequencies are there?" asked Dick.

"Well that depends on the curve of this graph," said Smithy pointing to his 'diode law'. "Non-linear circuits will at least have a 'product' term so you will at least get your original signals plus a sum and difference frequency."

Smithy turned to a clean page on the notepad and sketched again, this time showing a frequency spectrum. "You see, if the carrier were 1MHz and the modulating signal were a single 1kHz tone, then you'd get at least these four frequencies, 1kHz, 1mHz, 999kHz and 1.00 1MHz Different non-linear laws will produce other frequencies as well but these are very high - or very low."

"So they get completely lost after the first tuned circuit," interjected Dick pleased with his own understanding.

"Well - yes," conceded Smithy slowly. "Let's say that a 10kHz wide filter centred on the carrier frequency will attenuate those 'unwanted' components."

But Dick was oblivious to Smithy's careful phrasing. "Could you make an AM wave using three sig. gennies?" he asked.

"Yes, if you could ensure correct phasing of the individual signals," replied Smithy, but further discussion was abruptly halted.

"Look out," yelled Dick as the ignored Tracker hungrily pawing at the partially open cat food tin, had toppled it over and the tin was rolling towards the edge of the bench. Before either service-man could move, it disappeared over the edge, crashed on the floor and flipped over the brimming saucer of milk. A miniature white tidal wave swept four feet across the floor, hit the wall and started to drain away under the edge of the new floor covering.

Pandemonium!

The spitting cat took refuge at the highest point, on top of a new rack, by way of Dick's anorak.

Smithy dived for a floor cloth, fearful of the smell of stale milk which would pervade their new environment for days to come.

Dick stepped forward to inspect the spreading puddle - and trod on the saucer.

Crack!

And now gentle reader, we shall leave the bright new haven of peace and learning, lest illusions, like saucers, be shattered.

We shall also avoid Smithy's somewhat pointed remark to his enthusiastic but accident prone assistant that before he tries putting three signals together to make a *modulated* carrier he should properly glue together three pieces of crockery to make a *milk* carrier!

BOOK REVIEW

CP/M PRIMER

by Stephen M. Murtha and Mitchell Waite

96 pages; 215 x 280mm; Paperback, spiral bound; 1980; ISBN: 0-672-21791-0; Published by Howard W. Sams & Co. Inc.

£7.75

CP/M is a trademark of Digital Research Inc. It is an operating system for 8080, 8085 and Z-80 based microcomputer systems. Its success lies in the fact that most producers of hardware and software have accepted it as a standard.

This book starts off with an introduction to hardware and software concepts. It tells the reader why it is necessary to have an operating system in the first place, and the functions it performs.

The second part of the book goes into detail about how to get CP/M up and running on a system. This does not include details for configuration of CP/M for a particular hardware setup. It is a practical introduction explaining what is to be done to enter CP/M after turning the computer on. This book therefore assumes that a version of CP/M has been bought which will run immediately on the reader's own system. This is not an unreasonable line to take, as I would advise all but experienced assembler programmers against modifying CP/M.

The third part describes the commands which are available once CP/M is running, e.g. How to make copies of the disk and individual programmes, so that even if the worst possible catastrophe occurs and the original meets with an unfortunate accident, such as being eaten by next door's dog, then all is not lost. This part also covers how to find the amount of room left on the disk and how much space each programme or file takes up in bytes.

Part four shows how to write a programme using the Editor, following with details of how to get the programme working, i.e. How to debug it, assemble it and load it to achieve a working programme. The problem of how to get the programme to do something useful is left, quite rightly, as an academic exercise for the reader.

The final part is a list of suppliers of software to run with or under CP/M. Unfortunately, most of the addresses are in the States. Even so one can see the wide range of software available under CP/M in the six pages of suppliers. Also there is a cut out programmers reference card, with a brief explanation of all the commands, this being extremely useful as the book is too big to put in one's pocket!

The book is well written, easy to follow, and very well illustrated with humorous pictures to put over a point. It is in complete contrast to the heavy reading, and not very easy to follow manuals provided by digital research with CPM. There are a few mistakes, a few points missed out and some topics only briefly mentioned. The only bad point about the book is the complete absence of documentation on error messages such as 'BDOS error on A:', and what they mean. These can cause a considerable amount of confusion intitially, nevertheless, they are covered in the digital research manuals and it is assumed in the book that the reader is familiar with hexadecimal and binary.

In conclusion, I wish I had had access to this book when I first started learning about CP/M. In spite of its faults it is an invaluable aid to all but the experienced user of CPM. There is probably no other book which will get a new user familiar with the basics of CP/M

Written by **Keith Meech** 02.07.81

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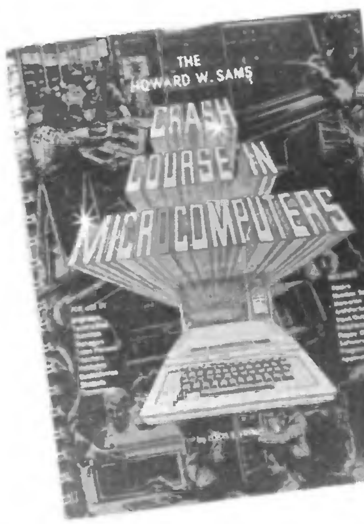
CRASH COURSE IN MICROCOMPUTERS

by Louis E Frenzel, Jnr.

1980; 264 pages; 215 x 280mm; Spiral bound.

£11.40

Because of its content and unique form of presentation, the reader is provided with a solid background in microcomputers quickly and effectively. This course, arranged as a series of lessons in a self-teaching format, featuring 14 units and 2 appendices that will teach the average 'consumer' - as effectively as the scientist with a PhD - how to deal with complete microcomputer systems. Each unit includes self-test review questions and answers.



DESIGN OF PHASE-LOCKED LOOP CIRCUITS - WITH EXPERIMENTS

by Howard M Berlin.

1978; 256 pages; 135 x 215mm; Paperback.

£6.45

The design of the basic PLL circuits is described; detector, phase comparator, and voltage-controlled oscillator circuits are detailed. Contains many practical circuits using the 560-series devices and the CMOS 4046 chip. With over 15 experiments.

Z-80 MICROCOMPUTER DESIGN PROJECTS

by William Barden Jnr.

1980; 208 pages; 280 x 215mm; Paperback.

£8.40

Even a beginner in electronics will enjoy constructing and operating the EZ-80 microcomputer, a project that requires surprisingly little time and money. The book is a solid introduction to the EZ-80 microcomputer and the remarkable chip, Z-80. Several EZ-80 application programs are included.

PRACTICAL RF COMMUNICATIONS DATA FOR ENGINEERS AND TECHNICIANS

by M F 'Doug' DeMaw.

1978; 256 pages; 135 x 215mm; Paperback.

£5.80

Communications engineers and technicians who need a practical reference of RF circuit design data will find that these five chapters of vital information have been compiled specifi cally for them. Subjects include ferromagnetic devices, networks for semiconductor circuits, transistor design basics, receiver design basics, and practical communications antennas. Each chapter contains an extensive bibliography.

6502 SOFTWARE DESIGN

by Leo Scanlon

1980; 272 pages; 135 x 215mm; Paperback.

£7.50

The 6502 integrated circuit is a very popular microprocessor that is currently being used in general-purpose micro-computers, video games, and personal computers. This material is presented to increase the reader's understanding of the 6502 integrated circuit. Fundamentals are first explained then more complex topics are gradually introduced in the nine information-packed chapters.

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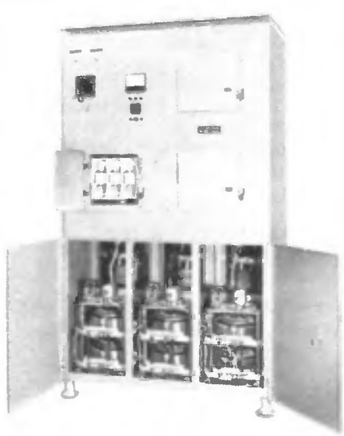
Why the need for a Voltage Stabiliser?

As microprocessor-based electronic technology is rapidly producing ever-more sophisticated products - in industrial and medical fields, for military and scientific research - then the growing need for an absolutely stable power supply becomes paramount.

And there's one company, more than any other, who are ideally qualified to supply the voltage stabilisers and control equipment so vital to ensure optimum and reliable performance of those advanced products, as well as communications, computers and process control.

Claude Lyons Limited. With 50 years experience in the highly specialised field of voltage and power control. An experience and expertise inherent in the design and manufacture of all our products, whatever their application - from our Series TS electro-mechanical stabilisers,



incorporating all silicon solid-state technology to simple low cost mains voltage compensators. From 850kVA 3-phase, down to 300VA single phase, all of which now incorporate transient absorbers.

Whatever the supply problem, there's sure to be a Claude Lyons stabiliser to fit the bill - in both technical and cost-effective terms.

And it's not difficult to see why we've become Europe's biggest and most renowned supplier.

Take, for example, our new Series VTR - Constant Voltage Transformers. They're ideal for a wide range of applications requiring low distortion and very fast response. The absence of moving parts ensures no maintenance. Therefore well-suited for computers, x-ray machines, photographic and medical equipment. In fact, for most equipment that is sensitive to voltage variations and spikes - where even the most instantaneous, minimal change of voltage could mean a memory bank wiped out or false reading of an electro-cardiograph machine. The Series VTR is just one of our vast and comprehensive stabiliser range.

Even with a grid system as advanced and reliable as the UK's peak time switching can have a detrimental effect on process-control equipment - especially in winter. It's obvious why stabilisers are increasingly becoming an integral part of modern installations.

And why Claude Lyons are the first-choice stabiliser supplier.

As well as stabilisers, we manufacture literally hundreds of voltage and power control products. Variable and fixed transformers, power rheostats, motor speed controls, fixed and variable resistors and load banks. All this from a one-source supply. With virtually everything from metal forming and finishing, to coil winding and final test achieved in-house.

And our second-to-none after sales service ensures a long lasting and reliable product life.

So now you know what made us Europe's current number one.

Write for our product guide, you'll see what we mean.

Claude Lyons Limited
Ware Road Hoddesdon Hertfordshire EN11 9DX
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Where advertisements offer any equipment of a transmitting nature, readers are reminded that a licence is normally required. Replies to Box Numbers should be addressed to: Box No..., **Radio and Electronics World,** 117A High Street, Brentwood, Essex.

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WIRELESS, VALVES, PRE-WAR ONWARD S.A.E. Modern bargains list 15p. Sole Electronics, (REC), 37 Stanley Street, Ormskirk, Lancs L39 2DH.

PRE-PACKED: Screws, nuts, washers, solder tags, studding. Send for price list. All Sales (RE), PO Box 402, London SW6 6LU.

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WANTED: FAX equipment manuals, service sheet, etc. G2UK, 21 Romany Road, Oulton Broad, Lowestoft, Suffolk NR32 3PJ.

PUSH BUTTON G.P.O. TELEPHONES. Saves you time and improves your image and efficiency. £35 + £2 P&P. Returnable if not satisfied. P D Electronics, 11 Bluebell Close, Orpington, Kent BR6 8HS.

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INTERESTED IN CB? Be the first in your street with the very latest receiver. It's legal and covers 2 CB bands, PB/WB and medium wave/AM/-FM/VHF aircraft and 2M ham. In fact everything you ever wanted in a radio. It's just arrived in England so it's not in the shops yet! Send cheque or PO for £24.50 inclusive.
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HIGH VOLTAGE FROM 9 VOLTS. This circuit will convert a low battery voltage into 450 volts or more. Applications include high voltage for neon display, geiger counters, strobes, etc. Supplied working and assembled. Price £3.95 plus 35p P&P. POs to P.D. Crisp, 32 Churchill Crescent, Wickham Market, Suffolk IP13 0RW.

COMMUNICATIONS RECEIVER BC348R. Ex-US army. £50 or offer. Wavemeter type D £5 or offer. Eddystone side operated key £10. Telephone: Maidenhead (Berks) 22902.

WANTED. High voltage gas discharge tubes, i.e. Tesla tubes, "Maltese Cross" tube, small gas discharge tubes, neons etc. to work from induction coil for demonstration purposes. Details to Box No. G404.

INTERESTED IN OSCAR? Then join AMSAT-UK. Newsletters, OSCAR NEWS Journal, prediction charts etc. Details of membership from: Ron Broadbent, G3AAJ, 94 Herongate Road, Wanstead Park, London E12 5EQ.

BREAKER, BREAK. Build your own CB rig. (27MHz AM transceiver). Circuit diagram, parts list, etc. All components available in UK. Send £3.95 and large S.A.E. to: P. Sherwood, 8 (T) Aylestone Walk, Manchester, M10 9NU. I'm down and on the side.

WANTED: Handbook for Eagle communications receiver Model RX-80. Phillips, 18 Chestnut Avenue, Hedon, Yorkshire. Telephone: 0482-899167.

WANTED: Two Books - *Circuit Consultants Handbook* by T.K. Hemingway, 1970 and *Practical Design with Transistors* by M. Horowitz, 1969. Box No. G405

CLASSIFIED ADS

ADVERTISERS INDEX

R&EW's reader response system

please don't call this a bingo card....

Slow down there

By this stage of the magazine, you are probably expecting to find that the chatty bit is over, and that the page turning accelerates until you 'crash' into the back cover. Not so with R&EW. We promised readers a different approach to electronics publishing, and we keep our word right up to the last page.

We think that **R&EW** advertisers deserve a new approach to the way in which their products are marketed, so rather than just acting as a billboard, **R&EW** wants to be able to provide useful feedback for all concerned.

Eyes down

The system of readers ticking numbers allocated to advertisers is affectionately known in the trade as the 'Bingo' response system. This system is viewed with ambivalence by advertisers, since a flood of requests for 'further information' is by no means indicative of a genuine commercial interest (ie leading to sales) in the product(s) being offered on the part of the enquirer.

The process adopted for sorting these responses varies from company to company, and too many companies adopt a policy of 'weeding' out enquiries that are considered frivolous, or commercially unviable. After all, it is in the interests of the publisher to simply demonstrate the 'pulling power' of his magazine - never mind the quality feel the numbers.

We feel that *anyone* reading **R&EW** with a genuine interest in the products found herein is entitled to get additional information. We will not fulfil our aim to expand awareness of -and information for - the entire electronics, communications and computing scene unless we can approach the whole subject in a more professional manner.

We hope to try and find a way around the practise of only replying to enquiries with impressive company names behind them. Today's students are tomorrow's engineers - but at the same time, we appreciate that many commercial organizations simply do not have the time to deal with this type of enquirer, on the basis of the effective deployment of limited resources. But there's no point in 'industrialists' carping about the parlous state of engineering education if we are not all prepared to do our bit to support it.

We don't expect the first issue of **R&EW** to get it right first time, but we do expect our readers to pitch in and help us to shape the sort of system that will benefit all concerned. Some of the features are keyed to help us analyse your reactions, so please remember to fill in that section too.

We offer our advertisers several options to make everyone's life a bit easier:

1. We ask that enquirers restrain their requests to genuine interests - but if this still means the products of every advertiser, then we are delighted.
2. Please complete the reader 'qualifier' section accurately, so that we can pre-sort and list enquirers accordingly, for the benefit of our advertisers.
3. Advertisers are asked to supply envelopes filled with 'standard' response information if possible, so that we can mail this directly to enquirers, so that this reaches enquirers with minimal delay.
4. We then supply advertisers with lists of names and addresses of the enquirers to whom this information has been sent, so that any further action can be implemented.
5. If an advertiser supplies a 'standard' product with appeal to the small quantity or 'private' user, and if there is no existing means (established distributor/retailer) of servicing this type of business, we suggest that pages of **The World of Radio Electronics** - the companion quarterly catalogue - are available to provide just this type of facility. Where this scheme is already in force, the adverts will be 'flashed' **WR&E** in the corner, together with the appropriate issue date.
6. **Overseas enquirers** must appreciate that the high cost of postage can deter many advertisers from replying to foreign requests received through the reader response system. However, we feel that *all* genuine enquiries should be answered, and so we will collate the information from the various advertisers to mail out in a single, less costly package. ***However, this facility will have to be charged at the rate of 25p per enquiry number ticked, minimum charge £2.00.***
7. We regret that we cannot enter into any correspondance on the subjectmatter of the reader response system. We all hope the system will settle down and operate like a well oiled machine - but as we hinted, there may be a few rough edges whilst the process is 'running in'.

PTO for the numbers - this form is valid until November 15th 1981

Your name:____________________ **Title/Job Function** ____________________

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If you would like to receive a personal copy of *R&EW* - then please enter your Access / Barclaycard number

____________________ **Signature** ____________________ **(Rates on page 1)**

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The complementary component catalogue *the World of Radio and Electronics* should be available from your local newsagent - but in case of difficulty, current copies can be obtained from here at 60p each - which may be added to the above.

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