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OCTOBER 1974

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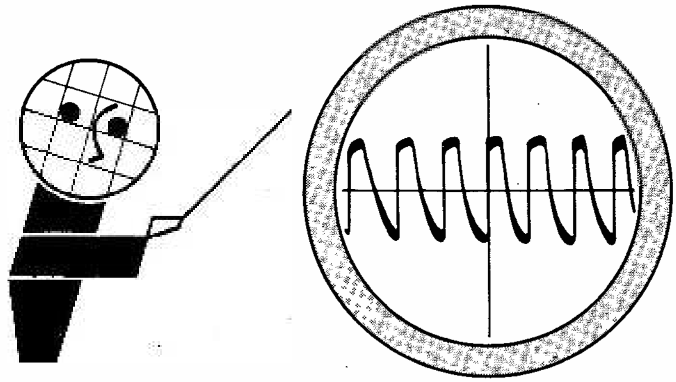

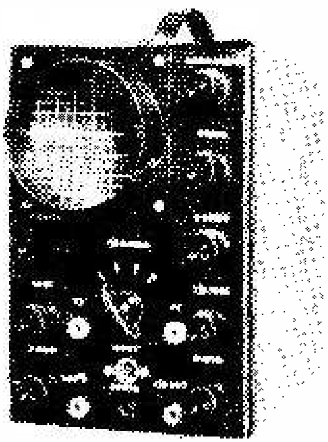

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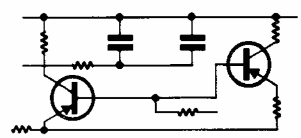

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PRACTICAL WIRELESS

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ISSUE 812
OCTOBER 1974

BRITAIN'S PREMIER MAGAZINE FOR THE DO-IT-YOURSELF RADIO AND ELECTRONICS CONSTRUCTOR

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C	1	4·7–10M	3·2	2·5	1·92	nett
MO	1/2	10–1M	4	3·3	2·3	nett
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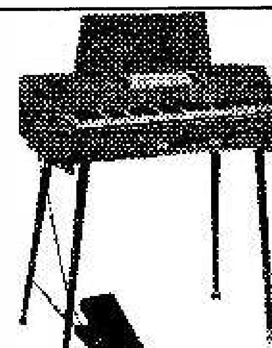

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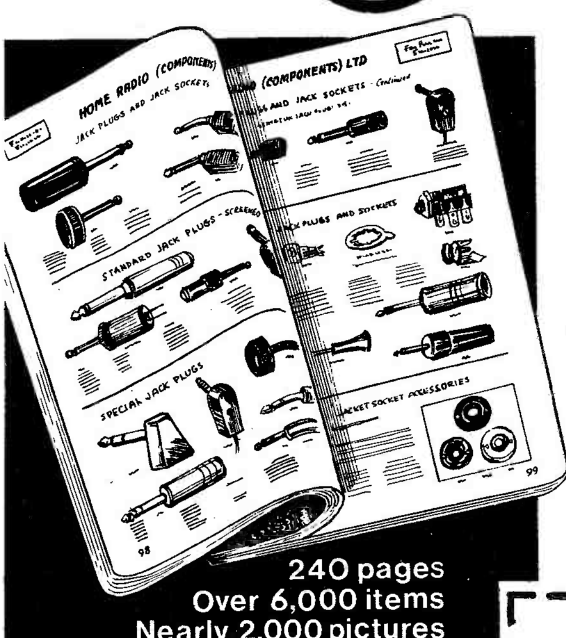

Over the years we've turned out lots of 'silly' advertisements, using cartoon characters, tongue-in-cheek copy and a joke or two here and there. Over the years we've also turned out lots of serious adverts—packed with facts and figures, illustrating typical components, giving details of our catalogue and the service we offer. Some folk like one kind of ad., some like the other. But whether you like the silly or the serious we hope we've put over the fact that we are a family firm with a 'human' outlook and a staff who share your enthusiasm for the world of electronics. We hope too that we've made it obvious that we go out of our way to help you to obtain your components with a minimum of fuss, expense and delay.

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Ref. No.	VA (Watts)	Weight lb	oz	Size cm.	£	P & P p
07	20	1	8	7·0 x 6·0 x 6·0	2·55	30
149	60	3	12	9·9 x 7·7 x 8·6	3·79	36
150	100	5	8	9·9 x 8·9 x 8·6	4·17	52
151	200	8	0	12·1 x 9·3 x 10·2	7·39	52
152	250	13	12	12·1 x 11·8 x 10·2	9·25	67
153	350	15	0	14·0 x 10·8 x 11·8	11·35	82
154	500	19	8	14·0 x 13·4 x 11·8	13·20	–
155	750	29	0	17·2 x 14·0 x 14·0	21·20	
156	1000	38	0	17·2 x 16·6 x 14·0	27·40	–
158	2000	60	0	21·6 x 15·3 x 18·1	49·25	–

PLEASE NOTE NEW ADDRESS AS BELOW

AUTO TRANSFORMERS

Ref. No.	VA (Watts)	Weight lb	oz	Size cm.	Auto Taps	£	P & P p
113	20	1	0	5·8 x 5·1 x 4·5	0-115-210-240	1·34	22
64	75	2	4	7·4 x 6·7 x 6·1	0-115-210-240	2·64	30
4	150	3	4	8·9 x 7·7 x 7·7	0-115-200-220-240	3·18	36
66	300	6	4	9·9 x 9·6 x 8·6	,,	6·19	52
67	500	12	8	12·1 x 11·2 x 10·2	,, ,,	8·33	67
84	1000	19	8	14·0 x 13·4 x 14·3	,, ,,	13·50	82
93	1500	30	4	14·0 x 15·9 x 14·3	,, ,,	17·50	–
95	2000	32	0	17·2 x 16·6 x 14·0	,, ,,	25·35	*
73	3000	40	0	21·6 x 13·4 x 18·1	,, ,,	32·80	*

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111	0·5	0·25		8	4·8 x 2·9 x 3·5	0·12V at 0·25A x 2	1·34	22
213	1·0	0·5	1	4	6·1 x 5·8 x 4·8	0·12V at 0·5A x 2	1·58	22
71	2	1	1	12	7·0 x 6·4 x 6·1	0·12V at 1A x 2	2·09	22
18	4	2	2	12	8·3 x 7·7 x 7·0	0·12V at 2A x 2	2·95	30
70	6	3	3	8	8·9 x 8·0 x 7·7	0·12V at 3A x 2	3·52	42
108	8	4	5	8	9·9 x 8·9 x 8·6	0·12V at 4A x 2	3·96	52
72	10	5	6	4	9·9 x 9·6 x 8·6	0·12V at 5A x 2	4·67	52
116	12	6	6	12	9·9 x 10·2 x 8·6	0·12V at 5A x 2	5·61	52
17	16	8	8	12	12·1 x 9·9 x 10·2	0·12V at 8A x 2	7·22	52
115	20	10	11	8	14·0 x 9·6 x 11·8	0·12V at 10A x 2	9·20	67
187	30	15	15	8	14·0 x 12·1 x 11·8	0·12V at 15A x 2	16·94	82
226	60	30	32	0	17·2 x 15·3 x 14·0	0·12V at 30A x 2	22·50	*

30 VOLT RANGE

Ref. No.	Amps.	Weight lb	oz	Size cm.	Secondary Taps	£	P & P p
112	0·5	1	4	6·1 x 5·8 x 4·8	0-12-15-20-24-30V	1·56	22
79	1·0	2	4	7·0 x 6·7 x 6·1	,, ,,	2·11	36
3	2·0	3	4	8·9 x 7·7 x 7·7	,, ,,	3·18	36
20	3·0	4	8	9·9 x 8·3 x 8·6	,, ,,	3·96	42
21	4·0	6	4	9·9 x 9·6 x 8·6	,, ,,	4·67	52
51	5·0	6	12	12·1 x 8·6 x 10·2	,, ,,	5·83	52
117	6·0	8	0	12·1 x 9·3 x 10·2	,, ,,	6·94	52
88	8·0	12	0	12·1 x 11·8 x 10·2	,, ,,	9·00	67
89	10·0	13	12	14·0 x 10·2 x 11·8	,, ,,	11·36	67

50 VOLT RANGE

Ref. No.	Amps.	Weight lb	oz	Size cm.	Secondary Taps	£	P & P p
102	0·5	1	12	7·0 x 6·4 x 6·1	0-19-25-33-40-50V	2·09	30
103	1·0	2	12	8·3 x 7·4 x 7·0	,, ,,	3·08	36
104	2·0	5	8	9·9 x 8·9 x 8·6	,, ,,	4·26	42
105	3·0	6	12	9·9 x 10·2 x 8·6	,, ,,	5·79	52
106	4·0	10	0	12·1 x 10·5 x 10·2	,, ,,	7·69	52
107	6·0	12	0	14·0 x 10·2 x 11·8	,, ,,	11·38	67
118	8·0	18	0	14·0 x 12·7 x 11·8	,, ,,	12·40	97
119	10·0	25	0	17·2 x 12·7 x 14·0	,, ,,	18·62	*

60 VOLT RANGE

Ref. No.	Amps.	Weight lb	oz	Size cm.	Secondary Taps	£	P & P p
124	0·5	2	4	7·0 x 6·7 x 6·1	0-24-30-40-48-60	2·12	36
126	1·0	3	4	8·9 x 7·7 x 7·7	,, ,,	2·97	36
127	2·0	6	4	9·9 x 9·6 x 8·6	,, ,,	4·67	42
125	3·0	8	12	12·1 x 9·9 x 10·2	,, ,,	7·11	52
123	4·0	13	12	12·1 x 11·8 x 10·2	,, ,,	9·20	67
40	5·0	12	00	14·0 x 10·2 x 11·8	,, ,,	10·83	87
120	6·0	15	8	14·0 x 12·1 x 11·8	,, ,,	13·35	82
121	8·0	25	00	14·0 x 14·7 x 11·8	,, ,,	15·01	*
122	10·0	25	0	17·2 x 12·7 x 14·0	,, ,,	19·60	*
189	12·0	29	00	17·2 x 14·0 x 14·0	,, ,,	21·60	*

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Ref.	MA.	Weight		Size cm	VOLTS	£	P & P p
238	200		2	2·8x2·6x2·0	3-0-3	1·44	10
212	1A 1A	1	4	6·1x5·8x4·8	0-6 0-6	1·67	22
13	100		4	3·9x2·6x2·9	9-0-9	1·23	10
235	330,330		4	4·8x2·9x3·5	0-9, 0-9	1·67	10
207	500, 500	1	00	6·1x5·4x4·8	0-8-9, 0-8-9	2·23	22
208	1A, 1A	1	12	7·0x6·4x6·1	0-8-9,0-8-9	3·00	30
236	200, 200		4	4·8x2·9x3·5	0-15, 0-15	1·67	10
214	300, 300	1	4	6·1x5·8x4·8	0-20, 0-20	1·76	22
221	700 (D.C.)	1	8	7·0x6·1x6·1	20-12-0-12-20	1·55	30
206	1A, 1A	2	12	8·3x7·7x7·0	0-15-20, 0-15-20	4·05	36
203	500, 500	2	4	8·3x7·0x7·0	0-15-27, 0-15-27	3·10	38
204	1A, 1A	3	4	8·9x7·7x7·7	0-15-27, 0-15-27	3·15	38

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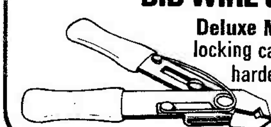

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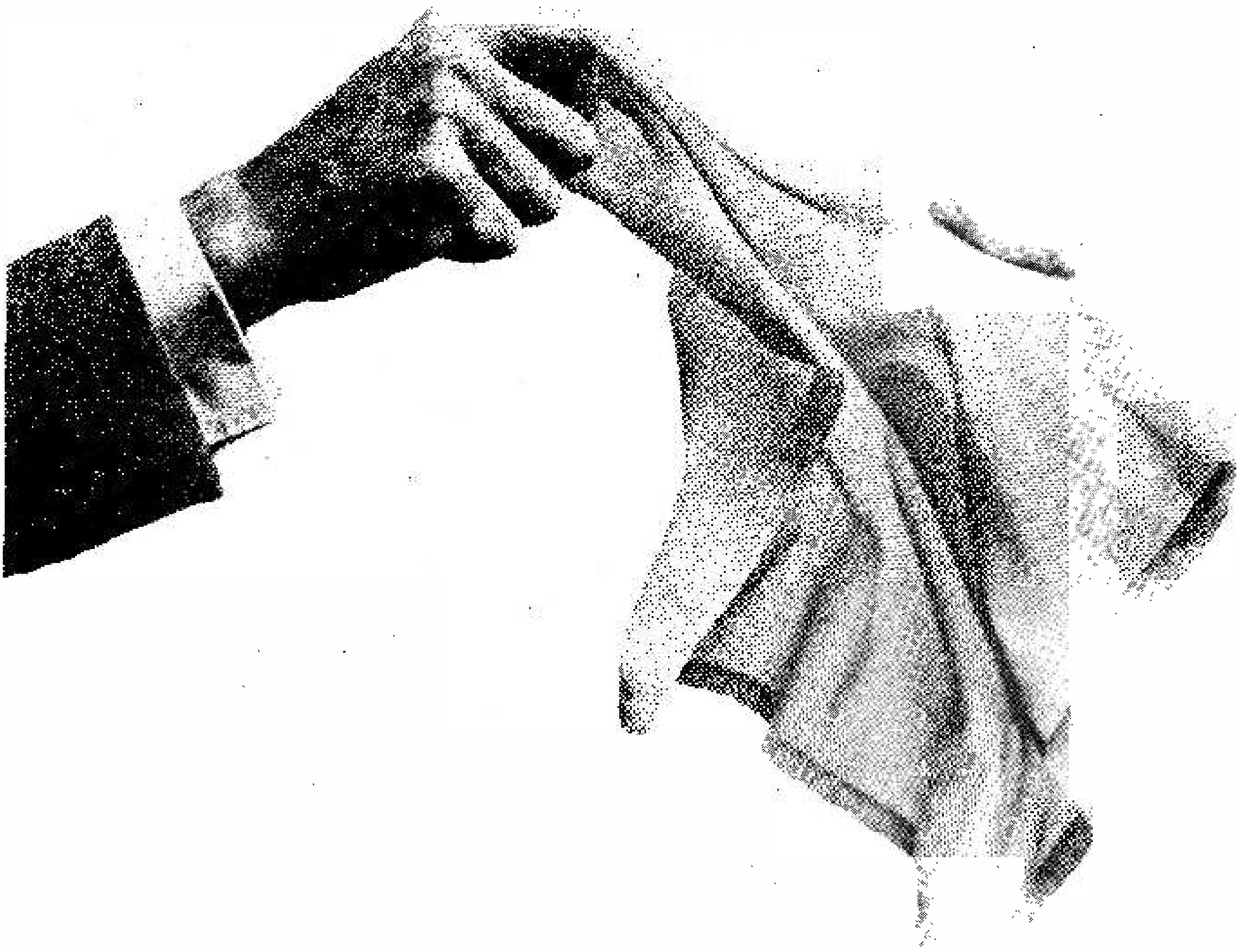

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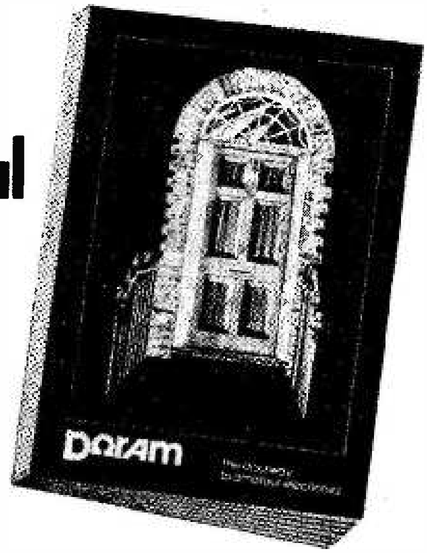

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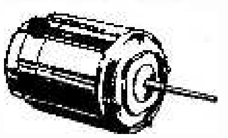

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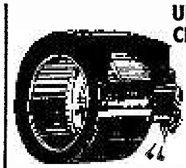
Fibre-glass copper-clad laminate. Finest quality epoxy resin base. Heat resistant, ideal for P.C.'s Sizes: 12" x 12"; 24" x 12"; 24" x 24"; FULL SHEET 43" x 37" (11 sq ft.) Single-sided Copper with thickness of 1/32", 3/64", 3/32". Also double-sided 1/32", 1/16", 3/32". £1 per sq ft. Cut sizes (1-10 sq. ft.) 25p. P. & P. Full Sheet £8 each. Carr. £1 for 1st sheet plus 25p each additional sheet.

SMITHS RINGER-TIMER

Reliable 15 minute times, spring wound (concurrent with time setting) 15 x 1min divisions, approximately ½" between divisions. Panel mounting with chrome bezel 3¾" dia. £1·40. 15p P. & P.

KNOWLE (U.S.A.) MINIATURE MICROPHONE CAPSULES

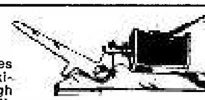
Impedance approx. 200Ω, output 60 or 80 DB at 1 Kc. As used in deaf aids, bugging devices, etc. Size (60 DB) 7/32" x 5/32" x ⅛"; (80 DB) ⅜" x 5/32" x ⅛". Ex-equipment, all tested. **£1·20** each. P. & P. FREE.



Ultra PRECISION CENTRIFUGAL BLOWER
by Air Control Ltd.

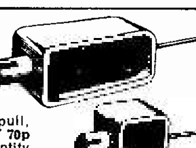
30 segments individually balanced in heavy cast alloy case. 2,300 r.p.m. 240 A.C. Very powerful and silent running. 5¾" dia. 3" inlet dia. Outlet flange 3" x 2½". LIMITED NUMBER ONLY **£8·95. P & P 40p.**

MAINS SOLENOID



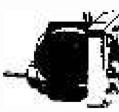
This little unit gives vertical lift of approximately 1" through hinged "elbow". Bracket incorporates 2 fixing screws. Length of arm, 2½". 240V AC. Pull at coil is approximately 1lb. **£1.** FREE P. & P. Special quotes for quantities.

SOLENOIDS by WESTOOL

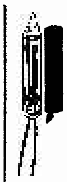


240AC type MM6. 3lb. pull, 2¼" x 1" x 1¼". Travel 1". **90p.** each. P. & P. 10p. 240AC type MM4. 2lb. pull, 1½" x 1¾" x 1". Travel ⅜" **70p** each. P. & P. 10p. Quantity discounts: 10-50 10%, 50 upwards 25%.

OPEN FRAME shaded pole GEARED MOTORS



(Dural gear case) 240 AC., 28rpm. NEW HIGH TORQUE, approx. overall size: 3½" x 3½" x 2¾" + spindle ¼" dia. as illustrated. **£2·70.** P. & P. 30p. Similar to above, 19rpm. **£2·70.** P. & P. **30p.** 110rpm with pressed steel gear case (similar to above but slightly smaller). **£2·70.** P. & P. 30p.

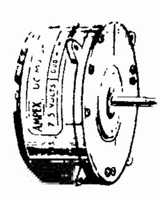


SILVANIA MAGNETIC SWITCH

Now complete with reference magnet!

A magnetically activated switch, vacuum sealed in a glass envelope. Silver contacts, normally closed. Rated 3amp at 120v. 1½amp at 240v. Size: (approx.) 1 7/16" long x ⅛" dia. Ideal for burglar alarms, security systems etc., and wherever non-mechanical switching is required. 10 for **£2·10**; P. & P. 15p. 50 for **£8·80**; 100 for **£15·50**. FREE P. & P. over 10.

AMPEX 7·5v. D.C. MOTOR



An ultra precision tape motor designed for use in the AG20 portable recorder. Torque 450GM/CM. Stall load at 500ma. Draws **60ma** on run. 600rpm ± speed adjustment. Internal AF/RF suppression. ⅛" dia. x 1" spindle, motor 3" dia. x 1⅞". Original cost £16·50. OUR PRICE **£3·30**. P. & P. 25p. Quantity available. Mu-metal enclosure available **75p** each. FREE P. & P.

ALL PRICES INCLUDE V.A.T.

Whilst we welcome official orders from established companies and Educational Departments, it is no longer practical to invoice goods under £5. Therefore, please remit cash with orders below this amount.

ELECTRO-TECH COMPONENTS LTD.

315/317, EDGWARE ROAD, LONDON, W2.
Tel : 01-723 5667 01-402 5580

NEW MULLARD & MAZDA VALVES

All individually boxed and guaranteed. Full trade discounts to bona fide companies. Price and availability lists on application.

EXPRESS POSTAGE
6p for 1 Valve. Each additional Valve add 2p.

DM70	0·63
DY51	0·85
DY86/7	0·42
DY802	0·45
EABC80	1·00
EB91	0·38
EBC81	0·75
EBF80	0·60
EBF83	0·62
EBF89	0·58
EC86	0·75
EC88	0·77
ECC81	0·45
ECC82	0·43
ECC83	0·45
ECC84	0·55
ECC85	0·53
ECC88	0·75
ECC189	0·71
ECF80	0·56
ECF82	0·73
ECF86	0·71
ECH81	1·00
ECH83	1·00
ECH84	0·78
ECL80	0·53
ECL82	0·61
ECL83	0·68
ECL86	0·63

EF80	0·46
EF83	1·03
EF85	0·43
EF86	0·90
EF89	0·81
EF91	1·30
EF92	1·40
EF95	1·35
EF183	0·60
EF184	0·60
EH90	0·56
EL34	0·95
EL36	1·05
EL81	0·90
EL84	0·47
EL85	0·55
EL86	0·95
EL95	0·70
EL91	1·31
ELL80	1·30
EM84	1·18
EM87	1·18
EY51	0·83
EY86/87	0·42
EY88	0·64
EZ80	0·51
EZ81	0·40
GY501	0·90
GZ34	0·78

PC86	0·75
PC88	0·75
PC97	0·45
PC900	0·56
PCC84	0·52
PCC88	0·80
PCC89	0·65
PCC189	0·65
PCF80	0·51
PCF82	1·30
PCF86	0·65
PCF200	0·85
PCF201	0·87
PCF801	0·65
PCF802	0·71
PCF806	0·66
PCH200	0·88
PCL82	0·54
PCL83	0·66
PCL84	0·59
PCL85	0·63
PCL86	0·63
PCL805/85	0·63
PD500	1·55
PFL200	0·80
PL36	0·88
PL81	0·75
PL81A	0·88
PL82	0·50
PL83	0·96

PL84	0·66
PL504	0·88
PL508	1·05
PL509	1·55
PL802	0·96
PY33	0·66
PY81/800	0·50
PY82	0·55
PY88	0·60
PY500A	1·05
PY800	0·50
PY801	0·50
U26	1·00
U191	1·00
U193	0·50
UABC80	0·90
UBC81	0·70
UBF89	0·60
UCC85	0·60
UCH81	1·00
UCL82	0·70
UCL83	0·70
UF89	0·80
UL84	0·95
UY85	0·50
6/30L2/ ECC804	1·00
6F23/EF812	1·05
30C1/PCF80	0·51

30C15/ PCF800	1·05
30C17	1·00
30C18/ PCF805	0·90
30F5/PF818	1·10
30FL1/ PCE800	0·75
30FL2	0·75
30FL12	1·05
30FL14	0·85
30L1/PCC84	0·52
30L15/PCC805	1·05
30L17	0·90
30P4MR	1·30
30P12/PC801	1·05
30P19/PC802	1·00
30PL1/PCL801	0·95
30PL13/ PCL800	1·20
30PL14/ PCL88	1·25
30PL15	1·05

NEW VALVES

Individually boxed and guaranteed but of European or other origin at greatly reduced prices. Quotations for any valve not listed. Send SAE for lists.

AZ1	0·60
AZ31	0·55
CBL31	1·20
CL33	1·50
CY31	0·50
DAF91	0·30
DAF96	0·50
DCC90	1·35
DF91	0·30
DF96	0·50
DK91	0·45
DK92	0·70
DK96	0·60
DL92	0·40
DL94	0·48
DL96	0·55
DY86/7	0·36
DY802	0·37
EABC80	0·38
EAF42	0·75
EB91	0·22
EBC33	1·00
EBC41	0·75
EBC81	0·33
EBF80	0·40
EBF83	0·40
EBF89	0·32
EBL31	1·50
ECC81	0·40
ECC82	0·33
ECC83	0·33
ECC84	0·30
ECC85	0·40
ECC88	0·40
ECH35	1·25
ECH42	1·00
ECH81	0·30
ECH83	0·45
ECL80	0·55
ECL82	0·35
ECL83	0·70
ECL86	0·40
ECLL800	3·20
EF37A	1·20
EF39	1·20

EF80	0·25
EF85	0·35
EF86	0·30
EF89	0·28
EF91	0·37
EF92	0·50
EF95	0·40
EF98	0·75
EF183	0·30
EF184	0·35
EL32	0·60
EL33	1·75
EL34	0·60
EL36	0·50
EL37	2·50
EL41	0·90
EL42	0·90
EL84	0·28
EL95	0·40
ELL80	1·25
EM80	0·45
EM81	0·60
EM84	0·35
EM85	1·00
EY51	0·40
EY86	0·40
EZ40	0·75
EZ41	0·75
EZ80	0·28
EZ81	0·29
GY501	0·90
GZ30	0·45
GZ32	0·50
GZ34	0·65
GZ37	1·25
HN309	1·50
KT61	1·75
KT66	2·50
KT81 (7C5)	1·30
KT81	1·75
KT88	2·90
KTW61	1·00
MU14	1·00
N78	2·75

PC86	0·60
PC88	0·60
PC97	0·50
PC900	0·48
PCC84	0·40
PCC88	0·55
PCC89	0·50
PCC189	0·60
PCF80	0·40
PCF82	0·35
PCF86	0·60
PCF801	0·50
PCF802	0·50
PCF805	0·90
PCF806	0·75
PCF808	0·90
PCL82	0·35
PCL83	0·66
PCL84	0·45
PCL85	0·60
PCL86	0·45
PCL805/85	0·50
PD500	1·30
PEN45	0·75
PL36	0·63
PL81	0·50
PL82	0·45
PL83	0·45
PL84	0·40
PL500	0·80
PL504	0·80
PL508	0·90
PL509	1·55
PL802	0·95
PX4	3·50
PX25	3·50
PY33	0·63
PY81	0·50
PY82	0·35
PY83	0·38
PY88	0·40
PY500	1·05
PY81/800	0·50
PY801	0·50

SP41	3·00
SP61	0·75
T41	1·00
U14	0·75
U25	0·85
U26	0·85
U191	0·75
UABC80	0·40
UAF42	0·75
UBC41	0·75
UBC81	0·45
UBF80	0·40
UBF89	0·40
UCC85	0·45
UCH42	0·75
UCH81	0·40
UCL82	0·35
UCL83	0·70
UF41	0·75
UF89	0·40
UL41	0·85
UL84	0·43
UY41	0·48
UY85	0·40
VR105-30	0·40
VR150-30	0·40
OA2	0·40
OB2	0·40
1R5	0·45
1S5	0·30
1T4	0·30
3S4	0·40
3V4	0·70
5R4GY	0·80
5U4G	0·40
5V4G	0·50
5Y3GT	0·45
5Z4G	0·45
6/30L2	0·90
6AK5	0·40
6AM5	1·00
6AQ5	0·45
6AS7G	0·85
6AT6	0·45
6AU6	0·30
6BA6	0·28
6BE6	0·35
6BH6	0·75
6BJ6	0·55
6BQ7A	0·55
6BR7	1·00
6BS7	1·35
6BW6	0·90
6BW7	0·90
6C4	0·35
6CD6G	1·30
6CH6	1·40
6CW4	1·00
6F23	1·05
6F25	1·00
6F28	0·70
6J5M	0·65
6J5G	0·45

6J6	0·30
6J7M	0·45
6J7G	0·40
6K6GT	0·75
6K7M	0·45
6K7G	0·35
6K8M	0·70
6K8G	0·45
6K25	1·00
6L6G	0·55
6Q7M	0·50
6Q7G	0·50
6SL7GT	0·48
6SN7GT	0·48
6SQ7GT	0·50
6U5G	0·75
6V6G	0·40
6V6GT	0·50
6X4	0·40
6X5G	0·45
6X5GT	0·45
7B6	0·75
7B7	0·70
7C5	1·30
7C6	0·75
7H7	0·70
7R7	0·75
7S7	2·25
7Y4	0·75
12AT6	0·40
12AT7	0·40
12AU6	0·45
12AU7	0·33
12AX7	0·33
12BA6	0·45
12BE6	0·50
30C1	0·40
30C15	1·05
30C17	1·10
30C18	0·90
30F5	1·10
30FL1	0·80
30FL2	0·75
30FL14	0·90
30L15	1·05
30L17	0·95
30P4MR	1·30
30P12	1·05
30P19	1·00
30PL1	0·95
30PL13	1·20
30PL14	1·25
35W4	0·50
35Z4GT	0·70
50CD6G	1·20
807	0·50
813 ITT	£13
813 USSR	£5·75
866A	1·00

TRANSISTORS-INTEGRATED CIRCUITS

EXPRESS POSTAGE
4p for first Transistor, for each additional add 1p.

All transistors, I.C's offered are new and branded. Manufactured by Mullard, Texas, RCA, Ferranti, Motorola, ITT, Fairchild, Lucas, etc. Quantity discounts on application. Send SAE for full lists.

AA119	0·7
AAZ13	0.10
AAZ15	0·10
AC107	0·35
AC126	0·25
AC127	0·25
AC128	0·20
AC176	0·25
AC187	0·20
AC188	0·20
ACY21	0·22
ACY39	0·65
AD140	0·50
AD149	0·50
AD161	0·39
AD162	0·39
AF115	0·25
AF116	0·25
AF117	0·20
AF186	0·40
AF239	0·44
ASY27	0·30
ASY28	0·25
BA102	0·25
BA115	0·10
BC107	0·12
BC108	0·12
BC109	0·12
BC113	0·16
BC117	0·21
BC143	0·30
BC147	0·12
BC148	0·10
BC169C	0·14
BC182	0·12
BC182L	0·12
BC184L	0·13
BCY32	1·20
BCY33	0·38
BCY34	0·45
BCY70	0·15
BCY71	0·20
BCY72	0·15
BCZ11	0·65
BD121	1·00
BD124	0·80
BD131	0·45

BD132	0·50
BF115	0·22
BF167	0·25
BF173	0·28
BF179	0·33
BF180	0·35
BF181	0·35
BF194	0·13
BF195	0·13
BF197	0·15
BF200	0·32
BFS61	0·25
BFS98	0·25
BFX29	0·28
BFX88	0·22
BFY50	0·20
BFY51	0·20
BFY52	0·20
BFW10	0·61
BY100	0·15
BY126	0·14
BY127	0·15
BZX61 series	0·20
BZY88 series	0·10
CRS1·05	0·30
CRS1·40	0·45
CRS3-05	0·40
CRS3-40	0·55
MJE340	0·50
MJE370	0·68
MJE520	0·65
MJE2955	1·10
MJE3055	0·75
MPF102	0·40
MPF103	0·36
MPF104	0·35
MPF105	0·46
NKT404	0·60
OA5	0·60
OA10	0·40
OA79	0·10
OA81	0·10
OA91	0·7
OA200	0·08
OA202	0·10

OC16	1·00
OC20	2·00
OC23	1·25
OC25	0·40
OC28	0·70
OC35	0·55
OC36	0·65
OC42	0·40
OC44	0·18
OC45	0·18
OC71	0·15
OC72	0·25
OC76	0·30
OC77	0·55
OC81	0·28
OC81D	0·28
OC81Z	0·45
OC83	0·25
OC140	0·65
OC170	0·25
OC171	0·30
OC200	0·55
OC201	0·80
OC202	0·90
OC203	0·55
OCP71	1·00
ORP12	0·55
ORP60	0·45
T1005	0·20
TIC44	0·29
TIC226D	1·50
TIL209	0·25
ZTX107	0·12
ZTX108	0·10
ZTX300	0·14
ZTX301	0·14
ZTX302	0·20
ZTX304	0·24
ZTX500	0·15

ZTX501	0·15
ZTX503	0·16
ZTX531	0·25
ZTX550	0·18
1N914	0·06
IN4001	0·6
IN4002	0·7
IN4003	0·8
IN4004	0·8
IN4005	0·10
IN4006	0·12
IN4007	0·12
1N4009	0·06
1N4148	0·06
1S921	0·07
IS2033	0·20
IS2051A	0·10
IS2100A	0·20
IS3010	0·25
2N696	0·15
2N697	0·15
2N706	0·10
2N706A	0·12
2N1131	0·25
2N1132	0·25
2N1302	0·18
2N1303	0·18
2N1304	0·22
2N1305	0·22
2N1306	0·28
2N1307	0·28
2N1308	0·28
2N1309	0·30
2N1613	0·20
2N1614	0·45
2N2147	0·75
2N2160	1·00
2N2369A	0·16
2N2646	0·50

2N2904	0·20
2N2904A	0·25
2N2905	0·32
2N2905A	0·25
2N2906	0·20
2N2926	0·10
2N3053	0·20
2N3055	0·60
2N3525	0·80
2N3614	0·59
2N3615	0·65
2N3702	0·11
2N3703	0·12
2N3704	0·14
2N3705	0·12
2N3706	0·10
2N3707	0·13
2N3708	0·07
2N3709	0·10
2N3710	0·11
2N3711	0·11
2N3819	0·35
2N3820	0·50
2N3823	0·50
2N3903	0·15
2N3904	0·20
2N3905	0·25
2N3906	0·16
2N4058	0·15
2N4059	0·10
2N4060	0·13
2N4061	0·13
2N4062	0·14
2N4289	0·20
3N141	0·81
40360	0·40
40361	0·45
40362	0·40
40430	0·85

SN7400	0·26
SN7401	0·20
SN7402	0·20
SN7403	0·20
SN7404	0·20
SN7405	0·20
SN7406	0·40
SN7407	0·40
SN7408	0·25
SN7409	0·33
SN7410	0·20
SN7411	0·23
SN7412	0·28
SN7413	0·30
SN7416	0·30
SN7417	0·30
SN7420	0·20
SN7422	0·28
SN7423	0·40

SN7425	0·37
SN7427	0·37
SN7428	0·43
SN7430	0·20
SN7432	0·37
SN7433	0·43
SN7437	0·43
SN7438	0·43
SN7440	0·20
SN7441AN	0·85
SN7442	0·85
SN7450	0·20
SN7451	0·20
SN7453	0·20
SN7454	0·20
SN7460	0·20
SN7470	0·33
SN7472	0·38

SN7473	0·44
SN7474	0·48
SN7475	0·59
SN7476	0·45
SN7480	0·80
SN7482	0·87
SN7483	1·20
SN7484	1·00
SN7486	0·50
SN7490	0·75
SN7491AN	1·10
SN7492	0·75
SN7493	0·75
SN7494	0·85
SN7495	0·85
SN7496	1·00
SN7497	4·32
SN74100	2·16

SN74107	0·51
SN74110	0·57
SN74111	0·86
SN74118	1·00
SN74119	1·92
SN74121	0·57
SN74122	0·80
SN74123	1·44
SN74141	1·00
SN74145	1·44
SN74150	2·30
SN74151	1·15
SN74154	2·30
SN74155	1·15
SN74156	1·15

SN74157	1·09
SN74170	2·88
SN74174	1·80
SN74175	1·29
SN74176	1·44
SN74190	2·30
SN74191	2·30
SN74192	2·30
SN74193	2·30
SN74194	1·72
SN74195	1·44
SN74196	1·58
SN74197	1·58
SN74198	3·16
SN74199	2·88

DIL SOCKETS 14 pin **15p** 16 pin **17p**

VAT

10% to be added to all orders including POSTAGE!

THIS MONTH'S

● OSCILLOSCOPE TUBE TYPE VCR 139A
Price £8·00 p & p 25p

SPECIAL OFFER

TERMS OF BUSINESS: C.W.O. A/c's available to approved companies on application. Telephone and telex orders accepted. Export and trade enquiries welcomed. Lists, etc. on application. Open daily to callers 9 a.m.–5 p.m. Mon.–Sat. Closed Sat. 1–3 p.m. Prices correct when going to press.

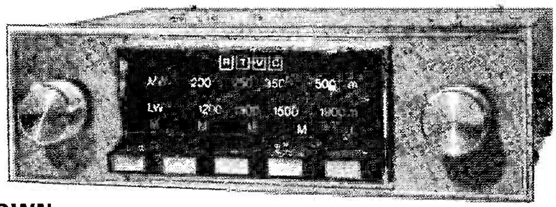
RST VALVE MAIL ORDER CO.

16a Wellfield Rd., London, SW16 2BS
Tel: 01-677 2424 Telex: 946 708.

R T V C FOR AUDIO ON A BUDGET

PUSH BUTTON CAR RADIO KIT

The Tourist II



NO SOLDERING REQUIRED!

NOW BUILD YOUR OWN PUSH BUTTON CAR RADIO

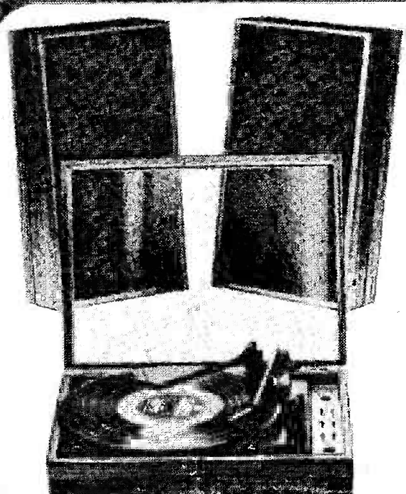
Easy to assemble construction kit comprising fully completed and tested printed circuit board on which no soldering is required. All connections are simple push fit type making for easy assembly.
Fine tuning push button mechanism is fully built and tested to mate with printed circuit board.

Car Radio Kit £7.70 + 55p p & p

Tourist Mk.1 kit still available-
price **£6.60+55p. p&p.**
See July issue for full specification

Technical specification:
(1) **Output** 4 watts R.M.S. output. For 12 volt operation on negative or positive earth.
(2) **Integrated circuit** output stage, pre-built three stage IF Module.
Controls volume manual tuning and five push buttons for station selection, illuminated tuning scale covering full, medium and long wave bands.
Size chassis 7″ wide, 2″ high and $4\frac{5}{16}$″ deep approx

Speaker including baffle and fixing strip **£1.65+23p. p&p.**
Car Aerial Recommended — fully retractable and locking
£1.37+20p. postage & packing



*STEREO 21 QUALITY SOUND FOR LESS THAN £19·00

Stereo 21, easy to assemble audio system kit. No soldering required.
Includes:- **BSR 3 speed deck**, automatic, manual facilities together with ceramic cartridge.
Two speakers with cabinets.
Amplifier module. Ready built with control panel, speaker leads and full, easy to follow assembly instructions.
Specifications: For the technically minded:—
Input sensitivity 600mV. Aux. input sensitivity 120mV. Power output 2.7 watts per channel.
Output impedance 8–15 ohms. Stereo headphone socket with automatic speaker cutout. Provision for auxiliary inputs – radio, tape, etc., and outputs for taping discs. **Overall Dimensions.** Speakers approx. $15\frac{1}{2}$″ × 8″ × 4″. Complete deck and cover in closed position approx. $15\frac{1}{2}$″ × 12″ × 6″.
Complete only **£18.95** + **£1.60 p & p. Extras if required.** Optional Diamond Styli **£1.37.**
Specially selected pair of stereo headphones with individual level controls and padded earpieces to give optimum performance. **£3.85.**
De-luxe model available in white PVC. Incorporates BSR deck with cue/pause control.
price **£20.55**+ **£1.60 p & p.**

BUILD YOUR OWN STEREO AMPLIFIER *

For the man who wants to design his own stereo — here's your chance to start, with Unisound — pre-amp, power amplifier and control panel. No soldering — just simply screw together. 4 watts per channel into 8 ohms. Inputs: 120mV (for ceramic cartridge). The heart of Unisound is high efficiency I.C. monolithic power chips which ensure very low distortion over the audio spectrum.
240V. AC only. **£7·64 + 55p. p&p**

8 TRACK CARTRIDGE PLAYER*

Elegant self selector push button player for use with your stereo system. Compatible with Viscount III system, Unisound module and the Stereo 21. Technical specification Mains input 240V. Output sensitivity 125mV
Comparable unit sold eleswhere at £24.00 approx. **Yours for only**
£10.95 + 90 p & p

COMPLETE* STEREO SYSTEM

System 1. £51·00

40 Watt Amplifier. Viscount III – R102 now 20 watts per channel.
System I includes:
Viscount III amplifier – volume, bass, treble and balance controls, plus switches for mono/stereo on/off function and bass and treble filters. Plus headphone socket.
Specification
20 watts per channel into 8 ohms. Total distortion @ 10W @ 1kHz 0·1%. *P.U.1* (for ceramic cartridges) 150mV into 3 Meg. *P.U.2* (for magnetic cartridges) 4mV @ 1kHz into 47K. equalised within ±1dB R.I.A.A. *Radio* 150mV into 220K. (Sensitivities given at full power). Tape out facilities: headphone socket, power out 250mW per channel. *Tone controls and filter characteristics.* Bass: +12dB to –17dB @ 60Hz. Bass filter: 6dB per octave cut. Treble controls treble +12dB to –12dB @ 15kHz. Treble filter: 12dB per octave. *Signal to noise ratio:* (all controls at max.) – 58dB. Crosstalk better than 35dB on all inputs. Overload characteristics better than 26dB on all inputs. Size approx. 13¾″×9″×3¾″.
Garrard SP 25 Mk III deck with magnetic cartridge, de luxe plinth and hinged cover.
Two Duo Type II matched speakers – Enclosure size approx. 17½″×10¾″×6″ in simulated teak. Drive unit 13″×8″ with parasitic tweeter. 10 watts handling.

Complete System £51·00

System 2. £69·00

Viscount III amplifier (As System I)
Garrard SP 25 Mk III deck (As System I)
Two Duo Type IIIA matched speakers – Enclosure size approx. 31″×13″×11½″ Finished in teak veneer. Drive units approx. 13½″×8¼″ with 3¼″ HF speaker. Max. power 20 watts, 8 ohms. Freq. range 20Hz to 20kHz.

Complete System £69·00

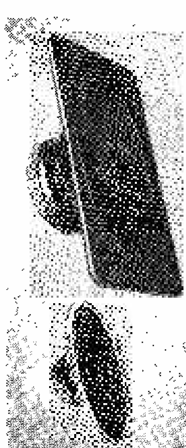
PRICES: SYSTEM 1	
Viscount III R102 amplifier	£24.20 + £1 p & p
2 Duo Type II speakers	£14.00 + £2.20 p & p
Garrard SP 25 with Mag. cartridge de luxe plinth and hinged cover	£21.00 + £1.75 p & p
total: £59.20	

Available complete for only:
£51·00
+ £3.50 p & p.

PRICES: SYSTEM 2	
Viscount III R102 amplifier	£24.20 + £1 p & p
2 Duo Type III A speakers	£39.00 + £4.00 p & p
Gerrard SP 25 with Mag. cartridge de luxe plinth and hinged cover	£21.00 + £1.75 p & p
total: £84.20	

Available complete for only:
£69·00
+ £4.00 p & p

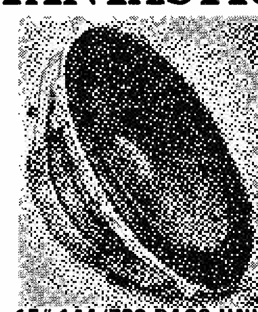
EMI SPEAKERS AT FANTASTIC REDUCTIONS



20 WATT SPEAKER SYSTEM

System consists of a 13″×8″ (approx) eliptical woofer unit with a 8″×5″ (approx.) mid range unit incorporating parasitic tweeter and crossover components.
Technical Specification:
Bass Unit
Flux density–100 K, speech coil–1½″, Cone, Triple laminated paper with P.V.C. surround.
Mid Range Unit
Flux density-33K, speech coil-1″ with parasitic tweeter.
Power Handling
20 watts R.M.S., impedance – 8 ohms, frequency response – 20 Hz to 18,000 Hz.

OUR PRICE £6.60. Complete +90p p & p.



15″ 14A/780 BASS UNIT

Bass unit on a rigid diecast chassis. Superior cone material handles up to 50 watts RMS, and is treated to give a smooth frequency response. Resonance 30 Hz. flux density 360,000 Maxwells. Impedance at 1 kHz is 8 ohms. 3″ voice coil.

Recommended retail price £40·80.
OUR PRICE £18·70 + £1·50 p&p

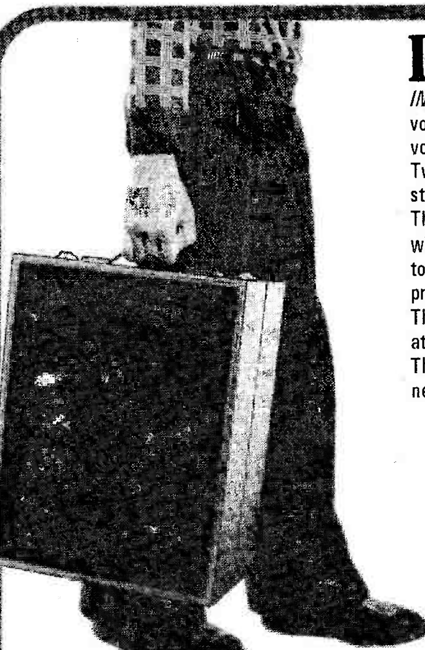
950 KIT

Five matched speakers and crossover unit for handling up to 45 watts, frequency response from 20 to 20,000 Hz.
Huge 19″ × 14″ (approx.) high efficiency Bass-Speaker with 16,500-gauss magnet built on a heavy diecast frame.
The four 10,000 gauss tweeters, each 3¼″ dia. approx., are fed by the crossover which critically adjusts signal for maximum fidelity. Impedance at 1 kHz is 8 ohms. Bass coil 2″, others 0·5″.
Recommended list price £44·00.

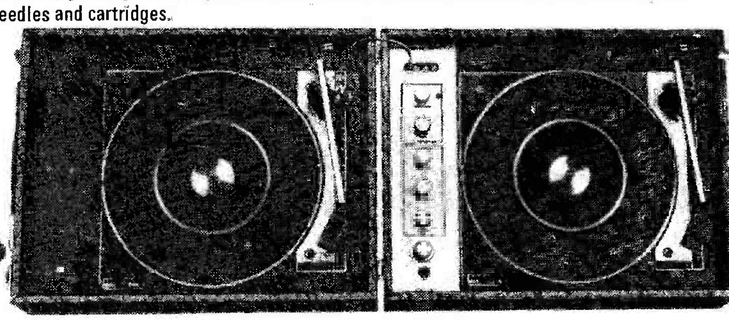
Special Offer
OUR PRICE £19.50 + £1·50 p&p

FOR DISCO PAGE AND DETAILS OF HOW TO ORDER – TURN OVER...

PORTABLE DISCO CONSOLE



INCORPORATES: Pre-Amp with full mixing facilities, including switched input for mic with volume control, switched input for auxiliary with volume control, bass and treble controls, volume control and blend control for turntables.
Two B.S.R. single play professional series decks, fitted with ceramic cartridges and diamond styli.
The turntables are designed and precision engineered. They combine clean modern styling with superb reproduction. Their many special features include square section aluminium tonearms, (high precision low mass design fully counterbalanced, with calibrated stylus pressure control for perfect tracking), and conveniently grouped easy to read linear controls. The turntables have viscous cueing devices which allows the tonearms to be placed or lifted at any point on the record.
The two lightweight cartridge shells have slide-in-holders to facilitate easy inspection of needles and cartridges.

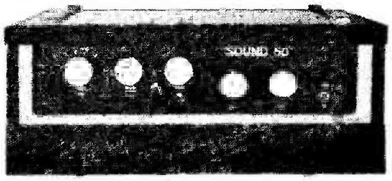


TECHNICAL SPECIFICATION:
Pre-amp – Output – 200mV. Auxiliary inputs – 200mV and 750mV into 1 meg. Mic input – 6mV into 100K. 240 volt operation.
Turntables capacity – 7", 10" or 12" records.
Rumble, wow and flutter – Rumble – Better than –35dB. Wow – Better than 0.2%. Flutter – Better than 0.06% (Gaumont kalee meter).
Finish – Satin black mainplate with black turntable mat inlaid with brushed aluminium trim. Tonearm and controls in black and brushed aluminium.

Console size – Unit Closed – 17¾"×13¾"×8¾" (approx.)
Unit Open – 35¾"×13¾"×4⅜" (approx.)
This disco console is ideally matched for the Reliant IV and Disco 50 or any other quality amplifier.
The unit is finished in black PVC with contrasting simulated teak edging diamond spun control knobs with matching control panel.

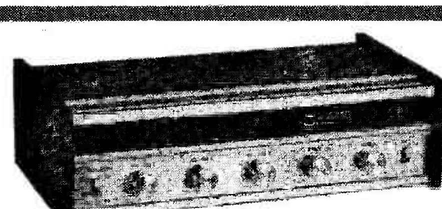
Yours for only £39.00 + £3.50 P. & P.

DISCO 50



45 WATT R.M.S. MONO DISCOTHEQUE AMPLIFIER
Ideal for Disco Work. Output Power: 45 watts R.M.S. Frequency Response 3dB points 30Hz and 18KHz. Total Distortion: less than 2% at rated output. Signal to noise ratio: better than 60dB. Bass Control Range: 13dB at 60Hz. Treble Control Range: 12dB at 10KHz. Inputs: 4 inputs at 5mV into 470K. Each pair of inputs controlled by separate volume control. 2 inputs at 200mV into 470K. Size: 19¼"×10½"×8" (approx.) Amplifier **£27.50 + £1.50 p. & p.**

Special Offer: Disco 50 plus two 15" E.M.I. speakers type 14A/780 (as illustrated on previous page) **Complete £55.00 + £4.00 p&p.**



DISCO AMPLIFIER

Reliant Mk IV Mono Amplifier, ideal for the small disco or house parties.
Outputs 20 watts R.M.S. into 8 ohms (suitable for 15 ohms).
Inputs *4 electrically mixed inputs. *3 individual mixing controls.
*Separate bass and treble controls common to all 4 inputs.
*Mixer employing F.E.T. (Field Effect Transistors) *Solid State circuitry.
*Attractive styling.

INPUT SENSITIVITIES
–Input – 1.) Crystal mic. guitar or moving coil mic, 2 and 10mV. (Selector switch for desired sensitivity).
–Inputs – 2), 3), 4). Medium output equipment – ceramic cartridge, tuner, tape recorder, organs, etc. – all 250mV sensitivity. AC Mains. 240V operation.
Size approx: 12½"×6"×3½".

£15.00 + 60p. post & pack.

BARCLAYCARD

DO NOT SEND YOUR CARD
Just write your order giving your credit card number

Mail orders to Acton. Terms C.W.O.
All enquires Stamped Addressed Envelope.
Goods not despatched outside U.K.

Leaflets available for all items listed thus ✱
Send stamped addressed envelope.

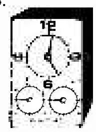
R T V C Radio and TV Components (Acton) Ltd.

21 High Street, Acton, London W3 6NG
323 Edgware Road, London W2

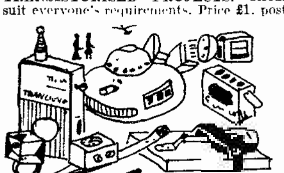
Personal Shoppers — Edgware Road: 9a.m.–5.30p.m. Half day Thurs.
Acton: 9.30a.m.–5p.m. Closed all day Wed.

RECORD PLAYBACK HEADS (TRUVOX)
Individual prices of these are:
2 track record playback heads **50p** each.
4 track record playback heads **72p** each.
Erase heads are also available separately:
2 track **33p**; 4 track **55p**.
MV metal mounting shields **39p** each.
2 track-heads already fixed on heavy mounting plate with shield **£1·22**.

DRILL CONTROLLER
NEW IKW MODEL
Electronically changes speed from approximately 10 revs. to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. **£1·95** plus 25p post and insurance. Made up model also available. **£2·95** plus 25p post & p.

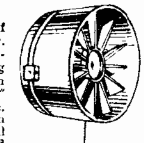
TIME SWITCH

Smith's mains driven clock with 15 amp switch, also notes showing how you can wake up with music playing, kettle boiling or come home to a warm house, warn off burglars, keep pets warm, halve your heating bills, etc. **£1·95**.

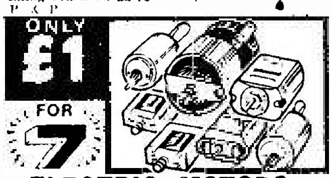
EXPERIMENTER PRINTED CIRCUIT KIT BUILD 60 INTERESTING PROJECTS
CONTENTS: (1) 2 Copper Laminate Boards 4½in. × 2½in. (2) 1 Board for Matchbox Radio. (3) 1 Board for Wristwatch Radio, etc. (4) Resist. (5) Resist Solvent. (6) Etchant. (7) Cleanser/Degreaser. (8) 16-page Booklet Printed Circuits for Amateurs. (9) 2 Miniature Radio Dials SW/MW/LW. Also free with each kit. (10) Essential Design Data Circuits, Chassis Plans, etc. for 60 TRANSISTORISED PROJECTS. Circuits to suit everyone's requirements. Price £1. post paid.



TELESCOPIC AERIAL

for portable, car radio or transmitter. Chrome plated — six sections, extends from 7½ to 47in. Hole in bottom for 6BA screw. **42p**. KNUCKLED MODEL FOR FM **55p**

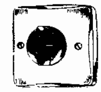
EXTRACTOR FAN

Cleans the air at the rate of 10,000 cubic ft. per hour. Suitable for kitchens, bathrooms, factories, changing rooms, etc., it's so quiet it can hardly be heard. Compact, 5½" casing with 5½" fan blades. Kit comprises motor, fan blades, sheet steel casing, pull switch, mains connector, and fixing brackets. £2·75 + [illegible] P. & P.

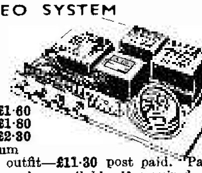


ELECTRIC MOTORS
7 powerful battery motors as used in racing cars and power models. Output and types vary to make them suitable for hundreds of different projects—tools, toys, models, etc. All brand new, reversible and for 1½ to 12v. Bats., wiring diagrams included. Post and VAT 30p.
FREE Details of how to make miniature power station.

HI-Q TUNER COMPONENTS
For experimenting with the **ZN414**.
KIT NO. 1. Plessey Miniature Tuning Condenser with built-in LW switch and 3in ferrite slab and litz wound MW coil, **72p**.
KIT NO. 2. Air spaced tuning condenser 6in. ferrite rod litz wound MW and LW coils. **94p**.
KIT NO. 3. Air spaced TC with slow motion drive 8in. ferrite rod, with litz wound LW and MW coils, **£1·10**.
KIT NO. 4. Permeability tuner with fast and slow motion drive and LW loading coils, **50p**.

INTEGRATED CIRCUIT BARGAIN
A parcel of integrated circuits made by the famous Plessey Company. A once-in-a-lifetime offer of Micro-electronic devices well below cost of manufacture. The parcel contains 5 ICs all new and perfect, first-grade device, definitely not sub standard or seconds. 4 of the ICs are single silicon chip GP amplifiers. The 5th is a monolithic NPN matched pair. Regular price of parcel well over **£5**. Full circuit details of the ICs are included and in addition you will receive a list of many different ICs available at bargain prices **25p** upwards with circuits and technical data of each. Complete parcel only **£1** post paid.
DON'T MISS THIS TERRIFIC BARGAIN.

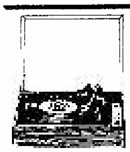
THYRISTOR LIGHT DIMMER

For any lamp up to 1kw. Mounted on switch plate to fit in place of standard switch. Virtually no radio interference. Price **£2·95**, plus 20p post and insurance. Industrial model 5A **£3·30**. Not on plate.

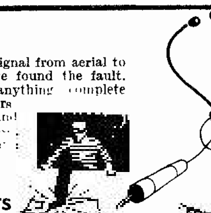
MULLARD UNILEX STEREO SYSTEM

There is no doubt that it is a good system, we believe that for the money it is without comparison. We demonstrate gladly at our Tamworth Road depot. Prices of the individual items for this:—

1 Unilex Amplifier	Ref. EP.9000	**£1·60**
1 Unilex Pre-Amp	Ref. EP.9001	**£1·80**
1 Unilex Power Unit	Ref. EP.9002	**£2·30**

1 Control panel kit with spun aluminium faced knobs **£3·30** Or the complete outfit—**£11·30** post paid. Pair of 15 ohm speakers made by E.M.I. are also available if required, **£3·30** the pair. No extra postage if ordered with the above, otherwise add 25p

DISTRIBUTION PANELS
Just what you need for work bench or lab. 4 × 13 amp sockets in metal box to take standard 13 amp fused plugs and on/off switch with neon warning light. Supplied complete with 6 feet of flex cable. Wired up ready to work. **£2·75** plus 25p P. & P.

THIS MONTH'S SNIP

Latest BSR Record Changer with ceramic Stereo Cartridge **£6·95** and if purchased at the same time teak veneered wooden plinth and Perspex cover for only **£4·00** instead of £4·95 P. & P. £1 on one or both items.

RADIO STETHOSCOPE

Easiest way to fault find—traces signal from aerial to speaker—when signal stops you've found the fault. Use it on Radio, TV. amplifier, anything. Complete kit comprises two special transistors and all parts including probe tube and crystal earpiece. **£2·20** twin stethoscope instead of earpiece **83p** extra post & ins. 20p

SWITCH TRIGGER MATS

So thin is undetectable under carpet but will switch on with slightest pressure. For burglar alarms, shop doors, etc. 24in × 18in **£1·69**. 13in × 10in **£1·21**.

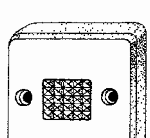
SHORTWAVE CRYSTAL SET
Although this uses no battery it gives really amazing results. You will receive an amazing assortment of stations over the 19.25.31.39 & 49 metre bands. Kit contains chassis front panel and all the parts. £1·25—crystal earphone **33p**.

HORSTMANN "TIME AND SET" SWITCH

(A 30 amp Switch). Just the thing if you want to come home to a warm house without it costing you a fortune. You can delay the switch on time of your electric fires, etc., up to 14 hours from setting time or you can use the switch to give a boost on period of up to 3 hours. Equally suitable to control processing. Regular price probably around £5. Special snip price **£1·65**, p. & ins. 23p.

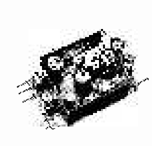
MAINS TRANSISTOR POWER PACK
Designed to operate transistor sets and amplifiers. Adjustable output 6v., 9v., 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: PP1, PP3, PP4, PP6, PP7, PP9 and others. Kit comprises: mains transformer rectifier, smoothing and load resistor, condensers and instructions. Real snip at only **£1·10**, plus 20p postage.

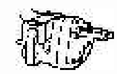
I CHIP RADIO
Ferranti's latest device **ZN414** gives result better than superhet. Supplied complete with technical notes and circuits. **£1·38** each. 10 for **£11·11**.

LIGHT SWITCH KIT

Light switch kit. Comprises photo resistive cell, solid state relay, resistors and condenser. This is mains operated and will switch up to 350W (1½ amps), price **£1** with circuit. Much higher loads can be switched if used in conjunction with relay type JB7 which is also available price **90p** with circuit.
Photo Resistive cell mounted on switch plate with filter and protective cover, **£1** (as illustrated).
Light switch kit with this, **£1·78**.
Light Switch
The above kit made up ready to work and tested, **£2·95**.

MULTI-SPEED MOTOR

Six speeds are available 500, 850 and 1,100 r.p.m. and 8,000, 12,000 & 15,500 r.p.m. Shaft is ⅛ in. diameter and approximately 1 in. long. 230/240v. Its speed may be further controlled with the use of our Thryrister controller. Very powerful and useful motor size approx. 2 in. dia. × 5 in. long. Price **97p** plus 23p postage and insurance.

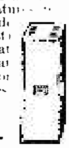
MULLARD AUDIO AMPLIFIERS

All in module form, each ready built complete with heat sinks and connection tags, data supplied.
Model 1153 500mW power output **72p**
Model 1172 750mW power output **94p**
Model EP9000 4 watt power output **£1·60**
EP 9001 twin channel or stereo pre amp. **£1·99**

SPIT MOTOR

200-250V induction motor, driving a Carter gearbox with a 1¼" output drive shaft running at 5 revs p.m. Intended for roasting chickens, also for driving models—windmills, coloured disc lighting effects, etc. **£2·05** plus 20p post and ins.

NUMICATOR TUBES

For digital instruments, counters, timers clocks, etc. Hi-vac XN.3. Price **99p** each. 10 for **£9**.

SEALED RELAYS
STC sealed relays. Makers type ref. 6945. These are metal encased plug in with two pairs changeover contacts. Approx. size 1½" high × 1" × ⅞". We understand these are vacuum sealed. Two types available 6v (45 ohms coil price **£1·50**; 24v (700 ohms coil) price **£1·75**.
STC sealed relay. Again, type 6945, sealed metal case plug in but for 12v operation (170 ohms coil) and with 2 pairs normal open contacts. **£1·25**.

WALL THERMOSTATS

Wall mounting and in a handsome plastic case. (Cream and beige). Adjustable by slider (lockable) and may be set to control temperatures around freezing through to 50°C. The slide panel is engraved and indicates (frost) (warm) (very warm), etc. The thermostat will control heaters, etc., up to 15 amp at normal mains voltage and is ideal for living room, bedroom and greenhouses etc. Price **£1·65**. Don't miss this.

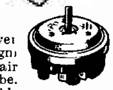
20 WATT CAMPING LIGHT
Also makes good car emergency light. This uses a standard 2 foot 20 watt tube and operates from a 12v. car battery drawing approx. 1A. This gives illumination per amp/hour of battery life far in excess to filament lamps and in fact to the miniature 8-13 watt camping lights often offered. Complete unit ready to operate, in strong white enamelled metal frame. These would normally sell at £6, are unused but slightly soiled and we offer these at **£4·50** plus **40p** post and packing.

WINDSCREEN WIPER CONTROL

Vary speed of your wiper to suit conditions. All parts and instructions to make. **£2·48**.

6 DIGIT COUNTER

Resettable. 440 ohm coil up to 25 impulses per second. Ex-equipment but guaranteed perfect, **£2·20** each.
4 digit counter as specified for telephone charge calculator **75p**.

PRESSURE SWITCH

Containing a 15 amp. change over switch operated by a diaphragm which in turn is operated by air pressure through a small metal tube. The operating pressure is adjustable but is set to operate in approx. 10 in. of water. These are quite low pressure devices and can in fact be operated simply by blowing into the inlet tube. Original use was for washing machines to turn off water when tub has reached correct level but no doubt has many other applications **£1·38**, each.

12 VOLT 1½ AMP POWER PACK

This comprises double-wound 230/240V mains transformer with full wave rectifier and 2000 mfd/ smoothing. Price **£2·20** + p. & p. 20p.
Heavy Duty Mains Power Pack· Output voltage adjustable from 15–40V in steps—maximum load 250W—that is from 6 amp at 40V to 15 amp at 15V. This really is a high power heavy duty unit with dozens of workshop uses. Output voltage adjustment is very quick—simply interchange push on leads. Silicon rectifiers and smoothing by 3,000mF. Price **£6·33** plus 65p post.

TERMS:—
Add 10% V.A.T.
Send postage where quoted—other items, post free if order for these items is £6·00, otherwise add 30p.

J. BULL (ELECTRICAL) LTD.
(Dept. P.W.), 102/3 TAMWORTH RD., CROYDON CRO IXX.

BUYERS' GUIDE

AS we promised a few months ago we are publishing for the first time the P.W. Buyers' Guide to Radio and Electronic Components. This has resulted from the years of experience we have of the several problems that we hear about from you, the readers.

Components form the basic requirements to building up a project and it can be argued that *Practical Wireless* is probably more involved in the problems of electronic component demand and supply than any other magazine of its kind. It is fitting therefore that we should launch this Buyers' Guide. It has not been possible to deal with every detail in the limited space available and certainly does not pretend to satisfy every reader's requirements. What we do aim to provide is a ready reference to component symbols used in circuit diagrams and a directory of those suppliers in the retail trade who have responded to our request for information on their trading policies and product lines. We are also pleased to welcome the assistance provided by these component suppliers who have taken space for their own personal announcements.

The fact that the response was at least up to our expectations confirms the value of such a service to the readership. We hope you will find something useful in this for your own personal needs.

We must point out that, in order to give this exercise the treatment it requires, it has been necessary to divide the Guide into sections. We do appreciate the problem that this may present to a few readers, but it would otherwise have been necessary to make it a separate book for which there would have been an additional charge. To offset this fact we have presented more than half of the Guide as extra pages, specially printed and added to the normal magazine this month; the remainder is included in the next three issues. We can now offer all this information in a form exclusive to *P.W.* readers at no extra cost to you. If you find, when you have the complete guide, that there are other aspects that you would like to have seen, related to buying components, then drop us a line and tell us.

For those readers, and that must be everyone, who are still looking for interesting projects to read about or make up, stay with us because we have more superb designs coming. This month we present a top rated project to beat other designs—an f.m. tuner. The designers said that they developed this because there were no other published do-it-yourself f.m. tuner designs that they felt were good enough. And that is certainly one way of looking at it. See us at the Audio Fair!

The November issue should be published before the Audio Fair and the Motor Show, so make sure you do not miss out on our Add-on Stereo Hi-Fi units. Also we shall have the second section of the P.W. Buyers' Guide.
Look out for the December issue in which we give you completely free of charge **the *Practical Wireless* screwdriver.**

(All advanced details are subject to the current industrial situation)

NEWS...

P.O. get PCM gear

MARCONI Communication Systems, a GEC-Marconi Electronics company, has received its largest single order for PCM equipment from the British Post Office, valued at £1½ million.

This follows a contract from the Post Office last October for £1¼ million worth of similar equipment and brings total PCM sales to the Post Office to £14½ million.

Most of the 24 channel equipment in the latest contract is destined for the London Telecommunications Region, but some will be used in the Eastern Region and Scotland. Delivery will be in two phases during the first half of 1975.

Pulse code modulation was developed specifically as a method of increasing the capacity of existing cables. Its use makes it possible to increase the number of telephone circuits by up to 12 on a single pair of wires.

PCM has obvious advantages in built up areas as an alternative to expensive and inconvenient cable laying. It has also been proved effective in rural areas where demand for telephones and pressure on the system has increased over the past few years.

University of Durham Radio Society

IT is proposed to start a University Radio Society, and the callsign of G4DUR has been provisionally reserved. Anyone interested please contact Peter Whittle (G4BBU), 1 Blinco Rd., Urmston, Manchester, M31 1NF, or during term c/o St. Chad's College, South Bailey, Durham.

"Cheesed off"

TWO Dutchmen — one in Nijmegen, the other in Wageningen — threw their TV sets out of the window as the final whistle of the World Cup between Holland and West Germany blew!

NEWS... NEWS... NEWS...

Listeners please note

MALCOLM CONNAH as most of you are probably aware will not be writing the Broadcast Bands article and Simon David has ceased to write the VHF Column.

It would be appreciated however, if you have any logs for either of these two features, you send them to the Editor, Editorial offices, Practical Wireless, Fleetway House, Farringdon Street, London, EC4A 4AD.

Motorola FETs

LATEST discrete components to come from Motorola are two new dual gate FETs offering a common source power gain of 10dB (min) and a noise figure of 6dB (max) at 500MHz.

Manufactured using a silicon nitride passivation process for excellent long-term stability, the devices feature a low reverse transfer capacitance (C_{rss}= 0·03pF max) and have built-in input protection zener diodes.

Designated types 3N209 (TO 72 package) and 3N210 (Micro-H package), the FETs are designed for a maximum drain-source voltage of 25V and a maximum power dissipation of 300mW (3N209 derated 1·7mW/°C above 25°C) and 350mW (3N310 derated at 2·8mW/°C above 25°C).

Tyne/Wear Local Radio

THE first Independent Local Radio station in North-East England, Metropolitan Broadcasting, began programmes on Monday, July 15 using the new sound radio transmitters of the I.B.A. This is the first station providing listeners in the North-East with stereo broadcasting.

The predicted v.h.f. service area includes Newcastle upon Tyne, Ashington, Bedlington, Sunderland, Blaydon, South Shields, Tynemouth, Morpeth, Washington, Blyth, Gateshead, Durham, Houghton-le-Spring, Stanley, Chester-le-Street, Jarrow, Hebburn, Wallsend, Longbenton and Gosforth and extends to parts of Bishop Auckland, Consett, Seaham, Spennymoor and Corbridge.

Decca and KW

FOLLOWING their recent acquisition of KW Communications Ltd. of Dartford, Decca have formed a new firm called Decca Communications Ltd.

KW Communications—formerly KW Electronics, formed in 1955, specialised in amateur radio gear. In recent years however, their interests have been diversified to include professional radio communications, especially mobile and point-to-point h.f. ssb systems.

The Decca policy for the new company is to develop and expand these activities.

Decca Communications Ltd., which took part in the recent Brighton Communications Exhibition, markets its products under the Decca name. Amateur radio equipment will be sold under the KW trade mark. In addition, certain equipment is being supplied to other manufacturers under contract.

John Carter presents . . .

IN the April issue of Practical Wireless, we mentioned a Collectors' Bazaar at Alexandra Palace, Wood Green, London, N.22 where one could buy anything from a vintage phonograph to a Victorian bottle.

Well, that one was very successful so the promoter, John Carter will be organising another one for Sunday October 20th. Once again it will be a five-bazaar event and John promises us that "Going Back" enthusiasts will probably be able to pick up quite a few bargains. There will be quite a number of stalls devoted to vintage records and radio gear.

If you want to know more about the bazaar or even want to hire a stall and sell some of your own goods, send a stamped, addressed envelope to: John Carter, "Smewins", Shottesbrooke, nr. Maidenhead, Berks, SL6 3SR (Tel Shurlock Row 539).

Duke visits cable ship

H.R.H. THE DUKE OF KENT, member of the Council of the Institution of Electronic and Radio Engineers, on board the Cable and Wireless cableship *Mercury* during her stay in London. C.S. *Mercury*, moored in the Pool of London, was the initiation point for the inaugural call of the newest transatlantic cable, Cantat-2. She is flagship of the Cable and Wireless fleet and has laid 2,630 nautical miles of Cantat-2. Built in 1962, C.S.*Mercury*, with a gross tonnage of 8,962, has sailed about half a million miles, laid 16,843 nautical miles of cable, 1139 repeaters and 86 equalisers.

His Royal Highness is pictured here receiving a plaque of the ship's crest from Radio Officer Paul Money (centre), Captain Robinson (left).

PW SANDOWN PART 1 f.m. stereo

THE introduction of integrated circuits into domestic products has dramatically changed the market for consumer electronic goods. Outstanding examples are, of course, the pocket calculator and the whole range of Hi Fi equipment, including FM tuners.

The integrated circuit has three main advantages for the equipment manufacturer—better performance, reduced component cost and simplified assembly and alignment. These are also of great benefit to the home constructor, especially the ease of alignment.

The PW "Sandown" tuner combines all the benefits of integrated circuits with a performance and facilities equalling those of the best commercial models. Particular attention has been given to simplifying the alignment procedure and making sure that the model can be successfully reproduced by the home constructor. A word of warning however, this is still not a project for the beginner and no one who has not successfully completed other projects should attempt this one.

SPECIFICATIONS

Tuner specifications can be somewhat bewildering. It is worth reviewing briefly just what the various terms mean and what the desirable minimum performance figures are.

Limiting voltage: The minimum signal level from the aerial for satisfactory rejection of A.M. interference. This should be as small as possible and not greater than about 1μV for long-distance reception.

Quieting sensitivities: The signal level from the aerial necessary to produce the quoted signal-to-noise ratio or quieting. Preferably less than 2·5μV for 30dB on mono.

Capture ratio: The ability of an FM tuner to select the stronger of two conflicting signals. The figure quoted indicates the minimum difference in strength necessary for capture and should be not greater than about 2·5dB.

Selectivity: The transmitted signal on Band II occupies a bandwidth of 200kHz and the tuner must obviously encompass this range. At the same time it must reject interference from stations on Adjacent Channels—spaced 200kHz away—or on Alternate Channels, spaced 400kHz away from the wanted station.

In a superheterodyne receiver, there are a number of spurious responses, the two most serious being the Image and IF Breakthrough. Image response occurs on frequencies spaced from the wanted station by twice the IF. Intermediate Frequency breakthrough results from incoming signals from the aerial at the IF passing through the RF stages at sufficient strength to cause interference.

Both responses are minimised by adequate RF selectivity. Rejection figures should exceed 50dB for Image and 70dB for IF breakthrough.

Audio output: This figure must be compared with the input sensitivity of your amplifier to assess its compatibility.

Stereo separation: Insufficient separation between the two stereo channels will spoil the reproduced stereo image. A desirable minimum is about 30dB.

COMPONENTS

At this time of fast changing device technology it seems that every equipment uses some new form of circuit and device. One is sometimes tempted to ask if the changes are necessary and whether the new devices confer any real benefit.

Dual gate MOSFETs are increasingly being used as amplifiers in circuits operating between 20 and 500MHz. They are preferred to bipolar transistors and junction FETs because they are intrinsically more linear devices so reducing spurious responses. They also have an excellent noise performance.

These advantages accrue to either the single gate or dual gate MOSFET. The inclusion of a second gate turns a good RF device into an outstanding one for uses such as this tuner. Since the voltage on the second gate controls the gain of the device it provides a simple method of applying automatic gain control to the RF stage. By the same means the local oscillator can be coupled into the mixer with very little chance that there will be any feedthrough to the aerial.

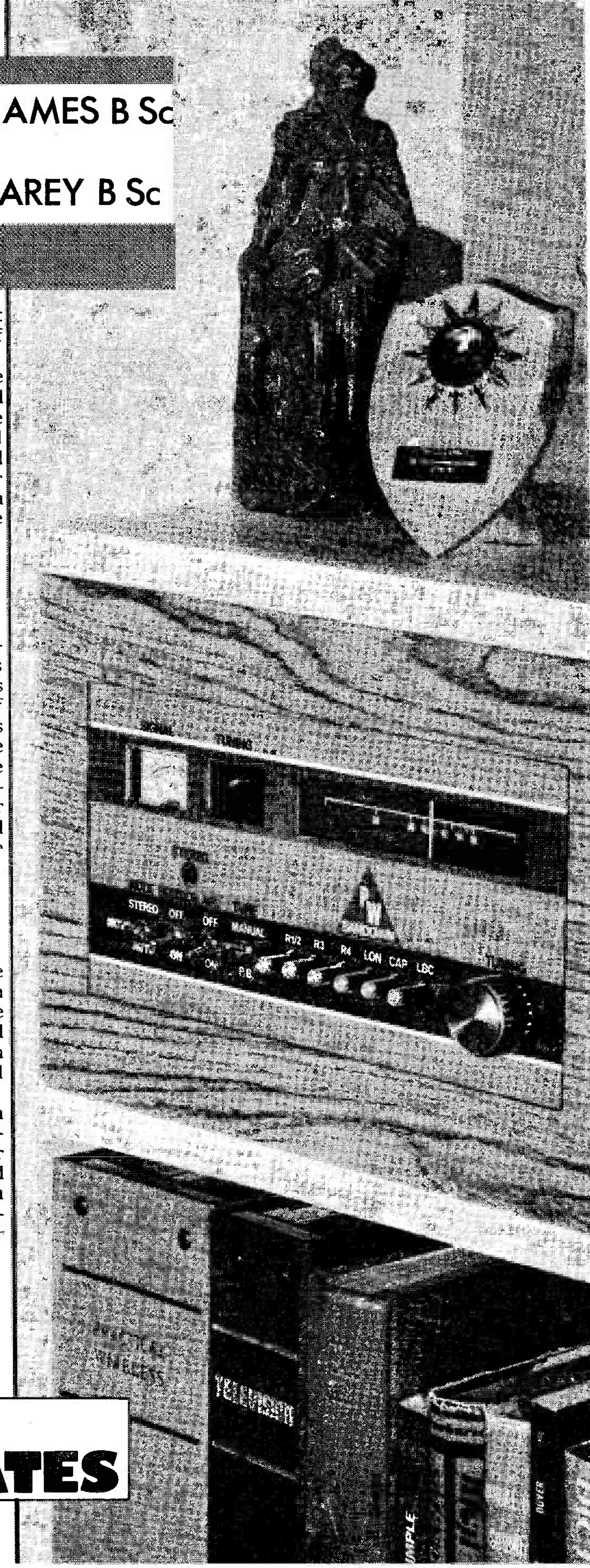
The second gate also serves to isolate the drain voltage from the first gate. This leads to a very small value of feedback capacitance so that the

★ Typical Performance

Sensitivity	
Limiting voltage	0·5μV
30dB quieting—mono	1·5μV
50dB quieting—stereo	12μV
Capture Ratio	2dB
Selectivity	
3dB bandwidth	250kHz
Adjacent channel rejection	25dB
Alternate channel rejection	65dB
Image rejection	60dB
I.F. rejection	85dB
Audio output (peak)	500mV
Stereo separation	40dB

tuner

J. R.W. AMES B Sc
&
M.J. CAREY B Sc



maximum gain of the device can be realised without neutralisation and with a reduced possibility of instability.

The main disadvantages of these devices are the high current consumption—about 10mA compared with 1mA for a bipolar device—and the delicate nature of the gate electrodes which can be damaged by static charges during handling. The devices used in this tuner overcome this by use of internal zener diodes which conduct away the charge before a dangerous voltage can build up. These diodes have a negligible effect on signal performance.

CERAMIC FILTERS

The high sensitivity and excellent noise performance of dual gate MOSFETs and integrated circuits would be of considerably less value if components of high selectivity were not available. It was of course always possible to build tuned circuit filters with a good response or to use quartz filters but the former were not easy to align and the latter were expensive. Now, however, ceramic filters are available which are preselected by the manufacturer for close frequency tolerances. They combine the good selectivity already mentioned with the linear phase response so vital to good stereo separation.

INTEGRATED CIRCUITS

There are several IF integrated circuits available from a number of manufacturers but none of them offers the complete range of functions which the RCA CA3089E performs. This IC has been designed as part of a system, and is intended to work in combination with a dual gate MOSFET front end and the CA3090AQ stereo decoder.

The circuit comprises a limiting amplifier chain followed by a quadrature detector and audio amplifier. Supplementary outputs include AFC drive for the local oscillator varicap tuning diode, delayed AGC for the RF amplifier stage and Signal-strength meter drive. This last output is also used to override the stereo switching in the CA3090AQ decoder if there is insufficient signal for noise-free stereo.

PW SUPER SEPARATES

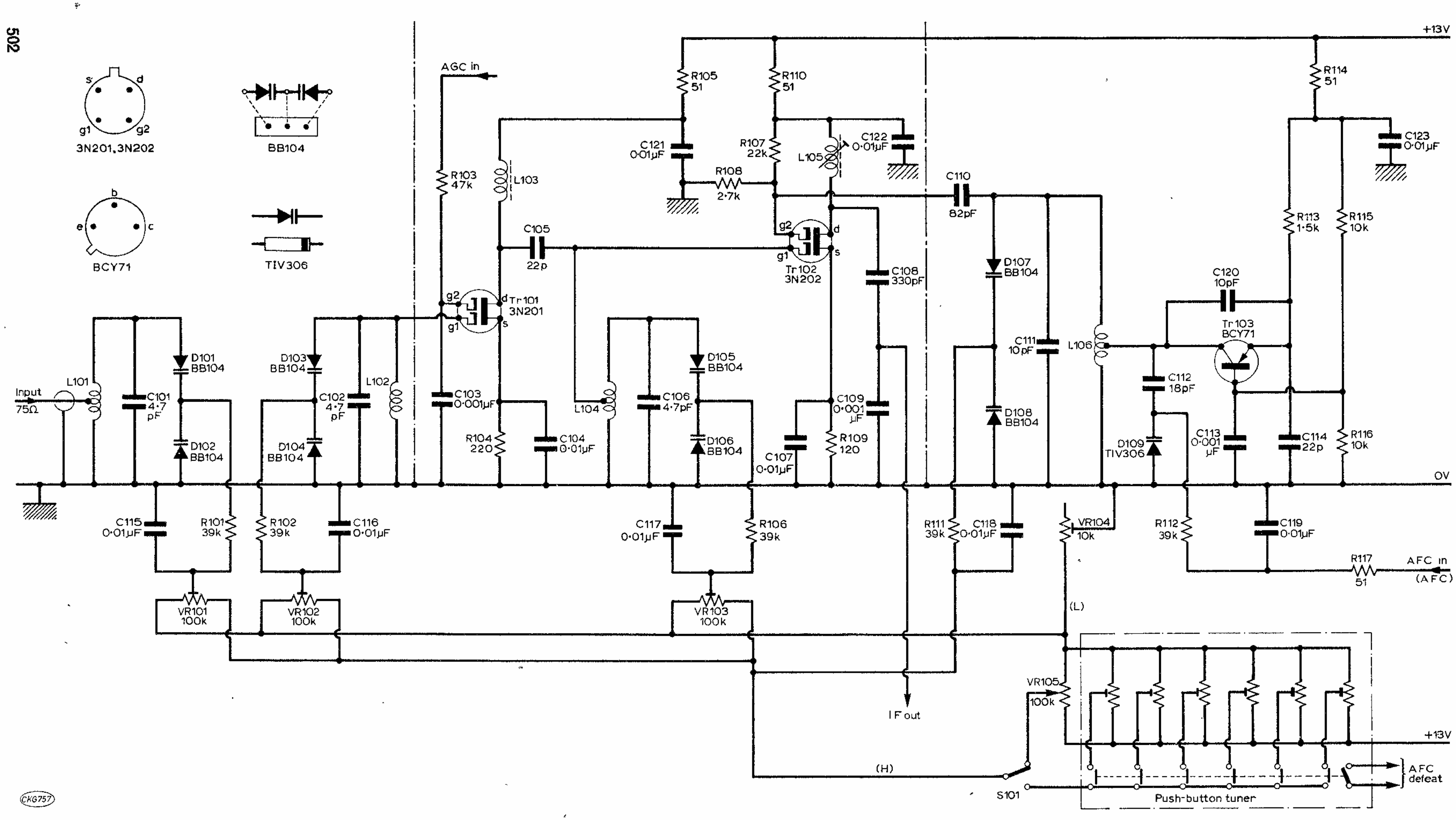


Fig. 1: Circuit diagram of the RF amplifier, Mixer and Oscillator stages. The letters in brackets denote labelled points on the printed circuit board.

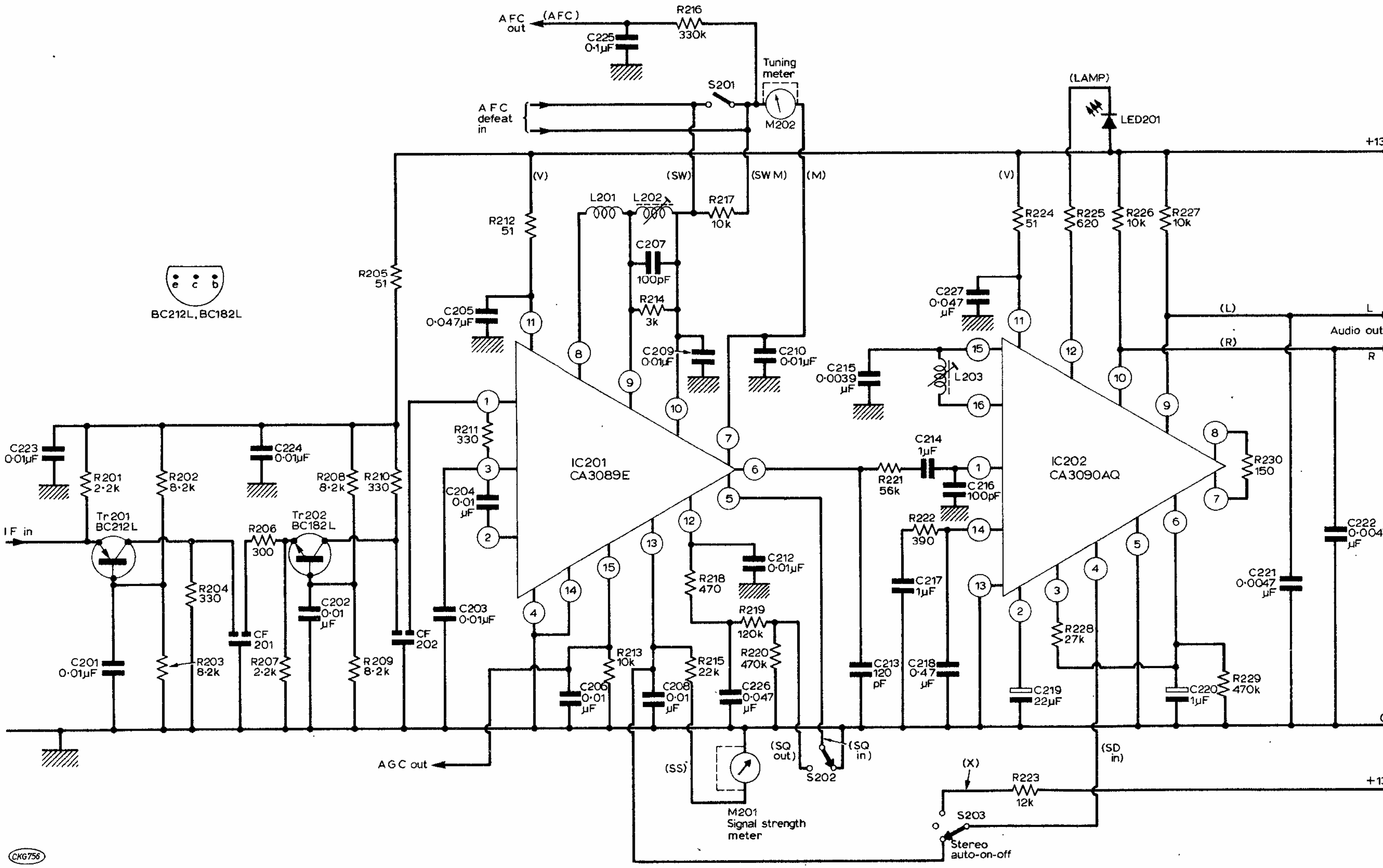


Fig. 2: Circuit diagram of the IF, Demodulator and Stereo Decoder stages. Either meter may be omitted provided the dotted links are added.

★ components list

Resistors (all ¼W 5%)

R101	39kΩ	R201	2·2kΩ	R218	470Ω
R102	39kΩ	R202	8·2kΩ	R219	120kΩ
R103	47kΩ	R203	8·2kΩ	R220	470kΩ
R104	220Ω	R204	330Ω	R221	56kΩ
R105	51Ω	R205	51Ω	R222	390Ω
R106	39kΩ	R206	300Ω	R223	12kΩ
R107	22kΩ	R207	2·2kΩ	R224	51Ω
R108	2·7kΩ	R208	8·2kΩ	R225	620Ω
R109	120Ω	R209	8·2kΩ	R226	10kΩ
R110	51Ω	R210	330Ω	R227	10kΩ
R111	39kΩ	R211	330Ω	R228	27kΩ
R112	39kΩ	R212	51Ω	R229	470kΩ
R113	1·5kΩ	R213	10kΩ	R230	150Ω
R114	51Ω	R214	3kΩ	R301	3·9kΩ
R115	10kΩ	R215	22kΩ	R302	5Ω
R116	10kΩ	R216	330kΩ	R303	7·5kΩ
R117	51Ω	R217	10kΩ	R304	7·5kΩ

Capacitors

C101, C102 4·7pF 63V
C103 0·001µF 100V
C104 0·01µF 100V
C105 22pF 63V
C106 4·7pF 63V
C107 0·01µF 100V
C108 330pF 63V
C109 0·001µF SMC
C110 82pF 63V
C111 10pF 63V
C112 18pF 63V
C113 0·001µF 100V
C114 22pF 63V
C115–C119 0·01µF 100V
C120 10pF 63V
C121–C123 0·01µF 100V
C201–C204 0·01µF 100V
C205 0·047µF 30V Disc
C206 0·01µF 100V
C207 100pF 63V
C208–C210 0·01µF 100V
C212 0·01µF 100V
C213 120pF 63V
C214 1µF 100V MP
C215 0·0039µF 63V PS
C216 100pF 63V
C217 1µF 100V MP
C218 0·47µF 100V MP
C219 22µF 16V TM
C220 1µF 35V TM
C221, C222 0·0047µF 63V PS
C223, C224 0·01µF 100V
C225 0·1µF 18V Disc
C226–C227 0·047µF 30V Disc
C301 1000µF 25V EL
C302 100pF 63V
C303 0·1µF 18V Disc

Capacitor type codes:—
SMC Sub-min tubular ceramic
Disc Disc ceramic
MP Metallized polyester
PS Polystyrene
TM Tantalum
EL Electrolytic
Remainder are miniature ceramic plate type

Potentiometers
VR101–VR103 100kΩ Cermet preset
VR104 10kΩ Cermet preset
VR105 100kΩ log Moulded track

Semiconductors
Tr101 3N201 Texas
Tr102 3N202 Texas
Tr103 BCY71
D101–D108 BB104 Siemens
D109 TIV 306 Texas
IC201 CA3089E RCA
IC202 CA3090AQ RCA
LED201 Miniature LED (Red)
Tr201 BC212L
Tr202 BC182L
D301, D302 1N4001
IC301 L123B SGS

Inductors and filters
L101, L102, L104, L106 20 swg tinned copper wire
L103 3/16" Threaded slug, powdered iron (100 MHz, blue) Cambion
L105, L202 Neosid A6 assembly
L201 RF Choke, Cambion 551-7108-27
L203 Toko 87BN135BX2
Also 34 swg enamelled copper wire for L103, L105, L202
CF201, CF202 Vernitron FM4 matched pair

Miscellaneous
M201 200µA FSD
M202 100-0-100µA FSD
T301 12-0-12V 250mA secondary
X101 Push-button tuner, 6-station
F301 100mA anti-surge
LP301, LP302 12V 100mA max.
S101, S201, S202 SPDT Sub-min toggle
S203 SP, C/Off Sub-min toggle
Aerial socket, co-axial. Audio output socket, 5 way DIN. Lead-through insulators, 17 off. Printed circuit board. Die-cast box 8¾" x 5¾" x 2¼". Tuning-drive parts (all by Jackson Bros.):—Cord drive 4555, 1½" drum 4509, ½" spring 4587, Pointer 4580

Note
The Push-button tuner and the pcb are available from:— F. W. Electronics,
40 Tuddenham Road,
Ipswich, IP4 2SL
priced respectively at £2·75 and about £3, plus VAT.
They will also be stocking the two FETs

A squelch or inter-station muting facility is also incorporated. This virtually cuts off the audio output in the absence of a received signal of reasonable strength.

The CA3090AQ decoder uses the phase-locked loop principle, which offers simplified initial alignment and more stable long-term performance. Automatic mono-stereo switching and stereo beacon drive is incorporated, operated by the 19kHz pilot tone on stereo transmissions.

CIRCUIT DETAILS

Coupled coils L101, L102 (Fig. 1) together with their associated components form a tuneable band-pass circuit which couples the 75Ω aerial input to the dual gate MOSFET RF amplifier Tr 101. Delayed AGC is applied to this stage via R103. The RF signals are then passed, via a further tuned stage to the MOSFET Tr 102 where they are mixed with the output of the Colpitts oscillator, Tr 103.

The oscillator is tuned to 10·7 MHz above the incoming signal frequency by L106, C111 and the tuning varicap diodes D107, D108. Varicap D109 changes the oscillator frequency in response to the AFC voltage to compensate for slight mistuning or oscillator drift. The mixer load is tuned to 10·7 MHz and is capacitively tapped to provide a low impedance output suitable for feeding to the IF stages.

Both the signal and oscillator circuits in this receiver are tuned by the back-to-back varicap diodes D101-D108 in Fig. 1. When operated under reverse bias conditions, the capacitance of these diodes varies with the bias voltage, decreasing as the voltage increases.

A potentiometer may be used to vary the reverse bias, and therefore the capacitance, of the diodes thus providing a simple means of tuning the receiver. The leads to this potentiometer do not carry high frequency currents so the tuning control may be mounted at some distance from the receiver. The Q factor of a varicap diode falls rapidly as the reverse bias approaches zero. VR104 is adjusted

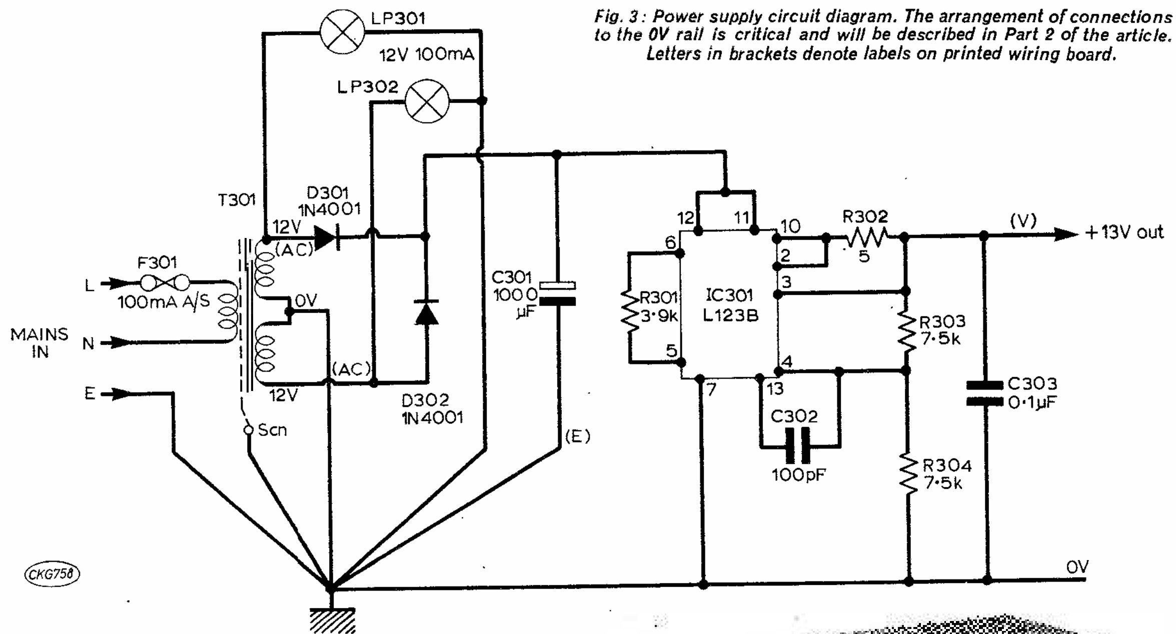


Fig. 3: Power supply circuit diagram. The arrangement of connections to the 0V rail is critical and will be described in Part 2 of the article. Letters in brackets denote labels on printed wiring board.

to ensure that the diodes do not approach this condition when the tuning voltage is at minimum.

For simplicity the tuning range of this receiver is determined by the oscillator, the RF circuits being adjusted to track over the same range by adjustment of L101, L102, L104 and VR101-VR103. S101 selects the source of the tuning bias voltage which may be either the manual tuning control, VR105, or the push-button unit. The selected button may be rotated to adjust the preset tuning potentiometers.

Selection of a button momentarily operates a switch which overrides the action of the AFC circuit as the tuning of the receiver changes. This prevents the receiver from locking on to strong signals whilst tuning to adjacent weak ones.

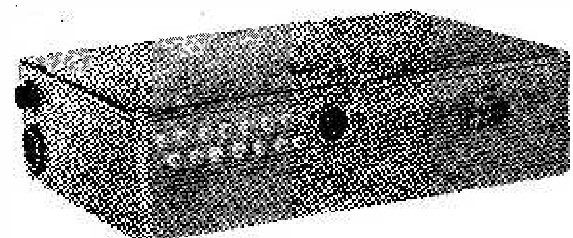
Alignment details will be given in a later part of the article. The simple alignment procedure means that no expensive equipment is needed, a voltmeter and a pair of ears being the only essential items!

The 10·7MHz IF signal is fed to the common-base stage Tr 201 (Fig. 2) which acts as a buffer between the low impedance output from the front end and the first ceramic filter CF201. A further buffer transistor Tr 202 feeds a second ceramic filter which completes the IF selectivity section.

Integrated circuit IC201 contains the IF amplifier and demodulator and provides outputs for a tuning meter, signal strength meter, delayed AGC, AFC, squelch and automatic stereo inhibit as previously described. Either or both meters may be omitted if they are replaced by wire links, shown dotted in Fig. 2, and any of the switched facilities may be permanently wired, allowing the switch to be omitted if required.

Demodulated signals which appear at pin 6 are fed to the stereo decoder IC202 via R221, which ensures that IC202 cannot be overloaded by large outputs from IC201. Capacitor C216 produces a break-point at 53kHz to reduce 'birdies' which can be produced by signals whose frequency is close to that of the required signal.

The oscillator frequency is determined by L203 and C215, whilst C217, 218 and R222 provide the filtering required for correct operation of the phase locked loop. Pin 4 receives the stereo defeat voltage which may be switched via S203 to automatic, to mono only, or to 'stereo lock' which causes any stereo signal to be decoded however poor the signal to noise ratio.



The prototype tuner box. In the final version there are three more leadthrough insulators which carry power to the dial lamps mounted on the front panel assembly.

Left and right hand audio outputs are de-emphasised by C221, C222 and provide about 500mV peak of audio which should be connected to the radio inputs of a good quality amplifier. A light emitting diode, LED 201, is illuminated to indicate that a stereo signal is being decoded.

The power supplies to individual stages of the IF and audio sections are separately decoupled, as in the front end, to avoid unwanted coupling effects.

A conventional full-wave rectifier feeds current to a power supply regulator IC301 (Fig. 3) which produces an extremely stable output of about 13V. A proportion of the output voltage, determined by R303 and R304, is compared with an internally generated stable reference voltage, the result being used to control the output via a high gain amplifier.

Resistors R303, R304 may be adjusted slightly to vary the output voltage, if required. R302 is used to monitor the output current, its value being chosen to limit the current to the safe value of 100mA in the event of a short-circuit.

If a different transformer/rectifier combination is used, ensure that the input voltage of IC301 does not exceed 19V unless it is fitted with an adequate heatsink.

Next month's article will give constructional details including printed circuit board layouts.

Dear Sir,

letters

Interference

With reference to your editorial "Interference". I cannot quite see why you think it surprising that the amateur who is being received on audio equipment is not responsible for curing the equipment.

Long before high fidelity equipment became popular there were well into the tens of thousands of licensed Amateur and commercial transmitting stations in the UK. Knowing this, surely the responsibility for ensuring that the equipment is protected against radio signals lies with the manufacturer. I am no lawyer, but surely at the moment under the Trades Descriptions Act, if we, as retailers sell an amplifier, the customer is entitled to receive an amplifier and not a radio receiver. Certainly with the high fidelity equipment our company has supplied, where difficulty with unwanted radio reception has arisen, we have felt it our responsibility, and with new equipment or equipment within the guarantee period, have always sorted out such difficulties without charge.

Might I also point out, that under the conditions of both receiving and transmitting licences, the Ministry of Posts and Telecommunications, is *not* responsible for sorting out difficulties with audio equipment. If asked nicely, they will usually assist, but they will certainly not close down any transmitter just because of its unwanted reception by audio equipment. They may of course, ask the amateur concerned to volunteer to close down temporarily, if a radio tuner unit is also involved, but strictly speaking, pure audio equipment is outside the field with which they are legally involved.

The suppression of audio equipment against unwanted radio frequency reception, is comparatively simple, and inexpensive at the design stage, and there is no real excuse for the present lack of attention on this point. A point which might not be so well known is that annoying "plops" and "bangs" from refrigerators and central heating thermostats disappear entirely when equipment is properly designed to prevent radio breakthrough, and that there is also evidence which would seem to point out that the elimination of these "spikes" also improves reliability. Several leading manufacturers have now incorporated components to alleviate these troubles, and it is to be hoped that with a little pressure others will soon follow suit. **—Harry Leeming (G3LLL) FSERT. T.Eng. (CEI)., (Technical Director, Holdings Photo Audio Centre).**

There appears to be some confusion arising from this article. The Secretary of the Interference Committee of the RSGB was recently quoted in a letter to the RTRA ("Dealer" Sept 1973) ". . . in the case of interference to audio equipment, strictly speaking the services of the Post Office are not available. Where breakthrough occurs on audio equipment, then it is "by definition" at fault since it is not intended to act as a radio receiver.

"The RSGB has, for several years, had a Committee whose specific purpose is to deal with problems of this nature, and on average we receive about ten enquiries a month from members.

The cures for the problems are often simple, and many of these have been covered in the Society's monthly magazine "Radio Communication". Other Society publications also deal with the matter."

Thank you, Mr. Leeming, for putting the record straight.—Editor.

Dry Battery Charging

I am writing to you to express my concern over the possible consequences to any of your readers who construct and use the dry battery charger described in the March 1974 issue of *Practical Wireless*.

Dry batteries are of primary electrochemical type and should be used only once. Attempts to recharge them are hazardous and in extreme cases could give rise to personal injury.

The underlying reasons for the danger are fundamental and stem from materials which are basic to the construction of dry cells. These materials do not possess the capability of reacting with the gases that are evolved on overcharge. Furthermore even on normal charge, gases are produced due to the Faradic inefficiency of attempting to drive the chemical reactions pertinent to normal useage in the reverse direction. A more insidious effect is that on charge the zinc which forms the negative electrode is not returned to its original state, which is properly inhibited to prevent corrosion but is deposited in a dendritic highly active form which corrodes steadily with the evolution of gaseous hydrogen.

Dry cells are well sealed to ensure that they reach the consumer with the minimum of deterioration and hence are not able to vent the gas resulting from the various charge effects. In consequence the outer construction of the battery ruptures. This may happen quite gradually and possibly not until the battery is in the battery using equipment, whereupon exudation of corrosive liquid is likely, or it may happen suddenly after considerable gas pressure has built up within the battery causing an explosion.

I repeat that dry cells should be used only once and attempts to recharge them are hazardous. **—F. L. Tye, B.Sc., A.K.C., Ph.D., F.R.I.C. (General Manager, Central Laboratories, The Ever Ready Co. (G.B.) Ltd.).**

Stop Watch

Readers who were interested in the construction of the "Solid State Stop Watch" in February P.W., and are fortunate enough to already possess a digital multimeter may not be aware that by simply connecting a 1000μF capacitor across the meter terminals and switching to the ohms range they can obtain a digital timer with no practical construction whatsoever.

On the 100kΩ range readout will be tenths of a second, on 1MΩ range readout will lie in seconds. Maximum readout will be dependent on number of digits available, accuracy depends on the tolerance of the 1000μF capacitor and its leakage. Mode of operation depends on use of constant current source with digital voltage readout.—**J. F. Latuskie** *(Kent)*.

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3S4	·85	6CM7	·75	6X5GT	.40	25Z4G	.38	7475	1.00	EC88	.70
4CB6	·55	6CU5	.75	7B6	.75	25Z5	·80	AC/PEN	·98	EC92	.45
5CG8	·55	6CW4	1.00	7B7	·70	25Z6G	·70	AC2/PEN/		ECC33	1.50
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5U4G	·43	6DT6A	·75	7R7	.80	30A5	.65	AC6PEN	.60	ECC40	1·00
5V4G	.54	6EW6	.75	7Y4	.65	30C15	.75	AC/TH1	£1	ECC81	.34
5Y3GT	.45	6E5	1·00	7Z4	.80	30C17	.90	AL60	1.00	ECC82	.28
5Z3	·70	6F1	.70	9D7	.65	30C18	.78	ATP4	·40	ECC83	.28
5Z4G	·85	6F6G	.40	10C2	.65	30F5	.80	AZ1	·60	ECC84	·30
5Z4GT	·45	6F13	.55	10DE7	.55	30FL1	.75	AZ31	.60	ECC85	.36
6/30L2	.80	6F14	.75	10F1	·50	30FL2	.75	AZ41	.65	ECC86	·85
6A8G	1.25	6F18	.55	10F9	.65	30FL12	1.00	BL63	2·00	ECC88	.44
6AC7	.49	6F23	.80	10F18	.55	30FL13	.55	CL33	1.50	ECC189	.65
6AG5	.27	6F24	.85	10LD11	.70	30FL14	.70	CY1C	1.00	ECC807	1·10
6AH6	.60	6F25	1.00	10P13	.70	30L15	.75	CY31	.45	ECF80	.34
6AJ5	.75	6F28	.60	10P14	2.00	30L17	.70	DAF91	.30	ECF82	.38
6AK5	.34	6F32	.65	12A6	1.00	30P4MR		DAF96	.44	ECF86	.75
6AK6	.60	6G6G	·75	12AC6	.65		1.00	DF91	.30	ECF804	
6AM8A	·55	6GH8A	.75	12AD6	.65	30P12	.80	DF96	.44		2·10
6AN8	·60	6GK5	·65	12AE6	.65	30P19/		DK40	.70	ECH21	2.00
6AQ5	·42	6GU7	.75	12AT6	.38	30P4	.75	DK92	.70	ECH35	1.25
6AR5	·55	6H6GT	.25	12AU6	.45	30PL1	.66	DK96	.60	ECH42	.70
6AS7	1·00	6J5GT	.49	12AV6	.50	30PL13	.75	DL96	.55	ECH81	.30
6AT6	.38	6J6	.25	12BA6	.40	30PL14	.80	DM70	.44	ECH83	.44
6AU6	.30	6J7G	.30	12BE6	.50	30PL15	.90	DM71	1.00	ECH84	.44
6AV6	.33	6JU8A	·75	12BH7	.50	35A3	.65	DY87/6	.30	ECL80	.40
6AW8A	.65	6K7G	.25	12E1	3·00	35D5	·75	DY802	.33	ECL82	.34
6AX4	.75	6K8G	.45	12J7GT	.55	35L6GT	.55	E80CC	1·65	ECL83	.75
6B8G	.30	6LI	2.00	12K5	1.00	35W4	.40	E80F	1.20	ECL84	.60

ECL85	.60	EZ41	.75	PCL84	.49	UC92	.45
ECL86	.40	EZ80	.28	PCL86	.47	UCC84	.75
EF22	1.50	EZ81	.27	PCL805	.55	UCC85	.45
EF40	.75	GY501	.75	PEN45	.80	UCF80	.65
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EF804	1·20	KT44	1.00	PL504/500		UY41	.49
EH90	.45	KT66	2.40		·67	UY85	.38
EL32	·50	KT81	2.00	PL505	1·15	U10	1.00
EL34	.46	KTW61	1·00	PL508	.90	U12/14	1.00
EL36	2·50	KTW62	1·00	PL509	1.15	U19	1.73
EL37	2·50	KTW63	1·00	PL802	.95	U25	.80
EL41	.60	MHLD6	£1	PY33/2	.50	U26	.60
EL81	.60	M8162	1·00	PY81	.31	U33	1.50
EL83	.55	P61	.50	PY82	.30	U35	1.50
EL84	.31	PABC80	.38	PY83	.35	U81	·80
EL85	.44	PC86	.60	PY88	.38	U191	.70
EL86	.38	PC88	.60	PY500	.85	U251	.80
EL91	.40	PC95	.75	PY500A	.85	U281	.55
EL360	1·20	PC97	.38	PY800	.35	U301	·58
EL506	.85	PC900	.45	PY801	.35	U403	.75
ELL80	1·25	PCC84	.40	PZ30	.48	U404	.49
EM80	.45	PCC85	.44	QQV03/10		U801	.85
EM81	.66	PCC88	.60		1.75	U4020	.55
EM83	.55	PCC89	.50	QS75/20	1·00	VP23	.75
EM84	.40	PCC189	.53	QS95/10	1·00	VP41	.75
EM85	1.00	PCF80	·33	QV04/7	1·00	VU111	.80
EM87	.70	PCF82	·35	R19	.38	VU120	1.00
EMM803	£2	PCF84	.59	TH233	.98	VU120A	
EY51	.40	PCF86	.55	TP2620	.98		1.00
EY81	.40	PCF200	.67	UABC80	.40	VU133	.80
EY83	.54	PCF801	.48	UAF42	.60	W107	1·00
EY84	.70	PCF802	.50	UBC41	.53	W729	1.00
EY87/6	.33	PCF806	.55	UBC81	.45	X65	1·25
EY88	.40	PCH200	.70	UBF80	.38	X101	2.00
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EZ40	.55	PCL83	.66	UBL21	.77		

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2N2369	·15	AF139	·72	OA47	·11
2N2613	·43	AF180	·53	OA70	·17
2N3053	·36	AF186	·61	OA73	·17
2N3121	2·75	BA115	·15	OA79	·10
2N3703	·21	BA116	·20	OA81	·10
2N3709	22	BA129	·14	OA85	·09
AA119	·17	BA130	·11	OA90	·14
AA120	·17	BA153	·17	OA91	·10
AA129	·17	BC107	·14	OA95	·10
AAZ13	·20	BC108	·14	OA200	·10
AC107	·17	BC113	·28	OA202	·11
AC113	·28	BC115	·17	OC44	·11
AC126	·14	BC116	·28	OC45	·13
AC127	·19	BC118	·25	OC46	·17
AC128	·22	BCY10	·50	OC70	·14
AC132	·22	BCY12	·55	OC71	·13
AC154	·28	BCY33	·22	OC72	·13
AC156	·22	BCY34	·25	OC74	·25
AC157	·28	BCY38	·25	OC75	·13
AC165	·28	BCY39	·28	OC76	·17
AC166	·28	BCZ11	·42	OC77	·30
AC168	·42	BF158	·20	OC78	·17
AC176	·61	BF159	·28	OC78D	·17
AC177	·31	BF163	·22	OC81	·13
ACY17	·28	BF173	·42	OC81D	·13
ACY18	·22	BF180	·33	OC82	·13
ACY19	·21	BF181	·44	OC82D	·13
ACY20	·20	BF185	·44	OC83	·22
ACY21	·21	BF194	·17	OC84	·26
ACY22	·17	BFY50	·25	OC123	·25
ACY28	·20	BFY51	·21	OC139	·25
AD140	·40	BFY52	·22	OC169	·25
AD149	·55	BY100	·20	OC172	·39
AD161	·50	BY105	·20	OC200	·24
AD162	·50	BY114	·20	OC201	·42
AF114	·28	BY126	·17	OC202	·47
AF115	·17	BY127	·20	OC203	·33
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		BYZ11	·28	OC205	·47

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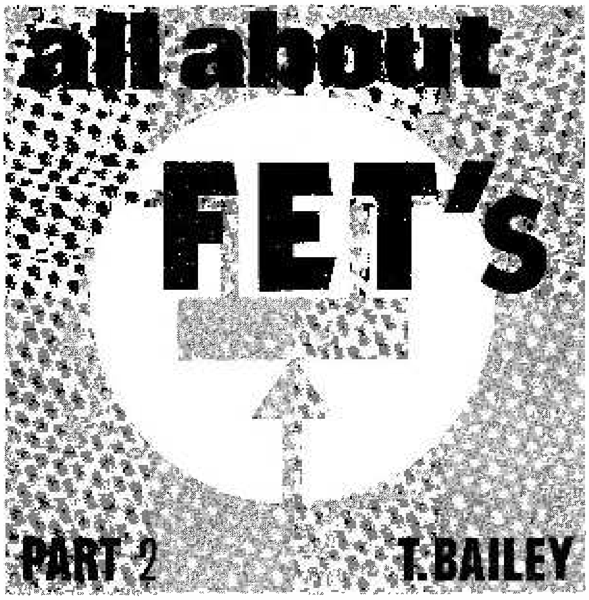


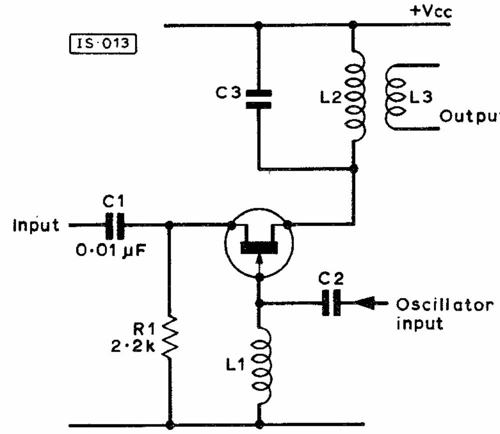


Fig. 13: Mixer circuit employing the common gate mode.

Mixers

The process of mixing really amounts to applying two separate signals to the FET and because the device is not totally linear (ie. the graph of V_{GS} against I_D is not a straight line) it will produce frequencies corresponding to the sum and difference of the original signals. A tuned circuit in the output, usually the drain, is tuned to whichever of the new frequencies is required. In superhets this is nearly always the difference signal and the tuned circuit is the primary of the first IF transformer.

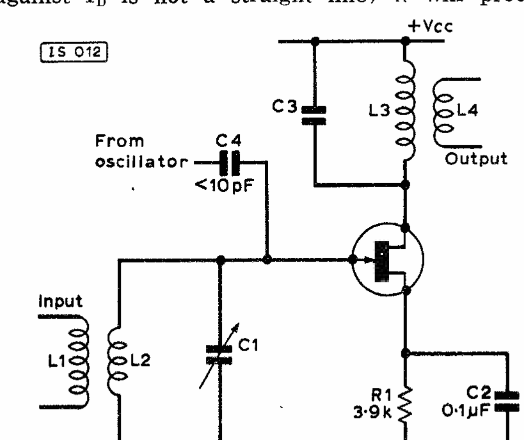


Fig. 12: Two circuits for common source mixers, the tuned circuit L3/C3 resonating at the required output frequency.

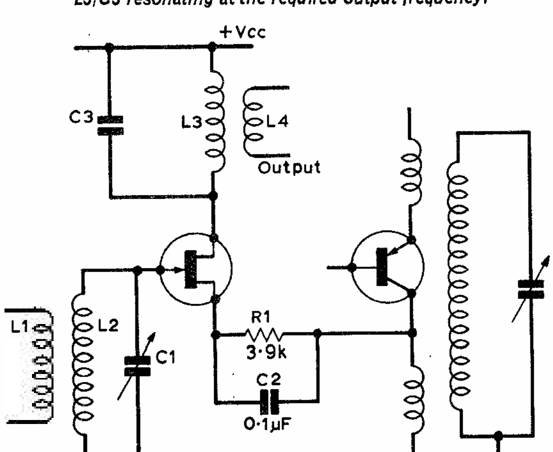


Fig. 12 shows two types of common source mixer. In the first the FET is set up as a common source amplifier but two signals are applied to the gate, one in the normal way and the other, from the oscillator, is connected by a very small capacitor. Because this method is used mainly at VHF the capacitor may be two short lengths of wire twisted together. The second circuit is also very similar to the conventional RF amplifier but the oscillator signal is introduced at the source by connecting the bypassed source resistor to earth via one of the coils in the oscillator. Part of a conventional bipolar transistor oscillator is shown to illustrate how the coupling is achieved.

Note that in this circuit the received signal is applied in common source mode whereas the oscillator signal is introduced in ground gate mode, the opposite of our next example which is a common gate mixer. To prevent confusion it must be made clear that when a mixer is referred to as common gate or common source it is the mode in which RF information carrying signal is applied that is being quoted.

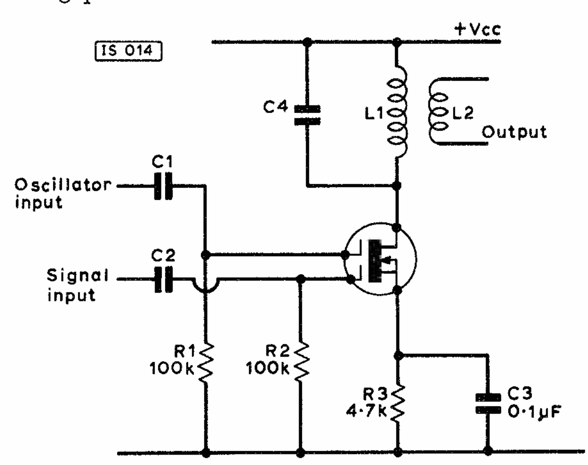


Fig. 14: Simple dual-gate MOSFET mixer.

A common gate mixer is shown in Fig. 13, the main RF signal may be applied in either of the ways discussed for ordinary common gate amplifiers. Note that the capacitor coupling the oscillator signal is kept small to ensure a low level of injection.

It is in mixers that MOSFETs have made an impact. They have been made with two gates and mixing is achieved by applying a signal to each gate, Fig. 14. The MOSFET may be a depletion or enhancement type. The diagram shows a depletion type but if an enhancement type were used the gates would have a DC isolating capacitor in series and gate resistors would be introduced going to the supply line.

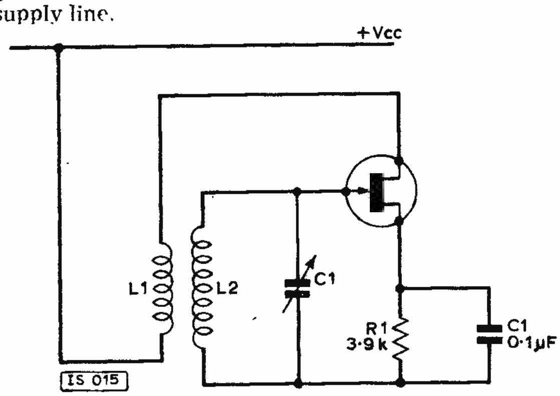


Fig. 15: Circuit of a JFET oscillator, the frequency of operation being determined by L2/C1.

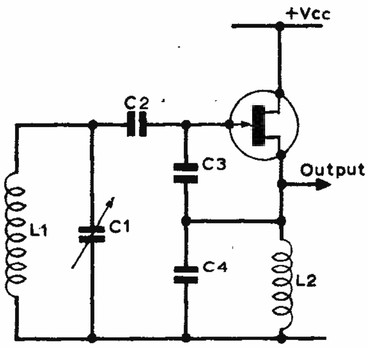
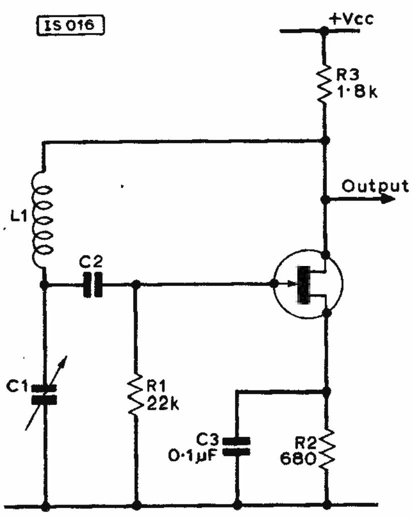


Fig. 16: Two more circuits of oscillators using an FET.



Oscillators

The use of an FET oscillator below VHF is not very common because bipolar transistors give good performance. A circuit of a simple FET oscillator is shown in Fig. 15 and if commercial coils are used they should be of the type intended for use with valves. Those who are familiar with valve circuitry will see how close a resemblance it bears to a tuned grid oscillator. If the circuit fails to work try changing over the connections to one of the windings. For those who wish to experiment two other FET oscillators are shown in Fig. 16.

The source follower

With all the reference being made to common gate and common source stages the common drain, or as it is often called, source follower, mode of operation, has been neglected. Fig. 17 shows a common drain stage and it is the equivalent of the emitter follower or common collector configuration of bipolar devices. It is used, like its bipolar counterpart, as an isolating stage. Its input impedance is very high, 10MΩ in our example, and it is superior in this respect to its bipolar equivalent. The voltage gain is a little less than unity and for maximum signal handling the source resistor should be chosen to make the source voltage about half the supply voltage.

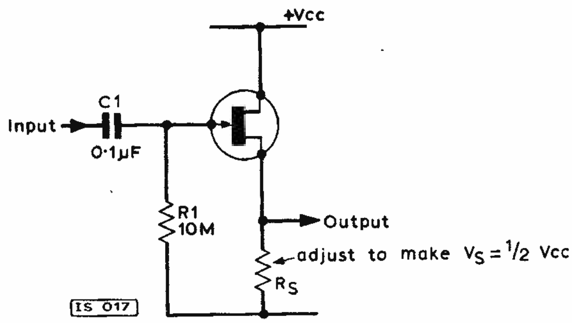


Fig. 17: Source follower isolating or buffer stage.

Common FETs

A brief list is given of some common and inexpensive FETs.

2N3819, 2N3823	n-channel JFET, good general-purpose types	Texas
2N3820	p-channel JFET, good general-purpose type	Texas
3N141	n-channel dual-gate MOSFET, depletion mode	RCA
40468A	n-channel depletion mode MOSFET	RCA

A useful publication on MOSFETs is the "MOSFET Selection Guide" which is free from RCA. Data on Texas devices may be obtained from Texas Instruments, Manton Lane, Bedford. RCA data may be obtained by writing to RCA, Sunbury-on-Thames, Middlesex, TW16 7HW. ■

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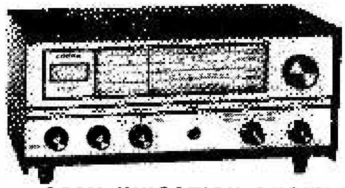

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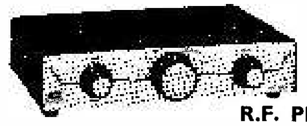

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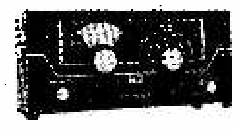

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TAKE 20

DAVID ANDREWS

No. 64 HIGH RESISTANCE VOLTMETER ATTACHMENT

A series of simple transistor projects, using not more than twenty components.

THIS month's project is extremely simple and yet could be a very useful accessory for anyone who owns a voltmeter and wishes to get more use from it. The circuit effectively increases the input resistance of the meter by a factor equal to the gain of the transistor, typically 200 and hence can convert a 20000 ohms-per-volt meter into a device having 4 megohms-per-volt sensitivity. When set to the 5V scale the input resistance of the meter is approximately 20 megohms and thus offers very little loading when measurements are carried out on high resistance circuits.

Alternatively the attachment will considerably improve the sensitivity of cheap 1000 ohm-per-volt multimeters and make them more suitable for electronic measurements. Either way there is a lot of potential value in such a simple device.

Circuit

The circuit is shown in Fig. 1 and is quite clearly an emitter follower in which the emitter load is the multimeter. Any potential at the base of Tr1 will be presented at its emitter but it must be remembered there is an approximate 600mV forward voltage drop across the pn junction of the transistor. Because of this a normal emitter follower will not respond to input voltages less than 600mV. In this case, however, we use two forward biassed silicon diodes, D1 and D2, to give a reference potential of approximately 1·2V at the bottom end of R1. A proportion of this voltage is tapped off by VR1 and we use this to place any input voltages on a pedestal voltage set by VR1. If the forward drop of the transistor were 600mV and we set the potential at the wiper of VR1 to exactly 600mV any extra potential applied at the input connections is bound to be displayed accurately at the emitter.

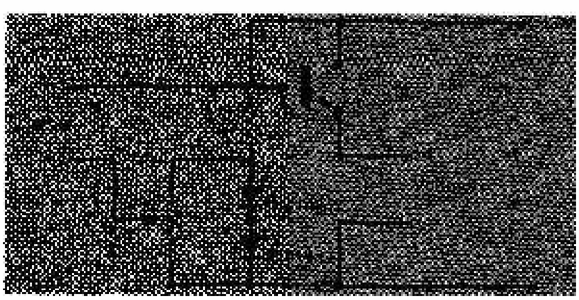


Fig. 1: Simple circuit of the voltmeter attachment. A component list has not been provided on this occasion! As an alternative to the construction shown in Fig. 2 the circuit could be built in the form of a probe with a pre-set potentiometer in place of VR1, the slider being adjusted with the forefinger.

Limitations

The circuit has its limitations. For example, voltages of reverse polarity will not be displayed so these should not be applied to avoid exceeding the reverse breakdown of the base emitter junction. Again, the circuit will not respond to input voltages having magnitudes greater than the emitter follower's supply voltage. In actual fact it is safer to assume a level less than this, say 7V, because of the pedestal voltage which takes up a portion of the range.

Operation

Care has to be taken in using the attachment because its simple design does not make allowances for temperature drift and it should be correctly zeroed before each measurement. This is done by shorting the input probes together and turning VR1 until a reading is seen on the meter. VR1 is then reduced until the needle on the meter JUST stops at the bottom end of its travel, but do not reduce the level beyond this point otherwise it will defeat the object of the pedestal voltage. This procedure sounds a little difficult and could cause inaccuracies but it is extremely straightforward in practice and the zero setting is very easy to determine.

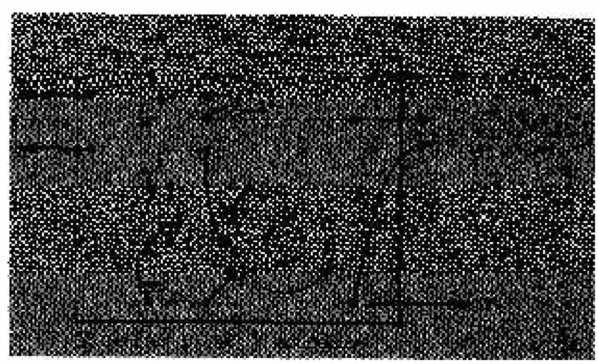
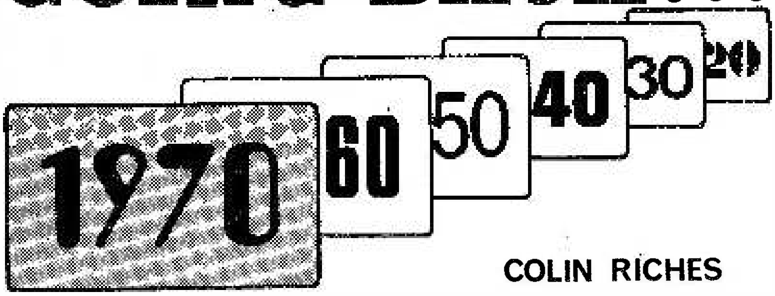


Fig. 2: Layout of attachment used by author and arranged to connect directly to the voltmeter terminals or sockets.

The zeroing procedure is made easier if the voltmeter is switched to a low voltage range. When carrying out measurements set the meter to any range, below the maximum already mentioned, and if the zeroing has been done correctly the meter scale will read off the voltage directly without any conversion being necessary. Due to the rectifying action of the base emitter junction of the transistor low voltage AC signals can be detected and measured by leaving the voltmeter set to DC. However, the signal should be free of any DC component.

GOING BACK...

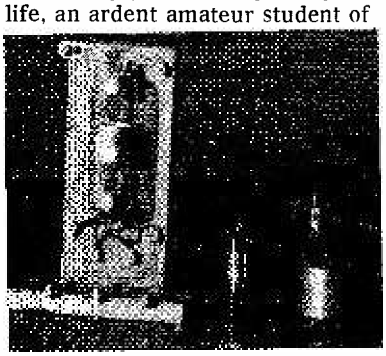


COLIN RICHES

A great future ahead of him

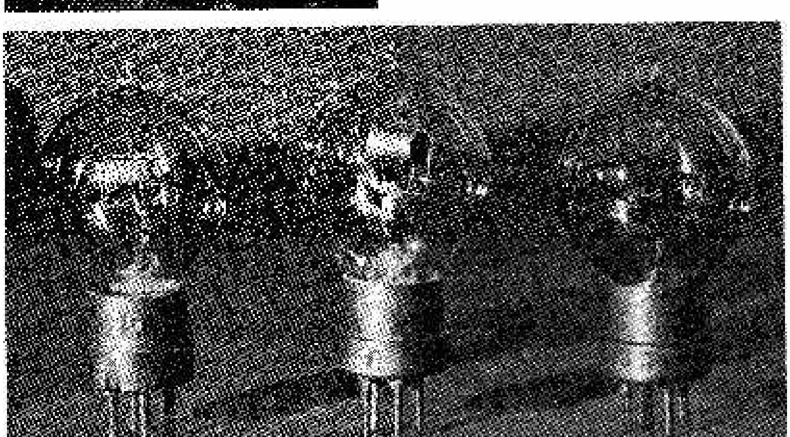
MR. R. J. Halls from Penzance, Cornwall sent me a cutting from an old "Windsor Magazine" dated 1897. It tells of a young man by the name of Marconi who "may have a brilliant career ahead of him".

"Guglielmo Marconi, whose name, in connection with "telegraphy without wires," has come lately into prominence, was born in Bologna. Although his name would seem to indicate an unmistakable Italian origin, as a matter of fact he is of English descent on his mother's side. He was always, from very early in life, an ardent amateur student of electricity. It was not, however, until two years ago, while making certain experiments on his father's estate at Bologna, that he made the great discovery of his life. This, briefly, was the transmission of signals by means of electric waves travelling in the air. Signor Marconi's invention having obtained little recognition in his native country, he decided to bring it to England. Here its value was instantly recognised by our eminent scientific experts. Committees representing the Army, Navy, and Post Office, have eagerly discussed the invention and are investigating its possibilities. As Signor Marconi has but just attained his twenty-second birthday, a brilliant career may lie before him."



Left to right: ANAKA AAB-S of 1916
"N" type of W.E. 1918
VT-Z of W.E. 1918

Bottom picture-left to right: British "R" valve of 1914
French "R" valve of 1916 by Métal
French Fotos valve of 1916 by Grammont



Readers' comments

Basil D. Van Der Syde, from Poole, Dorset sent me a photograph of part of his workshop. On the bench is a Thorn 3000 colour TV chassis. Its audio section is driving a model "H" horn speaker made by S. G. Brown about 1926.

Mr. Van Der Syde says his picture caused a lot of interest at work where the speaker is a good few years older than some of the engineers! One of them even went to the management with tongue in cheek and asked if all the department could be supplied with similar loudspeakers as audio aids.

The model "H" speaker contains a complex Brown type "A" mechanism of a conical metal cone connected via a reed and balanced armature magnet system. This particular unit started its life in London, found its way to New Zealand then came back to England when a N.Z. colleague sent it to Mr. Van Der Syde.

Letters

Don't forget to keep those letters pouring in—I hope to be able to publish some more "Readers' Comments" next month.

Vintage valves

Vintage radio enthusiast Chris Petsikopoulos from Athens tells me that he has come across some WW1 valves which are quite rare, especially the French "R" by Métal made in 1916 and the "FOTOS" by Societe Grammont.

French valves were developed by "Telegraphie Militaire" of the French army during 1914-1918 but were first made by Societe Grammont. Later the production output of the factory became insufficient for the war needs, so the "Compagnie des Lampes Metal" also began to manufacture them. All the WW1 French valves had a copper base shell.

Other valves included in Chris's collection are a 1914 British "R", a 1916 5W Japanese transmitting valve made by Anaka, a 1918 American VT-2 (Western Electric) a famous "N" type or "peanut" valve. This was one of the first miniature valves to be made for the US Signal Corps in late 1918, and was also made by Western Electric.

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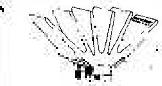

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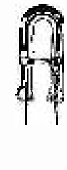

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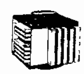

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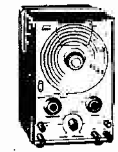

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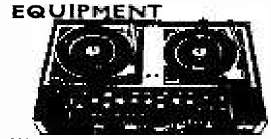

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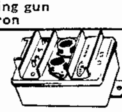

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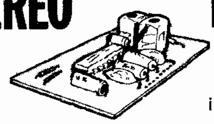

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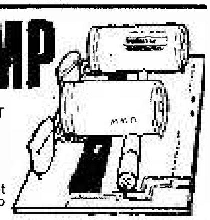

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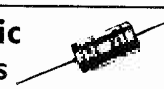

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100µF	6½p
220µF	6½p
330µF	6½p
1000µF	13p
4700µF	29p

6·3 VOLT

33µF	6½p
68µF	6½p
150µF	6½p
470µF	11p
680µF	13p
1500µF	18p
2200µF	18p
3300µF	26p

10 VOLT

22µF	6½p
47µF	6½p
100µF	6½p
220µF	8p
330µF	10p
470µF	10p
1000µF	11p
1500µF	20p
2200µF	24p

16 VOLT

15µF	6½p
33µF	6½p
150µF	6½p
150µF	8p
220µF	9p
680µF	17p
1000µF	17p
1500µF	25p
2000µF	43p

25 VOLT

10µF	6½p
22µF	6½p
47µF	6½p
100µF	8p
150µF	8p
220µF	10p
470µF	13p
680µF	20p
1000µF	22p
2200µF	39p
5000µF	68p

40 VOLT

6·8µF	6½p
15µF	6½p
33µF	6½p

40 VOLT

47µF	6½p
100µF	9p
68µF	10p
220µF	11p
470µF	19p
680µF	25p
1000µF	25p
2200µF	44p

63 VOLT

1µF	6½p
2·2µF	6½p
4·7µF	6½p
6·8µF	6½p
10µF	6½p
22µF	6½p
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160V: 0·01µF, 0·015, 0·022, 0·033, 0·047, 0·068 **3½p.** 0·1 **4p.** 0·15 **4p.** 0·1 **4½p.** 0·15, 0·22 **5½p.** 0·33 **7p.** 0·47 **9½p.** 0·68 **12p.** 1µF **14½p.** 1·5µF **22p.** 2·2µF **24p**

ON THE AIR

by Eric Dowdeswell G4AR

SUMMER holidays are obviously taking their toll of my correspondents, judging by the few reports received so far this month. Let's hope that they return rejuvenated for the winter's stint on the amateur bands! On the other hand, they may be busy refurbishing their aerial and earth systems or getting a few more feet of wire into space!

Strange how a new aerial seems to bring in DX not heard before. Switching back to the stand-by longwire usually reveals that the DX is still there, but it's a nice feeling anyway! If at all possible do put up a vertical aerial of some sort as an alternative to the horizontal wire. Verticals are reputed to pick up more of any locally generated electrical noise but they will also really bring up the more distant signals from around 8 to 10,000 miles away. You will, of course, use an aerial tuning unit to bring the vertical to resonance on each band!

Reporting in

Regular **John Porter** (Baslow, Derbys) kept at it with his Trio 9R59DS and multiband dipole and found some interesting calls on 15 and 20m. A warm welcome to **Alan Rae** (Glasgow) who uses a Grundig set for SSB and an Astrad 17 for AM. On the broadcast bands, presumably! Lack of space caused Alan to try the bedsprings as an aerial! Not novel but full marks for initiative! A 50ft wire outside proved more effective even though 'it's falling down around my head'. Nasty!

Newcomer **A. W. McNeill** (Newbury, Berks) pleased me with a log of CW titbits heard on 20m using old faithfull R1082 and a five valve (good lad!) TRF and 30ft of wire. He queried one or two callsigns but, as I have already suggested to him, it is a good idea to look at the ITU prefix block listing when the answer will often become apparent.

A QSL from EP2BQ confirming a reception report on 160m CW has brought much cheer to **Stan Sharred,** our correspondent in B'ham. The transmitting amateur often has trouble in getting a QSL after a QSO but it is many times harder for the listener. It is a fact that very, very few listeners reports indeed ever contain information of use to a DX station. To encourage a reply it is essential to send adequate postage in the form of IRC's and a fully addressed return envelope. Do make sure the envelope will take an average sized QSL!

Mr. B. F. Hughes (Worcester) BRS25901 sent in a list of interesting stations heard on his FR500SDX, but that's all! Welcome to the page Mr H and let's hope we shall have more details of you anon. **Ken Ranger** (Colchester) lists a few stations heard on his teeny-weeny three transistor reflex portable, which he is going to need as he takes off soon for Hong Kong. We hope he will keep in touch with us from VS6 land.

Copying the DX

I've always reckoned that there are three layers of stations to be heard on a DX band. On, say, 20m there are the Europeans and east coast W's, the weaker stations either using lower power or further away, and the real DX, weaker again but often quite readable in the absence of any QRM. It is the last category that will show a marked improvement if a vertical aerial is used instead of a horizontal one.

However good a receiver might be in terms of sensitivity and selectivity it is the ears of the operator which can provide the greatest degree of discrimination between wanted and unwanted signals and this ability comes only with experience. Using headphones of course (who has ever heard of a serious operator using a loudspeaker??) it is not difficult to train oneself to ignore the strong signals and to listen through them to the weaker signals below, whether they be SSB or CW. It is a bit easier to do this on CW where no two signals are quite the same in character, especially if hand sent. We all push or press the key in a different way in spite of the efforts of electronic keyers to iron out our differences, much to be deplored!

Log extracts

A. Rae:—80m PY4FUS PY4IR **40m** CP2SL CX1CL HC2TV KZ5JM M1C OX3LW TG8KT VX3AWU VK5PC YV2NO 9G1DY.

A. McNeill: — 20m A9XO FG7XC FL8CE TJ8FE TR8PB 5T5FP.

J. Porter: — 20m CE31F EL9C FY7AE TU2EN ZD7SD ZD8HD 3B8DD 5U7BA 6Y5GB 9X5PT 9Y4VT **15m** EA8HA HI8EJH SV1IM (Paros Is.)

K. Ranger: — 20m EL2AK FP8DH OJ0MA VE6AGV VU2DK 9M2CR.

B. Hughes: — 80m FP8DH TJ1EZ ZL2IR **20m** AX6XR DU1NRS FG7XL HI8XHN TR8AF VE8DC VP2DM VP9GR XW8AL ZD7SD 9M8VLC **15m** CX5BT HM4GF KS6DH VK8HA 5R8SD 9M8NK.

S. Sharred: — 160m EP2BQ VX1KE W1HGT WB8APH 80m EL7F OY5NS **ZS6ZE 40m** 9G1DY **PY7PO 20m** FM0AZY YV9AF 9Y4HR.

All CW stations in bold, remainder are SSB.

BROADCAST BANDS

Short Wave and **VHF/FM** reports by the 15th of the month to The Editor, Practical Wireless, Fleetway House, Farringdon Street, London, EC4A 4AD.

Medium Wave Logs to Charles Molloy, 132 Segars Lane, Southport, PR8 3JG.

AMATEUR BANDS

Logs covering any amateur band/s in band/alphabetical order by the middle of the month to **Eric Dowdeswell G4AR, Silver Firs, Leatherhead Road, Ashtead, Surrey, KT21 2TW.**

MEDIUM WAVE BROADCASTS
by CHARLES MOLLOY

CLIVE BARWOOD (Grimsby) has been trying for local radio stations with his Philips transistor receiver. His log includes day time reception of Capital Radio on 557kHz; Radio Blackburn 854kHz; Radio Sheffield 1034kHz; Radio Leeds 1106kHz; Radio Derby 1115kHz; IBA Birmingham 1151kHz; Radio Humberside 1484kHz; Radio Nottingham 1520kHz; Radio Leicester 1594kHz and Manx Radio, Isle of Man also on 1594kHz.

Brian Murray (Edinburgh) has been listening to London Broadcasting on 719kHz at 0100hrs with his GEC BC 3248 receiver and 25ft longwire antenna. He mentions that the new IBA station Radio Forth will be on 1546kHz (194m) when it comes on the air later this year. Radio City, Liverpool will also be on 1594kHz and is expected to open by October 1974.

Scottish DXers (and others) will be interested to learn that a medium wave/shortwave conference is being planned to take place in Scotland with the possibility of a DX expedition. All those interested should write to **Fred Dinning**, South Brae Cottage, Dunlop, Ayrshire, KA3 4BP, Scotland. Fred, who is a keen medium wave DXer, has a Hammerlund SP600JX6 receiver and an HRO MX. He has three external aerials; a 6000ft Beveridge at 10 to 15ft above the ground pointing SE/NW, a 600ft longwire pointing S/N, a 500ft longwire pointing SW/NE and a medium wave loop. With this formidable set-up the following DX was logged:— 587kHz Riyadh, Saudi Arabia at 2215hrs; Kishasa, Zaire 692kHz at 0010hrs; Bagdad 760kHz at 2310hrs; Dakar, Senegal 764kHz at 2324hrs; Acholi, Uganda 809kHz at 0300hrs; Radio El Espectador, Uruguay on 810kHz at 0300hrs; Radio Montecarlo, Uruguay 930kHz at 0210hrs; Radio Belgrano, Buenos Aires 950kHz at 0150hrs; PRE8 Rio de Janeiro 980kHz at 2325hrs; Bissau, Portuguese Guinea 1070kHz at 2330hrs; PRG9 Sao Paulo, Brasil 1100kHz at 0235hrs; CB114 Radio Nacional, Chile 1140kHz at 0310hrs; Radio Globo, Rio 1180kHz at 0200hrs; Radio Eldorado, Rio 1220kHz at 0210hrs; Radio Martinique 1310kHz at 0245hrs; Enugu, Nigeria 1320kHz at 2300hrs; Radio Chaco Boreal, Paraguay 1330kHz at 0230hrs; all times being GMT.

Noel Green (Blackpool) has an Edystone 850 and a medium wave loop. He reports hearing the new 1200kW station at Istanbul, Turkey on 1016kHz in mid-evening with interference from the West German outlet on the same channel. Two other megawatters have appeared recently. On the long waves Warsaw, Poland on 227kHz has increased power to 2000kW with a 2000ft mast as a radiator. Vidin, Romania is a newcomer to the band and is on 1232kHz with a power of 1000kW. At the other end of the power scale, the 2kW Radio na Gaeltachta station at Connermara located on the west coast of Eire is being heard regularly by the writer from his QTH in the north west of England. Programmes are in Gaelic with Irish music, during the evening.

An unusual report comes from **E. Jenkinson** of Sheffield who has been hearing the sound of Yorkshire TV on the medium waves with his Vidor 393 portable receiver. A receiver fault is suspected but it might be caused by re-radiation. Has any reader had similar reception of TV sound on the medium waves?

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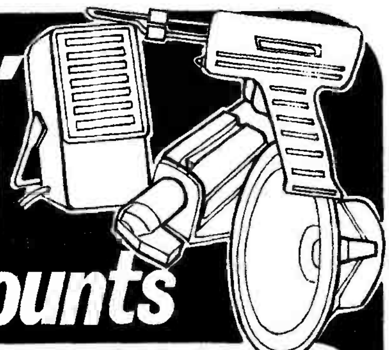

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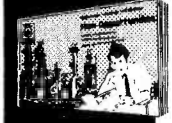

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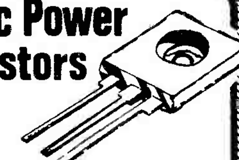

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TANDY

After eight months of operation, the U.S. Tandy Corporation has opened 50 own-name franchise audio shops in Great Britain.

The first half-dozen were opened in December 1973 in the West Midlands.

For further information on Tandy, please refer to the "NEWS . . ." page of our February 1974 issue.

MORE PRICE CUTS

Sinclair has announced reductions in the price of two more of its pocket calculators. The "Scientific" is cut from £49 + VAT to £29·95 + VAT and the slim "Executive Memory" model from £49 + VAT to £34·95 + VAT. A kit version of the "Scientific" is available at £19·95 inc. VAT.

The correct price of the new "Cambridge" model is £19·95 plus VAT. The kit version is £13·59 plus VAT and not as shown in the "NEWS . . ." feature in August P.W.

THE RN712

I first mentioned this unit in my "ICE" article in the June issue. Since then I have had a number of enquiries from readers for more gen—so here goes:

The RN712 employs 83 semiconductors (49 transistors and 34 diodes) and an IC.

The spec. is as follows: Power supply is 12V d.c. (—ve earth). Current consumption is 1·25A at 14·4V and output power 2 x 5W. Wave ranges are Medium (185-586m); Long (1154-2000m) and f.m. (87·5–104MHz). The intermediate frequencies are: 470kHz (a.m.) and 10·7MHz (f.m.).

Controls: rotary (left-hand)—front, on/off volume; centre, tone; rear, balance; (right-hand)—Super Turnolock pre-set station selector.

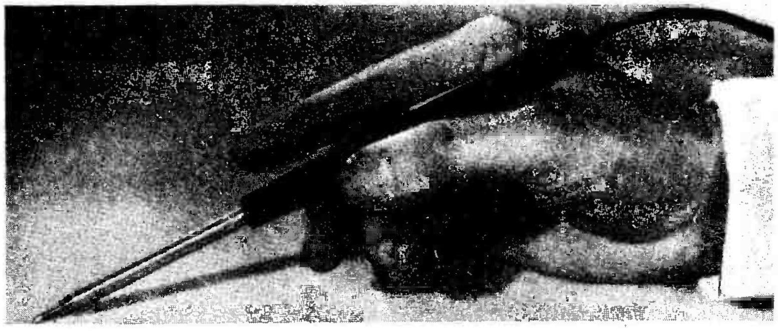
Slider controls are: (left hand) fast wind, rewind and stop. (right-hand)—top, radio/microphone record switch; (left-hand), bottom, stereo/mono switch and indicator.

Rear connections provide for a car aerial, automatic car aerial power supply, two 4Ω speakers, fused power supply and microphone.

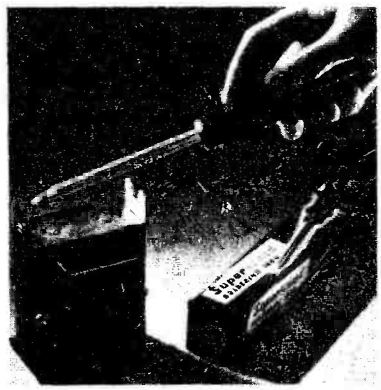
Frequency response of the cassette player/recorder is quoted as 80–10,000Hz within 6dB. Wow and flutter max ±0·3%. S/n ratio is quoted as being better than 45dB. Dimensions of the unit, which fits into a normal car-radio cut-out are: $7\frac{1}{16}$ x 2 x $6\frac{3}{8}$in.

Philips Electrical Limited, Century House, Shaftesbury Avenue, London, WC2H 8AS.

SOLDERING IRONS



Miniscope iron (above)
The Superspeed (right)

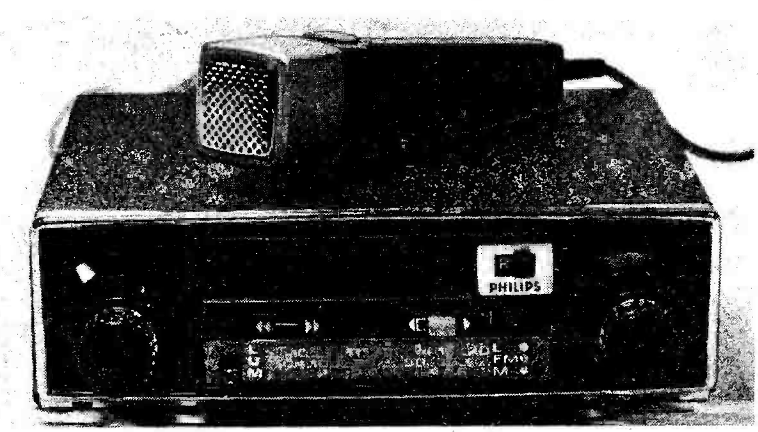


The EGM Superspeed and Miniscope soldering irons retain the shape, size and weight advantages of conventional irons yet have the rapid heating advantage of the heavier and often clumsier soldering gun.

With heating times of around 5 seconds these irons can be run from a 6V d.c. supply such as a car battery or from 2·5 to 6·3V a.c. from a mains transformer. EGM supply a transformer as an optional extra, supplying 4·5V at 20A indicating a standard (intermittent) rating of 90W for a single iron.

With the soaring cost of electricity it is good to see that these irons are off when not in use. Only light pressure is required on the switch ring, an automatic cut-out looking after bit temperature.

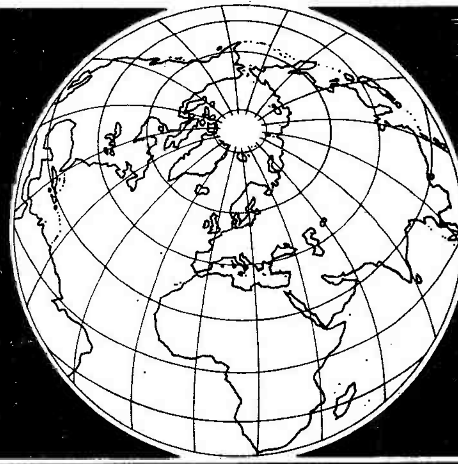
Further details from *EGM Solders (PW) 3 United Road, Manchester, M16 ORJ.*



PW EPSOM

ERIC DOWDESWELL G4AR

GENERAL COVERAGE SHORT WAVE RECEIVER



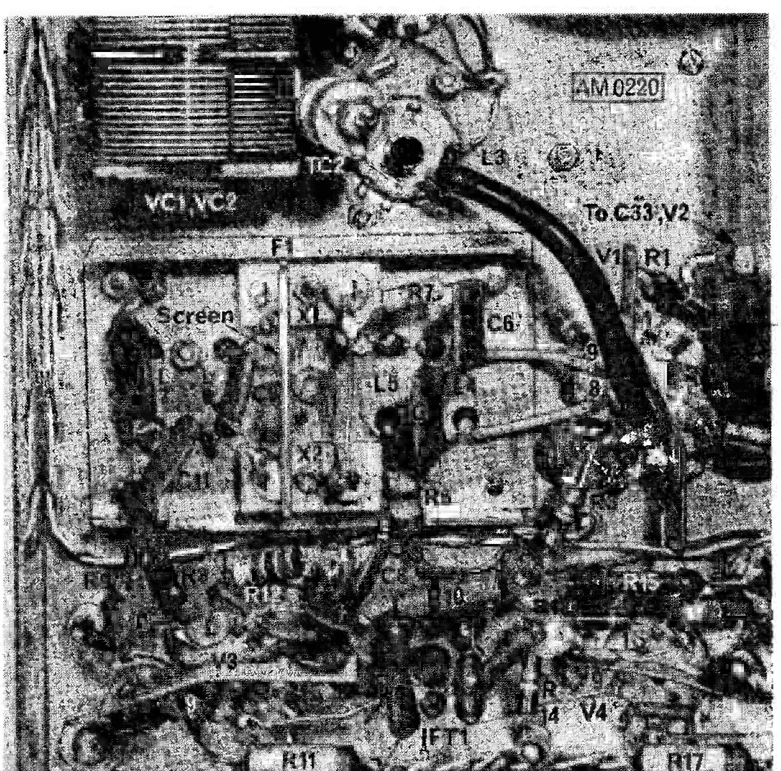
PART 2

CONSTRUCTION *(continued)*

The crystal filter unit, Fig. 8, can be wired and completed on the 3 x 2in box lid before installing it in the chassis but initially the lid should be placed in position and fixing holes and clearing holes for the crystal sockets drilled through the lid and chassis. Notches are cut in the lid flanges and in the edges of the box to clear the various leadout wires. The main tuning capacitor is fitted to the other aluminium box which is mounted vertically on the chassis providing a solid mounting but a simple stiff bracket could suffice here since there is a flexible coupling between the dial drive spindle and the tuning capacitor.

Note the correct position of the pins of the IF valveholders, Fig. 8, and ensure that the small screens, cut from thin tin plate, are correctly placed or instability could result. Each screen is soldered to a tag under a mounting bolt and to the centre spigot of the valveholder. Similarly, the anode pins of the mixer valveholder are placed for the shortest leads to the filter box, again aiming at a balanced layout as far as is possible. Another important screen is that between the RF coil sockets on top of the chassis.

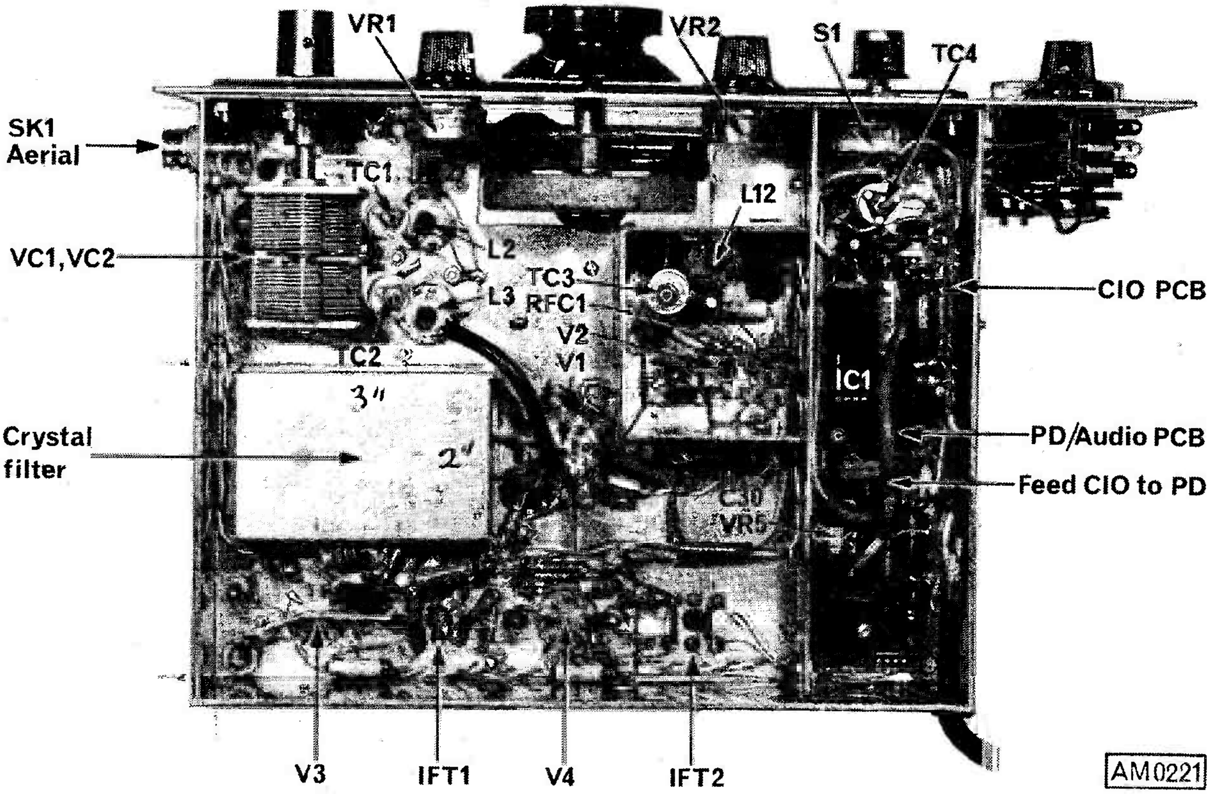
The first oscillator V2 is very simple, keep wiring short and direct and components firmly mounted. Capacitor C29 should be connected with shortest possible leads from pin to earth. Fig. 9 shows the layout.

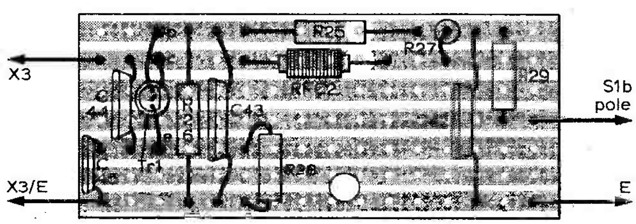


The CIO and the PD together with the IC audio stage are built up on two pieces of Veroboard as shown in Figs. 10 and 11. Spacers or extra nuts are used to keep the boards clear of the chassis. The three central earth rails on the PD board are directly earthed by the fixing bolts and nuts. Veropins provide connections to the external circuitry. The IC should be inserted only **after** carefully checking the wiring and, in particular, checking for solder splashes or blobs between the copper rails on the boards.

The S-meter should be fitted after all the drilling has been done, to avoid damaging the meter by excessive vibration. The components associated with the S-meter are mounted on a small piece of plain Veroboard which is held under the terminal screws of the meter. Fig. 12 shows the arrangement.

Fig. 8: Close-up of the crystal filter box and associated components. The crystal sockets shown are those used with surplus crystals in the original experiments with the filter. The crystals and holders supplied by Senator Crystals are HC6U style.





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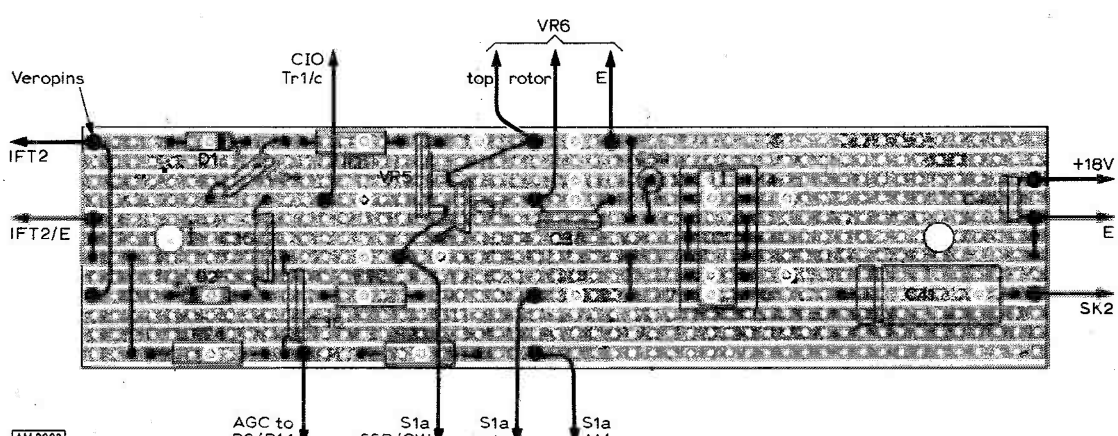


AM 0223

Fig. 9: above, gives the location of the principal components under the chassis. Figs. 10 and 11, left, show the layouts for the carrier insertion oscillator and product detector boards, actual size. Each board can be tested before being fitted into the chassis.

(9)

The various IF coils are wound as shown in Fig. 13. Turns are scramble wound and held in place by a spot of polystyrene cement similar to that used in model-making. It is a good idea to make a note of the pin numbers used for each winding on the coil formers to ensure correct positioning of the IFTs on the chassis.

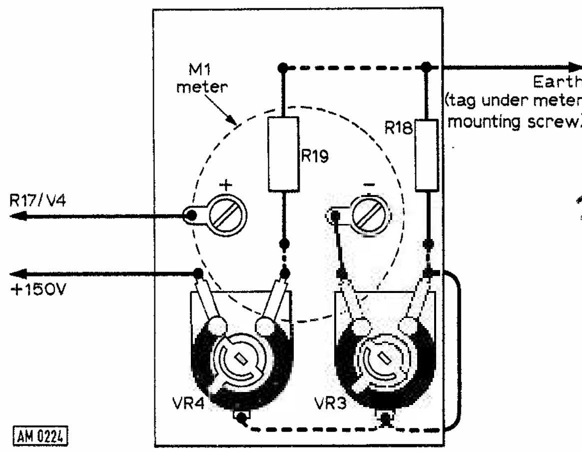


Fig. 12: Layout of the components in the S-meter circuit.

Note that L6 is bifilar wound. Take a length of wire sufficient for both windings, double over at the centre and wind on the requisite number of turns keeping the wires together, winding them as one. The earth end of L5 is taken out through the base of the coil former and soldered to an earth tag.

Scrape clean the ends of all the windings before soldering to the pins on the formers. Ensure that the holes in the chassis are big enough to clear the pins or, to be quite sure, slip a short piece of insulating sleeving over each pin.

As there are several holes to be drilled for each IFT it is a good idea to take a spare coil former and remove the pins thus enabling the former to be used as a template for marking out the holes, after the central hole is drilled.

The RF tuning ganged capacitor is mounted off the chassis with washers on the mounting bolts. First fit the slow motion drive to the panel in the correct position and then adjust the number of washers until the capacitor spindle fits into the drive without difficulty. If it is misaligned the drive will bind and stick. The slow motion drive is essential as the RF tuning is quite sharp. A small metal or card disc is fitted to the flange on the drive and eventually calibrated for the three RF tuning ranges.

HEATERS

The heater wires, preferably of differing colours, are twisted together between valveholders and one side earthed at the mixer valveholder **only**, the corresponding wire being earthed again in the power supply unit, hence the coding. The chassis should not be used for heater earth at other valveholders. Small stand-off insulators are used to support the otherwise free ends of resistors etc.

A slot is cut in the left hand side of the cabinet to clear the coaxial aerial socket and short leads go from the socket to the IF trap L1/C1 and from the trap to the RF tuning capacitor. The aerial socket could be mounted on the rear drop of the chassis and a short length of coaxial cable run back to the trap. This would necessitate cutting a hole in the back of the cabinet to clear the aerial socket. In any case, a similar size hole is required at the back for the plug on the end of the power supply cable to pass through.

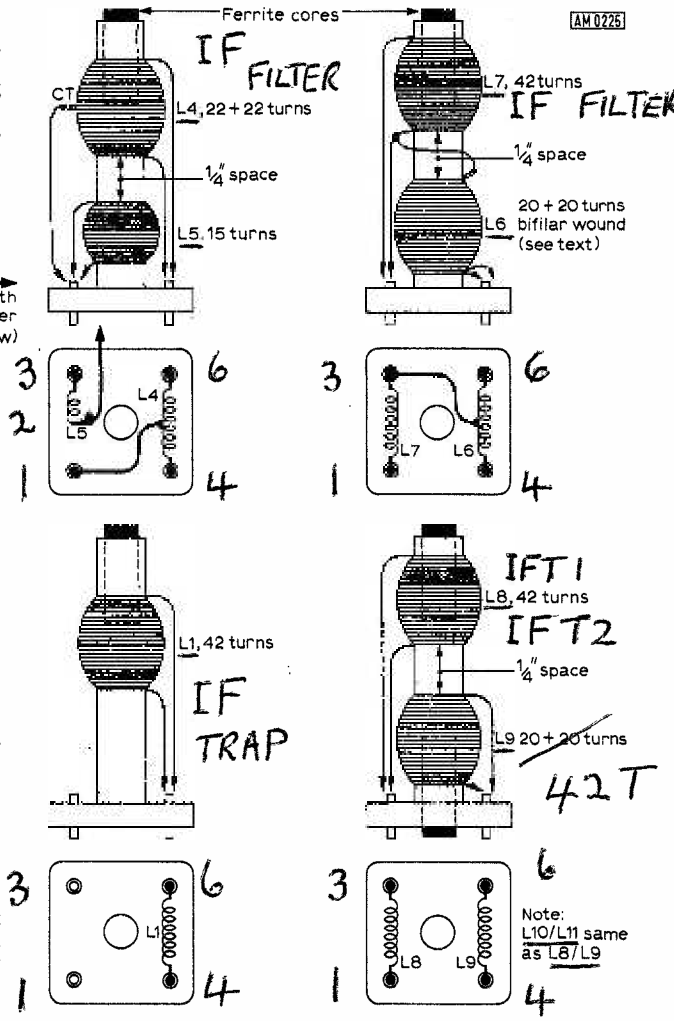


Fig. 13: Details of the windings for the filter and IF transformers and the IF trap. The former length is 1¾in. and not 1¼in. as shown in components list.

TESTING CIO/PD

The CIO board can be tested before it is fitted into the chassis by temporarily connecting the crystal to the board (do not solder to the crystal pins!!), ignoring capacitors TC4 and C46 and feeding a low voltage supply, from a 9V battery, to R29 and the earth line. The 5·5MHz signal should be heard on a short wave receiver at this frequency if the oscillator is placed close to the receiver's aerial socket. The receiver's BFO should be on.

Similarly the audio section of the PD and audio board can be tested, connecting the phone jack, volume control and a low voltage supply to the pins on the board. A test signal from a transistor radio headphone socket can be fed to the top of the volume control.

A five-way terminal strip is fitted inside the chassis where the power supply cable enters. The four-way screened cable is terminated with a B7G plug, plugging into a socket on the power unit.

(10)

POWER SUPPLY

The circuit of the power supply unit is shown in Fig. 14. All the valves in the receiver are fed from the 150V stabilised line rather than from the more conventional unstabilised 250V. The general result is improved frequency stability and less heat dissipation in valves and resistors. The 6·3V secondary feeding the valve heaters is also connected in series with the second 6·3V secondary (tapped at 5V) to provide 18V DC for the audio IC and CIO stage via rectifier D3 and smoothing components C2, C3 and R5.

The switch in the 150V line is very useful when testing and making adjustments. Even this voltage can produce an unpleasant shock! Resistor R4 is more of a safety device, discharging C1 when the unit is switched off. It also imposes a minimum load on the rectifier, lowering off-load peak voltages.

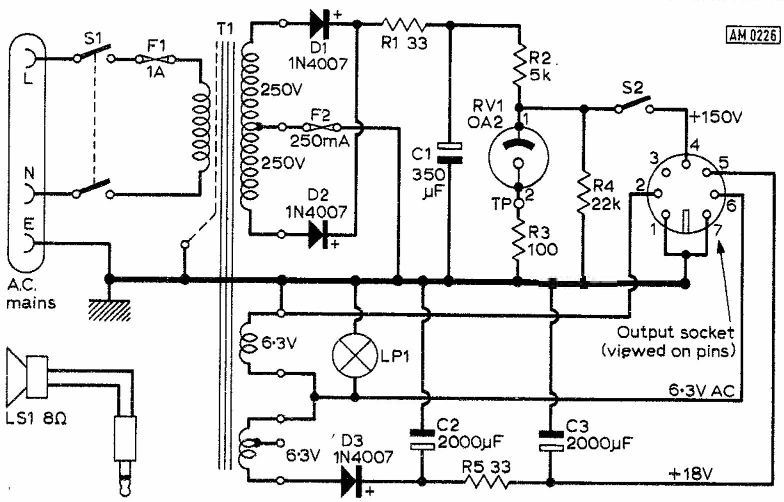
★ components list

POWER SUPPLY UNIT

R1	33Ω ½W	C1	350µF 350V
R2	5kΩ 10W WW	C2	2000µF 30V
R3	100Ω ½W	C3	2000µF 30V
R4	22kΩ 2W	F1	Fuse 1A
R5	33Ω ½W	F2	Fuse 250mA

Miscellaneous

D1/2/3, 1N4007. S1, 2 pole on-off. S2, Single pole on-off. Fuseholders (2). Valveholders B7G (2). Cable plug B7G. Panel indicator lamp 6·3V. T1, Transformer 250-0-250V 80mA, 6·3V + 6·3V (Douglas MT1AT). Case 8 x 6 x 6 in. (H. L. Smith & Co. Type U). RV1, voltage stabiliser OA2. Speaker 6 x 4 in. elliptical 8Ω, with cable and jack plug. Speaker grill.



250-0-250 80ma

6·3V - 3·5a

6·3V - 1a Tapped 5V 2a

Fig. 14: Circuit of the power supply unit which provides a stabilised 150V line plus 18V DC for the CIO and PD boards and 6·3V AC for the valve heaters.

The indicator lamp could be fitted to the set itself in the form of a dial light but this has never been found necessary with the 898 dial. The 100Ω resistor in the cathode side of the OA2 stabiliser is very useful as it enables the current in the OA2 to be monitored very easily. This should be around 10mA for best regulation which means 1V drop across the resistor. The important point is that OA2 should be seen to be working, by its glow, at all times. The current may be varied by changing the value of R2. Where a lower value is needed add low wattage resistors of 20kΩ or so in parallel with R2, rather than changing R2 itself. The total HT current taken by the receiver is approximately 40mA at 150V.

The supply to the CIO stage could be stabilised by means of a zener diode but since the stage is crystal controlled this was not thought to be necessary. The various output voltages are taken to a B7G valveholder at the rear of the unit.

CONSTRUCTION

The particular cabinet used to house the power supply unit and speaker has a pleasing appearance but there is nothing special in the choice or in the general construction. The layout can be seen in the photographs and only one or two points need any explanation.

A common bracket is used for the B7G valveholder for the OA2, mounted on long 6BA bolts, and the B7G output socket to which the various supplies are taken. Fuses, switches and the indicator lamp are fitted to the front edge of the cabinet, with twisted flex to each from the rest of the components mounted on the base plate. Make these leads of adequate length so that the cabinet can be separated from the base plate while the unit is working, for testing and checking purposes. The existing screw holes in the side of the cabinet are made into slots to facilitate this operation. When wiring any panel type fuse-holders always connect the live side of the circuit to the rear tag on the fuseholder to prevent the accidental touching of a live circuit via the fuse if it is being inserted with the fingers.

A large rectangular hole is cut in the front left hand side of the cabinet to suit the speaker chosen. This may seem a tedious job but by drilling a ¼in. hole in each corner and using a Mole Supercut tool it can be done in a couple of minutes. Alternatively, drill a series of small holes round the rectangle, cut between the holes with a pair of sidecutters and file clean. Yet another way is to punch a symmetrical series of holes over the area with a chassis punch such as will probably have been used to make the holes for the valveholders in the receiver. A plastic grille over the front of the cabinet gives a professional appearance to the unit.

Initially it was the intention to mount the speaker in the receiver cabinet but since the beam deflection valve is susceptible to external magnetic fields it was thought wiser to keep the speaker's permanent magnet well out of the way!

While in the mood punch a number of holes in the base plate and at the top edge of the back of the cabinet to provide through ventilation, assisted by fixing three rubber or plastic feet to the base

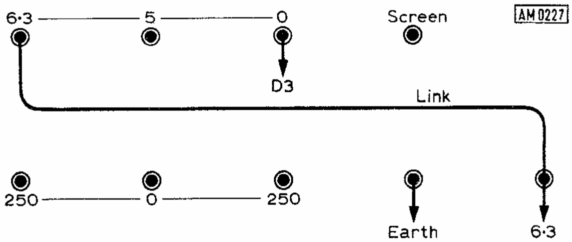


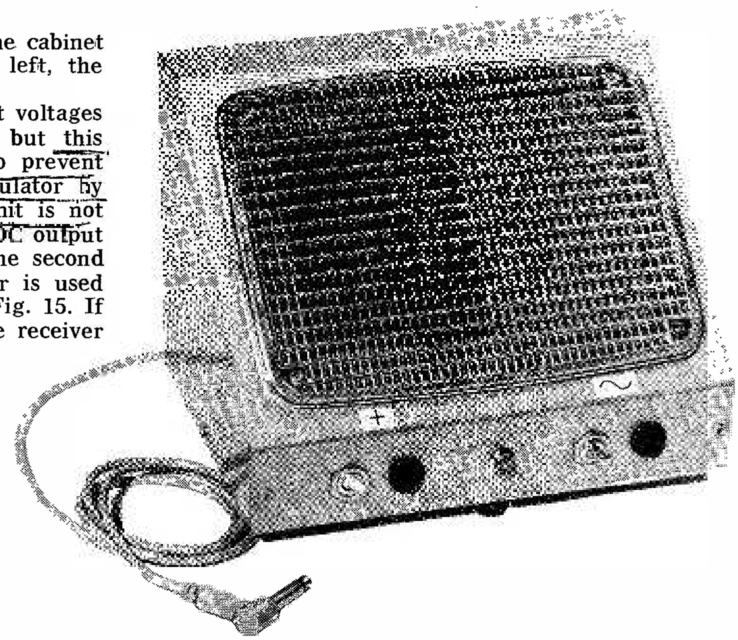
Fig. 15: If the specified transformer is used the wiring of the two 6·3V windings will be as shown here, for correct phasing.

plate. Slots are required in the back of the cabinet to clear the power outlet socket at the left, the speaker lead and the mains input lead.

The unit can be tested for correct output voltages before being connected to the receiver but this should be done as quickly as possible to prevent possible damage to the OA2 voltage regulator by excessive current through it when the unit is not being loaded by the receiver. If the 18V DC output is very low, reverse the connections to the second 6·3V winding. If the MT1AT transformer is used the correct connections are as shown in Fig. 15. If all is well plug in the B7G plug from the receiver and continue with the alignment procedure.

Initial adjustments. After checking and double checking the wiring of the receiver and power unit and with the mains switch off, fit all the valves and their screens with the exception of the ECC81. Fit the pair of Range 3 RF coils into their sockets. It is a good idea to mark the coil formers with a small label so that they are always used as correct pairs in the correct sockets. Use, for example, '3F' and '3R' meaning Range 3 front and rear. Once aligned the coils must not be interchanged. Ensure that 6BA lock nuts are fitted to each core screw.

Insert the IC, noting the correct position of pin 1 from Fig. 10, and then the three crystals again noting the correct position for each frequency from the Components List. With the HT switched off, switch on the power supply. The OA2 voltage regulator should glow and a background hiss heard in the headphones, controllable by the volume control. If the mode switch is on SSB/CW the hiss will increase slightly due to the CIO becoming operative. Check the low voltage supply at about 18V but if it is very



The finished power unit incorporates a loudspeaker having its own lead and plug enabling it to be used with the receiver or any other audio equipment. The supply lead from the receiver plugs into the back of the cabinet.

ALIGNMENT PROCEDURE

While a modulated signal generator is a highly desirable piece of equipment for aligning a receiver it is possible, in this design, to get adequate results without one. A 1MHz/100kHz crystal calibrator would help but failing even that it is possible to use either another short wave receiver or a domestic receiver having a short wave range covering the frequency of 8MHz. Calibration can be carried out by reference to stations of known frequency but this is a very tedious process.

When aligning a conventional superhet receiver it is customary to align the IF stages first at, say, 455kHz and then to feed test signals into the input stages adjusting the first oscillator until calibration is correct. The oscillator will in fact be working at signal frequency ±IF frequency, depending on the design. In this receiver the single range first oscillator is calibrated directly, initially at one frequency only, 8MHz, the rest of the calibration being done later.

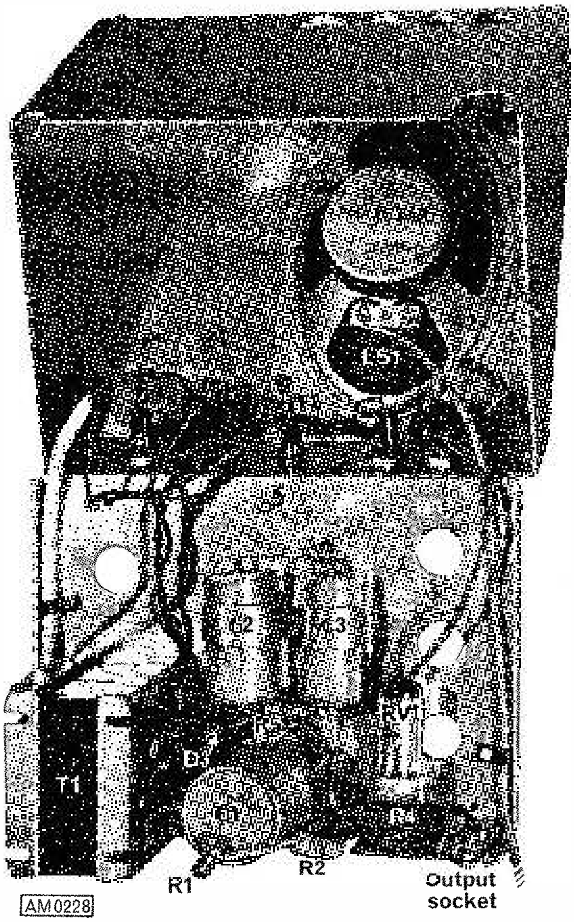
low, around zero, reverse the second of the 6·3V windings on the transformer, as noted in the section dealing with the power supply. The valve heaters should also be seen to be glowing.

Switch on the HT and check for 150V on the HT line in the receiver. Operation of the IF gain control should increase the background noise when near maximum, least resistance. The RF gain control will have little effect at this stage. With both gain controls at zero adjust VR4 on the S-meter panel until the meter reads zero.

IF Stages. Connect a few feet of wire directly to the signal grid, pin 6, of the mixer valve V1, turn up the gain controls and switch to AM when a babble of stations should be heard at the IF of 5·5MHz, the receiver in effect becoming a straight TRF. Peak the signals with the RF tuning control which should be near minimum capacity. There may be two tuning peaks but either will do. Continue to peak the

(12)

signals by adjusting the six cores in the filter and IF stages, V3 and V4. The S-meter is used as a tuning indicator for all these adjustments aiming at maximum reading. If it should reach full scale reduce the sensitivity by means of VR3 on the S-meter panel.



The cover of the power supply cabinet is removed to show the components mounted on the baseplate. The earth wire of the mains lead at the left is taken to the baseplate and the cover.

Now remove each core, one at a time, beginning at the filter, apply a spot of core locking compound or similar and replace the core adjusting for maximum signal. The object of this exercise is to ensure that the first tuning peak encountered is used since a second and incorrect peak may be found if the core is screwed in any further. Eventually the alignment should be repeated after the set is working properly in every respect. The adjustments, especially on the IFTs, will be found to be interdependent to some extent.

Calibration. The great advantage of having an IF filter of known frequency, 5·5MHz, is seen when the job of calibration is begun. In this design, once the low frequency end of the oscillator tuning range is established at 8MHz the rest of the scale calibration falls into place, more or less, for both ranges, the 8MHz point corresponding to 2·5MHz on one range and to 13·5MHz on the other. See Fig. 16.

Fit the ECC81 valve and its screen. Make quite sure that the tuning dial and capacitor are working smoothly from end to end of the travel, that the maximum capacity coincides with 0° on the dial and that the grub screws in the flexible coupling are tight. Unscrew the core (anticlockwise) in the oscillator coil L12 for minimum inductance and set trimmer capacitor TC3 to about the mid position of its travel. Set main tuning to 5° on the dial, almost maximum capacity.

It is only fair to mention at this point that signals around 2 to 3MHz can now be heard if an aerial is connected to the set and the RF tuning peaked, if only to demonstrate that all the work and expense has been worthwhile!

If another short wave receiver is available, having reliable calibration, set it for CW reception on 8MHz and run a short wire from its aerial terminal to the vicinity of the oscillator valve V2. Run in the core of L12 until the signal is heard on the check receiver. It is now necessary to set the upper end of the range to 18MHz, at 175° on the dial. Run the dial to this point following the signal on the check receiver and adjust TC3 to give 18MHz at 175°. Return to 5° and readjust L12 for 8MHz. This sequence should be repeated until the calibration at each end is correct, then lock the core of L12 with the nut.

Intermediate points can be filled in using the check receiver or, preferably, a 1MHz/100kHz crystal calibrator in conjunction with the check receiver. Use a soft pencil for marking the dial on a blank scale remembering that this calibration is for the first oscillator frequency only. The proper calibration can be done later for the actual tuning ranges, simply adding or subtracting 5·5MHz to or from the oscillator frequency. For example, when the oscillator is on 12MHz the scales will be marked 6·5MHz on one and 17·5MHz on the other, and so on. The intermediate 1MHz points can be filled in using the crystal calibrator at the aerial input.

All calibration should be temporary at this stage, being finalised at a later date when the receiver has been in use for a while. The initial calibration was in fact adjusted to place the 14MHz amateur band at the end of the scale.

If all else fails a domestic type short wave receiver may be pressed into service provided it can be tuned to 8MHz but its accuracy will be highly suspect! As before, take a wire from the set to the oscillator compartment and adjust L12 core until the signal is heard. As there is no BFO on the set the signal will be heard as a rushing noise unless there happens to be at station of some sort on 8MHz when a heterodyne whistle will be heard. This was tried using a cheap transistor portable enabling the 14MHz amateur band to be found a little way up the dial of the 'Epsom' without any trouble at all.

The owner of a good signal generator will presumably know how to use it to align this receiver but it should be remembered that the IF response is very sharp and to ensure that the SG is always on tune its dial should be rocked back and forth across the frequency as alignment proceeds. If the modulated CW facility of the SG is used the audio output of the receiver may be monitored at the output socket with a low range AC voltmeter but the AGC line must be temporarily shorted to earth to prevent AGC action masking the effect of alignment adjustments.

—continued on page 539

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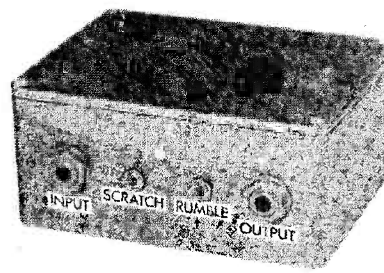

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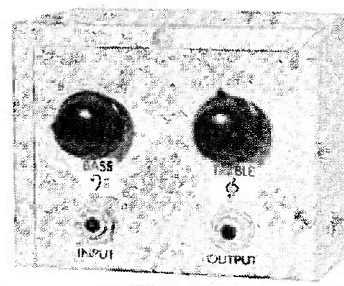

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Section 2 of the P.W. BUYERS' GUIDE

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PW 'SANDOWN' STEREO TUNER

PART TWO

OTHER CONSTRUCTIONAL ARTICLES AND SPECIAL FEATURES. ON SALE IN OCTOBER

The above details are subject to the national industrial situation at the time of going to press.

HOTLINES ON RECENT DEVELOPMENTS

MICRO TV

SOLID state replacements for things like television screens and even television camera tubes have been in the wind for some time. The latest evidence seems to bring these "dreams" very much closer. A British company has won a Queen's Award for its 64 x 64 scanned diode array which is used in a midget television camera. An American company displayed a tiny solid state TV camera at the Paris Components Show in April this year—it was not much bigger than a packet of 20 cigarettes. Perhaps the most significant thing about the British company is not so much the 64 x 64 array, but that a director of the company is quoted as saying that a "substantially larger" array is currently being developed and this could compete with conventional television cameras, in terms of resolution, within two years.

THE THYROPTER

Looking at state-of-the-art in the other type of arrays—those which emit light, the very latest from one Northern manufacturer has some intriguing possibilities. The device (no other details available) is called a Thyropter and is a light emitting diode (LED) with a built-in memory.

The construction is quite ingenious. It consists of a photosensitive junction in series with a high resistance layer plus light emitting capability. A steady voltage (about 5V) is applied to the device(s) and this causes a leakage current to flow. The devices are "switched" on by sending a pulse to them (about 5V). Once the leakage current reaches a certain level the light emitting portion starts to emit light. Because the light sensitive part is very close to the light emitting area the light from the latter shines on the high resistance layer and lower its resistance. This in turn allows more current to flow (because the resistance is now less and is in series with the current path). More current flowing causes even lower resistance and so the device switches on. This turn-on time is only about $1\mu s$ (one millionth of a second).

Conventional arrays in a x-y matrix have to be strobed and this limits their brightness. The Thyropter avoids this problem. By simply allowing less current through the device it will switch off.

Because there is a photosensitive area, light from the outside world can affect it and, if it were strong enough, switch the device on. This light would need to be about one hundred times stronger than the light from the light emitting part of the device—remember that the light emitting part and the photo-sensitive part are extremely close (typically 20 microns).

The Thyropter is interesting if one considers the basic things it offers. We have a device which can display information optically from an electronic input. But if the Thyropter array were fed from outside (say by scanning with a laser beam), then one could feed in the information optically and (by scanning the matrix) read out electronically.

At present, the Thyropter is only at the laboratory stage and is not obtainable in any form. However, it was felt the readers might like an insight of a device which was on the horizon.

$51m ORDER

Speaking of the electronics industry, many people think it's going through a terrible time world wide, yet reports of orders keep coming in. GTE Sylvania Inc. has just landed an order to work on communications equipment for the US Army. The contract is valued at nearly fifty one million dollars.

RADIATION SPARKLERS

Ever heard that diamonds are a girl's best friend? Well they're getting quite friendly with the medical profession too. The latest application for these precious morsels is as a sensor for nuclear radiation. Apparently certain diamonds are sensitive to radiation and can be used as probes. Advantages claimed are that they have no upper limit to the dose they can detect (in excess of 10^9 Rads.) and that they are reliable and constant. Only about one diamond in a thousand is suitable, so a company has set up manufacture for a machine which sorts these diamonds. Just shows how industries get started!

A YEN FOR WALES

Another snippet in the field of television is that a Japanese company has bought ten acres of land in South Wales to build a factory which will produce 5,000 colour television sets per month by 1976. Some £2 million has been invested and there is mention of a 250 work force—all this within less than two years, and the factory's not even built yet!

TOP SECRET

The science fiction fantasy of the space-age gun fighter swaggering about the cosmos with a laser on his hip has taken a step nearer reality. A laser, about the size of a cigar, has been made which has an output of one million watts peak (and that's a lot of watts no matter where it hits you!). The horrendous follow up from the manufacturer is that by increasing its size by five times, the output can be increased 250 times. No further details coz this information is top secret anyway. The work is sponsored by the US Air Force and the US Defence Department. I don't know if the US has its own Tower of London, but after this, Ginsberg will be in it (in more ways than one!).

---

* Our contributor, S. Ginsberg is back with us again, after a bucket and spade holiday.

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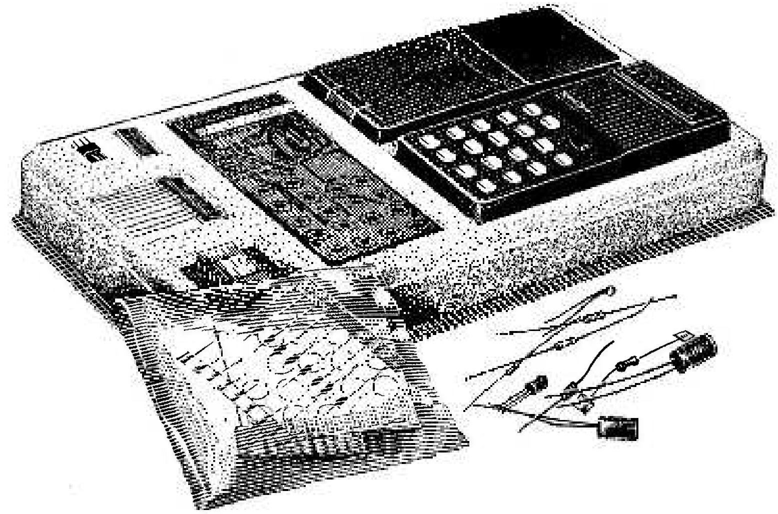
10. Soft wallet.



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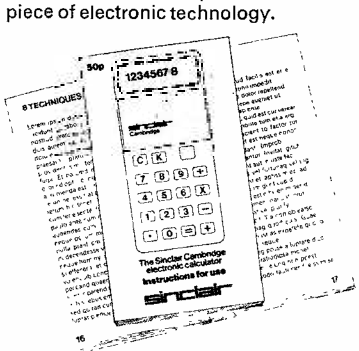

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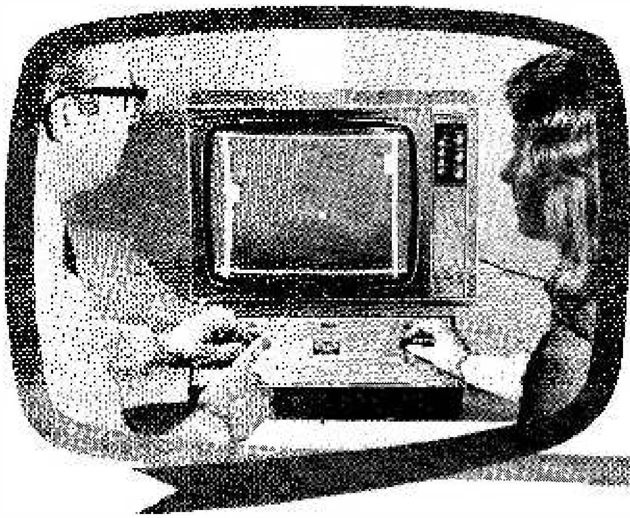
PART 4



M. J. HUGHES MA

This month we shall describe Boards C and D which carry the top and bottom base generators, bat vertical position and height generators, the vertical and horizontal ball control circuitry and the ball control logic.

Top and Bottom Bases

The circuitry for Board C is shown in Fig. 15 and some of the more important waveforms in Fig. 14. The top and bottom bases are generated in exactly the same manner as the left and right bases, described last month. The only differences are that they are triggered from the field sync pulse and the delays involved are somewhat larger. IC 16, connected as a monostable, sets the position of the top base relative to the field sync pulse. Ideally it should appear somewhere near the top of the screen in the final display and hence needs a delay of about 3mS. Plenty of latitude is built in and you can adjust the position to suit your own set by means of VR7.

The output of the monostable is inverted and the rising edge from pin 6 of IC17b is differentiated by C20 and R29 to produce a spike having a width of about 200μS at half its maximum amplitude. This is cleaned up by the Schmitt trigger, IC 17d/c, to give a nice rectangular 200μS pulse. Allowing for variations in component tolerances, this gives a brightening up on the screen equivalent to about 3 or 4 lines.

To increase the base height, C20 should be increased in value. This should not be necessary, as the values throughout the project have been chosen for optimum performance. However, we are mentioning these possible variations as they may help in trouble shooting or further experimentation.

The bottom base is generated in exactly the same fashion by IC18 and IC19. The only difference is that the delay is longer—hence it appears further down the screen. Final adjustment is carried out by means of VR8. Capacitor C19 decouples spikes on the logic supply rails.

Bat Position and Height

The rest of Board C is given over to the vertical positions and heights of the two bats. We shall describe the circuitry for the left bat only; the right bat is identical in every respect.

The vertical position of the bat has to be varied by means of the front panel slider potentiometer. In this design we use an NE555 as a voltage-controlled monostable to give the variation in position, the controlling voltage being derived from the potential divider action of the front panel control, VR13. The device which performs this variable delay function is IC20.

We must ensure that the bat can overlap the top base, so the minimum delay should be in the order of 2mS after the field sync. This is set by the components VR9, R36, R35 and C23 when the wiper of

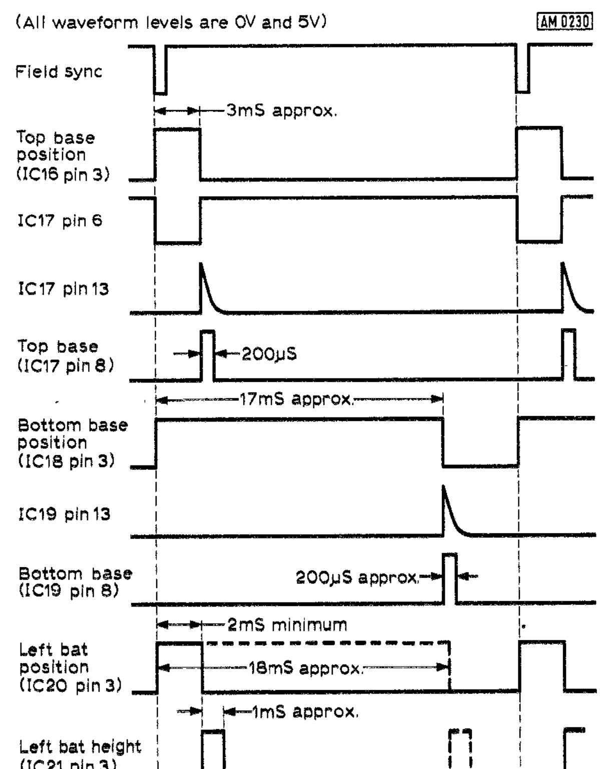


Fig. 14: Typical waveforms for the Top and Bottom Base and Bat Vertical waveform generators on Board C. The Right Bat waveforms are identical to those shown for the Left Bat.

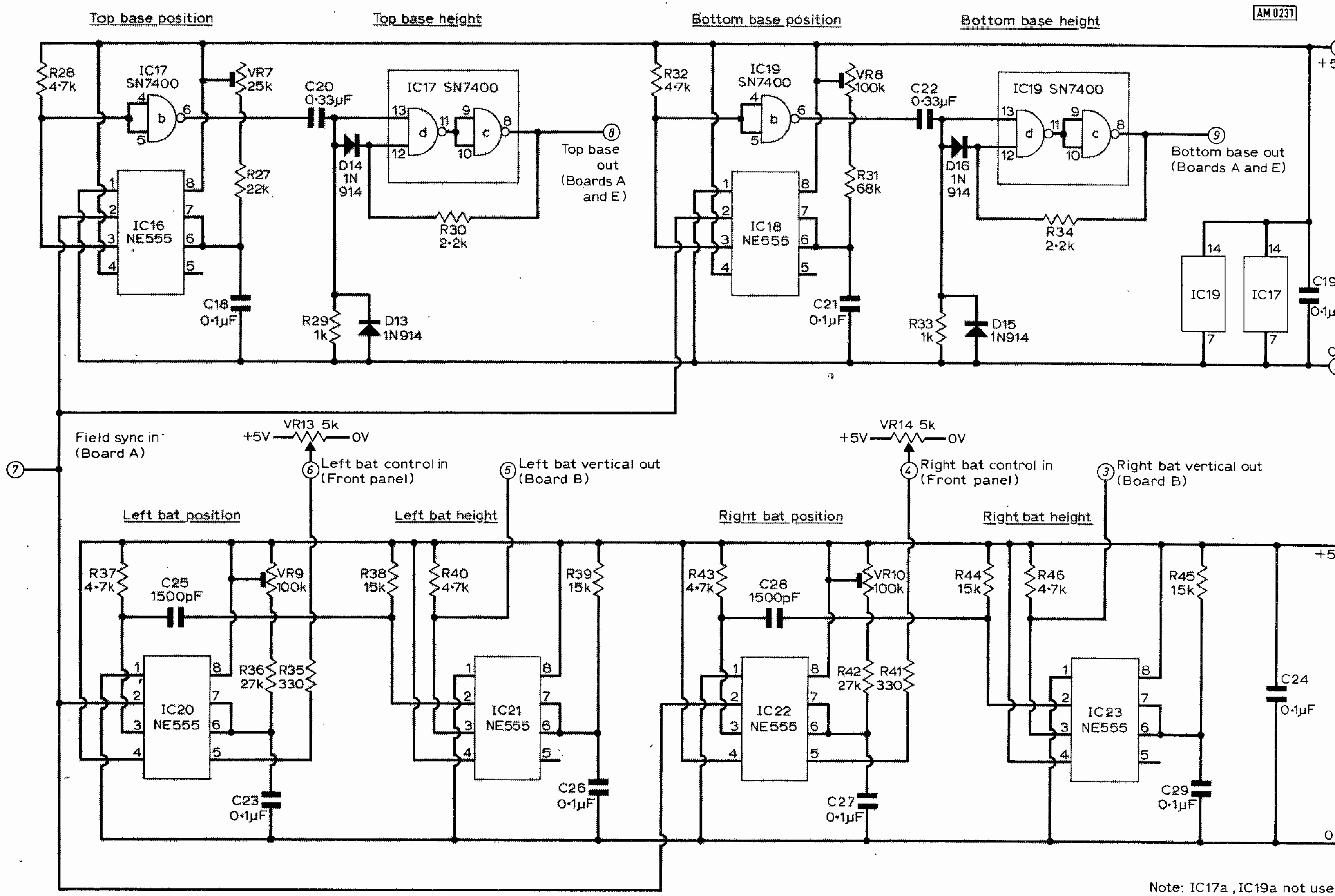
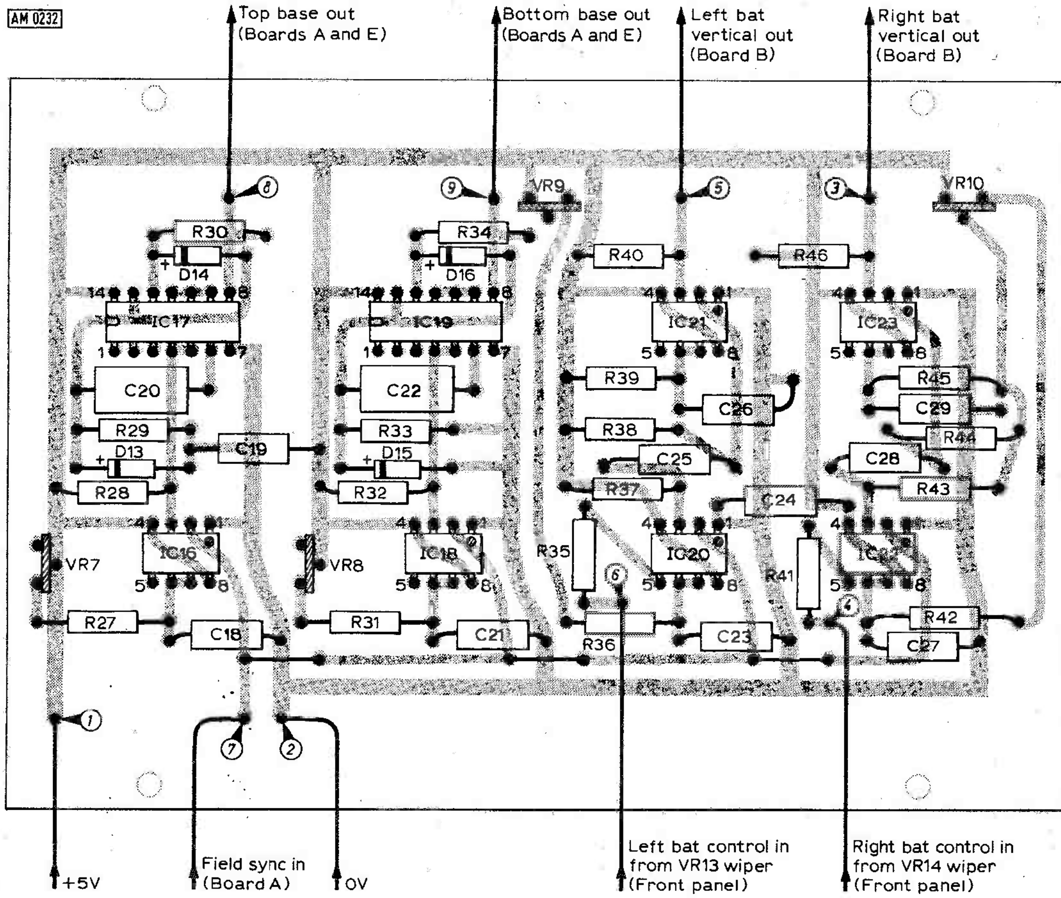


Fig. 15: Circuit of Board C, including Top and Bottom Base and Bat Vertical waveform generators. VR13 and VR14 are mounted on the front panel.



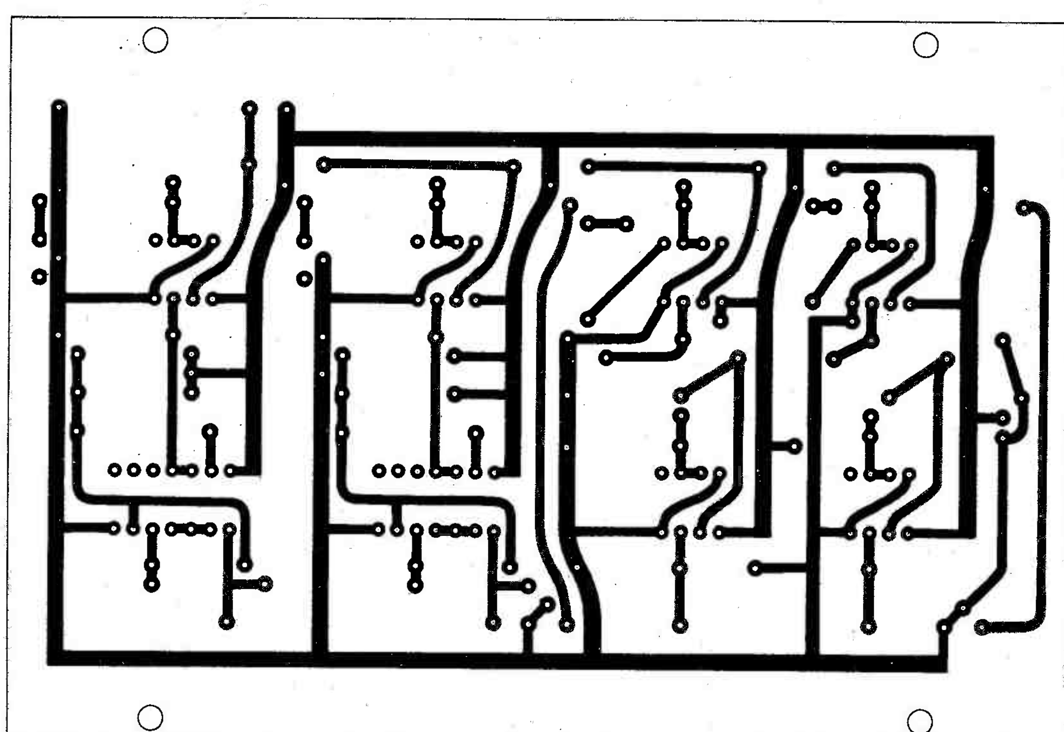


Fig. 16: Actual size layout of Board C and location of components.

VR13 is at the 0V end of its track. When VR13 is set to +5V we get our longest delay and the bat is nearest the bottom of the screen. It is possible for this delay to exceed the length of a field scan, in which case the bat would appear again at the top of every second field. To prevent this happening we have a preset maximum delay, set by VR9, which limits the extent of the voltage control. We shall describe how this is adjusted later.

The height of the bat is up to the individual reader—the smaller the bat the more difficult the game. You can see from the photographs of our game the relative size we have obtained with the specified components. In any event, the duration of brightening up must be quite large to ensure that enough lines are used to define its height. It is, perhaps, more important that the height of both bats should be the same so that there is no advantage to be gained from playing on one side.

Because of these two points we have opted to generate the bat height with another monostable, IC21, instead of the simple differentiator and trigger we have repeatedly been describing. R39 sets the dwell of the monostable; increasing this value heightens the bat and vice versa. The output from IC21 describes the bat height at its desired vertical position; this has to be combined in an AND gate with the left bat width signal generated on Board B. Reference to Fig. 12 in last month's issue will show the two signals being combined in IC15b. The right bat vertical signal is similarly combined with its width in IC15a.

Testing Board C

Following on with our usual advice we suggest you now build Board C and wire it into the subframe. Connect the field sync input to Board A and the TOP and BOTTOM BASE signals to board A and also to a pair of the unused diode inputs to board E. The connections to board A are for the circuitry which senses coincidence between BALL and TOP or BOTTOM BASES to give a direction change signal to the ball control circuitry. The left and right bat vertical signals have to be taken to their respective pins on Board B. Finally connect VR13 and VR14 temporarily with flying leads across the 5V power rails and take their wipers to pins 6 and 4 on Board C. Remember, of course, to connect the +5V and 0V rails to this board.

Now you can check the functioning of Board C. Set VR13 and VR14 to the 0V end of their travel and set VR7 and VR8 about mid-way. Apply power and tune in the television set as before. Check that the time bases are correctly set and note that all the features described last month should be displayed, except that the top and bottom bases are present and the bats appear at the top of the screen.

First adjust the positions of the top and bottom bases with VR7 and VR8. The top base should be set to cut across the centre of the bats when they are at their highest point and the bottom base should be in a symmetrical position. Now check that you can move the bats independently with their respective control potentiometers. Start with VR13 and **slowly** move the bat down the screen. If the bat stops before the potentiometer has reached its limit increase the value of VR7 a little and continue doing this until the bat is bisected by the bottom base when VR13 is at the +5V end of its track. Do the same with the right hand bat.

★ components list

BOARD 'C'

Resistors (all ⅛ or ¼W, 5%)

R27	22kΩ	R34	2·2kΩ	R41	330Ω
R28	4·7kΩ	R35	330Ω	R42	27kΩ
R29	1kΩ	R36	27kΩ	R43	4·7kΩ
R30	2·2kΩ	R37	4·7kΩ	R44	15kΩ
R31	68kΩ	R38	15kΩ	R45	15kΩ
R32	4·7kΩ	R39	15kΩ	R46	4·7kΩ
R33	1kΩ	R40	4·7kΩ		

Potentiometers (all sub-min. vertical presets)
VR7 25kΩ VR8–VR10 100kΩ

Capacitors

C18	0·1μF (P)	C22	0·33μF (P)	C26	0·1μF (P)
C19	0·1μF	C23	0·1μF (P)	C27	0·1μF (P)
C20	0·33μF (P)	C24	0·1μF	C28	1500pF
C21	0·1μF (P)	C25	1500pF	C29	0·1μF (P)

Semiconductors
D13–D16 1N914 or 1N4148
IC16, IC18, IC20–IC23 NE555
IC17, IC19 SN7400

Miscellaneous
6 DIL8 IC sockets; 2 DIL14 IC sockets; pcb; 9 pcb pins.

BOARD 'D'

Resistors (all ⅛ or ¼W, 5%)

R47	1kΩ	R52	620Ω	R57	4·7kΩ
R48	2·2kΩ	R53	620Ω	R58	620Ω
R49	100kΩ	R54	2·2kΩ	R59	620Ω
R50	4·7kΩ	R55	100kΩ	R60	1kΩ
R51	4·7kΩ	R56	4·7kΩ		

Potentiometers
VR11, VR12 1MΩ sub-min vertical presets

Capacitors

C30	2000μF 25V	C33	47μF 25V
C31	47μF 25V	C34	2·2μF (P)
C32	2·2μF (P)	C35	0·1μF

Semiconductors
Tr1, Tr2 BC108
IC24, IC25 LM741C IC26–IC29 SN7400

Miscellaneous
2 DIL8 IC sockets; 4 DIL14 IC sockets; pcb; 20 pcb pins.

NOTE—Capacitors marked (P) must be low-leakage polyester or polystyrene types.

If any of the features do not appear as specified, check the functioning of the various delay units by taking a flying lead from their outputs to the last unused diode on Board E, as described last month. A little thought and analysis should rapidly sort out the faulty zone and the fault will almost certainly be a forgotten soldered joint, a diode the wrong way round or a short caused by a blob of solder. We ought to repeat, once more, the warning that the identification marks on the NE555 timers point in the opposite direction to these on the SN7400 devices so be careful you have put these in the right way round!

Ball Control Circuit

We will assume all is well and proceed to the board which, although the simplest to assemble, is

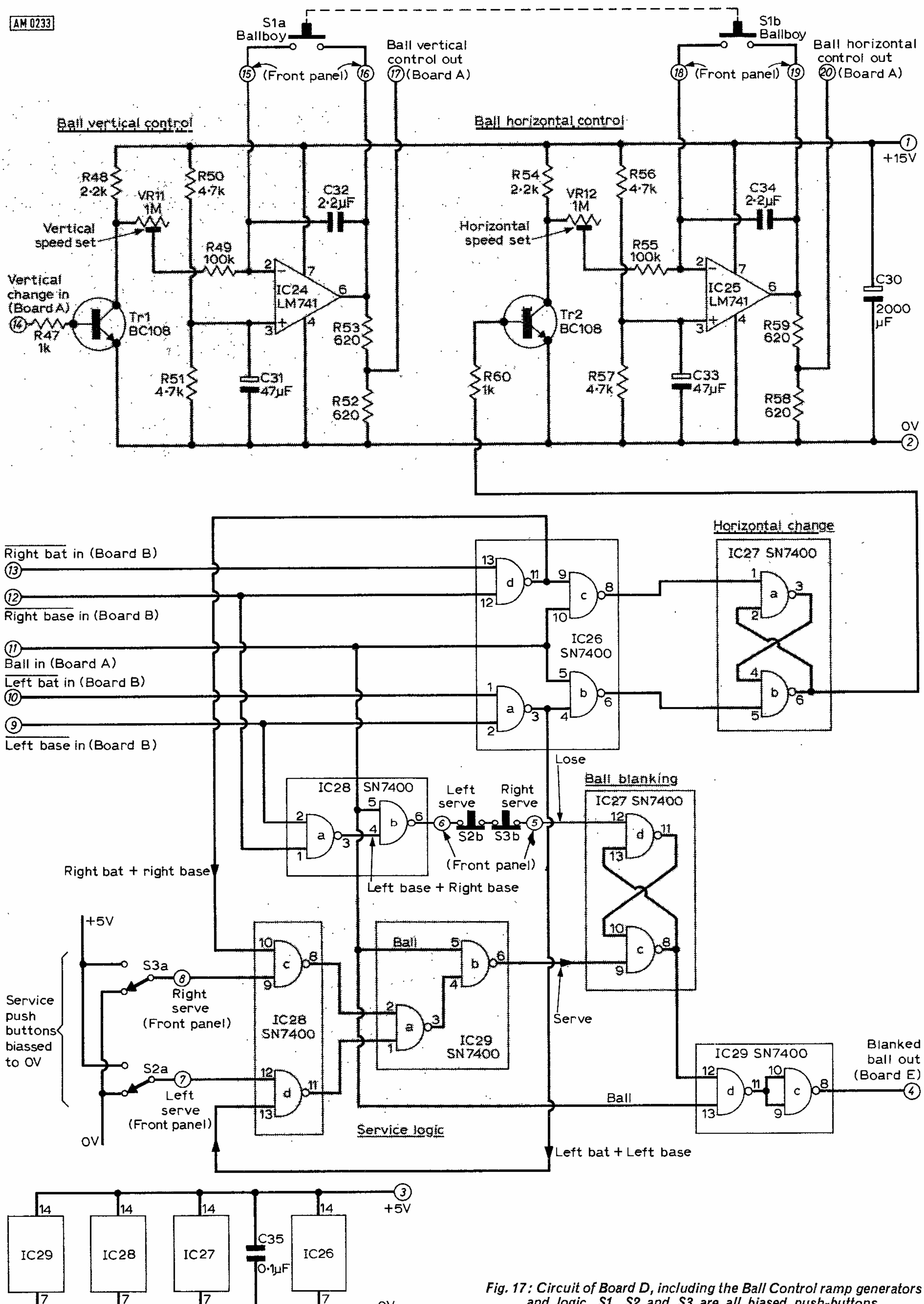


Fig. 17: Circuit of Board D, including the Ball Control ramp generators and logic. S1, S2 and S3 are all biased push-buttons.

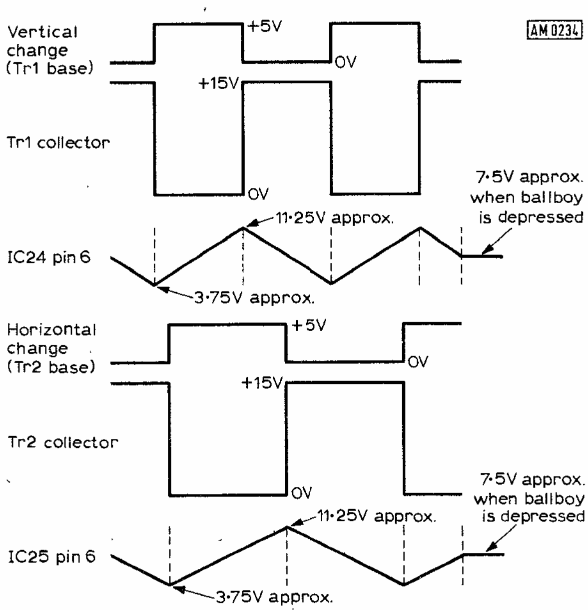


Fig. 18: Typical waveforms for Ball Control ramp generators.

the most complex to understand as it contains all the ball control logic. The complete circuitry is shown in Fig. 17 and, as can be seen, is split between the reversible ramp generators that provide the control voltages for ball movement and the logic that triggers the ramps, starts a service and ends a game when a "miss" is detected. Let's start with the ramp generators.

Ball Ramp Generators

Both the control voltage generators are the same so we shall describe only the vertical control unit comprising IC24, an operational amplifier connected to work as a linear integrator. When the voltage at the left hand end of the input resistors, VR11 and R49, rises in a positive direction the inverting function of the amplifier chip causes the output to fall, see Fig. 18. If a voltage step is applied to the input the output will fall with a time constant set by C32 and the combination of input resistors. The lower the input resistance the faster the rate of fall. If the input is suddenly switched into a low state the operation is reversed, whatever the output voltage happens to be, and the output will rise linearly with the same time constant.

We use the signal from pin 11 of IC8 (Board A) as the input signal. This goes to a high level when BALL is coincident with TOP BASE. When this happens the collector of Tr1 is pulled down to zero and the output of IC24 starts its upward-going ramp. A proportion of this is tapped off from R52 and R53 and fed back to the voltage control unit of the monostable controlling the ball's vertical position (pin 5 of IC3 on Board A). The increasing voltage of the ramp increases the delay from the monostable and the ball will move down the screen until it hits the bottom base at which time the output from pin 11 of IC8 will fall to a low level. The ramp then starts to fall and the ball rises up the screen until it hits the top base once again. We have, in effect, a complicated form of oscillator which causes the ball to move cyclically up and down the screen. The speed at which this happens is set by VR11.

At the time of switch-on it might be that the ball occurs instantaneously above the top base. If this happens there may not be a coincidence at the top of the screen and the ball would not move away from the top. This is why we have included the shorting link across the amplifier via Sla, the Ballboy switch. When it is pressed the output voltage from the ramp generator is centred and the ball is forced to a position about halfway down the screen and hence inside the controlled area.

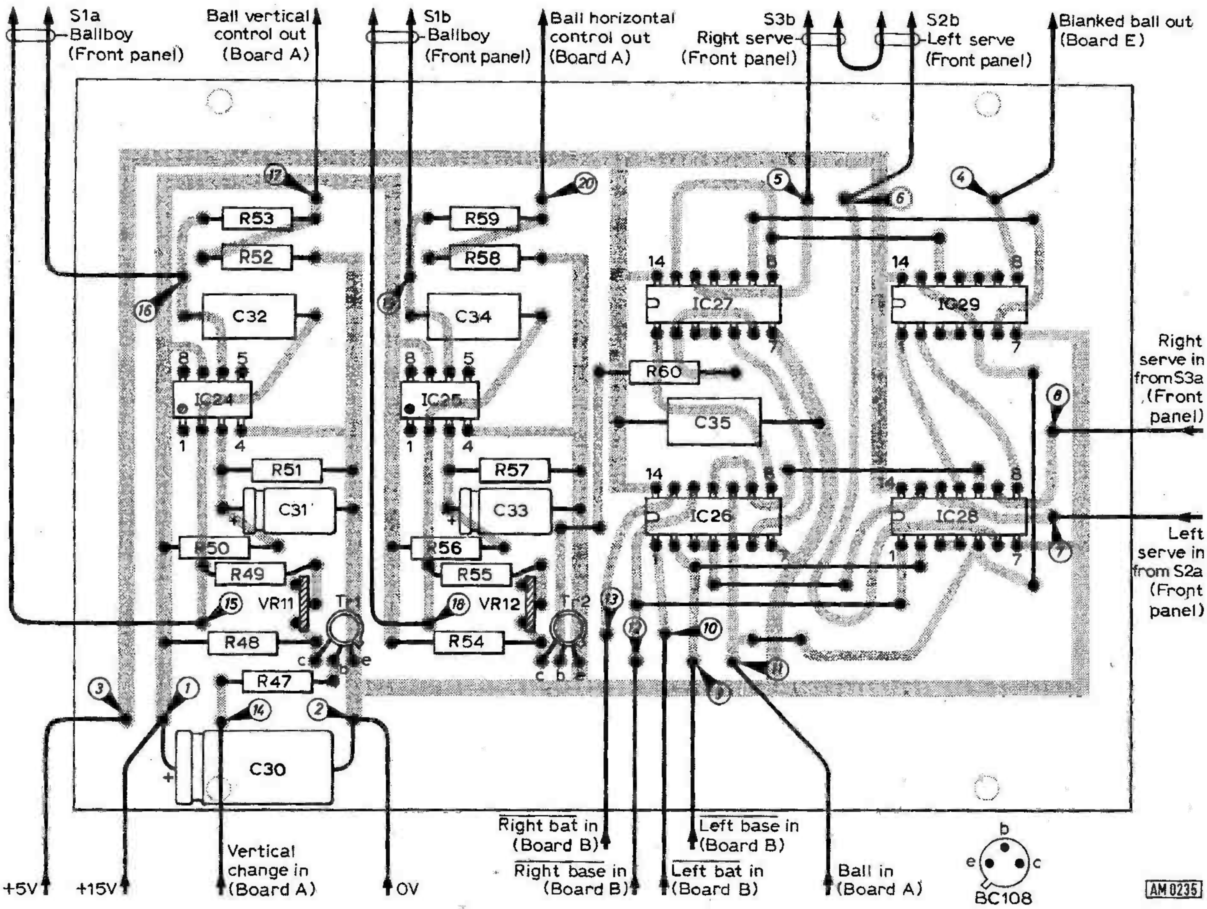
Ball Control Logic

The horizontal movement of the ball is controlled by coincidence signals between the ball and the left bat or left base, or the ball and right bat or right base. The logic for sensing these conditions is embodied in IC26. For example the signal at pin 11 of IC26 is RIGHT BAT or RIGHT BASE. When this is in a high condition and BALL is at level "1", the level at pin 8 of the same chip will go to "0". This sets a "1" at pin 3 and a "0" at pin 6 of IC27 which is connected as an RS flip flop. The low level at pin 6 is fed to the horizontal ramp generator (identical circuitry to that just described) and the output of IC25 starts to fall linearly. This is fed back to the monostable (IC5) which controls the ball's horizontal position and the ball moves from right to left across the screen. Coincidence between BALL and LEFT BAT or LEFT BASE causes a reversal of this process.

The horizontal ball speed is set by VR12. The relative vertical and horizontal speeds should be set so that there is as large a degree of randomness as possible in the ball's trajectory. Having them set at the same speed will make the ball travel at 45 degrees across the screen and it will simply precess slowly along slightly differing paths. When the unit is completed some experimentation is worthwhile to get the best effect. Again we shall repeat ourselves by pointing out that the ball's speed should not be too great otherwise the ball **might** cross a base line between field scans and a coincidence may not be detected. That is one reason why it is better not to make the ball too small nor the bases too narrow! If this should happen during setting up it is only necessary to increase the speed control resistor values slightly and bring the ball back into play with the Ballboy.

The other half of IC27 is a very important part of the game, called Ball Blanking. This ensures that the ball is not visible on the screen until a service is made. You must remember that, in our system, the ball is moving across the screen all the time—whether you can see it or not. We start a service by brightening up the ball when it is in coincidence with the bat or the base of the side whose turn it is to serve. When the ball misses either bat and hits the left or right base line a blanking signal is generated at pin 8 of IC27.

Let's go through a typical game and see what happens within the logic; we shall assume that the right hand player is to serve. He presses his service button (S3a) and **holds it down.** This puts a "1" on pin 9 of IC28c. When a RIGHT BAT or RIGHT BASE signal occurs (from pin 11 of IC26) the output at pin 8 of IC28 goes low and pin 3 of IC29 goes high. This is fed to pin 4 of IC29 and combined with the BALL signal coming into pin 5. If the ball and base or bat signals are coincident **while the service button is pressed** the signal at pin 6 of IC29



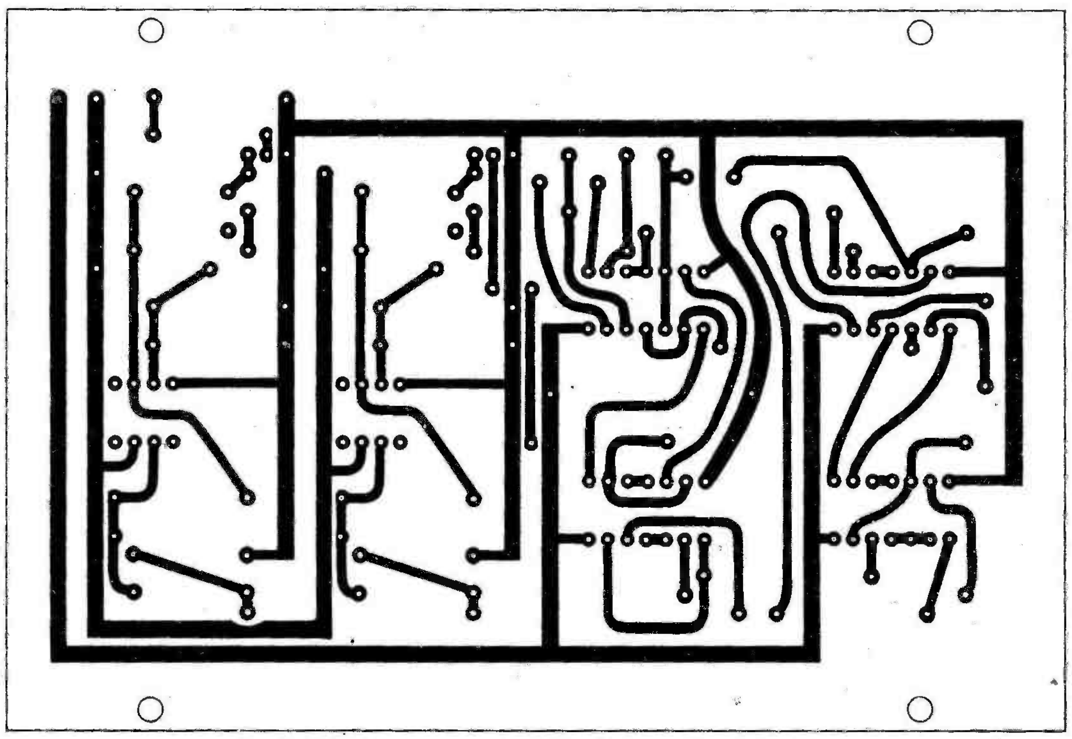


Fig. 19: Actual size layout of Board D and location of components.

goes low and this forces a "1" at pin 8 of the Ball Blanking flip flop. This output is combined with the ball signal in AND gate IC29d, and the output signal from pin 8 of IC29 is the true BALL signal which will brighten up on the screen.

As soon as the ball appears the right hand player takes his finger off the button and the game progresses—the ball stays bright because of the latching action of the ball blanking circuit. Let's say the left hand player successfully returns the ball but the right hand player misses it. What happens?

Whenever a LEFT or RIGHT BASE signal occurs, pin 3 of IC28 goes high and this is combined with the BALL signal in IC28b. When the right hand player misses the ball there is bound to be an eventual coincidence between BALL and his end base. This shows itself by the signal at pin 6 of IC28 momentarily falling to zero (we call this the Lose signal) and this resets the ball blanking flip flop thus extinguishing the ball. It should be clear that this would also have happened had the left hand player missed because the signal at pin 3 of IC28 is RIGHT BASE or LEFT BASE.

We shall not dwell on the logic any further except to draw your attention to the two series switches in the lose line feeding pin 12 of IC27. These open circuit the lose input to Ball Blanking during a service, otherwise we could get coincident noughts at both pins 12 and 9 (IC27) if the ball happened to be bouncing off the left or right base at the time. This would cause ambiguity in the logic which has to be avoided at all costs.

We expect that the lesser experienced constructor might have some difficulty in following this brief description of a fairly complex bit of logic. Do not let this put you off constructing the project, however. It is most unlikely that you will suffer faults in this region providing you are careful with your soldering.

Part 5, next month, will deal with testing Board D, final adjustments and will include inter-connection drawing for all boards and panel.

TECHNICROSS SOLUTION NO.6

1 R		2 D		3 A	4 C	O	5 U	S	6 T	I	7 C	S
8 E	M	I	T		H		S		U		O	
S		S		9 R	E	T	U	R	N	I	N	G
10 I	O	T	A		F		R		E		E	
S		O		11 P		12 A	P	E	R			13 W
14 T	A	R	G	E		U			15 S	16 I	L	O
O		T		17 R	A	D	I	18 O		N		R
19 R	E	S	20 T			I		21 H	O	T	E	L
S			22 E	R	23 G	O		M		E		D
	24 D		N		R		25 W		26 B	R	O	W
27 M	A	I	N	S	U	N	I	T		C		I
	T		I		N		R		28 L	O	A	D
29 C	A	S	S	E	T	T	E	S		M		E

PW EPSOM—*continued from page 527*

Mixer Stage. Again, this is just a matter of a logical sequence of adjustments, easier to perform than to describe! Fit Range 5 coils in the mixer stage (highest frequency range) and set dial to the low end of the scale, about 15MHz. Set trimmers on RF tuning gang capacitor and VC3 to about half way and RF gain control to maximum. If a signal generator is not available choose a station in the 20m broadcast band that is fairly steady in signal strength. Set the RF tuning to about two-thirds of maximum capacity and adjust the cores in the RF coils for maximum output, using the S-meter as before.

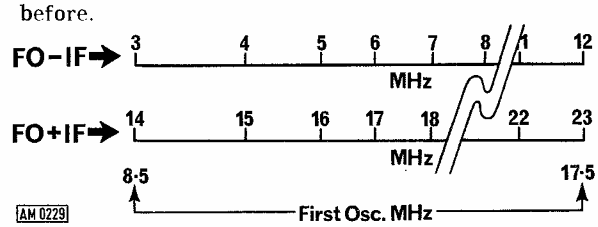


Fig. 16: Illustrating the way in which the single range first oscillator is used to provide the calibration of the two ranges actually marked on the dial.

To check this adjustment, rock the RF tuning back and forth when two peaks of maximum signal may be noted. The adjustment should aim at making the two peaks coincident. Tune to a station at the HF end of the band, the 13m broadcast band will do, and adjust trimmers TC1 and TC2 for maximum signal, aiming at a single peak. Check and readjust cores at the LF end, the trimmers again at HF. Tighten core lock nuts and seal trimmers. Mark the RF tuning dial at 1MHz points corresponding to the main dial calibration.

Repeat the above procedure with pairs of RF coils for Ranges 3 and 4 and tighten lock nut on cores. **Note:—** adjust the **cores only** on these two ranges, at the LF end of each range. Do not touch trimmers TC1 and TC2 again after they are aligned for Range 5, where they have most effect. The RF tuning dial calibration can be seen in the photographs.

Carrier Insertion Oscillator. With the mode switch on SSB/CW, tune in an SSB signal, on say the 20 or 80m amateur band, and while tuning very slowly across the signal adjust trimmer TC4 on the CIO crystal for best speech quality. Try this on several stations before finding an optimum position and then seal the trimmer.

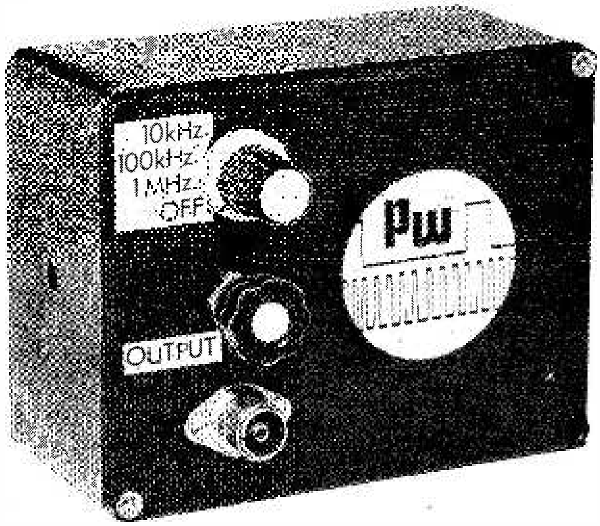
NOTES

The 'AE Trim' control VC3 allows the input tuned circuit to be peaked for different types of aerial and will be found to be most effective at the higher frequencies. In practice the RF tuning will be found to be very sharp and can very easily be missed when the receiver will be thought to be rather dead!

There is no reason why the first oscillator circuit should not be modified to provide amateur band coverage only or particular broadcast bands, replacing the tuning capacitor, in effect, with a fixed capacitor to find the band required plus a parallel tuning capacitor. Multiband operation merely requires a multiway bandswitch, preferably ceramic or PTFE, to bring in the various combinations of capacitors. Whatever alterations are made they do not affect the RF tuning which is just peaked to the signal frequency involved. ■

Frequency Marker Generator

S.M.LINDSAY B.Sc G3ZCE



THE short wave listener, the radio amateur, and all those who build, modify or use radio gear need to be able to measure frequencies fairly accurately. The calibration on most surplus receivers is usually way out, whilst searching for particular stations on the short wave bands is pretty futile unless one has a good idea, to within 20kHz, of where to start. The author has found that the calibration and tracking of brand-new amateur band receivers leaves a lot to be desired, with 10kHz errors at scale ends not that uncommon. Of course, the ultimate answer is a frequency counter, but this is beyond the pockets of many (author included!), so the next best solution is a crystal marker used in conjunction with a receiver. The calibrator described in this article has been found to give a reasonable output on all ranges to well over 35MHz at 1MHz, 100kHz and 10kHz intervals. The unit is simple to construct and works with a wide range of crystals and transistor gains.

CIRCUIT DESCRIPTION

Referring to Fig. 1 the oscillator is conventional, component values having been chosen to provide stable operation with even relatively poor crystals. The trimmer TC1 will pull most crystals on the high side on to the centre frequency of 1MHz. In the event of a crystal being on the low side, some pulling will result by reducing C2. The method of setting up is to listen to the output of the unit on 200kHz beating with the Droitwich transmission on 200kHz and adjust TC1 for zero beat.

Tr2 acts as a squarer, bias being obtained by R4. A 1MHz square wave is available at the collector of this transistor. Whereas most crystal calibrators have used dual crystals, locked multivibrators or step counters, the availability and price of decade counter ICs makes them the obvious choice for the task of dividing this 1MHz output by 10 and 100. IC1 performs the first division by 10 and the 10kHz waveform is obtained at the output of IC2 by a further division by 10.

THE DECADE COUNTERS

As some constructors may have yet to use these devices, a few words of description is in order. These counters consist of four JK flip-flops, wired in series. Suppose, to begin with, the four outputs are at 0000 (0 is OFF, 1 is ON). The input pulse train is connected to the clock input of the first flip-flop, each pulse in turn turning it on, then off. Thus after 10 pulses the configuration of the four flip-flops is 0101 ("New maths" people will recognise this as the binary equivalent of 10). A series of gates is arranged to give an output when this configuration is reached, the flip-flops are reset, and the whole process begins again.

★ components list

Resistors

R1	27kΩ	R3	1kΩ	R5	4·7kΩ
R2	15kΩ	R4	1kΩ	VR1	47kΩ carbon pot.

$\frac{1}{4}$ or $\frac{1}{8}$W 5 or 10%.

Capacitors

C1	0·05μF C	C6	18pF SM
C2	33pF SM	C7	0·05μFC
C3	150pF SM	C8	0·05μFC
C4	0·05μF C	TC1	12pF trimmer
C5	200pF C		

SM Silver mica C Ceramic

Semiconductors

IC1/2 SN7490 Tr1/2 BC109

Miscellaneous

S1, 4 pole, 4 way wafer switch. Diecast box $4\frac{3}{4}$ x $3\frac{3}{4}$ x 2in. or similar. X1, 1MHz crystal (HC6U) and holder. (Senator Crystals 36 Valleyfield Road, London SW16). Coil former $\frac{3}{16}$in. dia. and dust core. Output socket. IC holders, if required (2). Material for PCB.

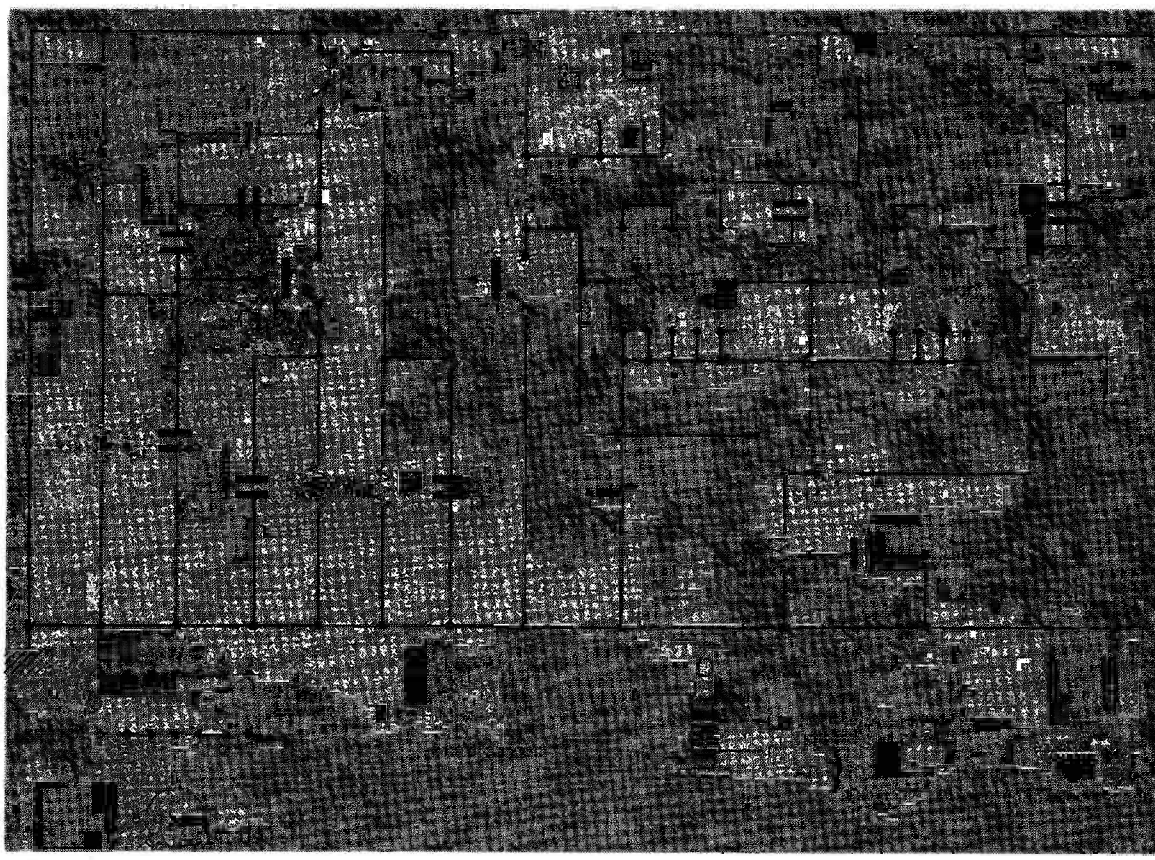
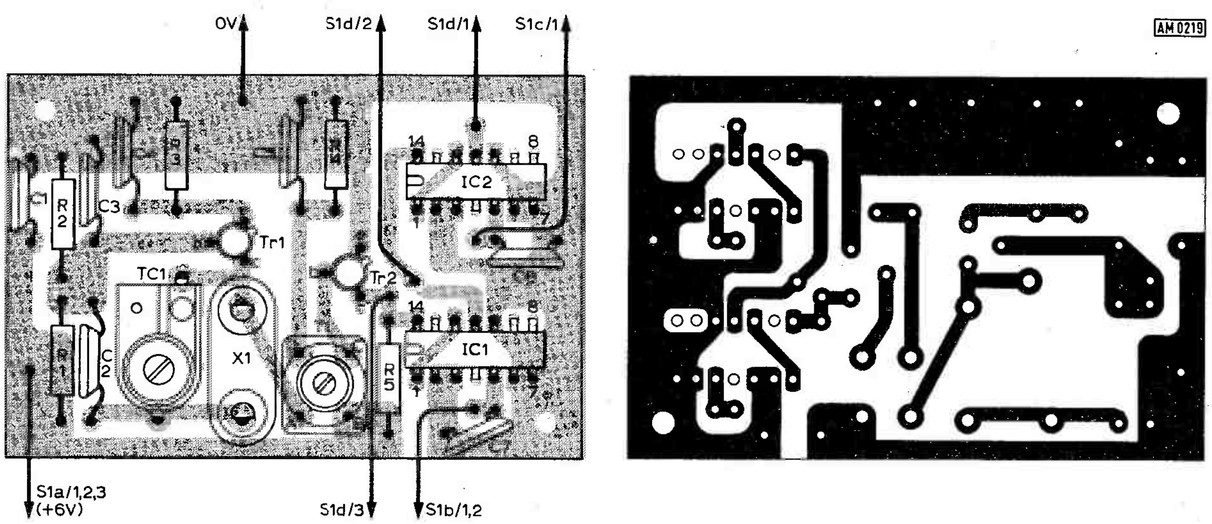


Fig. 1 : above, complete circuit diagram with details of coil. In Fig. 2, below, the PCB is shown full size together with component layout.



These devices have quite a considerable high-frequency gain so that long leads and undecoupled power supplies will almost certainly result in oscillation which can easily destroy the IC. The printed circuit layout, together with C7 and C8, soldered directly to the pins and the ground plane on the underside of the board, eliminate any chance of this happening.

The operation of these devices is such that the output of the device is **not** a 1:1 mark/space square wave. In a perfect 1:1 square wave no even harmonics are present. The spectrum of the wave form of the output of the counters is such that multiples of the 5th harmonic are weak, every 500kHz and every 50kHz. When calibrating receivers this point must be borne in mind as, particularly on the highest frequencies, this harmonic is quite a lot weaker than its neighbours and could be overlooked.

—continued on page 544

I.C. OF THE MONTH

Number 47 — Fairchild μA753 FM Receiver

MANY amateur constructors regard the alignment of receivers as one of the most difficult problems they have to meet. This is especially true in the case of FM receivers where incorrect alignment can result in distortion. The Fairchild μA753 device has been specially designed for use with 10·7MHz ceramic filters which avoid all alignment problems. Besides helping the amateur constructor, this also reduces labour costs for the commercial receiver manufacturer.

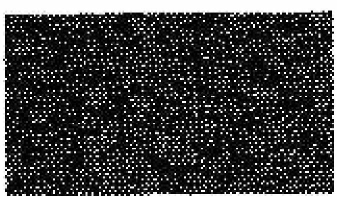


Fig. 1: Pin connections for the μA753.

The μA753 is an eight pin dual-in-line integrated circuit with the connections shown in Fig. 1. It provides an IF gain in the range 40 to 56dB, typically 50dB or a voltage gain of 316 at a frequency of 10·7MHz.

A typical circuit for the use of the μA753 is shown in Fig. 2. The output from an FM tuner is fed to one side of a 10·7MHz ceramic filter and the output from the filter is fed into pin 1 of the μA753 device. The μA753 contains three cascaded direct coupled amplifiers using emitter coupled pairs with emitter followers between stages to provide impedance matching and voltage shifts. There is overall feedback from the output of the third stage to the input. The two ceramic filters together provide all of the selectivity required in the IF stages of the receiver.

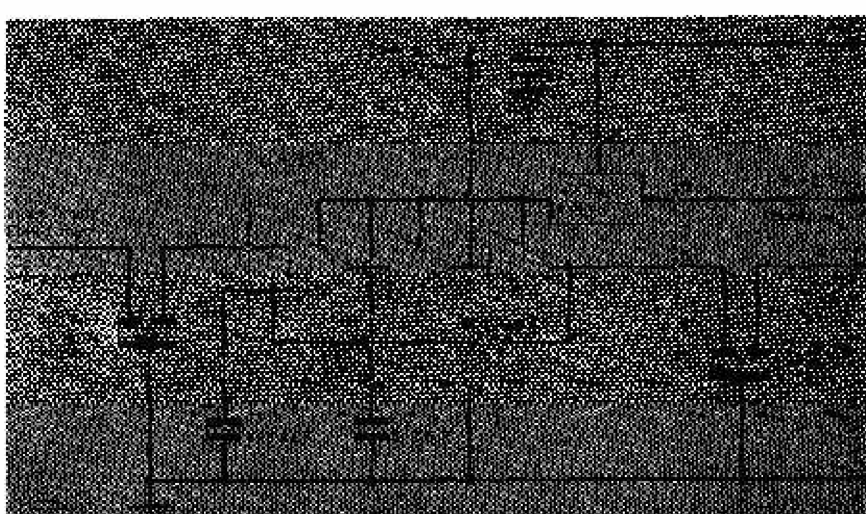
A low-level 10·7MHz output is available at pin 7 with a 330 ohm output impedance. It is intended that this shall be used to provide an AGC control voltage without interfering with the output impedance at pin 5. The device incorporates an internal voltage regulator which stabilises the performance against variations of temperature and supply voltage. In addition, the μA753 provides a regulated output at pin 6 of about 7·8V at up to 10mA which forms a suitable power supply for most types of tuner unit.

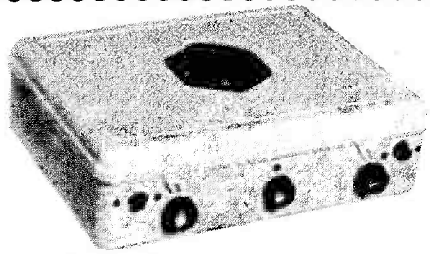
The μA753 has been designed so that a minimum number of external components are required. It can be seen that, apart from the ceramic filters, only three decoupling capacitors are required.

The output from the second 10·7MHz filter is normally fed to an integrated circuit which provides further amplification followed by demodulation.

The recommended power supply voltage range for the μA753 is 10V to 16V with an absolute maximum voltage rating of 18V. The power supply current

Fig. 2: Internal circuit of the IC together with basic external components





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- ★ 5 Transistor Push Pull Amplifier.
- ★ 7 Transistor Loudspeaker Radio MW/LW.
- ★ 5 Transistor Short Wave Radio.
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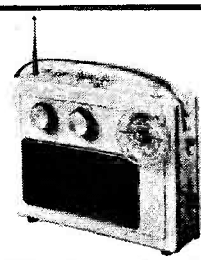

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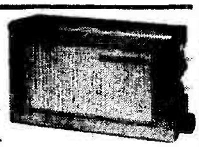

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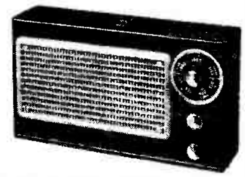

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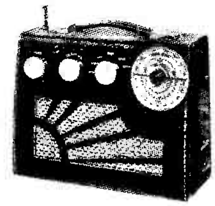

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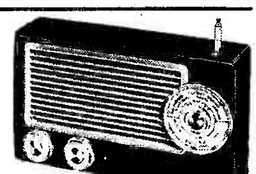

6 Tunable Wavebands: MW, LW, SW1, SW2, SW3 and Trawler Band. Sensitive ferrite rod aerial for M.W. and L.W. Telescopic aerial for Short Waves. 3in. Speaker. 8 improved type transistors plus 3 diodes. Attractive case in black with red grille, dial and black knobs with polished metal inserts. Size 9 × 5½ × 2½in. approx. Push pull output. Battery economiser switch for extended battery life. Ample power to drive a larger speaker. Parts price list and plans 25p (FREE with parts).

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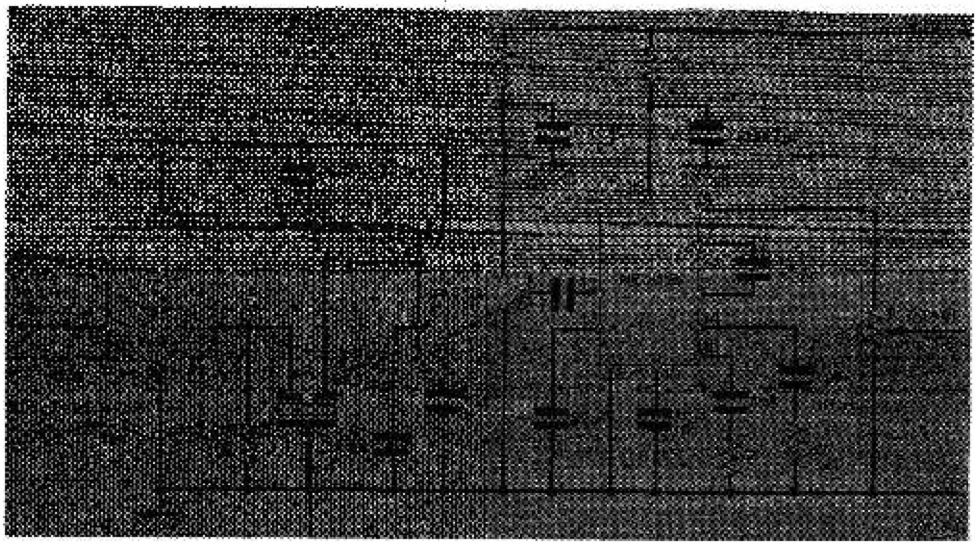


Fig. 3: Suggested FM receiver with no tuned circuits other than those in the tuner unit.

ranges from about 11 to 19mA. The internal power dissipation must not exceed 310mW. The device incorporates short circuit protection for all external connections.

Use in receivers

In one type of circuit, the output from the second ceramic filter of Fig. 2 may be fed into a circuit using the Fairchild 3075 device comprising a 10·7MHz amplifier, a differential peak detector and an audio preamplifier. One tuned circuit must be employed with this device.

The writer has employed the μA753 in a simple receiver which requires no tuned circuits other than those in the tuner unit. The circuit, shown in Fig. 3, can provide excellent linearity. A Toko ET-703UA tuner unit was used to feed a Toko CFS 10·7MHz ceramic filter. Unfortunately the tuner output impedance is not ideal for this application and R1 was therefore included.

The tuner provides a gain of at least 16dB and, although there is a loss of 6dB in the filter, there is a further gain in the μA753. It has been found experimentally that the low-level output of pin 7 of the μA753 is quite adequate to drive the NE561B phase locked loop detector circuit. If desired, the output may be taken from pin 5 of the μA753, but an excessively large signal fed to the NE561B will reduce the rejection of amplitude modulated signals, such as car ignition noise.

The only adjustment which must be made to the circuit involves the trimmer capacitor TC1 which should be adjusted so that the centre frequency of the phase locked loop is close to 10·7MHz. This adjustment is easily made by altering TC1 to the centre of its adjustment range at which locking occurs with any correctly tuned signal. When locking occurs with a modulated signal, an audio output is obtained. A slight "plop" noise may occur as the loop comes in or out of lock.

The writer fed the output from the loop into a Sinclair "Super IC-12" audio power amplifier which was fed from the same power supply line as the remainder of the receiver. Capacitive coupling must be employed so that the steady voltage on which the audio is superimposed does not reach the input of the power amplifier. However, the recommended circuit for the Sinclair amplifier employs an input capacitor which serves this purpose. The whole receiver provided an output which was more than adequate to drive an 8 ohm speaker at normal domestic listening levels.

In most FM receivers two CFS filters are employed to provide adequate selectivity. In some initial experiments the writer used a second CFS filter between the output of the μA753 and the input of the phase locked loop, with a matching resistor, but the results were no better than with the circuit shown. This occurred because the phase locked loop locked on to the desired signal and further selectivity is required only to eliminate any stronger signals to which the loop might lock.

The tuner, IC and filters are obtainable from Ambit International, 37 High Street, Brentwood, Essex. ■

FREQUENCY MARKER GENERATOR *from page 541*

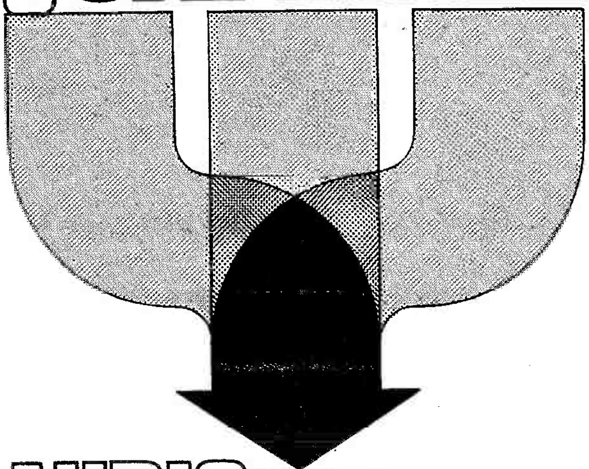
CONSTRUCTION

Undoubtedly the simplest method of construction is to make a printed circuit, although 0·1in. Veroboard could be used. The author used a piece of laminate board approximately 3×2in. and a suitable layout is shown in Fig. 2. Position the components on a piece of 0·1in. squared paper and mark the position of the leads. Transfer this layout to the copper laminate board, by punching through the paper into the board with a sharp tool and then paint in the pattern of Fig. 2 with an etch resistant lacquer. With the board cleaned, etched and drilled the components may be soldered into position.

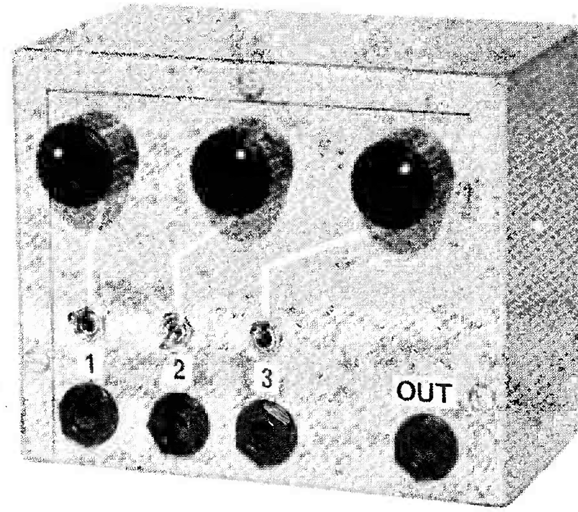
OPERATION

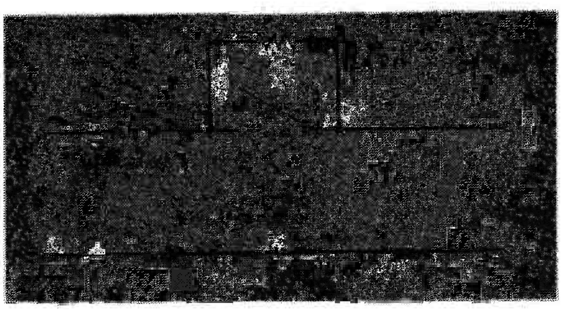
The outputs and the 6V supply lines have been switched so as to conserve batteries and avoid misleading pickup of the wrong output frequency. With the unit set to 1MHz output, strong signals should be heard on a receiver. If the ICs are functioning correctly, the oscillator can then be set by switching to the 100kHz output and using the BBC signal on 200kHz as previously described. Current consumption should be approximately: 1MHz, 5mA: 100kHz output 40mA: 10kHz output, 75mA, from the internal 6V battery. ■

3 CHANNEL AUDIO Mixer



A. FOORD



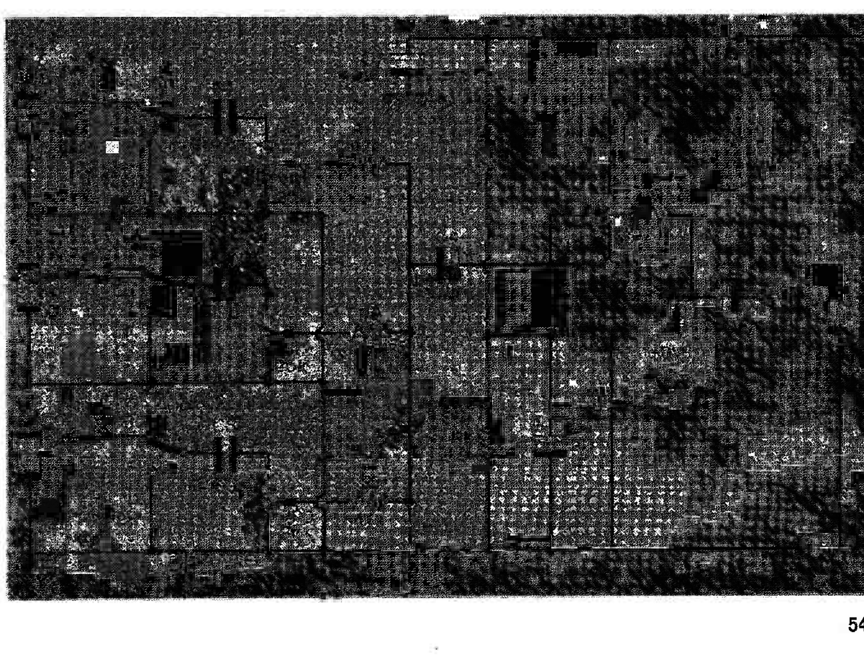


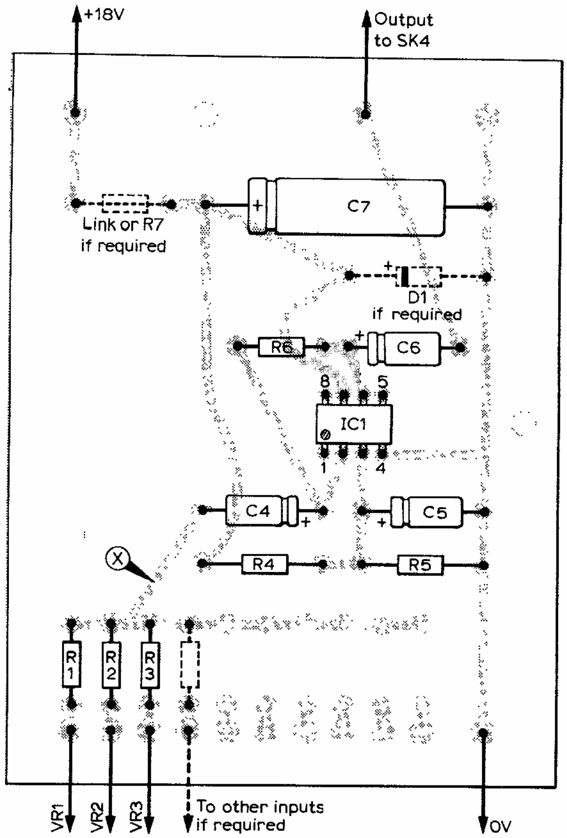
THERE are many audio applications where a mixing unit is invaluable, for example, tape recording or electronic music production. This unit was built as a three channel mixer although it can readily be extended for up to ten channels if required. The 741 integrated circuit used here is a high gain operational amplifier intended for general purpose applications. The basic arrangement is shown in Fig. 1. When certain theoretical conditions are satisfied the overall gain is determined exactly by the resistors R1 and R2.

$$\text{Overall gain} = \frac{\text{output level}}{\text{input level}} = \frac{R2}{R1}$$

For our circuit the gain for each channel is about two when the input gain controls are at maximum. Input impedance is 15kΩ and output impedance very low.

Fig. 1: above, shows the arrangement of a virtual earth amplifier.
Fig. 2: right, is the complete circuit for the three-channel mixer.





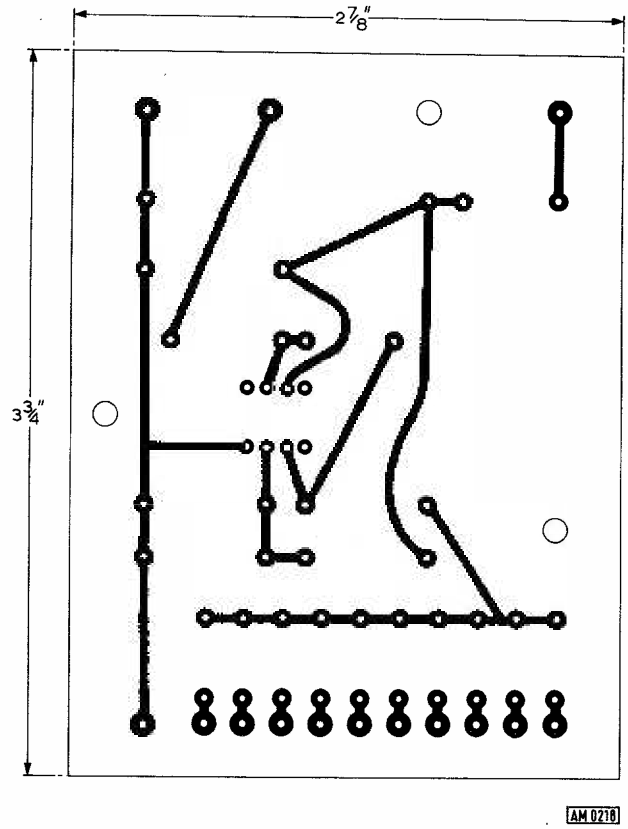
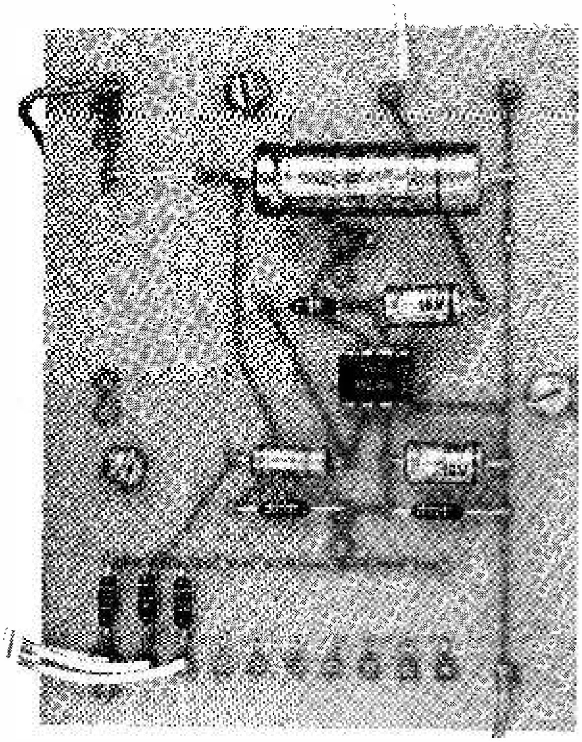


Fig. 3: above, gives the printed circuit board actual size together with the layout of the components. The photograph below shows the completed board.



CIRCUIT

The 741 can work with a supply voltage up to 30 volts. A potentiometer chain to the non-inverting input biases the circuit so that the DC voltage at the input (and output) is approximately half the supply voltage. For the 18V supply shown in the complete diagram of Fig. 2 the output terminal will have a DC bias of 9V.

The junction X forms a virtual earth mixing point for all the signals connected here. This is in effect a current (rather than voltage) mixing arrangement where the individual input currents through R1, R2 and R3 are added and produce a resultant current through R6. This means that the signal voltage at this point is very low, a few millivolts, and cannot normally be detected.

★ components list

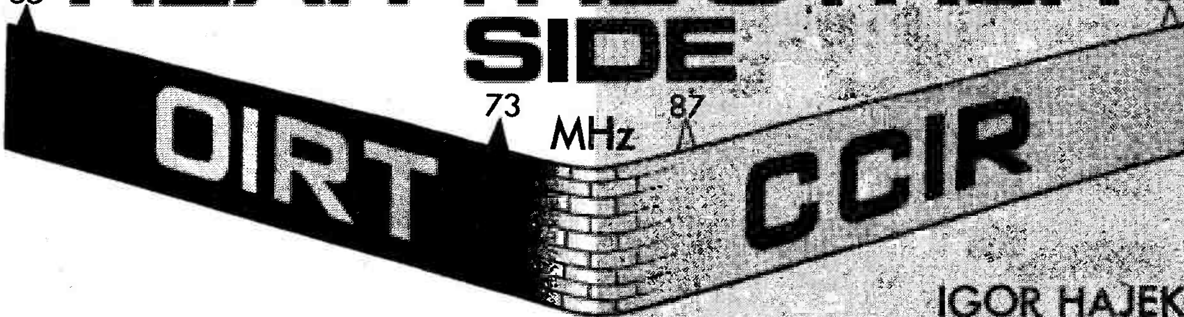
Resistors
R1/5 47kΩ R6 100kΩ R7 see text
¼ or ½W 5 or 10%
VR1/3 25kΩ log. potentiometers

Capacitors
C1/3 0·47µF 250V polyester C4 10µF 16V
C5/6 20µF 16V C7 40µF 25V

Miscellaneous
IC1 8pin DIL 741, SN72741P or similar. PCB. Case 5 x 4 x 3in. or to suit. Supply terminals (2). Knobs. D1, zener diode, see text. SK1/4, jack sockets. S1/3, single pole, change over.

—continued on page 550

HEAR THE OTHER SIDE



IGOR HAJEK

IF you happen to own a Japanese made tuner, it may surprise you to learn that it would turn out to be of little use should you ever decide to settle in the country of its origin. A look at the Japanese FM radio frequencies will explain why: they start at 80 and do not extend beyond 90MHz so that four-fifths of the VHF band would be outside the scope of your dial. More in fact, as nominally the Japanese FM band covers 76-90MHz.

Similarly, if you plan to take a VHF set with you on a Black Sea holiday, you should be warned that while the locals on a beach in, say, Rumania, may be enjoying music from their FM radios all that you will be able to receive on yours will be a TV sound channel. Again, the VHF band used for FM broadcasting there is not the same as the familiar Band II used in the United Kingdom and elsewhere in Western Europe.

The main cause of these differences was the hasty and unorganized allocation of VHF TV channels in the 1940's and 1950's; FM radio, coming a few years later, in most cases had to do with what had been left. Indeed there are countries like Australia, where almost nothing has remained of the VHF band and it is hard to see how they could ever start FM radio down there without first phasing out VHF television. In South Africa, on the other hand, an extensive FM radio network has been built up before the introduction of a TV service with the result that the interference and atmospherics-ridden medium wave broadcasting in that country is to close down entirely by the end of 1974.

DIVISIONS

Returning to Europe, FM broadcasting here is regulated by two standards, which divide the continent into two groups of countries roughly along the lines separating the Eurovision and Intervision TV link systems. In member countries of the European Broadcasting Union the standard adhered to is that recommended by the International Radio Consultative Committee (CCIR) with FM radio occupying, with some variations, the 87·5-104MHz band. In Bulgaria, Czechoslovakia, Hungary, Poland, Rumania and the Soviet Union, members of OIRT (Organisation Internationale de Radiodiffusion et Télévision), FM radio is allocated the 65-73MHz band. There is at least one anomaly: the German Democratic Republic, though a member of OIRT, adopted the CCIR standard at a time when hope still lingered that the two parts of Germany would eventually be reunited. The reasons for the division of Europe between two standards were actually as much political as organizational and technological, but this is no place to examine them in detail. The small differences in technical specifications such as peak deviation, frequency range etc. are not of much significance, either.

POTENTIAL DX

Perhaps more important is the finding that here lies an area very little explored by long distance FM enthusiasts, although TV DXers in Britain have for some time been achieving interesting results in the reception of television from Eastern Europe. (Neither is this term strictly geographical. Prague, for instance, is west of Vienna). Also, the FM sound of East European TV stations on OIRT channels R4 and R5 which overlap with the CCIR Band II has been occasionally received here during the Sporadic E season on 91·75 and 99·75MHz from places as far as Rumania. The OIRT FM radio stations in turn tend to play havoc at such times with the vision of UK 405 lines TV on channel 5 which overlaps with their frequencies.

The 65-73MHz band should offer a good opportunity for long distance reception as Sp.E openings on lower frequencies may take place more often than those reaching into the 90s and 100s. Ron Ham, who runs a VHF observatory in Southern England, has recorded a number of events in the OIRT band between May and August 1973 involving over four hundred stations. Enough to whet anybody's appetite!

SPORADIC E

With Sporadic E, stations most likely to be received in Britain are the Polish and Czechoslovak ones; due to the relative proximity of the two countries, reception could be just possible during periods of very good tropospheric conditions, at least for those who live in the Southeast. The Polish FM network carries all three programmes of the home service and most of the transmitters are of considerable power.

In contrast, none of the Czechoslovak transmitters are more than 10kW, yet coverage maps indicate that FM signals are effectively spread over all the country with some extensions across the borders. The location of most transmitters on top of hills and mountains must be helpful: the 10kW transmitter of Králova holá, for instance, which carries two (Slovak) programmes on 68·06 and 69·20MHz respectively, is situated 6500 ft a.s.l. Czechoslovakia is ideally placed for local FM DXers, being surrounded by six countries, each within reach of a sensitive tuner. Three of them broadcast in the CCIR band (East and West Germany, Austria) the other three on OIRT frequencies (Poland, Hungary, USSR).

TUNERS

Small wonder that there is a demand for tuners covering both bands there (as mentioned by Simon David). The Tesla T632A features two switchable front ends and the two bands appear on the scale one above the other, much like the FM and AM bands on more common tuners. On a new tuner now advertised by Tesla, the ST 100, they are placed in line so that tuning is continuous over both European FM bands. The tuners are fitted with stereo decoders, 19kHz pilot tone system, although the proportion of stereo programmes and stereo equipped transmitters is somewhat smaller in Eastern Europe than in Britain, Germany or France. It is mostly limited to the respective 3rd programmes, broadcast on VHF only and similar in character to BBC Radio 3.

In Hungary, stereo programmes are broadcast on 69·38MHz (Budapest III); in Czechoslovakia from Vltava (Czech) and Devín (Slovak) networks including Prague on 68·96, Liberec on 69·98 and Bratislava on 68·84MHz. Of the six FM programmes broadcast in the Moscow area the one on 72·14MHz is in stereo. But this could well be too far for any DXing; Soviet stations heard in Britain during Sporadic E are usually those in the Baltic republics, Estonia, Lithuania and Latvia, or Leningrad on 65·93 and 70·42MHz.

EQUIPMENT

Which brings us to the crucial problem of where to get the necessary equipment without which any attempts at long distance reception on the East European frequencies are impossible. We may yet see the day when these frequencies come into use in Britain. With the crowding of IBA and BBC local stations around 97MHz and the rest of the band reserved for public services, voices have been heard (among them that of the Editor of *PW*) that the lower VHF band should be allocated to FM radio, possibly after the phasing out of 405 lines television. However, many a Sporadic E season will pass before this is seriously considered.

No two-band tuners are commercially available in this country and a VHF communications receiver may prove a bit too costly, but you can build an extra bands VHF receiver for much less (*PW* July 1973). A good idea is a 4m converter; radio amateurs use them, as they have a small allocation at this frequency, and there are few designs available. It should not be too difficult to adjust the IF so that the 65-73MHz band appears between 108 and 100MHz on an ordinary tuner. The author is experimenting with a miniature converter design hopefully to be published in *PW*. In the meantime, do not discard the old channels 1-5 TV aerial; it may come in handy later on! ■

THREE CHANNEL AUDIO MIXER—
continued from page 546

CONSTRUCTION

A printed circuit board, Fig. 3, was used for the prototype but a similar layout could be done with Veroboard if required. The jack sockets have insulated bodies and it is necessary to make the chassis connection for each one. The switches S1, S2 and S3 were added so that inputs could be switched straight in at a preset level and they may be omitted if this facility is not required.

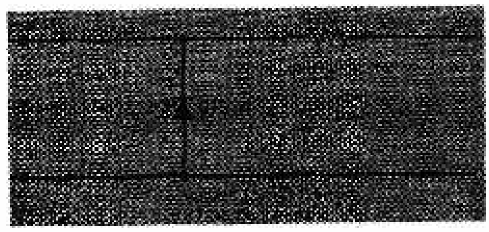
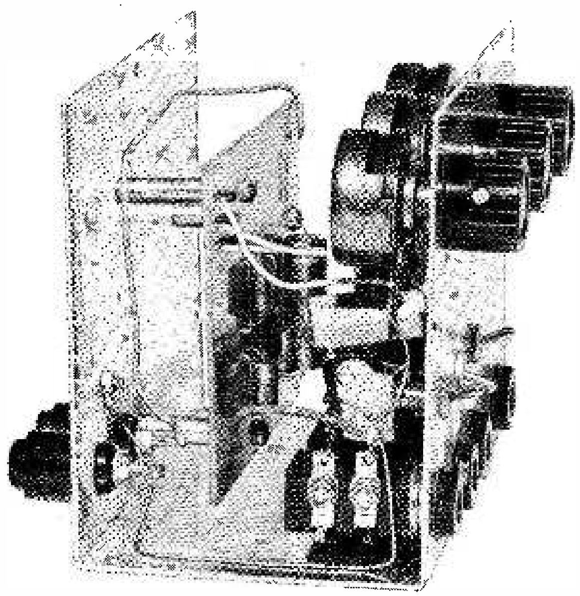


Fig. 4: Alternative power supply circuit.

The coupling capacitors C1, C2 and C3 are polyester types rated at 250 volts. Lower voltage types may be substituted. Input components up to the volume controls are mounted on the box. Extra inputs, up to a total of ten, may be connected in parallel at point X and space has been allowed on the board for any extra input resistors. Space has also been allowed for a zener diode D1 and resistor R7, as shown in Fig. 4. This enables the supply to be modified, if desired, for use with an existing supply.



View inside the finished mixer unit.

TESTING

The DC voltage at pin 6 of IC1 should be checked when the unit is first switched on. If this is found to be approximately half the supply rail then the DC conditions are correct. An AC signal should now be applied to each input and the overall performance checked. ■

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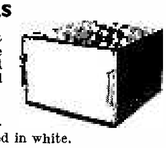

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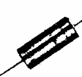
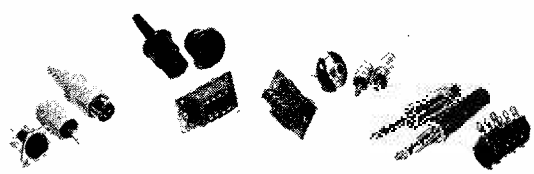


Mfd	V	Price	Mfd	V	Price	Mfd	V	Price
1	63	6p	68	6·3	6p			
1·5	63	6p	68	16	6p			
2·2	63	6p	68	63	10p			
3·3	63	6p	100	4	6p			
4·7	63	6p	100	10	6p	470	6·3	6p
6·8	40	6p	100	25	6p	470	10	10p
6·8	63	6p	100	40	6p	470	25	12p
10	25	6p	100	63	12p	470	40	18p
10	63	6p	150	6·3	6p	680	6·3	10p
15	16	6p	150	16	6p	680	16	12p
15	40	6p	150	25	6p	680	25	18p
15	63	6p	150	40	10p	680	40	22p
22	10	6p	150	63	12p	1000	4	10p
22	25	6p	220	4	6p	1000	10	12p
22	63	6p	220	10	6p	1000	16	18p
33	6·3	6p	220	16	6p	1000	25	22p
33	16	6p	220	25	10p	1500	6·3	12p
33	40	6p	220	40	12p	1500	10	18p
47	4	6p	220	63	18p	1500	16	22p
47	10	6p	330	4	6p	2200	6·3	18p
47	25	6p	330	10	6p	2200	10	22p
47	40	6p	330	16	10p	3300	6·3	22p
47	63	6p	330	63	22p	4700	4	22p

PLUGS AND SOCKETS



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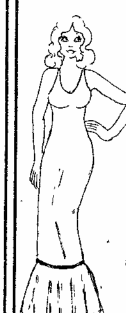

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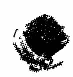

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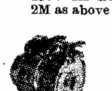

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Carbon Film ½W 5% 11Ω to 910k	E12 & E24	1p
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Metal Oxide ½W 2% 10Ω to 1M	E12 & E24	4p
Wirewound 2½W 10% 0·22ohms to 0·47ohms	E12	12p
Wirewound 2½W 5% 1ohm to 270ohms	E12	12p

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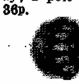
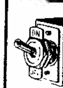


Push to make non-locking 14p



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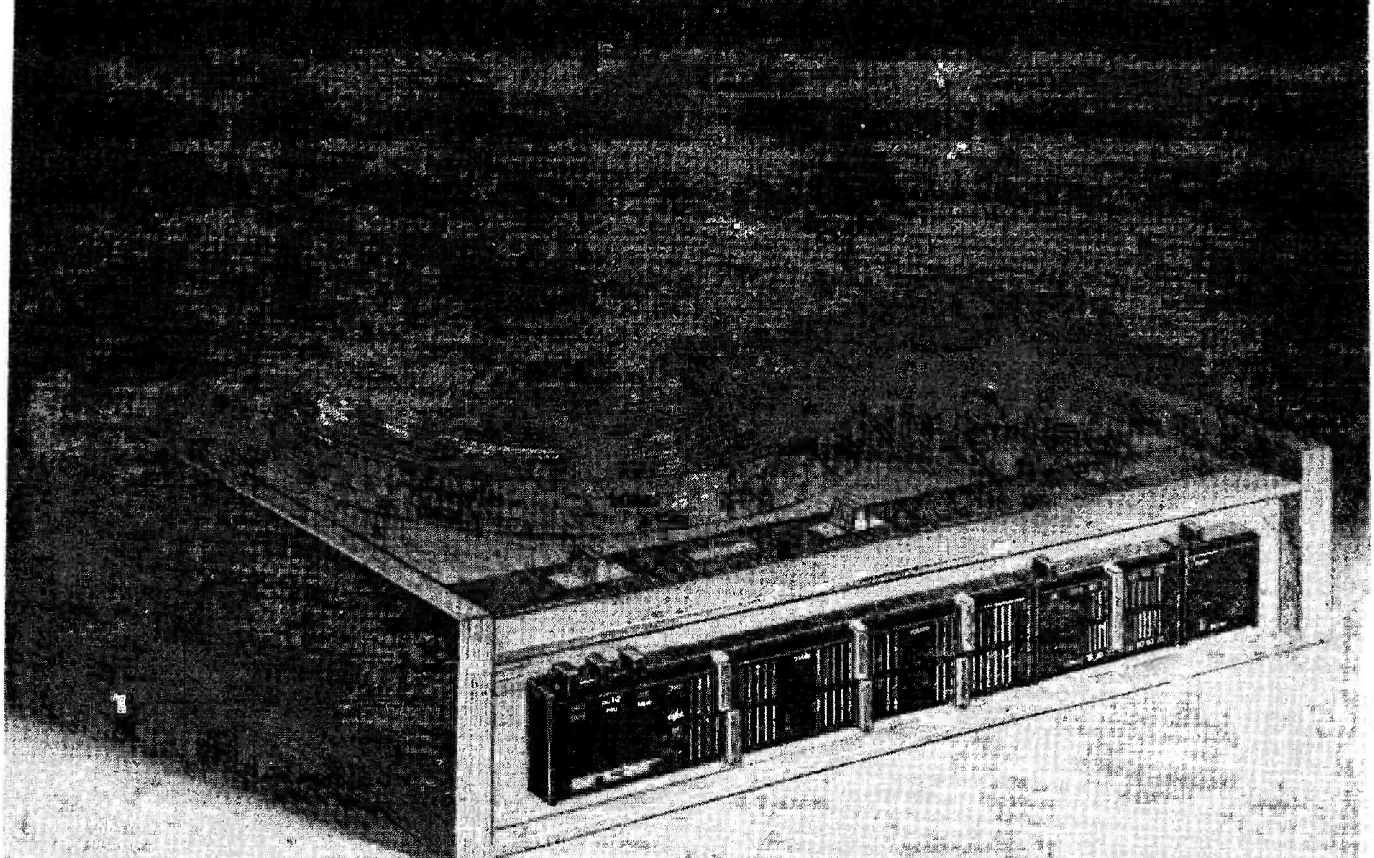
Project 80

a brilliant new concept in modular hi-fi



Project 80 is going to be the ultimate in modular hi-fi construction for a very long time to come. It combines the qualities most demanded of any modern domestic system – good circuitry, reliability and fine performance – with other features to be found nowhere else in the world. For example, *compactness* – Project 80 control units are $\frac{3}{4}$" deep × 2" high, and each one is completely self-contained. *Elegance* – all of Sinclair's design leadership has been concentrated on producing designs of outstanding functional elegance unsurpassed for styling and simplicity. *Flexibility* – the size and styling of Project 80 modules makes them the most versatile units ever. Combine them how you will, where you will, the Project 80 System of your choice gives you the best.

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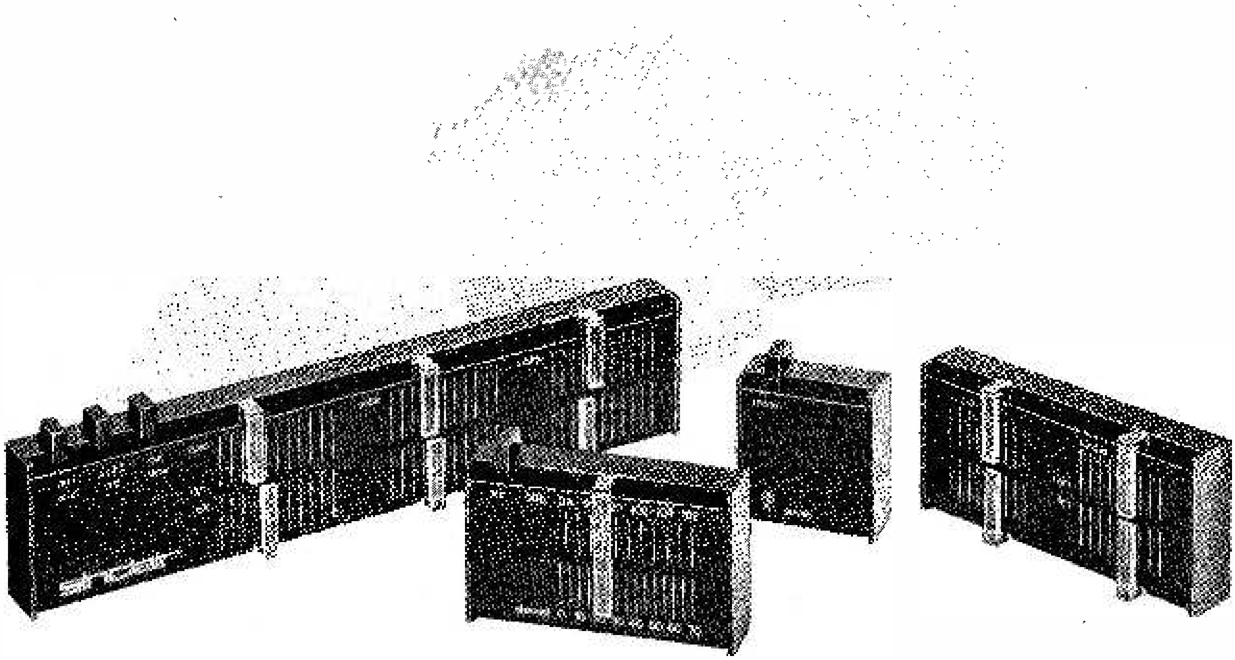

technically the world's most advanced

Project 80 gives you choice from a range of 9 different modules for combining in a variety of ways to suit your requirements. The Stereo 80 is a versatile pre-amp control unit designed to meet all domestic hi-fi requirements including tape monitoring, high sensitivity magnetic cartridge input, and of course, individual slide controls on each channel for precise output matching. By separating the F.M. tuner and stereo decoder, useful economies can be effected where stereo radio reception is not needed. Two power amplifiers – Z.40 (18 watts RMS continuous into 4 ohms using 35V) and Z.60 (25 watts RMS continuous into 8 ohms using 50V) are available with choice of 3 different power supply units. The PZ.8 with its virtually indestructible circuitry is particularly recommended. For the final word in system building, the Active Filter Unit puts the finishing touch of quality to what are easily the world's most technically advanced hi-fi modules. Any further units likely to be added to Project 80 range will be compatible with those already available.

Guarantee

If, within 3 months of purchasing any product direct from us, you are dissatisfied with it, your money will be refunded on production of receipt of payment. Many Sinclair appointed stockists also offer this guarantee Should any defect arise in normal use, we will service it without charge

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Sinclair Radionics Ltd
London Rd, St Ives
Huntingdon PE17 4HJ
Telephone
St Ives (0480) 64646

Stereo 80 Control Unit Size – 260 · 50 · 20mm (10¼ · 2 · ¾ins) **Finish** – Black with white indicators and transparent sliders **Inputs** – Magnetic pick-up 3mV RIAA corrected; Ceramic pick-up 350mV Radio 100mV. Tape 30mV **Signal/noise ratio** – 60db **Frequency range** – 20Hz to 15KHz ± 1dB, 10Hz to 25KHz ± 3dB **Power requirements** – 20 to 35 volts **Outputs** – 100mV – AB monitoring for tape **Controls** – Press button tape radio and P U Sliders on each channel for volume bass treble R R P (add £1 19 V A T.) **£11.95**

Project 80 FM Tuner Size – 85 · 50 · 20mm (3½ · 2 · ¾ins) **Tuning range** Dual varicap – 87·5 to 108MHz **Detector** – I C balanced coincidence **One I.C. equal to 26 transistors Distortion** – 0 2% at 1KHz for 30% modulation **4 pole ceramic filter in I.F section Aerial impedance** – 75 Ω or 240-300 Ω **Sensitivity** – 5 microvolts for 30dB S/N ratio **Output** – 300mV for 30% modulation **Power requirements** – 25 to 35 volts (R.R.P add £1·19 V A T) **£11.95**

Project 80 Stereo Decoder Size – 47 · 50 · 20mm (1⅞ · 2 · ¾ins) **One 19 transistor I.C. Channel separation** greater than 30dB **Power requirements** – 25V **Output** 150mV per channel R R.P (add 74p V A T.) **£7.45**

Active Filter Unit Separate controls on each channel **Size** – 108 · 50 · 20mm (4¼ · 2 · ¾ins) **Voltage gain** – minus 0·2dB **Frequency response** – 40Hz to 22KHz controls minimum **Distortion** – at 1KHz – 0 03% using 30V supply **H.F. cut off (scratch)** – 22 KHz to 5 5KHz, 12dB/oct slope **L.F. cut off (rumble)** – 28dB at 20Hz, 9dB/oct slope R R P (add 69p V A T) **£6.95**

Z.40 Power Amplifier Size – 55 · 80 · 20mm (2⅛ · 3⅛ · ¾ins) 9 transistors **Input sensitivity** – 100mV **Output** 18 watts RMS continuous into 4 Ω (35V) **Frequency response** – 30Hz-100KHz ± 3dB **S/N ratio** – 64dB **Distortion** – at 10 watts into 8 Ω less than 0 1% **Power requirements** – 12 to 35 volts, built in protection against overload R.R.P. (add 54p V.A.T) **£5.40**

Z.60 Power Amplifier Size – 55 · 98 · 15mm (2⅛ · 3¾ · ¾ins) 12 transistors **Input sensitivity** – 100-250mV **Output** – 25 watts RMS continuous into 8 Ω (50V) **Distortion** – typically 0·03% **Frequency response** – 15Hz to more than 200KHz · 3dB **S/N ratio** – better than 70dB **Built-in protection** against transient overload and short circuiting **Load impedance** – 4 Ω min. safe on open circuit R R P (add 69p V.A T) **£6.95**

Power Supply Units PZ.8 Stabilised. Re-entrant current limiting makes damage from overload or even direct shorting impossible Normal working voltage (adjustable) 50V R R P **£7·98** · 79p V A T Without mains transformer **PZ.6** 35V stabilised R.R P **£7·98** – 79p V A T. **PZ.5** 30V unstabilised R R P **£4·98** · 49p V A T

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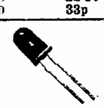

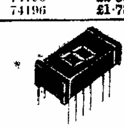

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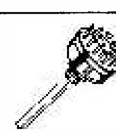

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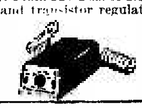

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	·1	·15	Plain ·15
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$2\frac{1}{2} \times 5$	34p	34p	18p
$3\frac{3}{4} \times 3\frac{3}{4}$	34p	34p	
$3\frac{3}{4} \times 5$	39p	45p	
$17 \times 2\frac{1}{2}$	1·06p	77p	60p
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17×5	1·85p		1·10p

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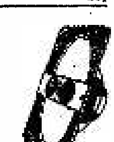

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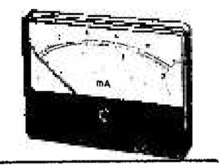

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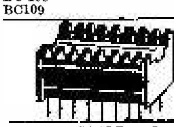

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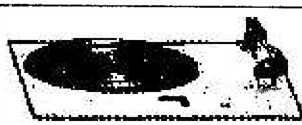

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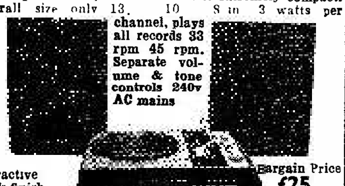

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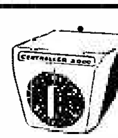

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Ideal for Mike, Tape P.U., Guitar, etc. Can be used with Battery 9-12v. or H.T. line 200-300V. D.C. operation. Size 1½" × 1½" × ½". Response 25 c.p.s. to 25 Kc/s, 26 db gain. For use with valve or transistor equipment. Full instructions supplied. Details S.A.E. **99p** Post 10p

NEW TUBULAR ELECTROLYTICS				CAN TYPES	
2/350V	14p	250/25V	14p	16+16+16/275v	45p
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8/450V	18p	1000/25V	35p	60+100/350V	85p
16/450V	22p	1000/50V	47p	32+32/250V	20p
32/500V	50p	8+8/450V	22p	32+32/450V	60p
25/25V	10p	8+16/450V	25p	100+50+50/350V	85p
50/50V	10p	16+16/450V	40p	32+32+32/350	65p
100/25V	10p	32+32/350V	40p		

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250-0-250 80 mA. 6·3 v. 3·5 a. 6·3 v. 1 a. or 5 v. 2 a. £2·50
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MAINS ISOLATING TRANSFORMER

Primary 0-110-240v. Secondary 0-240v. 3 amps. 720 watts. Insulated terminals. Varnish impregnated. Fully enclosed in steel case with fixing feet. Famous make. (Value £19) OUR PRICE **£10** Carr. 50p Suitable for outside use.

SET OF 3 MOTORS FOR COLLARO STUDIO 115 volt TAPE DECK £2·50 Post 50p.

VOLUME CONTROLS

5 K. ohms to 2 Meg. LOG or LIN. L/S 15p. D.P. 25p. STEREO L/S 55p. D.P. 75p. Edge 5K. S.P. Transistor 25p

80 Ohm Coax 5p yd.

BRITISH AERIALITE AERAXIAL-AIR SPACED 40 yd. £2; 60 yd. £3.
FRINGE LOW LOSS Ideal 625 and colour. **10p** per yd

Wirewound controls 1¼in. diam. 3 watts. 10 ohms to 100K British made with long spindles ¼in. dia 45p ea.
DUAL CONCENTRIC POT 500k LOG + 500k LIN D.P. switch. Inner spindle 3⅛in; outer spindle 2½in. 75p.

E.M.I. 13½ × 8 in. SPEAKER SALE!

With twin tweeters. And crossover. 10 watt. State 3 or 8 or 15 ohm. As illustrated. **£4·50** Post 25p

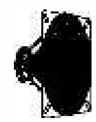
With flared tweeter cone and ceramic magnet. 10 watt. Bass res. 45-60 cps. Flux 10,000 gauss. State 3 or 8 or 15 ohm. **£2·75** Post 25p

Bookshelf Cabinet
16 × 10 × 9in. Fluted wood front. Teak Veneer **£6·60** Post 35p

E.M.I. 6½in. HI-FI WOOFER

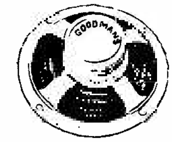
8 ohm, 10 watt. Large ceramic magnet Special Rubber cone surround. Frequency response 30-12,000 cps. Ideal P.A. Columns, Hi-Fi Enclosure Systems, etc. **£4** Suitable cabinet 12 × 8 × 6 £4·00. Suitable Tweeter £2·00.

ELAC CONE TWEETER



The moving coil diaphragm gives a good radiation pattern to the higher frequencies and a smooth extension of total response from 1,000 cps to 18,000 cps. Size 3¼ × 3½ × 2in. deep. Rating 10 watt, 3 ohm. Crossover £1.25 Post 20p **£1·90**

GOODMANS 8 in. WOOFER



8 ohm 12 watt. Deep cone. Heavy ceramic magnet. Bass resonance 35 cps. Frequency response 30-8,000 cps. Ideal bass unit for Hi-Fi systems **£3·75**

LOUDSPEAKERS P.M. 3 OHMS. 7×4in. £1·25; 6½in. £1·50; 8 × 5in. £1·60; 8in. £1·75; 10 × 6in. £1·90; 10in. £2·00.
SPECIAL OFFER LOUDSPEAKERS! All Brand New. 3 ohm, 2½in; 2¾in; 3½in; 5in. 8 ohm, 2¼in; 2½in; 5in × 3in; 5in. 15 ohm, 3½in; 5in; 6×4in; 5in×3in; 7×4in; 8×5in. 25 ohm, 2½in; 3in; 3in; 5 × 3in; 5in. 35 ohm, 2in; 3in; 5in. 80 ohm, 2½in; 2¾in. **£1** EACH

LOUDSPEAKER VOLUME CONTROL 15 ohm 10 watt with 1in long threaded bush for wood panel mounting 65p.
RICHARD ALLAN TWIN CONE LOUDSPEAKERS. 8in. diameter 4W £2·50, 10in. diameter 5W £2·75; Post 25p. 12in. diameter. 6W, £3·30; 3 or 8 or 15 ohm models.
SPEAKER COVERING MATERIALS. Samples Large S.A.E.
Horn Tweeters 2-16Kc/s. 10W 8 ohm or 16 ohm £2·20.
De Luxe Horn Tweeters 2-18 Kc/s, 15W, 8 ohm £3·50.
TWO-WAY 3,000 c.p.s. CROSS OVERS 3, 8 or 15 ohm £1·25.
3-WAY CROSSOVER 850 cps and 3000 cps £1·95.

TWO-WAY CROSSOVER NETWORK 3,000 c/s

With variable tweeter attenuator giving accurate high/low frequency balance. Mounted on panel 5½in. × 4in. with control knob, tweeter and woofer leads and input terminals. Suitable for 3 to 8 ohm impedance. **£3·75** Post 20p

ELECTRO MAGNETIC PENDULUM MECHANISM

1·5v d.c. operation over 250 hrs. continuous on SP2 battery. fully adjustable swing and speed. Ideal displays teaching electro magnetism or for metronome; strobe etc. 95p, Post 20p

R.C.S. VALVE AMPLIFIER

2 Stage Triode Pentode valve. 3 watts 3 ohm output. Volume on/off and tone controls AC mains. Complete and tested. With Loudspeaker. **£4·50** Post 25p.

WEYRAD COILS

P50/2CC-40p.	RA2W 85p.	Twin Gang 75p.
P50/3CC-40p.	OPT1 65p.	Printed Circuit 60p.
	LFDT4. 65p.	

COAXIAL PLUG 10p. PANEL SOCKETS 10p. LINE 18p
OUTLET BOXES, SURFACE MOUNTING 25p.
BALANCED TWIN RIBBON FEEDER 300 ohms, 7p yd.
JACK SOCKET Std. open-circuit 14p, closed circuit 23p; Chrome Lead Socket 45p. Phono Plugs 5p. Phono Socket 5p
JACK PLUGS Std. Chrome 20p; 3·5mm Chrome 12p. DIN SOCKETS Chassis 3-pin 10p; 5-pin 10p. DIN SOCKETS Lead 3-pin 18p; 5-pin 15p. DIN PLUGS 3-pin 18p; 5-pin 25p.
VALVE HOLDERS 5p; CERAMIC 10p; CANS 5p.

BRITISH FM/VHF TUNING HEART

88 to 108 Mc/s British made. 2 Transistors ready aligned—requires 10.7 Mc/s IF. Complete with tuning gang. Connections supplied but some technical experience required. Our Price **£3·95** Post 20p.

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RADIO COMPONENT

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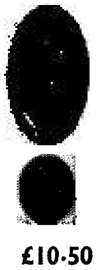
ALL OUR PRICES INCLUDE V.A.T.

E.M.I. WOOFER AND TWEETER KIT



THE PAIR. Post 25p. (Available separately. Woofer £5·25; Tweeter £1·90).

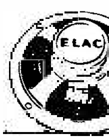
£6·75

Comprising a fine example of a Woofer 10¼ × 6½in. with a massive Ceramic Magnet. 44oz. Gauss 13,000 lines. Aluminium Cone centre to improve middle and top response. Also the E.M.I. Tweeter 3½in. square has a special lightweight paper cone and magnet flux 10,000 lines. Crossover condenser and full instructions supplied.

Impedance Standard	8 ohms
Maximum power	12 watts
Useful Response	25 to 18,000 cps
Bass Resonance	45 cps

SUITABLE ENCLOSURE 20 × 13 × 9in. MODERN DESIGN. TEAK WOOD FINISH. **£10·50** Post 45p

ELAC 8in. or 10 × 6in. HI-FI SPEAKER



Dual cone plasticised roll surround. Large ceramic magnet. 50-16,000 cps. Bass resonance 55 cps. 8 ohm impedance. 8in. 10 watts **£3·75**

TEAK VENEER HI-FI SPEAKER CABINETS
Fluted Wood Fronts

MODEL "A". 20 × 13 × 9in. For 12in. dia. 10in. speaker. **£10·50** Post 45p

MODEL "B". 16 × 10 × 9in. For 13 × 8in. or 8in. speaker. **£6·60** Post 35p
MODEL "B2" ditto. Triangular corner version.

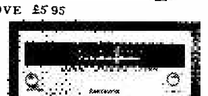
MODEL "C". 16 × 8 × 6in. For 8 × 5in. speaker. **£5** Post 25p

LOUDSPEAKER CABINET WADDING 18in. wide, 20p ft.

CALLERS ONLY—HI-FI CABINET BAKER RECOMMENDED 12 inch Enclosure 4 cubic ft. Size 30 × 20 × 12in. Teak Finished Fluted Front. £18·50

BARGAIN AM TUNER. Medium Wave. Transistor Superhet Ferrite aerial. 9 volt. **£4·95**

BARGAIN 4 CHANNEL TRANSISTOR MONO MIXER. Add musical highlights and sound effects to recordings. Will mix Microphone, records, tape and tuner with separate controls into single output. 9 volt battery operated. **£4·50**
STEREO VERSION OF ABOVE £5·95



BARGAIN FM TUNER. 88-108 Mc/s Six Transistor. 9 volt. Printed circuit. Calibrated slide dial tuning. Walnut Cabinet. Size 7 × 5 × 4in. **£14**

BARGAIN FM TUNER. As above less cabinet. **£10**

BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built with volume, treble and bass controls. 18 volt battery operated. **£4·50**

WAFER THIN HEATING ELEMENTS

OFFERING 1001 USES for every type of heating and drying applications in the home, garage, greenhouse, factory (available in manufacturing quantities). Approx. size 10¾ × 8¾ × $\frac{1}{16}$in. Operating voltage 200/250V. a.c. 250 watts approx. Printed circuit element enclosed in asbestos fitted with connecting wires. Completely flexible providing safe Black heat. British-made for use in photocopiers and print drying equipment.
Ideal for home handymen and experimenters. Suitable for Heating Pads, Food Warmers, Convector Heaters, etc. Must be clamped between two sheets of metal or asbestos, etc., to make efficient clothes dryers, towel rails—ideal for airing cupboards. Ideal for anti-frost device for the garage—preventing frozen radiators or acting as oil sump heater. Use in the greenhouse for seed raising and plant protection. Invaluable aid for bird houses, incubators, etc., etc. Can be used in series for lower heat. Or in parallel for higher heat applications.

ONLY **40p** EACH (FOUR FOR £1·50)
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BAKER MAJOR 12" £9·90

Post Free
30-14,500 c/s. 12in. double cone, woofer and tweeter cone together with a BAKER ceramic magnet assembly having a flux density of 14,000 gauss and a total flux of 145,000 Maxwells. Bass resonance 40 c/s Rated 20 watts. NOTE: 3 or 8 or 15 ohms must be stated.

Module kit, 30-17,000 c/s with tweeter, crossover, baffle and instructions. **£12·50**

Please state 3 or 8 or 15 ohms. Post Free

"BIG SOUND" BAKER SPEAKERS

Robustly constructed to stand up to long periods of electronic power. As used by leading groups.

Useful response 30-13,000 cps. Bass Resonance 55 cps.

GROUP "25" 12in. 25 watt 3, 8 or 15 ohms. **£8·80** Post Free

GROUP "35" 12in. 35 watt 3, 8 or 15 ohms. **£9·90** Post Free

GROUP "50" 15in. 50 watt 8 or 15 ohms. **£20·00** Post Free

GROUP 50/12in. 50 watt 8 or 15 ohms **£16·00**

Group + PA Cabinets in stock. Callers only. Send for Leaflet.

MAJOR 100 WATT ALL PURPOSE TRANSISTOR AMPLIFIER

All purpose transistorised. Ideal for Groups, Disco and P.A. 4 inputs speech and music. 4 way mixing. Output 8/15 ohm. a.c. Mains. Separate treble and bass controls. Guaranteed. Details SAE. **£49** Carr. £1·00

NEW MODEL—MAJOR 50 WATT £40.

CALLERS ONLY! DE LUXE 100 WATT VALVE AMPLIFIER CHASSIS

4 input 10 wide range controls. For Mikes, Discos, Organs Guitars, etc. 4, 8 & 15 ohm loudspeakers matching £69·00.

THE "INSTANT" BULK TAPE ERASER & HEAD DEMAGNETISER. Suitable for cassettes, and all sizes of tape reels. A.C. mains 200/250V. Leaflet S.A.E. **£3·50** Post 20p

QUALITY LOUDSPEAKER ENCLOSURE

Teak veneered ⅝in thick wood cabinet. Size 18½in × 18½in × 8½in. Weight 23lbs. This cabinet features a wide mesh Silver Grill covering a separate compartment for mounting Tweeters or Mid-Range Horn. The fully sealed bass compartment is cut out for 6½inch Woofer. £7·50 Carr. 85p. Rosewood Version £8·50 Carr. 85p.

SPECIAL OFFER 95p. Post 25p.
100 Ohm 20 watt Rheostat 2½in diam. Cera micFormer. Screw Terminals ¼in. diam. spindle.

REVERSIBLE 4 POLE MOTOR

1,400 r.p.m. Reversible 42 Watt, spindle 1¼" × 7/32", size 3½" × 3". As illustrated, 240v. AC mains. **£2·25** Post 25p

E.M.I. TAPE MOTOR

4 pole, 240 v. 135 mA. Size 3⅜ × 2¼ × 2¼in. 1200 rpm. **£1·85** Post 30p.

BAKER HI-FI SPEAKERS
HIGH QUALITY — BRITISH MADE

REGENT
12in. 15 watts

An inexpensive unit for the beginner in high fidelity and for general purposes. May be used to improve any Radio, Amplifier, Hi-Fi or Television receiver.

Bass Resonance	45cps
Flux Density	12,000gauss
Useful response	45-13,000cps

3 or 8 or 15 ohm models.

£8·80 Post Free

DE-LUXE Mk II
12in 15 watts

Especially designed to provide full range reproduction at an economical cost. Suitable for use with any high fidelity system. Built-in concentric tweeter cone.

Bass Resonance	30cps
Flux Density	14,000gauss
Useful response	25-16,000cps

8 or 15 ohms models.

£11 Post Free

SUPERB
12in. 20 watts

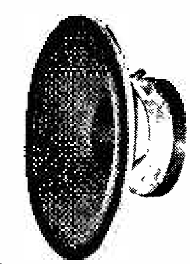
A high quality loudspeaker, its remarkable low cone resonance ensures clear reproduction of the deepest bass. Fitted with a special copper drive and concentric tweeter cone resulting in full range reproduction with remarkable efficiency in the upper register.

Bass Resonance	25cps
Flux Density	16,500gauss
Useful response	20-17,000cps

8 or 15 ohms models.

£16·50 Post Free

AUDITORIUM
12in. 25 watts



A full range reproducer for high power, Electric Guitars, public address, multi-speaker systems, electric organs. Ideal for Hi-Fi and Discotheques.

Bass Resonance	35cps
Flux Density	15,000gauss
Useful response	25-16,000cps

8 or 15 ohms models.

£15·40 Post Free

AUDITORIUM
15in. 35 watts

A high wattage loudspeaker of exceptional quality with a level response to above 8,000 cps. Ideal for Public Address, Discotheques, Electronic instruments and the home HI-FI.

Bass Resonance	35cps
Flux Density	15,000gauss
Useful response	20-14,000cps

8 or 15 ohms models.

£20 Post Free

Hi-Fi Enclosure Manual containing 20 plans, designs, crossover data and cubic tables. 42p. Post Free.

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Teleton SAQ307 8+8 watt £27·00
Sansui
- AU101 15+15 watt £48·25
- AU505 25+25 watt £72·50

Sinclair 2000 £34·95
Sinclair 4000 £45·95

TUNERS & TUNER AMPLIFIERS
Sinclair 2000/4000 Tuner £34·95
Rotel RX150A Tuner/Amp. £59·95
Sansui
- 210 AM/FM/MPX £84·25
- 310 AM/FM/MPX £99·00
- 350A AM/FM/MPX £106·95

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Garrard SP25 MkIV £12·95
BSR MP60 £11·00
BSR Invicta P & C/SC7M £9·95
Garrard
- SP25 MkIV P & C G/800 £21·00
- AP76 Module £30·00

Goldring GL78 P & C/G800E £59·95
Connoisseur
- BDI. Kit £12·25
- BD2 Chassis/SAU2 £29·95
- SAU2 £13·00
- SCU1 £4·95

Plinth & Cover for Garrard SP25 MkIV Mk. III 2025TC £3·95

TAPE DECKS
Akai
- 4000DS £93·95
- 1721L £87·95
- GXC36D £82·00
- GXC38D £103·95
- CS33D £79·95

Akai CR81D 8-track Rec. player £73·95

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Wharfedale
- Denton 2 (pair) £33·00
- Linton 2 (pair) £42·95
- Linton 2 Kits (pair) £19·95
- Glendale 3 Kit (pair) £36·95
- Dovedale 3 Kit (pair) £59·95

Chassis Speakers
EMI (Plain) 13in x 8in, 3, 8 or 15 ohm Bass unit £2·30
- with Single Tweeter (only 8ohm) £2·45
- with Twin Tweeter £3·95

Type 350 Kit 15 watt 8 ohm £8·25
13in x 8in Bass unit 15 watt 8 ohm £4·95
8in x 5in 5 watt 3, 8 or 15 ohm £1·50
8in x 5in 10 watt Dualcone 8 ohm £2·50
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Adastra 'Top 20' 12in 25 watt 8 or 15 ohm £8·25
Adastra 'Hi-Ten' 10in 10 watt 8 or 15 ohm £3·60
Also 5in 8 ohm speaker £0·99
- 2½in 8 or 64 ohm speaker £0·50

SPEAKER CABINETS IN KIT FORM (Teak Veneer)
12in x 8in x 6in (8 x 5 or 7 x 4 cutout) £2·50
14in x 12in x 9in (8 x 5, 8", 6½" & 3½") £3·75
18in x 11in x 9in (8" x ¾" or 13 x 8) £4·50
22in x 14in x 9in (12" & ¾" or 13 x 8) £6·25

TWEETERS & CROSSOVERS
EMI 3½" c/magnet in 3 or 8 ohm £1·10
Cone Tweeter 10 watt 8 or 15 ohm (K2006) £2·50
Cone Tweeter 3 watt 8 ohm (K2003) £1·55
Horn Tweeter 8 ohm (K2007) £6·50
Dome Tweeter 8 ohm (K2011) £5·50
2-way Crossovers (CN23, CN28, CN216) £1·20
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CARTRIDGES
Acos
- GP1/2SC or 3SC £1·10
- GP93/1 £1·35
- GP94/1 £1·75
- GP96/1 £1·75
- GP101 £0·90
- GP104 £1·75

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Ampex	80p	95p	£1·10

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Sharp RD4225 MW/3SW £46·50
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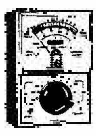
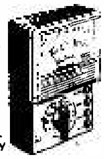
ASK LASKYS

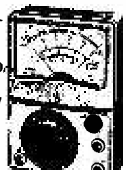
and make no mistake

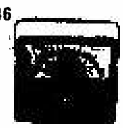
AUDIOTRONIC Model ATM1
Top value 1,000 opv pocket multi-meter. Ranges:– 0/10/50/250/1,000 volt AC and DC. DC current 0-1mA/100mA. Resistence: 0/150k ohms. Decibels: –10 to +22dB. Size 90 x 60 x 28mm. Complete with test leads.

OUR PRICE £3.25 P&P 15p

AUDIOTRONIC Model ATM5
Jewel movement, attractively moulded case with edgwise ohms adjustment. Ranges: 0-3/15/150/300/1200V AC. (2500 opv). 0-6/30/300/600V DC. (5000 opv). 0-300 uA/0-300mA DC. Resistance: x 10 & x 100. –10 to +16dB. Supplied with battery test leads and data booklet. Size: 121 x 73 x 29mm.

OUR PRICE £3.95 P & P 20p

MODEL TH12
20,000 opv. Overload protection. Slide switch selector. 0/0.25/2.5/10/50/150/1000V DC. 0/10/50/250/1000V AC. 0/60uA/25/250mA DC. 0/3k/30k/300k/3 Megohms. –20 to +50dB.

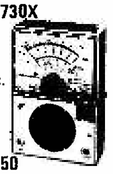
OUR PRICE £5.95 P&P30p

HIOKI Model 720X VOM
A versatile, accurate measuring instrument. 20,000 opv. 0/5/25/100/500/1000V DC. 0/10/50/250/1000V AC. 0–50uA/250mA. 0–20k/2 Megohms.

OUR PRICE £5.97 P&P 30p

MODEL PL436
20,000 opv DC. 8000 opv AC. Mirror scale ·6/3/12/30/120/600V DC. 3/30/120/600V DC. 60/600µA/60/600mA. 10/100K/1 Meg/10 Meg Ohm. –20 to +46 dB.

OUR PRICE £6.97 P&P 30p.

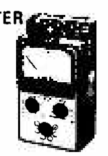
U4323 MULTIMETER
20,000opv. Simple unit with audio/IF oscillator. Suitable for general receiver tuning. Ranges: 0.5/2.5/10/50/250/500/1000V DC. 2.5/10/15/250/500/1000V AC. 0.05/0.5/5/50/500mA DC. Resistance: x 10, x 100, x 1,000, x 10,000 (50Ω, 500Ω, 5kΩ, 50kΩ centre scale) Battery operated. Size: 160 x 97 x 40mm. Supplied in carrying case complete with test leads.

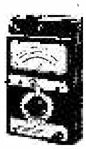
OUR PRICE £7.00 P&P 30p

MODEL HIOKI 730X
30,000 opv. Overload protection. 6/30/60/300/600/1200V DC. 12/60/120/600/1200V AC. 60/µA/30mA/300mA. 2K/200K/2 Meg Ohm. –10 to +63 dB.

OUR PRICE £7.50 P&P 30p.

U4324 MULTIMETER
High sensitivity, overload protected. 20,000opv. Ranges: 0.6/1.2/3/12/30/60/120/600/1200V DC. 3/6/15/60/150/300/600/900V AC. Current: 0.06/0.6/6/60/600mA/3A DC. 0.3/3/30/300mA/3A AC. Resistance: 25/500 ohms/0.5/5/50/500k ohms/5 Mohms. Decibels: –10 to +12dB. Size 167 x 98 x 63mm. Supplied complete with test leads, spare diode and instructions.

OUR PRICE £8.00 P&P 30p

U435 MULTIMETER
20,000opv. Ranges: 75mV/2.5/10/25/100/250/500/1000V DC. 2.5/10/25/100/250/500/1000V AC. Current: 50uA/1/5/25/100mA/0.5/2.5A DC. 5/25/100mA/0.5/2.5A AC. Resistance: 3/30/300k ohms. Size: 205 x 110 x 84mm. Supplied complete with leads, crocodile clips and steel carrying case.

OUR PRICE £8.75 P&P 30p

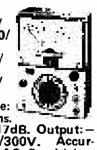
U4312 MULTIMETER
extremely sturdy instrument for general electrical use. 667opv. 0/0.3/1.5/7.5/30/60/150/300/600/900V DC & 75mV. 0/0.3/1.5/7.5/30/60/150/300/600/900V AC. 0/300uA/1.5/6/15/150/60/600mA/1/1.5/6A DC. 0/1.5/6/15/60/150/600mA/1.5/6A AC. 0/200/3k/30k ohms. DC accuracy 1%. AC 1.5%. Knife edge pointer, mirror scale. Complete with sturdy metal carrying case, leads and instructions.

OUR PRICE £9.75 P&P 50p

U91 Clamp VOLT AMMETER
For measuring AC voltage and current without breaking circuit. Ranges: 300/600V AC. Current: 10/25/100/250/500A. Accuracy 4%. Size 283 x 94 x 36mm. Complete with carrying case, leads and fuses.

OUR PRICE £10.50 P&P 30p

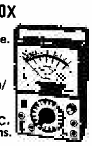
MODEL 500
30,000 opv with overload protection. Mirror scale. 0/0.5/2.5/10/25/100/250/500/1000V DC. 0/2.5/10/25/100/250/500/1000V AC. 0/50uA/5/50/500mA. 12A DC. 0/60k/6 meg/60 megohms.

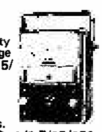
OUR PRICE £13.95 Carr. paid
Leather case for above £1.75

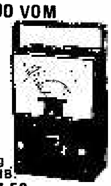
HIOKI 750X VOLT-OHM-MILLIAMETER
43 ranges: 0–0.3/0.6/1.5/3/6/12/30/60/150/300/600/1,200V DC. 0–3/6/15/30/60/120/300/600/1,200V AC. Current: 0–30/60uA/1.5/3/15/30/150/300 mA/6/12A. Resistence: 0–3/300k/3/30Mohms. Decibels: –10 to +17dB. Output:– 0–3/6/15/30/60/120/300V. Accuracy ± 3% DC, ± 4% AC. Sensitivity: 50,000 opv DC, 5,000 opv AC. 4 inch meter. Built in protection. Size: 57 x 102 x 153mm.

OUR PRICE £11.95 P&P 40p

TMK MODEL TW50K
46 ranges, mirror scale. 50k/V DC 50k/V AC. DC Volts: 0.125/0.25/1.25/2.5/5/10/25/50/125/250/500/1000. AC Volts 1.5/3/5/10/25/50/125/250/500/1000. DC current 25/50uA/2.5/5/25/50/250/500mA/5/10A. Resistence: 10k/100k/1 Meg/10 Meg ohms. –20 to +81.5dB.

OUR PRICE £12.50 P&P 20p

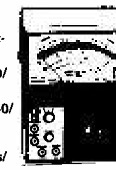
HIOKI MODEL 700X
100,000opv. Overload protection. Mirror scale. 0.3/0.6/1.2/1.5/3/6/12/30/60/120/300/600/1200V DC. 1.5/3/6/12/30/60/150/300/600/1200V AC. 15/30uA/3/6/30/60/150/500mA/6/12A DC. 2k/200k/2M/20MOhms. –20 to +63dB.

OUR PRICE £14.95 P&P30p

Model HT100B4 MULTIMETER
Overload protected, shock proof circuits. 9.5uA Meter with mirror scale. Sensitivity 100kV. Polarity change switch. Ranges: 0.5/2.5/1/50/250/500/1,000 Volts DC. 2.5/10/50/250/1,000 Volts AC. DC resistence' 0–20/200k/2/20 Meg. ohms. DC current:– 10/250uA/2.5/25/250 mA/10A. AC current:–0–10A. –20 to +62dB. Operates from 2 x 1.5V batteries. Size: 180 x 134 x 79mm.

OUR PRICE £17.50 P&P 40p

MODEL AS.1000 VOM
100,000 opv. Mirror scale. Built-in meter protection. 0/3/12/60/120/300/600/1200V DC. 0/6/30/120/300/600V AC. 0/10µA/6/60/300mA/12 Amp. 0/2K/200K/2M/200 Meg Ohm. – 20 to +17 dB.

OUR PRICE £17.50 P&P 30p.

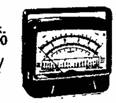
KAMODEN HM720B FET VOM
Input impedence 10 Megohms. Ranges:– 0/.25/1/2.5/10/50/1000V DC. 0/2.5/10/50/250/1000V AC. 0/25uA/2.5/25/250 mA DC. 0/5k/50k/500k/5 M 500 Megohms

OUR PRICE £21.00 P & P 40p

KAMODEN 360 MULTIMETER
High sensitivity. DC 100kohm/V AC 10kohm/V 5" mirror scale, overload protected. Ranges: 0.5/2.5/10/50/250/1000V DC. 5/10/50/250/1000V AC. Current: 0.01mA/0.5/5/50/500mA/10A. Resistance: 0.1/1/10/100 ohms/1/10/100k ohms/10/100M ohms. Decibels –20 to +62dB. Battery operated. Size: 180 x 140 x 80mm. Supplied complete with, test leads etc.

OUR PRICE £17.50 P & P 40p

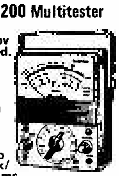
TMK MODEL 117 FET ELECTRONIC VOLTMETER
Battery operated. 11 Meg input, 26 ranges. Large 4½" mirror scale. Size: 149 x 117 x 60mm. 0.3–12000V DC. 3–300V RMS AC. 8–800V P-P. DC current 0.12–12mA. Resistence up to 2000MOhms. Decibels: –20 to +51dB. Supplied complete with leads and instructions.

OUR PRICE £18.50 P&P 20p

TMK 100K LAB TESTER
100,000opv. 6½" scale. Buzzer short circuit check. Sensitivity 100,000 opv DC. 5k/V AC DC Volts: 0.5/2.5/10/50/250/1000V AC. 3/10/50/250/500/1000V DC. current 10/100uA/10/10/100/500mA/2.5/10A. Resistence: 1k/10k/100k/10 Meg/100 Meg ohms. Decibels: –10 to +49dB. Plastic case with carrying handle. Size: 190 x 172 x 99mm.

OUR PRICE £19.95 P&P 30p

370WTR MULTIMETER
Features AC current ranges. 20,000opv. 0/0.5/2.5/10/50/250/500/1000V DC. 0/2.5/10/50/250/500/1000V AC. 0/50uA/1/10/100 mA/1/10A DC. 0/100mA/1/10A AC. 0/5k/50k/500k/5 Meg/50 Meg. Decibels: –20 to +62dB.

OUR PRICE £19.95 P&P 30p

KAMODEN 72.200 Multitester
High sensitivity tester. 200,000 opv Overload protected. Mirror scale. Ranges:–0/.06/.3/3/30/120/600/1200V DC. 0/3/12/60/300/1200 V AC. 0/6uA/1.2mA/120mA/600mA/12A DC 0/12A AC. –20 to +63dB. 0/2k/200k/2 Meg/200 Megohms.

OUR PRICE £22.50 P&P 30p

U4317 MULTIMETER
High sensitivity instrument for field and laboratory work. Knife edge pointer, 86mm. mirror scale. Overload protection. Ranges: 100mV/0.5/2.5/10/25/50/100/250/500/1000 V DC. 0.5/2.5/10/25/50/100/250/500/1000V AC. Current: 50uA/0.5/1/5/10/50/250mA/1/5A DC. 0.25/0.5/1/5/10/50/250mA/1/5A AC. Resistance: 0.5/10/100/200 ohms/1/3/30/300k ohms. Decibels: –5 to +10dB Battery operated. Size: 210 x 115 x 90mm. Supplied in carrying case complete with leads.

OUR PRICE £15.00 P&P 40p

MODEL U4311 Sub-standard Multi-range Volt-Ammeter
Sensitivity 330 Ohms/Volt AC and DC. Accuracy 0.5% DC. 1% AC. Scale length: 165mm. 0/300/750uA/1.5/3/7.5/15/30/75/150/300/750mA/1.5/3/7.5A DC. 0/3/7.5/15/30/75/150/300/750mA/1.5/3/7.5A AC. 0/75/150/300/750mV/1.5/3/7.5/15/30/75/150/300/750V DC, 0/750mV/1.5/3 /7.5/15/30/75/150/300/750V AC. Automatic cut out device. Supplied complete with test leads, manual and test certificates.

OUR PRICE £49.00 P&P 50p

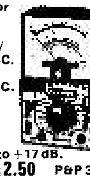
ALL PRICES EXCLUDE VAT

TE65 VALVE VOLTMETER
28 ranges. DC volts 1.5–1500V. AC volts 1.5–1500V. Resistance up to 1000 Megohms. 200/240V AC operation. Complete with probe and instructions.

OUR PRICE £17.50 P&P 60p
Additional probes available: RF £2.12, HV £2.50

LB3 TRANSISTOR TESTER
Tests ICO and B. PNP/NPN. Operates from 9V battery. Instructions supplied.

OUR PRICE £3.95 P&P 20p

MODEL AF.105 VOM
50,000 opv. Mirror scale. Meter protection. 0/3/3/12/60/120/300/600/1200V DC. 0/6/30/120/300/600/1200V DC. 0/30µA/6/60/300 mA/12 Amp. 0/10K/1m/10m/100 Meg Ohms. –20 to +17 dB.

OUR PRICE £12.50 P&P 30p.

LB4 TRANSISTOR TESTER
Tests PNP or NPN transistors. Audio indication. Operates on two 1.5V batteries. Complete with instructions etc.

OUR PRICE £4.50 P&P 20p

U4341 Multimeter & Transistor Tester
27 ranges. 16,700opv. Overload protected. Ranges: 0.3/1.5/6/30/60/150/300/900V DC. 1.5/7.5/30/150/300/750V AC. Current: 0.06/0.6/6/60/600mA DC. 0.3/3/30/300mA AC. Resistance: 0.06/0.6/2/6/20/60/200k ohms/2 Mohms. Battery operated. Supplied complete with probes, leads and steel carrying case. Size: 115 x 215 x 90mm.

OUR PRICE £10.50 P&P 30p

S100TR MULTIMETER TRANSISTOR TESTER
100,000opv. Mirror scale. Overload protection. 0/0.12/0.6/3/12/30/120/600V DC. 0/6/30/120/600V AC. 0/12/600uA/12/300mA/6/12A DC 0/10k/1 Meg/100 Meg. –20 to +50dB. 0.01–0.2 MFD Transistor tester measures Alpha, Beta and ICO. Complete with instructions, batteries and leads.

OUR PRICE £19.95 P&P 25p

CI5 PULSE OSCILLOSCOPE
For display of pulsed and periodic waveforms in electronic circuits. VERT. AMP. Bandwidth: 10MHz. Sensitivity at 100kHz VRMS/mm: 0.1–25; HOR. AMP. Bandwidth: 500kHz. Sensitivity at 100kHz VRMS/mm: 0.3–25 Preset triggered sweep 1–3000usec. Free running 20–200 kHz in nine ranges. Calibrator pips. 220 x 360 x 430mm. 115–230V AC.

OUR PRICE £39.00 Carr. paid

RUSSIAN CI16 Double Beam OSCILLOSCOPE
5 MHz pass band. Separate Y1 and Y2 amplifiers. Rectangular 5" x 4" CRT. Calibrated triggered sweep from 0.2usec. to 100 milli-sec/cm. Free running time base, 50Hz–1MHz. Built-in time base Calibrator and amplitude Calibrator. Supplied complete with all accessories and instruction manual.

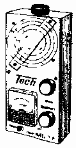
OUR PRICE £87.00 Carr. paid

SWR METER Model SWR3
Handy SWR meter for transmitter antenna alignment, with built-in field strength meter. Accuracy 5%, Impedence 52' Indicator 100uA DC. Full scale 5 section collapsible antenna. Size 145 x 50 x 60mm.

OUR PRICE £4.25 P&P 30p

Also see following pages

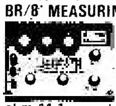
MODEL TE15 GRID DIP METER



Transistorised. Operates as Grid Dip, Oscillator, Absorbtion Wave Meter and Oscillating Detector. Frequency range 440kHz–280MHz in six coils. 500uA meter. 9V battery operation. Size: 180 x 80 x 40mm.

OUR PRICE £19.95 P&P 30p

TRANSISTORISED L.C.R. A.C. BR/8 MEASURING BRIDGE



A new portable bridge offering excellent range and accuracy at low cost. Resistance: 6 ranges: 0·1 ohm-11.1 megohm ± 1%. Inductance: 6 ranges. 1 microhenry-111 henries ± 2%. Capacity: 6 ranges 10pf-1110 mfd ± 2%. Turns Ratio: 6 ranges: 1:1 1000-1:11100 ± 1%. Bridge Voltage at 1,000cps. Operated from 9-volt battery. 100 microamp meter indication. Size 7⅞" x 5" x 2".

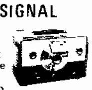
OUR PRICE £25.00 P&P 30p

TE16A TRANSISTORISED SIGNAL GENERATOR

5 ranges, 400kHz to 30 MHz. An inexpensive instrument for the handy-man. Operates on 9V battery. Wide easy to read scale. 800kHz modulation. Size: 149 x 149 x 92mm. Complete with instructions and leads.

OUR PRICE £8.97 P&P 30p

MODEL TE20 RF SIGNAL GENERATOR



Six bands. 120kHz–260MHz. Dual output RF terminals. Separate variable audio output. Accuracy ± 2%. Audio output to 8V. Power requirements: 105–125V, 220–240V AC. Size: 193 x 265 x 150mm. Complete with test leads etc.

OUR PRICE £17.50 P&P 50p

TE-20D RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120 kHz-500 MHz on 6 bands. Directly calibrated. Variable R.F. attenuator audio output. Xtal socket for calibration. 220-240V a.c. Brand new with instructions. Size 140mm x 215mm x 170mm.

OUR PRICE £17.50 P&P 50p

TE22 SINE SQUARE WAVE AUDIO GENERATOR

Sine 20cps to 200kHz on 4 bands. Square 20 cps to 30 kHz. Output impedence 5000 Ohms. 200/250V AC operation. Supplied brand new guaranteed, with instruction manual and leads.

OUR PRICE £24.95 P&P 50p

ARF 300 AF/RF SIGNAL GENERATOR

All transistorised compact fully portable. AF sine-wave 18Hz to 220 kHz. AF square wave 18Hz to 100k Hz. Output Square/Sine wave 10V. P-P RF 100kHz to 200MHz. Output 1V maximum. 220/240V AC operation. Complete with instructions and leads.

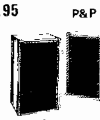
OUR PRICE £37.50 P&P 50p

MODEL MG100 SINE SQUARE WAVE AUDIO GENERATOR

Range 19–220,000Hz Sine Wave 19–100,000 Hz Square Wave. Output Sine or Square wave 10v P. to P. Size 180 x 90 x 90mm. Operation 220/240v. A.C.

OUR PRICE £19.95 P&P 50p

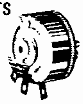
SPECIAL BARGAIN! FERGUSON 3406 HI-FI SPEAKERS



High quality 2 way speaker systems. 25 Watts. 4–8 ohms. 40Hz–18kHz. Size: 560 x 340 x 255mm. approx. Wood grain finish with black fronts.

OUR PRICE £22.50 PR. P&P £1

POWER RHEOSTATS



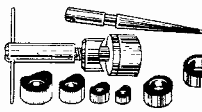
High quality ceramic construction. Windings embedded in vitreous enamel. Heavy duty brush wiper. Continuous rating. Single hole fixing. ¼" diameter shafts. Bulk quantities available.

25 WATT 10/25/50/100/500/1000, 2500 ohms. **£1.15** P&P 10p

50 WATT 10/50/100/250/500/1500, 5000 ohms **£1.62** P&P 10p

100 WATT 1/5 10/25 50 250 500 2500 ohms. 500 Ohms **£2.34** P&P 15p

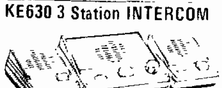
CP110 CHASSIS PUNCH SET



Carefully machined top grade steel. Contains 1/2", 5/8", 3/4", 1" and 1 1/8" punches complete with gripper and accessories.

OUR PRICE £3.00 P&P 40p

KE630 3 Station INTERCOM



Master and two sub-stations. Can be used on desk or wall mounted. Complete with cable and batteries

OUR PRICE £5.25 P&P 50p

EMI LOUDSPEAKERS

Model 350 13 x 8" with single tweeter/crossover. 20–20,000Hz. 15 watts RMS. Available 8 or 15 ohms

OUR PRICE £7.50 each P&P 37p

Model 450 13 x 8" with twin tweeter/crossover. 55–13,000Hz. 8 watts RMS. Available 8 or 15 ohms

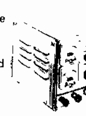
OUR PRICE £3.62 each P&P 35p

SPECIAL PURCHASE LIMITED QUANTITY! Tannoy 12" DR/8 Bass Speakers

8 ohms 30 watt. Heavy duty. Ideal for Hi Fi P.A. Group.

OUR PRICE £12.50 P&P 50p

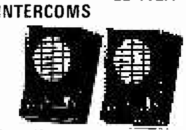
PS200 Regulated POWER SUPPLY UNIT



Solid state. Variable output 5–20V DC up to 2 Amp. Independent meters to monitor voltage and current. Output 220/240V AC.. Size: 190 x 136 x 98mm.

OUR PRICE £19.95 P&P 50p

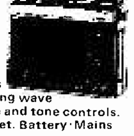
AUDIOTRONIC LE-102A INTERCOMS



Beautifully made and finished in two tone ivory buff, the LE-102A is useful in the home, office or shop and is suitable for use as baby alarm. Wall or desk mounting 57mm speaker mic gives clear 2 way communication with on/off and volume control on master unit. Operates on 9V batt. Approx 60ft lead.

OUR PRICE £3.95 P & P 30p

TRITON 4318 PORTABLE 8 TRACK CARTRIDGE PLAYER WITH MW/LW RADIO



Will play 8 track stereo cartridge monaurally. Channel selector switch. Covers medium and long wave bands. Volume and tone controls. Earphone socket. Battery/Mains operation.

OUR PRICE £11.95 P & P 50p

EA41 REVERBERATION AMPLIFIER

Self contained, transistorised, battery operated. Simply plug in microphone, guitar etc. and output to your amplifier. Volume control and depth of reverberation control. Beau-walnut cabinet. 184 x 77 x 108mm.

OUR PRICE £7.50 P&P 30p

LH02S STEREO HEADPHONES

Light weight headphones with padded ear pieces. 4/16 ohms 20–20,000Hz. Complete with 6' lead and plug.

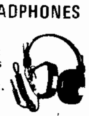
OUR PRICE £1.97 P&P 30p

DH02S STEREO HEADPHONES

Wonderful value and excellent performance combined. Adjustable head band. Impedence 8 ohms. 20–12,000Hz. Complete with lead and plug.

OUR PRICE £2.25 P&P 30p

TE1035 Stereo HEADPHONES



Low cost with excellent response. Foam rubber earcups. Adjustable headband. 8 ohms impedence. Frequency response 25Hz–18kHz. Complete with cable and stereo jack plug.

OUR PRICE £2.60 P&P 30p

SDH8V MONO/STEREO HEADPHONES

Volume control for each channel. 4/16 ohms impedence. Frequency response 20Hz–18kHz. Complete with 10ft. coiled lead and jack plug.

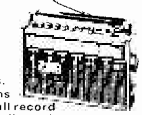
OUR PRICE £4.97 P&P 30p

BH001 HEADSET and Boom Microphone

Moving coil. Ideal for language teaching, communications etc. Headphone impedence 16 ohms. Microphone impedence 200 ohms.

OUR PRICE £5.95 P&P 30p

HANIMEX HRC 3075 CASSETTE RADIO



Covers Medium and FM wave bands. Slider volume and tone controls. Battery/Mains operation. Will record direct from radio or through built in condenser microphone. Complete with batteries, earphone, and cassette.

OUR PRICE £24.30 P & P 50p

TRITON CT.555 CASSETTE RECORDER

Battery/Mains. Piano key and slider controls. Automatic level control. Complete with mike and earphone.

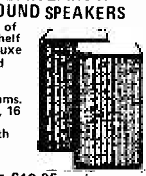
OUR PRICE £10.50 P & P 50p

ZEPHYR TC1500B CASSETTE RECORDER

Battery/Mains. Complete with mike, cassette, earphone.

OUR PRICE £9.95 P & P 50p

SPECIAL BARGAIN !! STEREOSOUND SPEAKERS



Matched pair of stereo bookshelf speakers. Deluxe teak veneered finish. Size: 368 x 229 x 190mm. 8 ohms. 8 watts RMS, 16 watts peak. Complete with Din lead.

OUR PRICE £12.95 PAIR P&P 50p

FM TUNER CHASSIS

6 transistor high quality tuner. Size only 153 x 101 x 63mm. 3 IF stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9V battery. Covers 88–108MHz. Ready built, ready for use. Fantastic value for money.

OUR PRICE £8.95 P&P 20p

Stereo Multiplex Adaptor £5.95 extra

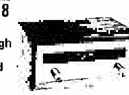
GOODWIN 4 CHANNEL CONVERTER plus pair Audio Development AD-15 speakers.

Add 4 channel sound to your existing stereo system with this special package. Converter splits stereo sound into 4 live channels. Bookshelf speakers handles 10 watts and has 70-18,000 Hz performance. Normal retail value £25.50

OUR PRICE £15.80 p&p £1

Converter available seperately £3.95 p & p 50p

Model A1018 FM TUNER

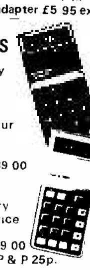


6 transistor high quality unit—3 IF stages and double tuned discriminator. For use with most amplifiers. Covers 88–108MHz. Powered by 9V battery.

OUR PRICE £13.50 P&P 30p

Stereo multiplex adapter £5.95 extra.

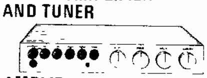
SINCLAIR CALCULATORS



Cambridge Ready Built List £19.95 Our Price £17.95 P & P 25p.
Cambridge Kit Our Price £13.50 Post Free
Executive List £39.00 Our Price £35.45 P & P 25p
Executive Memory List £49.00 Our Price £44.50 P & P 25p
Scientific List £49.00 Our Price £27.50 P & P 25p.

MANY OTHER CALCULATORS IN STOCK FROM AS LITTLE AS £9.00. Send for list

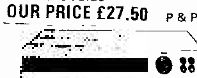
SINCLAIR SYSTEM 2000 STEREO AMPLIFIER AND TUNER



AMPLIFIER

Amplifier output 8 watts per channel RMS. Distortion less than 0.06%. Silicon transistors. Two pick-up plus radio and tape inputs, tape output and scratch filter. Excellent Value.

OUR PRICE £27.50 P & P 60p.



FM TUNER

Excellent selectivity and sensitivity. Twin dual-varicap tuning. 4 pole ceramic filter. 19 transistor stereo demodulator giving 40 dB separation. Distortion 0.2% output. Fantastic Value.

OUR PRICE £27.50 P & P 60p.

SINCLAIR IC12 INTEGRATED CIRCUIT AMPLIFIER

complete with printed circuit mounting board.

OUR PRICE £1.50 P & P 15p.

SINCLAIR Project 80 Modules

Z40 Power Amp	£5.45	P & P 15p
Z60 Power Amp	£6.95	P & P 15p
Stereo 80 Pre-Amp	£11.95	P & P 15p
Active Filter Unit	£6.95	P & P 15p
Project 805	£26.95	P & P 50p
PZ5 Power Supply	£4.98	P & P 30p
PZ6 Power Supply	£7.98	P & P 30p
PZ8 Power Supply	£7.98	P & P 30p
Transformer for PZ8.	£4.05	P & P 50p

SINCLAIR Project 80 Packages

2 x Z40/Stereo 80/PZ5	£25.00
2 x Z40/Stereo 80/PZ6	£27.75
2 x Z60/Stereo 80/PZ8	£30.45

POST & PACKING 35p each.

JOSTY KIT HIGH QUALITY CONSTRUCTION KITS

WE ARE APPOINTED STOCKISTS AT ALL BRANCHES

All kits are complete with comprehensive easy to follow instructions and covered by full guarantee.

Post and Packing 15p per kit.

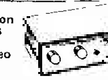
AF20 Mono amplifier	£4.80
AF25 Mixer	£3.60
AF30 Mono pre-amplifier	£2.61
AF35 Emitter amplifier	£2.27
AF80 0.5W mic. amplifier	£4.22
AF305 Intercom	£7.35
AF310/2 Mono Amplifier	£7.56
AT5 Automatic light control	£2.58
AT25 Window wiper robot	£5.82
AT30 Photo cell switch unit	£5.70
AT50 400W triac light dimmer/speed control	£4.80
AT56 2,200W triac light dimmer/speed control	£6.90
AT60 1 channel light control	£7.80
AT65 3 channel light control	£14.55
GP304 Circuit board	£4.94
GP310 Stereo pre-amplifier for use with 2 x AF310	£21.27
GP312 Circuit board	£11.45
GU330 Tremolo unit	£7.50
HF61 Diode detector	£3.32
HF65 FM transmitter	£2.70
HF75 FM receiver	£2.87
HF310 FM tuner	£15.81
HF325 Deluxe FM tuner	£24.12
HF330 Decoder (HF310/325)	£9.96
HF380 lw/vhf aerial amplifier	£5.04
HF395 broadband aerial amp.	£1.77
LF380 Quadraphonic device	£11.36
M160 Multi-vibrator	£1.71
M191 VU Meter	£4.55
M192 Stereo balance meter	£4.97
M1302 Transistor tester	£8.45
NT10 Stabilised power supply 100mA, 9V	£6.15
NT300 Stabilised p. supply	£12.51
NT305 Voltage converter	£4.50
NT310 Power Supply 240 V AC or 2 x 18 V D C at 2 amps	£5.71
NT315 Power supply 240V AC to 4.5/15V DC, 500mA	£9.57

Amateur Electronics by Josty-Kit, the professional book for the amateur—covers the subject from basic principals to advanced electronic techniques. Complete with circuit board for AE1 to AE10 listed below.

OUR PRICE £3.30 (No VAT) P&P 25p plus VAT.

AE1 100mW output stage	£1.50
AE2 Pre-amplifier	£1.15
AE3 Diode receiver	£1.82
AE4 Flasher	99p
AE5 Astable multi-vibrator	95p
AE6 Monostable multi-vibrator	93p
AE7 RC generator	97p
AE8 Bass filter	90p
AE9 Treble filter	90p
AE10 CCIR filter	90p

TE1021 Stereo Listening Station



For balancing and gain selection of loudspeakers with additional facility for stereo headphone switching. Two gain controls, speakers on–off slide switch, stereo headphone socket.

OUR PRICE £2.25 P&P 15p

AUDIOTRONIC LOW NOISE CASSETTES

TYPE	5	10	25
C60	£1.57	£3.00	£7.08
C90	£2.24	£4.25	£10.00
C120	£2.73	£5.17	£12.24

AUDIOTRONIC 8 TRACK CARTRIDGES

TYPE	Each	5	10
40M	85p	£4.00	£7.50
80M	£1.15	£5.40	£10.25

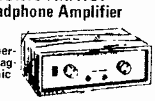
P&P Cassettes 3p, Cartridges 5p each. OVER 10 of either POST FREE!

MP7 MIXER-PREAMPLIFIER

5 Microphone inputs each with individual gain controls enabling complete mixing facilities. Battery operated. Size: 235 x 127 x 76mm. Inputs: Mics. 3 x 3mV 50k; 2 x 3mV 600 ohms. Phono. Mag. 4mV 50k; Phono Ceramic 100mV 1 Meg. Output 250mV 100k.

OUR PRICE £8.97 P&P 20p

AUDIOTRONIC AHA101 Stereo Headphone Amplifier



All silicon, transistor amplifier operates from magnetic, ceramic or tuner inputs with twin stereo headphone outputs and separate volume controls for each channel. Operates from 9V battery. INPUTS: 5mV and 100mV. OUTPUT: 50mV per channel.

OUR PRICE £8.50 P&P 30p

Also see previous page

ALL PRICES EXCLUDE VAT

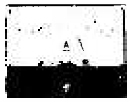
SEW PANEL METERS

SEW PANEL METERS ARE STOCKED AT 3 LISLE ST., 311 EDGWARE RD., & 152 FLEET ST., or order by post from head office.

USED EXTENSIVELY BY INDUSTRY, GOVERNMENT DEPARTMENTS, EDUCATIONAL AUTHORITIES ETC.
Over 200 ranges in stock—other ranges to order. Quantity discounts available. Send for fully illustrated brochure.

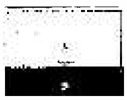
*Items with asterisk are Moving Iron type, all others are Moving Coil

CLEAR PLASTIC MODEL SD640
Size: 85 x 64mm



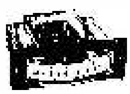
50uA	£3.80	10V DC	£3.65
100uA	£3.75	20V DC	£3.65
200uA	£3.70	50V DC	£3.65
500uA	£3.65	300V DC	£3.65
50-0-50uA	£3.75	15V AC	£3.75
100-0-100uA	£3.70	300V AC	£3.75
1mA	£3.65	VU Meter	£3.90
5mA	£3.65		
10mA	£3.65		
50mA	£3.65		
100mA	£3.65		
500mA	£3.65		
1A DC	£3.65		
5A DC	£3.65		
10A DC	£3.65		
5V DC	£3.65		

CLEAR PLASTIC MODEL SW100
Size: 100 x 80mm



50uA	£4.60	150V AC	£4.45
100uA	£4.50	300V AC	£4.45
500uA	£4.30	VU Meter	£4.90
50-0-50uA	£4.50		
100-0-100uA	£4.45		
1mA	£4.30		
1A DC	£4.30		
5A DC	£4.30		
20V DC	£4.30		
50V DC	£4.30		
300V DC	£4.30		

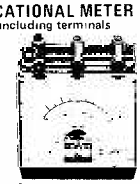
EDGWISE MODEL PE70
Size: 90 x 34mm



50uA	£4.15
100uA	£4.10
200uA	£4.05
500uA	£3.90
50-0-50uA	£4.10
100-0-100uA	£4.05
1mA	£3.85
300V AC	£3.95
VU Meter	£4.30

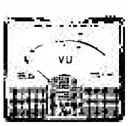
MODEL ED107 EDUCATIONAL METER
Size: 100 x 90 x 150mm including terminals

A range of high quality moving coil instruments ideal for school experiments and other bench applications. 3" mirror scale. The meter movement is easily accessible to demonstrate internal working.



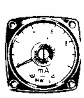
50uA	£8.50	20V DC	£7.60
100uA	£7.90	50V DC	£7.60
50-0-50uA	£7.90	300V DC	£7.60
1mA	£7.60	500mA/5A DC	£8.60
1-0-1mA	£7.60	5V/50V DC	£8.60
1A DC	£7.60	5V/15V DC	£8.60
5A DC	£7.60	1.5A DC	£8.60
5V DC	£7.60	1A/15A DC	£8.60
10V DC	£7.60		
15V DC	£7.60		

CLEAR PLASTIC MODEL MR 85P
Size: 120 x 110mm

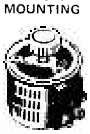


50uA	£5.45	300V DC	£5.20
100uA	£5.40	15V AC	£5.30
200uA	£5.35	300V AC	£5.30
500uA	£5.25	S Meter 1mA	£5.20
50-0-50uA	£5.40	VU Meter	£5.55
100-0-100uA	£5.35	1A AC	* £5.20
500-0-500uA	£5.20	5A AC	* £5.20
1mA	£5.20	10A AC	* £5.20
1-0-1mA	£5.20	20A AC	* £5.20
5mA	£5.20	30A AC	* £5.20
10mA	£5.20		
50mA	£5.20		
100mA	£5.20		
500mA	£5.20		
1A DC	£5.20		
5A DC	£5.20		
15A DC	£5.20		
30A DC	£5.40		
10V DC	£5.20		
20V DC	£5.20		
50V DC	£5.20		
150V DC	£5.20		

240° Wide Angle 1mA METERS
MW1-8 80 x 80mm
£6.90 P&P 15p



YAMABISHI VARIABLE VOLTAGE TRANSFORMERS
Excellent quality at low cost. Input: 230V 50/60Hz. Output 0–260V.
MODEL S260 BENCH MOUNTING



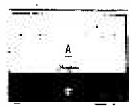
		P&P
1A	£10.50	50p
2.5A	£12.00	50p
5A	£17.50	50p
8A	£30.35	£1.00
10A	£33.75	£1.00
12A	£35.40	£1.00
20A	£85.00	£1.50
25A	£95.00	£1.50
40A	£120.00	£1.50

MODEL S260B PANEL MOUNTING

1A	£10.00	50p
2.5A	£12.00	50p

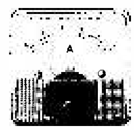
ALL PRICES EXCLUDE VAT

CLEAR PLASTIC MODEL SD830
Size 110 x 83mm



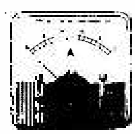
50uA	£4.30	10V DC	£4.10
100uA	£4.25	20V DC	£4.10
200uA	£4.20	50V DC	£4.10
500uA	£4.15	300V DC	£4.10
50-0-50uA	£4.25	15V AC	£4.20
100-0-100uA	£4.20	300V AC	£4.20
1mA	£4.10	VU Meter	£4.40
5mA	£4.10		
10mA	£4.10		
50mA	£4.10		
100mA	£4.10		
500mA	£4.10		
1A DC	£4.10		
5A DC	£4.10		
10A DC	£4.10		
5V DC	£4.10		

CLEAR PLASTIC MODEL MR 45P
Size: 50 x 50mm



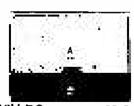
50uA	£3.20	300V AC	£3.05
100uA	£3.15	S Meter 1mA	£2.95
200uA	£3.10	VU Meter	£3.40
500uA	£3.00	1A AC	* £2.95
50-0-50uA	£3.15	5A AC	* £2.95
100-0-100uA	£3.10	10A AC	* £2.95
500-0-500uA	£2.95	20A AC	* £2.95
1mA	£2.95	30A AC	* £2.95
5mA	£2.95		
10mA	£2.95		
50mA	£2.95		
100mA	£2.95		
500mA	£2.95		
1A DC	£2.95		
5A DC	£2.95		
10V DC	£2.95		
20V DC	£2.95		
50V DC	£2.95		
300V DC	£2.95		
15V AC	£3.05		

CLEAR PLASTIC MODEL MR 38P
Size: 42 x 42mm



50uA	£3.10	20V DC	£2.80
100uA	£3.05	50V DC	£2.80
200uA	£3.00	100V DC	£2.80
500uA	£2.85	150V DC	£2.80
50-0-50uA	£3.05	300V DC	£2.85
100-0-100uA	£3.00	500V DC	£2.85
500-0-500uA	£2.80	750V DC	£2.90
1mA	£2.80	15V AC	£2.90
1-0-1mA	£2.80	50V AC	£2.90
2mA	£2.80	150V AC	£2.90
5mA	£2.80	300V AC	£2.90
10mA	£2.80	500V AC	£3.00
20mA	£2.80	S Meter 1mA	£2.80
50mA	£2.80	VU Meter	£3.20
100mA	£2.80		
150mA	£2.80		
200mA	£2.80		
300mA	£2.80		
500mA	£2.80		
750mA	£2.80		
1A DC	£2.80		
2A DC	£2.80		
5A DC	£2.80		
10A DC	£2.80		
3V DC	£2.80		
10V DC	£2.80		
15V DC	£2.80		

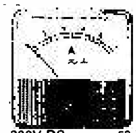
CLEAR PLASTIC MODEL SD460
Size: 59 x 46mm



50uA	£3.50	10V DC	£3.30
100uA	£3.45	20V DC	£3.30
200uA	£3.40	50V DC	£3.30
500uA	£3.35	300V DC	£3.30
50-0-50uA	£3.45	15V AC	£3.45
100-0-100uA	£3.40	300V AC	£3.45
1mA	£3.30	VU Meter	£3.65
5mA	£3.30		
10mA	£3.30		
50mA	£3.30		
100mA	£3.30		
500mA	£3.30		
1A DC	£3.30*		
5A DC	£3.30		
10A DC	£3.30		
5V DC	£3.30		

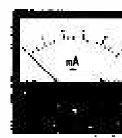
POSTAGE & PACKING 15p

CLEAR PLASTIC MODEL MR 65P
Size: 86 x 78mm



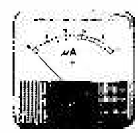
50uA	£3.95	300V DC	£3.70
100uA	£3.85	15V AC	£3.80
200uA	£3.80	50V AC	£3.80
500uA	£3.75	150V AC	£3.80
50-0-50uA	£3.85	300V AC	£3.90
100-0-100uA	£3.80	500V AC	£3.80
500-0-500uA	£3.70	S Meter 1mA	£4.10
1mA	£3.70	VU Meter	£3.70
1-0-1mA	£3.70	1A AC	* £3.70
5mA	£3.70	5A AC	* £3.70
10mA	£3.70	10A AC	* £3.70
50mA	£3.70	20A AC	* £3.70
100mA	£3.70	30A AC	* £3.70
500mA	£3.70	50mA AC	* £3.70
1A DC	£3.70	100mA AC	* £3.70
5A DC	£3.70	200mA AC	* £3.70
10A DC	£3.70	500mA AC	* £3.70
15A DC	£3.70		
20A DC	£3.80		
30A DC	£3.85		
50A DC	£4.05		
5V DC	£3.70		
10V DC	£3.70		
15V DC	£3.70		
20V DC	£3.70		
50V DC	£3.70		
150V DC	£3.70		

BAKELITE MODEL S80 Enlarged Window
Size: 80 x 80mm



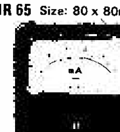
50uA	£4.50
100uA	£4.45
500uA	£4.20
50-0-50uA	£4.45
100-0-100uA	£4.40
1mA	£4.20
1A DC	£4.20
5A DC	£4.20
20V DC	£4.20
50V DC	£4.20
300V DC	£4.20
300V AC	£4.30
VU Meter	£4.70

CLEAR PLASTIC MODEL MR 52P
Size: 60 x 60mm



50uA	£3.70	S Meter 1mA	£3.30
100uA	£3.50	VU Meter	£3.80
500uA	£3.35	1A AC	* £3.30
50-0-50uA	£3.50	5A AC	* £3.30
100-0-100uA	£3.45	10A AC	* £3.30
1mA	£3.30	20A AC	* £3.30
5mA	£3.30	30A AC	* £3.30
10mA	£3.30		
50mA	£3.30		
100mA	£3.30		
500mA	£3.30		
1A DC	£3.30		
5A DC	£3.30		
10V DC	£3.30		
20V DC	£3.30		
50V DC	£3.30		
300V DC	£3.30		
15V AC	£3.40		
300V AC	£3.40		

BAKELITE MODEL MR 65 Size: 80 x 80mm



25uA	£5.25	300V DC	£3.60
50uA	£4.00	30V AC	* £3.60
100uA	£3.95	50V AC	* £3.60
500uA	£3.65	150V AC	* £3.60
50-0-50uA	£3.95	300V AC	* £3.60
100-0-100uA	£3.90	500V AC	* £3.60
500-0-500uA	£3.60	VU Meter	£4.10
1mA	£3.60	1A AC	* £3.60
1-0-1mA	£3.60	5A AC	* £3.60
5mA	£3.60	10A AC	* £3.60
10mA	£3.60	20A AC	* £3.60
50mA	£3.60	30A AC	* £3.60
100mA	£3.60	50A AC	* £3.60
500mA	£3.60	500mA AC	* £3.60
1A DC	£3.60	50mV DC	£3.75
2A DC	£3.60	100mV DC	£3.75
5A DC	£3.60		
10A DC	£3.60		
15A DC	£3.60		
30A DC	£3.60		
50A DC	£3.80		
5V DC	£3.60		
10V DC	£3.60		
15V DC	£3.60		
20V DC	£3.60		
50V DC	£3.60		
150V DC	£3.60		

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311 EDGWARE RD. W2	01-262 0387
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382 EDGWARE RD. W2	01-723 4194
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27 TOTTENHAM CT. RD.	01-636 3715
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NEW from A.S.P.

"SPLASH PROOF" SAFETY TRANSFORMER

750 VA Isolation Unit (Interwinding Screen) Housed in a tough Fibreglass case, with carrying handle. Complete with Heavy Duty 3 core power cable, splash proof outlet plug and socket, internal fuse. 110 Volt and 240 Volt versions available. Price **£26·20.** Carriage £1.30

2″ and 4″ PANEL METERS

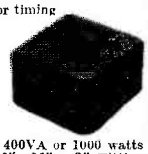
2″		4″	
SIZE: 60mm Wide x 45mm High x 40mm Deep.		SIZE: 110mm Wide × 82mm High × 43mm Deep.	
Movement	I.R. Ohms	Movement	I.R. Ohms
0–50 micro A.	1250	0–50 micro A.	1400
0-100 micro A.	580	0–100 micro A.	730
0–500 micro A.	170	0–500 micro A.	200
0–1 mA	170	0–1 mA	200
0–5 mA	170	0–5 mA	200
0–10 mA	6	0–10 mA	6
0–50 mA	0·5	0–50 mA	0·5
0–100 mA	0·5	0–100 mA	0·5
0–500 mA	0·5	0–500 mA	0·5
0–1 AMP	0·5	0–1 AMP	0·5
0–2 AMP	0·5	0–2 AMP	0·5
0–25 Volt	15K	0–25 Volt	15K
0–50 Volt	50K	0–50 Volt	50K
0–300 Volt	300K	0–300 Volt	300K
"g" Meter	170	"g" Meter	200
VU Meter	5250	VU Meter	5250

VU Meters are complete with detectors. Modern wide view.
Price 2″ **£2·95** Post 10p. Price 4″ **£3·95** Post 10p. Lamps **55p** per set.

¼ watt CARBON FILM RESISTORS

¼ watt at 70°C E 12 range 10 Ω—1M Ω 5% tol above 470 K Ω 10% tol at **95p** per 100.

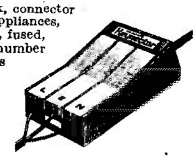
ELECTRONIC MAINS TIMER



A reliable unit ideal for timing Bathroom/Toilet Ventilators Stairway/Cloakroom Lighting etc. Gives up to 30 mins delay before switching off. Delay 1–30 mins. adjustable. Max Load 400VA or 1000 watts resistive. White Case 3⅜″ × 3⅞″ × 2″. Fitting instructions included.

Trade Price **£5·80.** Post 20p.

MAINS KEYNECTOR



The safe, quick, connector for electrical appliances, 13 Amp rating, fused, will connect a number of appliances quickly and safely to the mains, ideal for testing, demonstrating, window displays, etc. Warning Light, interlocked to prevent connecting when live.
Trade Price: **£2·95.** Post 25p.

TRANSFORMERS

SAFETY ISOLATING

Prim. 120/240V. Sec. 120/240V. Centre Tap with Screen.

VA (watts)	Ref. No.	Price Cased	Price Open	Post £
60	149	—	£3·74	0·38
100	150	—	4·16	0·52
200	151	£9·48	7·48	0·52
250	152	12·05	9·57	0·65
350	153	14·00	11·44	0·80
500	154	15·80	13·20	1·00
1000	156	30·70	27·46	1·20
2000	158	60·95	55·44	
3000	159	79·53	72·49	

50 Volts

Prim. 200–240V.
Sec. 19, 25, 33, 40, 50V.

Amps	Ref. No.	Price £	Post £
0·5	102	2·11	0·30
1	103	3·08	0·38
2	104	4·29	0·42
3	105	5·77	0·52
4	106	7·48	0·52
6	107	11·00	0·67
8	118	14·19	0·97
10	119	17·60	0·97

60 Volts

Prim. 200–240V.
Sec. 24, 30, 40, 48, 60V.

Amps	Ref. No.	Price £	Post £
0·5	124	2·10	0·38
1	126	2·97	0·38
2	127	5·77	0·42
3	125	7·15	0·52
4	123	9·35	0·67
5	40	11·55	0·67
6	120	13·57	0·82
8	121	16·00	1·00
10	122	19·40	1·00
12	189	21·62	1·10

12 & 24 Volts Prim. 200–240V.

Amps 12V	Amps 24V	Ref. No.	Price £	Post £
0·3	0·15	242	1·34	0·22
0·5	0·25	111	1·34	0·22
1	0·5	213	1·59	0·22
2	1	71	2·09	0·22
4	2	18	2·75	0·38
6	3	70	3·56	0·42
8	4	108	3·96	0·52
10	5	72	4·67	0·52
12	6	116	5·67	0·52
16	8	17	6·64	0·52
20	10	115	10·23	0·69
30	15	187	13·75	0·97
40	20	232	18·26	1·00
60	30	226	22·52	1·10

MINIATURE AND EQUIPMENT

Prim. 240V with screen.

Volts Sec. 1	Volts Sec. 2	Milliamps Sec. 1	Milliamps Sec. 2	Ref. No.	Price £	Post £
3–0–3	—	200	—	238	1·23	0·10
0–6	0–6	500	500	234	1·30	0·10
0–6	0–6	1000	1000	212	1·68	0·22
9–0–9	—	100	—	13	1·23	0·10
0–9	0–9	330	330	235	1·43	0·10
0–8–9	0–8–9	500	500	207	2·28	0·22
0–8–9	0–8–9	1000	1000	208	3·08	0·30
15–0–15	—	40	—	240	1·23	0·10
0–15	0–15	200	200	236	1·30	0·10
20–0–20	—	30	—	241	1·23	0·10
0–20	0–20	150	150	237	1·30	0·10
0–15–20	0–15–20	500	500	205	2·97	0·38
0–20	0–20	300	300	214	1·76	0·22
0–20	—	3500	NO SCREEN	1116	3·00	0·40
20–12–0–12–20	—	700 (D/C)	—	221	1·55	0·30
0–15–20	0–15–20	1000	1000	206	3·80	0·38
0–15–27	0–15–27	500	500	203	3·08	0·38
0–15–27	0–15–27	1000	1000	204	2·24	0·38

30 Volts

Prim. 200–240V. Sec. 12, 15, 20, 24, 30V.

Amps	Ref. No.	Price £	Post £
0·5	112	1·58	0·22
1	79	2·20	0·38
2	3	3·19	0·38
3	20	3·96	0·42
4	21	4·68	0·52
5	51	5·80	0·52
6	117	6·93	0·52
8	88	9·00	0·67
10	89	10·00	0·67

PLASTIC CASED SILICON BRIDGE RECTIFIERS

One Amp	Two Amp	Four Amp	Six Amp
50 P.I.V. 25p	50 P.I.V. 35p	100 P.I.V. 55p	50 P.I.V. 65p
100 P.I.V. 25p	100 P.I.V. 40p	200 P.I.V. 59p	100 P.I.V. 70p
200 P.I.V. 28p	200 P.I.V. 45p	400 P.I.V. 65p	200 P.I.V. 80p
600 P.I.V. 30p	400 P.I.V. 50p	600 P.I.V. 75p	400 P.I.V. 90p

ADD 10p P & P PER ORDER

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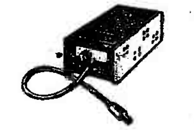
Cased versions are 240 Volt Mains to 115 Volts, smart steel cased units coated in tough resin with power lead, fuse and 115 Volt American type socket up to 500VA, above 500VA cable entry.

VA (Watts)	Ref. No.	Price Cased £	Price Open £	Post
Tapped at 115, 200, 220, 240 Volts				
20	113	£2·52	1·32	0·30
75	64		2·63	0·30
Tapped at 115, 220, 240 Volts				
150	4		3·29	0·39
200	65	5·56	3·96	0·40
300	66		4·64	0·52
500	67	9·50	8·03	0·67
1000	84	15·92	13·50	0·82
2000	95	29·70	25·30	1·50
3000	73		33·00	1·20

PLEASE ADD 8% FOR V.A.T.

POWER UNIT Type CC 12–05

Output switched 3, 4·5, 6, 7·5 9 and 12 volts at 500 mA D.C Operates from 240 V mains suitable for Radios, Tape Recorders, Record Players etc Size 7·5 × 5·0 × 14·0cm. Price **£3·95.** Post 25p.



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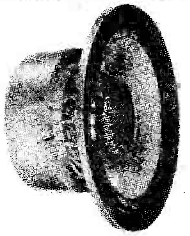

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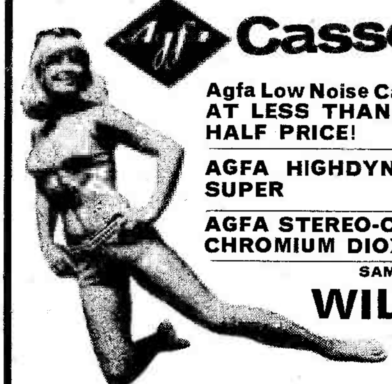

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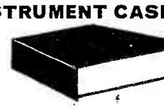

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BA4	5¼"	×	4"	×	1½"	50p
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BA6	3"	×	2"	×	1"	34p
BA7	7"	×	5"	×	2½"	70p
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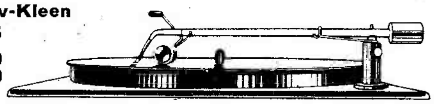

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PS 26	Jack 3·5mm Plastic	0·16
PS 27	Jack ¼" Plastic	0·30
PS 28	Jack ¼" Screened	0·35
PS 29	Jack Stereo Plastic	0·30
PS 30	Jack Stereo Screened	0·38
PS 31	Phono Screened	0·18
PS 32	Car Aerial	0·22
PS 33	Co-Axial	0·22

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PS 38	D.I.N. 5 Pin 240°	0·11
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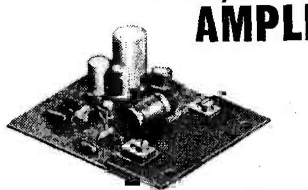
AL10/AL20/AL30 AUDIO AMPLIFIER MODULES



The AL10, AL20 and AL30 units are similar in their appearance and in their general specification. However, careful selection of the plastic power devices has resulted in a range of output powers from 3 to 10 watts R.M.S.
The versatility of their design makes them ideal for use in record players, tape recorders, stereo amplifiers and cassette and cartridge tape players in the car and at home.

Parameter	Conditions	Performance
HARMONIC DISTORTION	Po = 3 WATTS f = 1KHz	0·25%
LOAD IMPEDANCE	—	8 - 16 Ω
INPUT IMPEDANCE	f = 1KHz	100 kΩ
FREQUENCY RESPONSE ± 3dB	Po = 2 WATTS	50 Hz - 25KHz
SENSITIVITY for RATED O/P	Vs = 25V. Rl = 8 Ω f = 1KHz	75mV. RMS
DIMENSIONS	—	3″ x 2¼″ x 1″

The above table relates to the AL10, AL20 and AL30 modules. The following table outlines the differences in their working conditions.

Parameter	AL10	AL20	AL30
Maximum Supply Voltage	25	30	30
Power output for 2% T.H.D. (RL = 8 Ω f = 1 KHz)	3 watts RMS Min.	5 watts RMS Min.	10 watts RMS Min.

AUDIO AMPLIFIER MODULES

AL 10. 3 watts RMS £2·19
AL 20. 5 watts RMS £2·59
AL 30. 10 watts RMS £3·01

PRE-AMPLIFIERS

PA 12. (Use with AL10 & AL20) £4·35
PA 100. (Use with AL30 & AL60) £13·15

POWER SUPPLIES

PS 12. (Use with AL10, AL20, AL30) 88p
SPM 80. (Use with AL60) £3·25
FRONT PANELS SP 12 with Knobs £1·10

TRANSFORMERS

T461 (Use with AL10) £1·38 P & P 15p
T538 (Use with AL20, AL30) £1·93 P & P 15p
BMT80 (Use with AL60) £2·15 P & P 25p

PA 12. PRE-AMPLIFIER SPECIFICATION

The PA 12 pre-amplifier has been designed to match into most budget stereo systems. It is compatible with the AL 10, AL 20 and AL 30 audio power amplifiers and it can be supplied from their associated power supplies. There are two stereo inputs, one has been designed for use with *Ceramic cartridges while the auxiliary input will suit most †Magnetic cartridges. Full details are given in the specification table. The four controls are, from left to right: Volume and on/off switch, balance, bass and treble. Size 152mm × 84mm × 35mm.

Frequency response— 20Hz - 50KHz (−3dB)
Bass control— ± 12dB at 60Hz
Treble control— ± 14dB at 14KHz
*Input 1. Impedance 1 Meg. ohm Sensitivity 300mV
†Input 2. Impedance 30 K ohms Sensitivity 4mV

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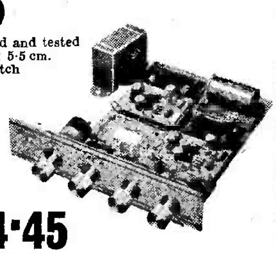
The STEREO 20



The 'Stereo 20' amplifier is mounted, ready wired and tested on a one-piece chassis measuring 20 cm × 14 cm × 5·5 cm. This compact unit comes complete with on/off switch volume control, balance, bass and treble controls, Transformer, Power supply and Power amps. Attractively printed front panel and matching control knobs. The 'Stereo 20' has been designed to fit into most turntable plinths without interfering with the mechanism or alternatively, into a separate cabinet. Output power 20w peak. Input 1 (Cer.) 300mV into 1M. Freq. res. 25Hz-25kHz. Input 2 (Aux.) 4mV into 30K. Harmonic distortion. Bass control ±12dB at 60Hz typically 0·25% at 1 watt. Treble con. ±14dB at 14kHz.

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For Stereo 20 (front board undrilled) size 10½″ x 8¾″ x 3″, £3·95, plus 30p postage

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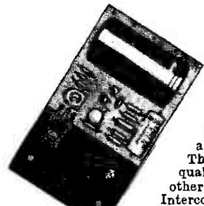
- Signal to noise ratio 80dB
- Overall size 63mm × 105mm × 13mm

Especially designed to a strict specification. Only the finest components have been used and the latest solid state circuitry incorporated in this powerful little amplifier which should satisfy the most critical A.F enthusiast.

STABILISED POWER MODULE SPM80



SPM80 is especially designed to power 2 of the AL60 Amplifiers, up to 15 watt (r.m.s.) per channel simultaneously. This module embodies the latest components and circuit techniques incorporating complete short circuit protection. With the addition of the Mains Transformer BMT80, the unit will provide outputs of up to 1·5 amps at 35 volts. Size: 63mm × 105mm × 30mm.
These units enable you to build Audio Systems of the highest quality at a hitherto unobtainable price. Also ideal for many other applications including:—Disco Systems, Public Address Intercom Units, etc. Handbook available 10p **PRICE £3·25**

TRANSFORMER BMT80 £2·15 p. & p. 28p

STEREO PRE-AMPLIFIER TYPE PA100

Built to a specification and NOT a price, and yet still the greatest value on the market, the PA100 stereo pre-amplifier has been conceived from the latest circuit techniques. Designed for use with the AL50 power amplifier system, this quality made unit incorporates no less than eight silicon planar transistors, two of these are specially selected low noise NPN devices for use in the input stages.
Three switched stereo inputs, and rumble and scratch filters are features of the PA100, which also has a STEREO/MONO switch, volume, balance and continuously variable bass and treble controls.

SPECIFICATION

Frequency Response	20Hz — 20KHz ± 1dB
Harmonic Distortion	better than 0·1%
Inputs: 1. Tape Head	3·25 mV into 50K Ω
2. Radio, Tuner	75 mV into 50K Ω
3. Magnetic P.U.	3 mV into 50K Ω

All input voltages are for an output of 250mV. Tape and P.U. inputs equalised to RIAA curve within ± 1dB. from 20Hz to 20KHz.

Bass Control	± 15dB at 20Hz
Treble Control	± 15dB at 20 KHz
Filters: Rumble (High Pass)	100Hz
Scratch (Low Pass)	8KHz
Signal/Noise Ratio	better than −65dB
Input overload	+ 26dB
Supply	+ 35 volts at 20mA
Dimensions	292mm × 82mm × 35mm

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MK 60 AUDIO KIT

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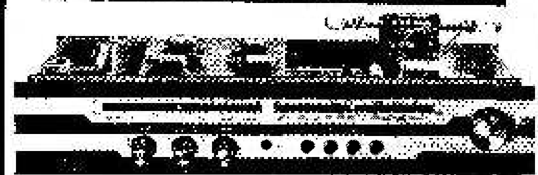

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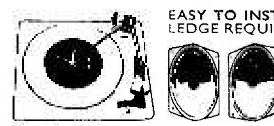

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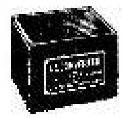

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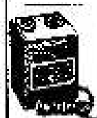

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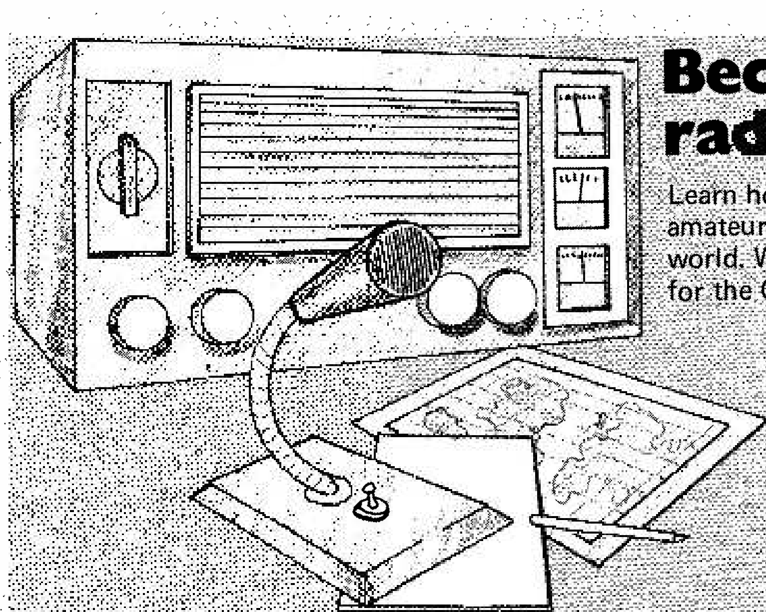

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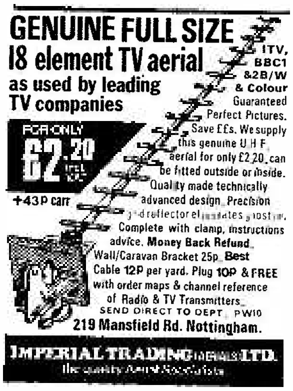

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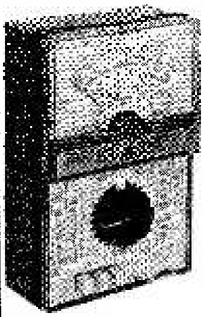
AC/DC MULTIMETER TYPE U4324



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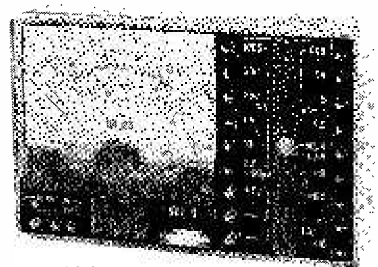

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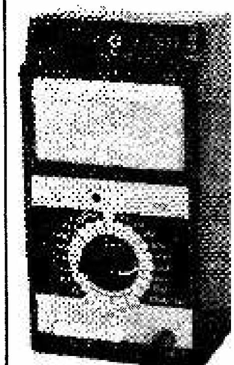

39 ranges:
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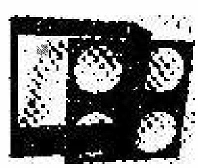

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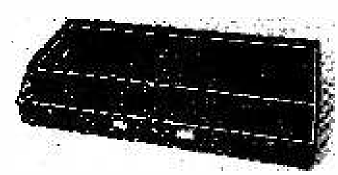

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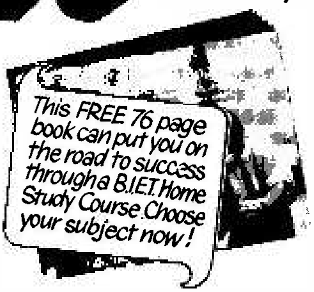

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