PRACTICAL WIRELESS

FEBRUARY 1976

35p

'STEP-BY-STEP'

GENERAL COVERAGE RECEIVER

PART 1

2 Channel Stereo Mixer

Plus

CURING RADIO BREAKTHROUGH - Part 1

ALL MAIL ORDER BY RETURN. C.O.D. SERVICE WELCOME

C. T. ELECTRONICS

Tel: 01-994 6275

All mail order and enquiries to 270 Acton Lane, Chiswick, London W4 5DG

V.A.T.
Unless otherwise stated all prices are exclusive of VAT. Please check whether the goods you are ordering are 25% or 8%. Carriage orders under £5 please add 33p. Order over £10 post free in U.K. only. This to be at our discretion.

SEMICONDUCTORS

AAZ12	25p
AC107	35p
AC125	25p
AC126	25p
AC127	25p
AC128	25p
AC176	25p
AC187	27p
AC188	27p
ACY17	25p
ACY18	25p
ACY19	25p
ACY20	25p
ACY21	25p
AD140	60p
AD142	60p
AD161	45p
AD162	45p
AF114	25p
AF115	25p
AF116	25p
AF117	25p
AF118	50p
AF124	30p
AF239	60p
BA102	30p
BA112	50p
BA114	16p
BA155	16p
BA156	15p
BC107	13p
BC108	12p
BC109	14p
BC109c	16p
BC113	13p
BC114	13p
BC115	15p
BC116	15p
BC117	20p
BC118	15p
BC119	30p
BC143	25p
BC147	12p
BC148	12p
BC149	12p
BC149c	14p
BC157	14p
BC158	14p
BC159	15p
BC167	14p
BC168	14p
BC169	14p
BC169c	15p
BC172	13p
BC182	12p
BC182L	12p
BC183	12p
BC183L	12p
BC184	12p
BC184L	12p
BC185	35p
BC186	27p
BC212	12p
BC212L	14p
BC213	12p
BC213L	12p

BC214	14p
BC214L	15p
BC238	15p
BC239	15p
BC300	30p
BC301	30p
BC302	30p
BC303	35p
BCY31	35p
BCY32	95p
BCY33	60p
BCY34	65p
BCY38	65p
BCY39	95p
BCY55	£1·50
BCY70	20p
BCY71	20p
BCY72	20p
BD121	75p
BD123	85p
BD124	70p
BD131	40p
BD132	50p
BD135	50p
BD136	50p
BD139	75p
BD140	87p
BD153	80p
BD156	80p
BDY17	£1·50
BDY18	£1·75
BDY19	£1·90
BDY20	£1·20
BF152	20p
BF166	30p
BF178	35p
BF180	35p
BF194	16p
BF195	16p
BF196	16p
BF197	16p
BF200	35p
BF224	18p
BF244J	18p
BF245	45p
BF259	55p
BFX29	30p
BFX34	30p
BFX85	30p
BFX86	30p
BFX88	30p
BFY10	35p
BFY44	50p
BFY50	25p
BFY51	25p
BFY52	25p
BFY53	25p
BFY90	65p
BSV68	70p
BSW63	65p
BSW68	80p
BSX19	15p
BSX20	15p
BSX21	25p
BY127	20p
BY164	65p

IS100	15p
IS103	15p
MJ340	50p
MJ481	95p
MJ2801	£1·25
MJ2901	£1·95
MJE340	50p
MJE370	75p
MJE371	90p
MJE520	65p
MJ2955	£1·20
MJE3055	75p
MM1613	45p
MM1712	60p
MPF102	45p
MPF103 (2N5457)	35p
MPF104 (2N5458)	35p
MPF105 (2N5459)	40p
OA47	10p
OA70	10p
OA79	10p
OA81	10p
OA90	10p
OA91	10p
OA200	10p
OA202	10p
OA210	35p
OA211	35p
OC16	90p
OC19	85p
OC22	55p
OC26	65p
OC28	60p
OC35	60p
OC36	65p
OC42	40p
OC44	20p
OC45	25p
OC70	15p
OC71	12p
OC72	20p
OC75	25p
OC76	25p
OC77	40p
OC81	25p
OC83	25p
OC84	25p
OC139	30p
OC170	25p
OC171	30p
OC200	60p
OC201	60p
OC202	75p
TIP29A	45p
TIP30	55p
TIP31A	57p
TIP32A	69p
TIP33A	£1·00
TIP34A	£1·40
TIP35A	£3·20
TIP36A	£3·50
TIP41A	70p
TIP42A	85p

TIP29B	54p
TIP30B	60p
TIP31B	65p
TIP32B	77p
TIP33B	£1·06
TIP34B	£1·62
TIP35B	£2·71
TIP36B	£3·50
TIP41B	78p
TIP42B	95p
TIP29C	68p
TIP30C	72p
TIP31C	80p
TIP32C	£1·00
TIP33C	£1·20
TIP34C	£1·80
TIP35C	£3·00
TIP38C	£3·74
TIP41C	90p
TIP42C	£1·00
TIS50	40p
ZTX107	15p
ZTX300	15p
ZTX500	16p
ZTX501	20p
ZTX504	50p
ZTX531	30p
ZTX550	25p
IN659	8p
IN914	8p
IN916	8p
IN4001	8p
IN4002	9p
IN4003	9p
IN4004	10p
IN4005	12p
IN4006	14p
IN4007	16p
IN4148	7p
2N696	25p
2N697	25p
2N698	25p
2N706	12p
2N706A	14p
2N708	15p
2N929	22p
2N930	20p
2N1132	25p
2N1302	30p
2N1303	30p
2N1304	30p
2N1305	30p
2N1306	30p
2N1307	30p
2N1308	30p
2N1309	30p
2N1613	30p
2N1711	30p
2N1890	60p
2N2146	15p
2N2147	90p
2N2160	80p
2N2217	25p
2N2218	25p
2N2219	25p
2N2222	20p
2N2222A	25p
2N2306	70p

2N2369A	50p
2N2477	30p
2N2646	50p
2N2846	£1·50
2N4904	25p
2N2905	30p
2N2906	25p
2N2907	25p
2N2926	13p
2N3053	25p
2N3055	50p
2N3232	£1·35
2N3525	£1·10
2N3553	£1·40
2N3643	30p
2N3702	12p
2N3703	12p
2N3704	12p
2N3705	12p
2N3706	12p
2N3707	12p
2N3708	14p
2N3709	14p
2N3771	£1·50
2N3772	£1·60
2N3792	£1·80
2N3794	30p
2N3819	35p
2N3820	55p
2N3823	70p
2N3866	85p
2N3904	22p
2N3905	25p
2N3906	25p
2N4014	80p
2N4036	62p
2N4037	44p
2N4058	14p
2N4059	14p
2N4060	12p
2N4061	12p
2N4062	12p
2N4126	18p
2N4286	25p
2N4287	25p
2N4288	27p
2N4289	30p
2N4290	25p
2N4291	32p
2N4302	45p
2N4444	£1·90
2N4871	35p
2N4903	£1·30
2N4919	90p
2N5069	£1·30
2N5191	96p
2N5192	£1·20
2N5194	£1·10
2N5195	£1·40
2N5245	45p
2N5296	55p
2N5298	50p
2N5457	35p
2N5458	35p
2N5459	40p
2N5485	55p
2N5490	55p
2N5555	65p
2N5777	40p

QTY. DISCOUNTS: 12+ 10%; 25+ 15%; 100+20%

S.C.R.s

CRS1/05	40p
CRS1/10	56p
CRS1/20	60p
CRS1/40	65p
CRS1/60	90p
CRS3/10	62p
CRS3/20	62p
CRS3/40	90p
CRS7/400	£1·00
CRS16/100	85p
CRS16/200	90p
CRS16/600	£1·60
C106B	45p
C106D	70p
40669	90p
TIC44	35p
2N4444	£1·90
BT10/500A	90p

BRIDGE RECTIFIERS

W02 1A 200V	38p
BY164 1·4A 200V	57p
MDA952/2 6A 100V	80p

ZENER DIODES

BZY88 Series 400mW

3·3V-33V, 5%	11p
1·5W range	25p
10W range	45p

L.E.D.

TIL209	20p
HP5082	28p
MA2082R	20p

L.D.R.

ORP12	70p

NE555 Timer 75p

TRIACS

TXL228B 8A 400V	85p
SC40D	£1·40
SC40E	£1·65
SC45D	£1·70
SC45E	£2·10
SC50D	£2·42
SC50E	£2·70
DIAC	25p

LINEAR I.C.s

LM304 Neg Voltage Reg.	£1·80
LM309K 5V. 1A. Voltage Reg.	£2·10
LM723C 2·37V. 150mA Voltage Reg.	75p
MFC4000 250mW Audio	75p
TBA800 5 Watt Audio	99p
709C Op Amp D.I.L./TO99	45p
741C Op Amp 8/14 D.I.L./TO99	25p
747C Dual Op Amp	£1·20
748C Op Amp D.I.L.	75p
ZN414 Radio I.C.	£1·25
TAD100 Radio I.C. inc. Filter	£1·90
CA3014	£1·55
CA3018	£1·00
CA3028	£1·20
CA3036	£1·00
CA3046	95p
CA3048	£2·35
CA3075	£1·60
CA3089E	£1·90
CA3090Q	£4·85
MC1303L	£2·20
MC1310P	£2·80
SN76660 EQ TBA120	65p

TO3 VOLTAGE REGULATORS

L005 5V 650mA
L036 12V 600mA
L037 15V 450mA £1·60 ea.

VEROBOARD

	0·1	0·15
2½ x 3¾	32p	23p
2½ x 5	35p	35p
3¾ x 3¾	35p	35p
3¾ x 5	40p	41p
17 x 2½	£1·05	79p
17 x 3¾	£1·43	£1·12
17 x 5	£1·84	—
PIN INS. TOOL	72p	72p
SP.F. CUTTER	52p	52p
100 PINS SS	30p	30p
100 PINS DS	30p	30p
500 PINS SS	£1·55	£1·55
500 PINS DS	£1·55	£1·55

BNC PLUGS at 35p each
UHF (N) PLUGS at 50p each.
Industrial, R.F., Military, Multiway to numerous to list, also a large stock of Multiway Cable to suit.
All the above are new in original packets. Please add 8% VAT P & P 30p.

POTENTIOMETERS

Linear or Log	Single	Double
Rotary Pots	20p	45p
Rotary Switched	30p	—

TTL (full stocks available)

Miniature Aerospace Synchros', Servo's, Stepping Motors by Muirhead, Rank, etc.
Muirhead Type D885-BC Synchronous Receiver £10·00
Servo Motor Type 11 M10 A6 £10·00
(Both in sealed containers)+8% VAT
AEG Telefunken High Performance Oscilloscope Tube, Type D14/131 125mm x 107mm face + accessories £25·00 each + 8% VAT. Data available.

PRICE + 8% VAT
Standard Choice of Colours

550–4mm Plug	10p each
551–4mm Socket	10p each
552–4mm Terminal	20p each
553–4mm Stackable Socket Plug	18p each
554–4mm In Line Socket	18p each
560–3mm Plug	10p each
561–3mm Socket	10p each
562–Spade Terminal	10p each
581–Phono Line Plug	25p each
582–Phono Line Socket	26p each

★★SPECIAL OFFERS★★

MINIATURE MAINS TRANSFORMER, PRI 240V. SEC. 12V. 100Ma Manuf.: Hinchley Size. 36 x 45 x 40mm. F.C. 53mm. Price 1·65p. 100 60p ea. 1,000 50p ea. 10,000 40p ea. 8% VAT.

MINIATURE MAINS TRANSFORMER, Primary 115/240v Sec. 18v/250 Ma at 80p ea. + VAT & postage 33p, 8% VAT.

MULLARD POT CORE TYPE FX2241 at 60p ea. + 33p p.p. 8% VAT.

24V D.C. SOLENOID by MAGNETIC DEVICES 60p each. 2¼ long x ⅝ x ⅞in. + 8% VAT.

240V. A.C. SOLENOID. Reversible operation; twin coil. Size approx. 2¾ x 1¼ x 1¾in. 90p.

30 unmarked OC71 transistors 75p

A MILLION PLUS METAL OXIDES always in stock.
TR4/TR5 at 3p each TR6 at 4p each TR8 at 7p each Manufacturers. Phone for quantity discounts.
Please state voltage required.

50 GE Diode OA47 equivalent. £1·00

8μF 600V WKG **PAPER CAPACITORS**, ideal for Strobe Constructors £1·50 each + 8% VAT + 33p post.
Many other values of **PAPER CAPACITORS** in stock. Phone for details.

PLESSEY AIRSPACED CAPACITORS to suit ¼in. spindle:
100pF Two Gang at 55p + 25% VAT
500pF Two Gang at 75p + 25% VAT

MULLARD TUBULAR CERAMIC UHF TRIMMERS (PROFESSIONAL)

Type		
092	0·8-2·2p	Price 10p ea.
801	0·8-2·2p	
991	0·5-1·3p	

QUANTITY DISCOUNTS PLEASE TELEPHONE

1000pF Feedthrough capacitor 5p ea.
Miniature tubular P.C. trimmers
3·5-13pF
6-30pF 10p ea.

Wire wounds from ½ watt–100 watts. Please phone for prices, etc.

Gold Flashed professional **TRANSISTOR SOCKETS.** To suit small signal TO18, etc. 30 for £1·00 + 8% VAT.

W. WOUND POTS 1 Ω–100K Ω at 30p each Colvern or Reliance styles + 25% VAT

VERO EDGE CONNECTOR 24 way ·1" pitch 30p each + 8% VAT. All the other sizes in stock.

SIEMENS VARLEY RELAY 4P C/O 700 Ω 24V 50p each.

PLESSEY RELAY 2 P C/O 6V operation 40p each.

MODERN DISC CERAMICS £1·00 a hundred, £8·00 a thousand + 25% VAT. Phone or write for list.

ACCESSORIES
DIL SOCKETS, 8 pin 14p, 14 pin 14p, 16 pin 14p. Mica Washers + 2 Bushes (TO3 or TO66) 4p.

METAL BOXES

ALUMINIUM BOXES IDEAL FOR VEROBOARD WITH BASE & P.K. SCREWS

	Long	Wide	High	
AB7	2¾"	5¼"	1½"	60p
AB8	4"	4"	1½"	60p
AB9	4"	2¾"	1½"	60p
AB10	4"	5¼"	1½"	60p
AB11	4"	2½"	2"	60p
AB12	3"	2"	1"	50p
AB13	6"	4"	2"	77p
AB14	7"	5"	2½"	90p
AB15	8"	6"	3"	£1·16
AB16	10"	7"	3"	£1·32
AB17	10"	4½"	3"	£1·10
AB18	12"	5"	3"	£1·32
AB19	12"	8"	3"	£1·80

ALUMINIUM BOXES WITH SLOPING TOP PANEL—IDEAL FOR PRE-AMPS, ETC., USING SLIDER CONTROLS

AB20 8" Long 9" Wide 3½" High at back £2·20
2" High at front 6" Slope to front
With P.K. Screws
AB21 As above but 10" long £2·20
AB22 As above but 12" long £2·60

★ ★ SPECIAL OFFERS ★ ★

MULTICORE CABLE. 20 way 7/0076 + Screen at 70p per yard+postage by weight.

REXINE COVERED ALUMINIUM CASES WITH SCREWS and FEET

RB1	6" x 4½" x 1¾"	£1·05	RB4	11" x 6" x 3"	£1·85
RB2	8" x 5" x 2"	£1·20	RB5	11" x 7½" x 3½"	£2·35
RB3	9" x 5" x 2½"	£1·35		+ 8% VAT	

DIN CONNECTORS
Plugs: 3 pin, 4 pin, 5 pin, 180°, 5 pin 240°, 6 pin, 7 pin and speaker plugs. All at one price 18p each
Chassis Sockets: to fit above (please state which) 15p each
Free Sockets: 3 pin, 5 pin, 180° and speaker plugs + 25% VAT 18p each

10 TURN TRIMPOTS by Bourns, Mec, Painton, etc. All values in stock. 50p each. Discount on quantity.

KOKUSAI MECHANICAL FILTER. 455 Kc/S, 6 Kc/S overall. Ideal for A.M. £5 each INC VAT. Postage 33p each.

COLVERN LTD. Ten turn Pot Type CLR 2402/9S.
5 K Ω at £1·50 each + 8% VAT
1·5K Ω at £1·50 each + 8% VAT

OMRON 11 PIN RELAY 240V A.C. 3P c/o 75p each+ 8% VAT.

SLEEVING 2000 pieces approx. size ¾" x 2mm. Price 50p +33p P&P+VAT 8%

We are open from 9.30 a.m.—6.00 p.m. Monday-Saturday.

We have the largest retail selection of components available. Phone or write if you are in difficulties obtaining a particular component.

C.O.D. service welcome. All mail order by return. Official orders welcome to Government establishments, Education Authorities, etc.

01-994-6275

PRACTICAL WIRELESS

VOL. 51 NO. 10
ISSUE 828
FEBRUARY 1976

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

EDITOR
Lionel E. Howes, G3AYA

ASSISTANT EDITOR
Eric Dowdeswell, G4AR

ART EDITOR Peter Metalli

PRODUCTION & NEWS EDITOR
Colin Riches

TECHNICAL SUB-EDITOR
Bill Tull

TECHNICAL ARTIST
Alan Martin

SECRETARIAL Jill Austin

ADVERTS MANAGER
01-634 4293 Roy Smith

CLASSIFIED ADVERTS
01-634 4301 Colin R. Brown

Published by IPC Magazines Ltd., Fleetway House, Farringdon Street, London EC4A 4AD. Tel. 01-634 4444

BINDERS
Binders (£1·90) and indexes 30p (inc. VAT) can be supplied by the Binders Dept at Carlton House, 66-68 Great Queen Street, London, WC2 5DD.

BACK NUMBERS
We regret that we are unable to supply back numbers of Practical Wireless. Readers are recommended to enquire at a public library to see copies. **Requests for specific back numbers** of *Practical Wireless* and *Television* can be published in our CQ Column.

NEWS & COMMENT

CONSTRUCTIONAL

OTHER FEATURES

TRANSFORMERS

ALL EX-STOCK—SAME DAY DESPATCH VAT 8%

MAINS ISOLATING
PRI. 120/240V. SEC. 120/240.
CENTRE TAP WITH SCREEN
115V or 240V Sec. only

Ref. No.	VA (Watts)	£	p & p £
07	20	3·77	0·58
149	60	4·69	0·72
150	100	5·33	0·85
151	200	8·54	1·12
152	250	10·32	1·41
153	350	12·47	1·41
154	500	14·33	1·61
155	750	21·94	BRS
156	1000	30·57	BRS
157	1500	34·89	BRS
158	2000	38·92	BRS
159	3000	61·48	BRS

12 and or 24 Volt
PRIMARY 240-250 VOLTS

Ref. No.	Amps 12v	Amps 24v	£	p & p £
111	0·5	0·25	1·54	0·28
213	1·0	0·5	1·86	0·58
71	2	1	2·41	0·58
18	4	2	2·97	0·72
70	6	3	4·43	0·72
108	8	4	5·09	0·85
72	10	5	5·50	0·85
116	12	6	5·80	0·97
17	16	8	7·48	0·97
115	20	10	10·91	1·61
187	30	15	14·20	1·41
226	60	30	17·67	BRS

30 VOLT RANGE
Prim. 200-240V
Sec. 0-12-15-20-24-30V

Ref. No.	Amps	£	p & p £
112	0·5	1·90	0·58
79	1·0	2·52	0·72
3	2·0	3·77	0·72
20	3·0	4·70	0·85
21	4·0	5·56	0·85
51	5·0	6·73	0·97
117	6·0	7·52	1·12
88	8·0	10·20	1·25
89	10·0	10·36	1·41

50 VOLT RANGE
Prim. 200-240V
Sec. 0-19-25-33-40-50V

Ref. No.	Amps	£	p & p £
102	0·5	2·71	0·58
103	1·0	3·55	0·72
104	2·0	4·95	0·85
105	3·0	6·10	0·97
106	4·0	7·98	1·12
107	6·0	12·71	1·25
118	8·0	13·63	1·61
119	10·0	17·75	BRS

60 VOLT RANGE
Prim. 200-240V
Sec. 0-24-30-40-48-60V

Ref. No.	Amps	£	p & p £
124	0·5	2·48	0·72
126	1·0	3·68	0·72
127	2·0	5·33	0·85
125	3·0	7·90	0·97
123	4·0	9·19	1·41
40	5·0	10·24	1·25
120	6·0	12·07	1·41
121	8·0	15·75	BRS
122	10·0	19·40	BRS
189	12·0	20·25	BRS

AUTO TRANSFORMERS

Ref No	VA (Watts)	Auto Tops	£	p & p £
113	20	0-115-210-240	1·75	0·51
64	75	,, ,,	3·05	0·72
4	150	0-115-200-220-240	4·33	0·72
66	300	,, ,,	6·11	0·85
67	500	,, ,,	9·36	1·25
84	1000	,, ,,	14·36	1·61
93	1500	,, ,,	19·02	BRS
95	2000	,, ,,	25·41	BRS
73	3000	,, ,,	36·84	BRS

CASED AUTO TRANSFORMERS
240V mains lead input & USA 2 pin outlets.
20VA £3·29 P&P £0·72 Ref 113W
150VA £6·37 P&P £0·85 Ref 4W
500VA £10·97 P&P £1·25 Ref 67W
1000VA £18·39 P&P BRS Ref 84W

SCREENED MINIATURES

Ref	mA	Volts	£	p&p p
238	200	3-0-3	1·62	39
212	1A, 1A	0-6, 0-6	1·93	46
13	100	9-0-9	1·56	25
235	330, 330	0-9, 0-9	1·64	25
207	500, 500	0-8-9, 0-8-9	2·02	51
208	1A, 1A	0-8-9, 0-8-9	3·07	58
236	200, 200	0-15, 0-15	1·56	25
214	300, 300	0-20, 0-20	2·03	58
221	700(DC)	20-12-0-12-20	2·38	58
206	1A, 1A	0-15-20, 0-15-20	3·63	72
203	500, 500	0-15-27, 0-15-27	3·15	72
204	1A, 1A	0-15-27, 0-15-27	4·14	72
S112	500	12, 15, 20, 24, 30	1·97	58

HIGH VOLTAGE
Mains Isolating
Prim. 200/220 or 400/440
Sec. 100/120 or 200/240

VA	Ref.	£	p & p £
60	243	4·37	0·97
350	247	10·93	1·41
1000	250	26·31	BRS
2000	252	44·12	BRS

PLUS

BRIDGE RECTIFIERS

50V	2A	35p
100V	2A	40p
200V	1A	45p
400V	4A	65p
600V	2A	50p
500V	10A(PM 7A6)	£2·35

P & P 15p. VAT 25%

TEST METERS
AVO 8 MK5 £55·88
AVO 72 £21·72
U4313* £13·85
U4315* £11·80
*(USSR) inc. steel carrying case
P & P £1·10. VAT 8%

ANTEX SOLDERING IRONS
15W £2·68 18W £2·45 25W £2·26
SOLDERING IRON KIT £3·61
STAND FOR ABOVE £1·13
P & P 25p. VAT 8%

MAGNETIC TO CERAMIC CARTRIDGE CONVERTOR
OPERATING VOLTAGE 20-45V
ONLY £2·65 *P & P 18p. VAT 25%*

INSTRUMENT CASES
(in two sections, black vinyl covered top and sides and bezel) *VAT 25%. P & P 25p*

Length	Width	Height	Price
8″	x 5¼″	x 2″	£1·25
11″	x 6″	x 3″	£1·62
6″	x 4¾″	x 1½″	£0·92
9″	x 5¼″	x 2½″	£1·39

POWER UNIT
CC12-05 Output Switched
3-4-5-6-7·S 5-9-12V at 500mA.
£4·08. *P & P 48p. VAT 25%*

HIGH QUALITY MODULES
3 Watt RMS AMPLIFIER £2·30
5 Watt RMS AMPLIFIER £2·65
10 Watt RMS AMPLIFIER £2·95
25 Watt RMS AMPLIFIER £3·95
PRE-AMP for 3-5-10W £4·03
PRE-AMP for 3-5-25W £13·20
POWER SUPPLIES 3-5-10W 88p
POWER SUPPLIES 25W £3·00
TRANSFORMER 3W £1·48
TRANSFORMER 5-10W £2·13
TRANSFORMER 25W £2·60
P & P Amps/Pre-Amps/Power Supplies 18p VAT 25%
P & P Transformers 37p VAT 25%

ELECTROSIL METAL OXIDE RESISTORS

Style	Tol.	Omic range	Price per 100
TR4	2%	10R-300K	£10·50
	5%	10R-300K	£6·00
TR5	2%	10R-470K	£2·50
	2%	510K-1M	£2·60
	2%	10R-47R	£16·50
TR6	2%	51R-510K	£7·50
	2%	560K-2M	£16·50
	2%	10R-91R	£18·50
TR8	2%	100R-100K	£10·50
	2%	110K-1M5	£17·50

Qty.—P.O.A. P. & P. 25p/100

PLEASE ADD VAT AFTER P. & P.
AUDIO ACCESSORIES & BARGAIN COMPONENT PAKS
SEMICONDUCTOR STOCKIST
Callers Welcome (Mon. Fri.) or send stamp for lists.

Barrie Electronics Ltd.
3, THE MINORIES, LONDON EC3N 1BJ
TELEPHONE: 01-488 3316/7/8
NEAREST TUBE STATIONS: ALDGATE & LIVERPOOL ST

RSC

DISCO SYSTEM
40 WATT

carr. £3

Consisting of Twin Turntable Console with Pre-Amp and built-in Power Output. Sep. vol. controls for each T/table. H/phone monitoring facilities. Sep. Bass and Treble controls. Mic. Vol. control. Neon Mains Indicator. Plus Pair 12″ 25w Spkrs. in matching Rexine covered cabinets.

£99·99

Terms: Dep. £15·99 and 18 fortnightly paymts. £5·38. (Total £112·83)

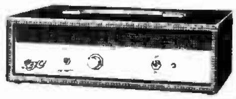
AS ABOVE LESS SPEAKERS £79·95
Terms: Dep. £9·00 and 18 fortnightly payments £4·61 (Total £91·98).

MOBILE DISCO CONSOLE £59·95

Carr. £3

MIC., JACK, PHONE JACK, MONITOR VOL. CONTROL. MONITOR SELECTOR DECK (1) Vol. Control. DECK (2) Vol. control, Mic. Vol. Control. Treble Control, Bass Control and ON/OFF Switch. Neon Indicator, Twin Turntables.
Terms: Dep. £7·95 and 18 fortnightly paymts. £3·33 Total £67·89.

POWER (SLAVE) AMPLIFIER 100 WATT



Suitable for use with above or other DISCO-Consoles.
Also for increasing output of lower-powered Amplifiers. **£45·00** Terms: Dep. £5·80 and 8 mthly payments of £5·80 (Total £52·20) carr. £1

TITAN GROUP/DISCO SPKRS

Imp. 8-15 Ω

Guaranteed for 5 years	Rec. Price	RSC Price
T12/35 12″ 35w	£13·00	£10·95
T12/60 12″ 60w	£20·00	£14·95
T12/100 12″ 100w	£35·00	£27·95
T15/70 15″ 70w	£27·00	£19·95
T15/100 15″ 100w	£38·50	£27·95
T18/100 18″ 100w	£42·50	£29·95

R.S.C. TRANSFORMERS, L.F. CHOKES & RECTIFIERS

FULLY GUARANTEED. Impregnated and Interleaved where necessary.
Primaries 200-250v. 50c/s. Screened ALL PRICES INCLUDE VAT

MIDGET CLAMPED TYPE
250v. 60mA 6·3v. 2a. £1·75
250-0-250v. 60mA 6·3v. 2a. £1·85

FULLY SHROUDED UPRIGHT MOUNTING
250-0-250v. 60mA 6·3v. 2a. 0-5-6·3v. 2a. £2·60
250-0-250v. 100mA 6·3v. 4a. 0-5-6·3v. 3a. £4·35
300-0-300v. 130mA 6·3v. 4a. C.T. 6·3v. 1a. for Mullard 510 Amplifier £5·20
350-0-350v. 100mA 6·3v. 4a. 0-5-6.3v. 3a. £4·35
350-0-350v. 150mA 6·3v. 4a. 0-5-6·3v. 3a. £5·20
425-0-425v. 200mA 6·3v. 4a. C.T. 5v. 3a. £9·85
425-0-425v. 200mA 6·3v. 4a. 6·3v. 4a. 5v. 3a. £10·00
450-0-450v. 250mA 6·3v. 4a. C.T. 5v. 3a. £10·45

TOP SHROUDED DROP-THROUGH TYPE
250-250v. 70mA 6·3v. 2a. 0-5-6.3v. 2a. £2·60
250-0-250v. 100mA 6·3v. 3·5a. £2·90
250-0-250v. 100mA 6·3v. 2a. 6·3v. 1a. £3·20
350-0-350v. 80mA 6·3v. 2a. 0-5-6·3v. 2a. £3·20
250-0-250v. 100mA 6·3v. 4a. 0-5-6·3v. 3a. £4·35
300-0-300v. 100mA 6·3v. 4a. 0-5-6·3v. 3a. £4·35
300-0-300v. 130mA 6·3v. 4a. 0-5-6·3v. 1a suitable for Mullard 510 Amp. £5·20
350-0-350v. 100mA 6·3v. 4a. 0-5-6·3v. 3a £4·35
350-0-350v. 150mA 6·3v. 4a. 0-5-6·3v. 3a. £5·20

FILAMENT OR TRANSISTOR POWER PACK
Type: 12v. 1a. £1·10. 6·3v. 1·5a £1·06, 6·3v. 2a. £1·10 6·3v. 3a £1·70, 6·3v. 6a. £2·60, 12v. 3a. or 24v. 1·5a. £2·60 0-9-18v. 1½a. £2·26, 0-12-25-42v. 2a. £3·19

AUTO (STEP UP/STEP DOWN) TRANSFORMERS
0-110/120v. 200-230-250v. 50-80w. £2·90 150 watts £5·20, 250 watts £6·37, 500 watts £9·84

CHARGER TRANSFORMERS
0-9-15v. 1½a. £2·03, 2½a. £2·26, 3a. £2·32, 5a. £2·84, 6a. £3·19, 8a. £3·48

OUTPUT TRANSFORMERS
Standard Pentode 5000 to 3 ohm, or 7000 ohm to 3 ohm £1·12. Push Pull 8 watts EL84 to 3 ohm or 15 ohm £1·68; Push Pull 10-12 watts 6v. 6 to 3 ohm or 15 ohm £2·61; Push Pull 10-12 watts to match 6v. 6 to 3, 5, 8 or 15 ohm £2·72; Push Pull EL84 to 3 or 15 ohm 10-12 watts £2·61; Push Pull Ultra Linear for Mullard 510 etc. £4·35;.

SELENIUM RECTIFIERS
F. W. (Bridged)
All 6/12 v. D.C. output. Max. A.C. input 18v. 1a 45p. 2a 57p. 3a 65p. 4a 95p. 5a £1·15.

L.F. CHOKES
150mA, 7-10H. 250 Ω £1·28: 100mA, 10H, 200 Ω £1·10: 60mA, 10H, 400 Ω 41p.

HI-FI ITEMS PREVIOUSLY ADVERTISED INCLUDING DISCOUNT LINES are still available

ALL R.S.C. PRICES INCLUDE VAT

MACK'S ELECTRONICS for

MOTOROLA McMos®

MC14001CP	Quad 2 Input NOR	18p
MC14002CP	Dual 4 Input NOR	20p
MC14011CP	Quad 2 Input NAND	18p
MC14015CP	Dual 4 Bit Static Shift Register	£1·26
MC14017CP	Decade Counter	£1·22
MC14021CP	8 Bit Static Shift Register	£1·25
MC14023CP	Triple 3 Input NAND	20p
MC14027CP	Dual J-K Flip-Flop	86p
MC14042CP	Quad Latch	£1·26
MC14046CP	Phase Locked Loop	£1·85
MC14049CP	Hex Invertor Buffer	61p
MC14510CP	BCD Up-Down Counter	£1·40
MC14511CP	BCD 7 Segment Latch Decoder Driver	£2·12
MC14528CP	Dual Monostable	96p

TEXAS TTL 74 SERIES

SN7400N	Quad 2 Input NAND	16p
SN7402N	Quad 2 Input NOR	16p
SN7404N	Hex Invertor	19p
SN7413N	Dual NAND Schmitt Triggers	32p
SN7447AN	BCD To 7 Segment Decoder Driver	95p
SN7472N	J-K Master-Slave Flip-Flop	26p
SN7473N	Dual J-K Master-Slave Flip-Flop	30p
SN7475N	8 Bit & 4 Bit Bistable Latches	50p
SN7490N	Decade Counter	50p
SN7493N	4 Bit Binary Counters	50p
SN7495N	4 Bit Right Shift Left Shift Registers	70p
SN74121N	Monostable Multivibrators	35p

MC 1310P — **MOTOROLA**
14 Pin DIL
Colless
Stereo
Decoder
£2·10

723 — **FAIRCHILD**
14 Pin DIL
var. voltage
Regulator
55p

741 — **FAIRCHILD**
8 Pin DIL
Op-amp
30p

LM 1303 — **NATIONAL SEMI-CONDUCTOR**
14 Pin DIL
Stereo
Pre-Amp
£1·65

MFC 4000 B — **MOTOROLA**
½ Watt
Audio Amp
75p

NE 555v. — **SIGNETICS**
8 Pin DIL
Timer
60p

ZN 414 — **FERRANTI**
Radio
Chip
£1·25

SPECIAL OFFER

"ECONOMACK"

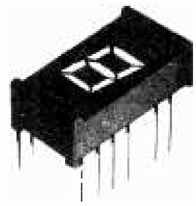
7 SEGMENT LED DISPLAYS

Common Anode

707E 0·3" 75p each
4 for £2·75

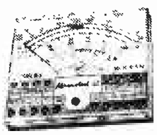
727E 0·5" Dual £1·65 each
4 for £6·00

747E Jumbo ·6" £1·95 each
4 for £7·00



MICROTEST 80

Measures only 90×70×18mm
Electronic Zero Ω
Amazing value at
£12·90
8 fields of measurement and 40 ranges



PRINTED CIRCUIT BOARD IS REMOVABLE WITHOUT SOLDERING

Volts D.C. 6 ranges: 100mV – 2V. – 10V. – 50V. – 200V. – 1000V. (20k Ω/V) 2% precision on DC and AC
Volts A.C. 5 ranges: 1·5V. – 10V. – 50V. – 250V. – 1000V. (4k Ω/V)
Amp. D.C. 6 ranges: 50μA – 500μA – 5mA – 50mA – 500mA – 5A.
Amp. A.C. 5 ranges: 250μA – 2·5mA – 25mA – 250mA – 2·5A
Ohms 4 ranges: Low Ω – Ωx1 – Ωx10 – Ωx100 from 1/10 dl Ω until 5 Mega Ω
V Output 5 ranges: 1·5V. – 10V. – 50V. – 250V. – 1000V
Decibels 5 ranges: +6dB, +22dB, +36dB, +50dB, +62dB
Capacity 4 ranges: 25μF – 250μF – 2500μF – 25,000μF

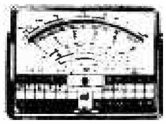
LM 380 N — **NATIONAL SEMI-CONDUCTOR**
14 Pin DIL
2 watt
Audio Amp
£1·20

LM 3900 N — **NATIONAL SEMI-CONDUCTOR**
14 Pin DIL
Quad Amp
69p

MM 5314 — **NATIONAL SEMI-CONDUCTOR**
24 Pin DIL
Clock Chip
£4·35

E 1109 — **EUROSIL**
24 Pin DIL
Clockchip
£7·78

SUPERTESTER 680R ICE



10 Fields-80 Ranges: 20,000 Ohm per Volt/sensitivity ● Fully screened against external magnetic fields ● Scale width and small case dimensions (128 x 95 x 32mm) ● Accuracy and stability (1% in D.C., 2% in A.C.) of indicated reading ● Simplicity and ease of use and readability ● Full ranges of accessories ● 1000 times overload ● Printed circuit board is removable without desoldering ● More ranges than any other meter.

£19·95

SEMICONDUCTORS

AC128	16p	BC338	16p
AD161 } AD162 }	*£1·00	BC347	13p
		BC348	12p
AF114	25p	BC349	12p
AF116	25p	BC350	15p
AF239	45p	BC351	15p
BC107	12p	BC352	15p
BC108	12p	BCY71	21p
BC147	10p	BD131	40p
BC148	10p	BDV55	£1·85
BC149	10p	BF194	10p
BC157	10p	BF195	10p
BC158	8p	BF196	12p
BC159	9p	BF197	12p
BC172B	12p	BFX29	25p
BC237	15p	BFY51	20p
BC238	12p	BSX60	60p
BC239	15p	BU102	£1·85
BC261A	18p	BU104	95p
BC307	15p	MJE3055	70p
BC308	13p	OC28	60p
BC309	15p	OC71	15p
BC317A	18p	TIP29A	45p
BC318B	18p	TIP41A	97p
BC319C	20p	TIP42A	£1·05
BC320A	20p	2N1302	20p
BC321A	20p	2N1304	25p
BC322B	20p	2N2243	70p
BC327	20p	2N2369	12p
BC328	18p	2N3055	70p
BC337	18p	2N3553	£1·10

*'matched pair'

SPECIAL OFFER

PROFESSIONAL QUALITY LOW NOISE CASSETTES (Screw case)

C60 35p each Ten for £3·00
C90 45p each Ten for £4·00

AMTRON KITS

UK105/C	FM Microtransmitter	£8·07
UK220	Signal Injector	£3·53
UK230	AM/FM Antenna Amplifier	£4·16
UK285	UHF/VHF Antenna Amplifier	£8·87
UK302	4Ch. Radio Control Transmitter	£17·50
UK345/A	Superhet R/C Receiver	£8·81
UK325	GXC 2Ch. R/C Splitter 1000Hz. & 2000Hz.	£8·34
UK330	GXC 2Ch. R/C Splitter 1500Hz. & 2500Hz.	£8·34
UK555	Radio Control Strength Meter	£9·65
UK780	Electronic Metal Detector	£11·65
UK875	Capacitive Discharge Electronic Ignition Kit Neg. Earth	£17·33

MACK'S ELECTRONICS

283 Edgware Road, London W2.
Tel. 01-262 8614
Hours of business 9.30 - 6.00
Monday to Saturday Callers welcome
ALL PRICES INCLUDE VAT PLEASE ADD 20p P & P

Send SAE for FREE LISTS

NEW MULLARD & MAZDA VALVES

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

EXPRESS POSTAGE
12p for 1 Valve. Each additional Valve add 2p in UK

DM70	0·69	EF80	0·53	PCC84	0·63	PL504	1·02	30C15/PCF800	1·22
DY86/7	0·53	EF83	1·10	PCC85	0·90	PL508	1·30	30C17	1·29
DY802	0·53	EF85	0·53	PCC88	0·98	PL509	1·77	30C18/PCF805	1·29
EABC80	1·16	EF86	1·30	PCC89	0·73	PL802	2·00	30F5/PF818	1·35
EB91	0·73	EF89	1·30	PCC189	0·91	PY33	0·73	30FL1/PCE800	0·98
EBC81	0·89	EF91	1·35	PCF80	0·63	PY81/800	0·56	30FL2	1·02
EBF80	0·63	EF92	1·51	PCF82	1·37	PY82	0·70	30FL12	1·44
EBF83	0·66	EF95	1·63	PCF86	0·73	PY88	0·63	30FL14	1·20
EBF89	0·50	EF183	0·69	PCF200	1·13	PY500A	1·15	30L1/PCC84	0·63
EC86	0·82	EF184	0·69	PCF201	1·13	PY800	0·56	30L15/PCC805	1·35
EC88	0·86	EH90	0·91	PCF801	0·73	PY801	0·56	30L17	1·12
EC90	0·94	EL34	1·06	PCF802	0·78	U26	1·22	30P4MR	1·63
EC97	0·69	EL36	1·15	PCF806	0·73	U191	1·17	30P1Z/PC801	1·22
ECC81	0·54	EL84	0·53	PCH200	1·30	U193	0·56	30P19/PC802	1·06
ECC82	0·53	EL86	1·06	PCL82	0·63	UABC80	1·01	30PL1/PCL801	1·35
ECC83	0·53	EL95	0·78	PCL83	0·73	UBC81	0·80	30PL13/PCL800	1·47
ECC84	0·63	ELL80	2·81	PCL84	0·69	UBF89	0·65	30PL14/PCL88	1·72
ECC85	0·78	EM81	1·24	PCL85	0·72	UCC85	0·66	30PL15	1·44
ECC88	0·91	EY51	0·89	PCL86	0·73	UCH81	1·30		
ECC189	0·77	EY86/87	0·53	PCL805/850	0·73	UCL82	0·78		
ECF80	0·63	EY88	0·81	PD500	2·11	UCL83	0·78		
ECF82	0·90	EZ80	0·63	PFL200	0·91	UL84	1·03		
ECF86	0·76	EZ81	0·53	PL36	1·06	UY85	0·63		
ECH81	1·29	GY501	1·30	PL81	0·91	6/30L2/ECC804	1·20		
ECH83	1·06	GZ34	0·91	PL81A	1·06	6F23/EF812	1·16		
ECH84	1·17	PC86	1·05	PL82	0·48	30C1/PCF80	0·63		
ECL80	0·78	PC88	1·05	PL83	1·29				
ECL82	0·69	PC97	0·53	PL84	0·78				
ECL83	0·72	PC900	0·65	PL500	1·02				
ECL86	0·73								

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	0·75	EF39	1·25	KTW61	1·50	PY83	0·50	6F28	0·75
AZ31	0·60	EF80	0·35	MU14	1·00	PY88	0·63	6J5M	0·65
CBL31	1·40	EF85	0·45	N78	5·00	PY500	1·10	6J5G	0·45
CL33	1·50	EF86	0·50	OA2	0·45	PY81/800	0·50	6J6	0·35
CY31	0·60	EF89	0·35	OB2	0·45	PY801	0·55	6J7G	0·30
DAF91	0·40	EF91	0·40	PC86	0·65	SP41	3·00	6J7M	0·65
DAF96	0·60	EF92	0·50	PC88	0·65	SP61	0·85	6K6GT	0·80
DCC90	1·85	EF95	0·45	PC97	0·55	T41	1·00	6K7G	0·35
DF91	0·40	EF98	0·80	PC900	0·55	U14	0·75	6K7M	0·45
DF96	0·60	EF183	0·40	PCC84	0·45	U25	1·00	6K8G	0·45
DK91	0·50	EF184	0·40	PCC88	0·62	U26	0·85	6K8M	0·70
DK92	1·00	EL32	0·60	PCC89	0·55	U191	0·75	6K25	1·00
DK96	0·75	EL33	3·00	PCC189	0·65	UABC80	0·40	6L6G	1·25
DL92	0·50	EL34	0·70	PCF80	0·40	UAF42	0·75	6Q7G	0·40
DL94	0·48	EL36	0·60	PCF82	0·42	UBC41	0·60	6Q7M	0·60
DL96	0·55	EL37	2·50	PCF86	0·65	UBC81	0·50	6SL7GT	0·55
DY86	0·45	EL41	0·90	PCF801	0·60	UBF80	0·50	6SN7GT	0·55
DY87	0·45	EL42	1·65	PCF802	0·55	UBF89	0·50	6SQ7GT	0·40
DY802	0·47	EL84	0·35	PCF805	0·90	UCC85	0·50	6U5G	1·50
EABC80	0·88	EL95	0·60	PCF806	0·80	UCH42	0·80	6V6G	0·30
EAF42	0·70	ELL80	2·00	PCF808	1·00	UCH81	0·50	6V6GT	0·60
EB91	0·30	EM80	0·55	PCL82	0·45	UCL82	0·40	6X4	0·45
EBC33	1·00	EM81	0·60	PCL83	0·70	UCL83	0·70	6X5G	0·45
EBC41	0·75	EM84	0·40	PCL84	0·50	UF41	0·75	6X5GT	0·55
EBC81	0·40	EM85	1·00	PCL85	0·60	UF89	0·50	7B6	0·80
EBF80	0·40	EM87	1·00	PCL86	0·50	UL41	0·85	7B7	0·80
EBF83	0·40	EY51	0·45	PCL805/85	0·60	UL84	0·50	7C5	1·80
EBF89	0·32	EY86	0·45	PD500	1·50	UY41	0·55	7C6	1·00
EBL31	2·00	EZ40	0·60	PEN45	0·85	UY85	0·45	7H7	0·80
ECC81	0·45	EZ41	0·75	PL36	0·62	VR105/30	0·40	7R7	0·80
ECC82	0·38	EZ80	0·30	PL81	0·55	VR150/30	0·45	7S7	2·25
ECC83	0·38	EZ81	0·31	PL82	0·50	1R5	0·50	7Y4	0·80
ECC84	0·35	GY501	0·90	PL83	0·50	1S5	0·40	12AT6	0·45
ECC85	0·45	GZ30	0·65	PL84	0·50	1T4	0·40	12AT7	0·45
ECC88	0·50	GZ32	0·65	PL500	0·85	3S4	0·50	12AU6	0·50
ECH35	1·50	GZ34	0·75	PL504	0·85	3V4	0·85	12AU7	0·38
ECH42	0·85	GZ37	1·25	PL508	0·90	5R4GY	1·00	12AX7	0·38
ECH81	0·35	HN309	1·50	PL509	1·55	5U4G	0·55	12BA6	0·50
ECH83	0·50	KT61	2·50	PL802	1·25	5Y3GT	0·65	12BE6	0·60
ECL80	0·60	KT66	2·95	PX25	3·50	5Z4G	0·65	30C1	0·40
ECL82	0·42	KT81 (7C5)	1·80	PY33	0·63	6/3OL2	0·90	30C15	1·00
ECL83	0·75	KT81	1·75	PY81	0·50	6AK5	0·45	30C17	1·00
ECL86	0·55	KT88	3·25	PY82	0·45	6AM5	1·00	30C18	0·90
ECLL800	3·50					6AQ5	0·50	30F5	1·00
EF37A	1·20					6AS7G	1·00	30FL1	1·00
						6AT6	0·60	30FL2	1·00
						6AU6	0·40	30FL14	1·00
						6BA6	0·38	30L15	0·95
						6BE6	0·45	30L17	0·95
						6BH6	0·75	30P4MR	1·30
						6BJ6	0·75	30P12	1·00
						6BQ7A	0·55	30P19	0·95
						6BR7	1·20	30PL1	0·95
						6BS7	1·40	30PL13	1·10
						6BW6	1·00	30PL14	1·10
						6BW7	1·00	35W4	0·60
						6C4	0·40	35Z4GT	0·70
						6CD6G	1·60	50CD6G	1·20
						6CH6	1·50	807	1·00
						6CW4	3·00	813ITT	14·00
						6F23	0·90	813USSR	6·00
						6F25	1·00	866A	1·20

TRANSISTORS-INTEGRATED CIRCUITS

EXPRESS POSTAGE
12p per order in UK

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	0·07	BD124	0·65	OA91	0·07	ZTX500	0·13	2N2904	0·20
AAZ13	0.12	BD131	0·42	OA200	0·08	ZTX501	0·15	2N2904A	0·25
AAZ15	0·10	BD132	0·50	OA202	0·06	ZTX503	0·16	2N2905	0·22
AC107	0·51	BF115	0·20	OC16	1·00	ZTX531	0·25	2N2905A	0·25
AC126	0·25	BF167	0·25	OC20	2·00	ZTX550	0·18	2N2906	0·20
AC127	0·25	BF173	0·28	OC23	1·25	1N914	0·06	2N2926	0·12
AC128	0·15	BF179	0·33	OC25	0·40	IN4001	0·06	2N3053	0·18
AC176	0·26	BF180	0·36	OC28	0·66	IN4002	0·07	2N3055	0·45
AC187	0·21	BF181	0·35	OC35	0·55	IN4003	0·08	2N3525	0·91
AC188	0·20	BF194	0·10	OC36	0·60	IN4004	0·08	2N3614	0·65
ACY21	0·35	BF195	0·13	OC42	0·40	IN4005	0·10	2N3615	0·65
ACY39	0·75	BF197	0·15	OC44	0·20	IN4006	0·12	2N3702	0·11
AD140	0·50	BF200	0·32	OC45	0·20	IN4007	0·12	2N3703	0·12
AD149	0·50	BFS61	0·25	OC71	0·25	IN4009	0·06	2N3704	0·14
AD161	0·44	BFS98	0·25	OC72	0·28	IN4148	0·06	2N3705	0·15
AD162	0·44	BFW10	0·61	OC76	0·30	1S921	0·07	2N3706	0·11
AF115	0·25	BFX29	0·28	OC77	0·55	IS2033	0·20	2N3707	0·13
AF116	0·25	BFX88	0·24	OC81	0·29	IS2051A	0·20	2N3708	0·07
AF117	0·24	BFY50	0·20	OC81D	0·28	IS2100A	0·20	2N3709	0·10
AF186	0·48	BFY51	0·20	OC81Z	0·45	IS3010	0·25	2N3710	0·11
AF239	0·44	BFY52	0·20	OC83	0·35	2N696	0·15	2N3711	0·11
ASY27	0·33	BR100	0·40	OC140	1·14	2N697	0·16	2N3819	0·28
ASY28	0·25	BY100	0·27	OC170	0·30	2N706	0·10	2N3820	0·50
BA102	0·25	BY126	0·14	OC171	0·30	2N706A	0·12	2N3823	0·50
BA115	0·10	BY127	0·15	OC200	0·75	2N1131	0·25	2N3903	0·15
BC107	0·14	BZX61 series	0·20	OC201	1·50	2N1132	0·24	2N3904	0·20
BC108	0·13	BZY88 series	0·10	OC202	1·50	2N1302	0·18	2N3905	0·25
BC109	0·12	CR81-05	0·35	OC203	0·75	2N1303	0·18	2N3906	0·25
BC113	0·15	CR81-40	0·50	OCP71	1·20	2N1304	0·22	2N4058	0·15
BC117	0·21	CR83-05	0·40	ORP12	0·60	2N1305	0·22	2N4059	0·10
BC143	0·30	CR83-40	0·65	ORP60	0·55	2N1306	0·28	2N4060	0·13
BC147	0·10	MJE340	0·47	TIC44	0·29	2N1307	0·28	2N4061	0·13
BC148	0·08	MJE370	0·68	TIC226D	1·50	2N1308	0·28	2N4062	0·14
BC169C	0·15	MJE520	0·65	TIL209	0·20	2N1309	0·30	2N4289	0·30
BC182	0·12	MJE2955	1·27	ZTX107	0·12	2N1613	0·21	3N125	1·75
BC182L	0·12	MJE3055	0·75	ZTX108	0·10	2N1614	0·45	3N141	0·81
BC184L	0·13	MPF102	0·40	ZTX300	0·13	2N2147	0·78	40360	0·40
BC338	0·15	MPF103	0·36	ZTX301	0·14	2N2160	0·78	40361	0·45
BCY32	0·85	MPF104	0·65	ZTX302	0·18	2N2369A	0·16	40362	0·40
BCY33	0·88	MPF105	0·36	ZTX304	0·24	2N2646	0·50	40430	0·85
BCY34	0·45	NKT404	1·00						
BCY70	0·18	OA5	0·72						
BCY71	0·22	OA10	0·40						
BCY72	0·15	OA79	0·10						
BCZ11	0·65	OA81	0·18						
BD121	1·00								

SN7400	0·16	SN7428	0·40	SN7486	0·47	SN74145	1·26	SN74192	2·00
SN7401	0·16	SN7430	0·16	SN7490	0·55	SN74150	1·75	SN74193	2·00
SN7402	0·16	SN7433	0·37	SN7491AN	1·00	SN74151	1·00	SN74194	1·30
SN7403	0·16	SN7437	0·37	SN7492	0·70	SN74154	2·00	SN74195	1·10
SN7404	0·26	SN7438	0·37	SN7493	0·70	SN74155	1·00	SN74196	1·20
SN7405	0·22	SN7440	0·22	SN7494	0·80	SN74156	1·00	SN74197	1·20
SN7406	0·42	SN7441AN	0·92	SN7495	0·80	SN74157	0·95	SN74198	2·77
SN7407	0·42	SN7442	0·79	SN7496	0·95	SN74170	2·52	SN74199	2·52
SN7408	0·28	SN7450	0·16	SN7497	3·37	SN74174	1·57		
SN7409	0·28	SN7451	0·16	SN74100	1·89	SN74175	1·10		
SN7410	0·16	SN7453	0·16	SN74107	0·45	SN74176	1·26		
SN7411	0·25	SN7454	0·16	SN74110	0·58	SN74190	2·00		
SN7412	0·30	SN7460	0·16	SN74118	0·90	SN74191	2·00		
SN7413	0·36	SN7470	0·36	SN74119	1·68				
SN7416	0·36	SN7473	0·41	SN74121	0·50				
SN7417	0·36	SN7474	0·42	SN74122	0·70				
SN7420	0·16	SN7480	0·60	SN74123	1·00				
SN7422	0·25	SN7483	1·10	SN74141	0·90				
SN7423	0·37								

DIL SOCKETS 14 pin 15p
16 pin 17p

VAT

To be added to all orders
VALVES & TRANSISTORS 25%
INTEGRATED CIRCUITS 8%

THIS MONTH'S

- OSCILLOSCOPE TUBES
  Types CV 1526,
  DG 7-5, VCR 139A
  All at £8·00 each, +p & p 25p.
  Add 8% VAT

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.

RTVC

FOR SPEAKERS AT FANTASTIC REDUCTIONS

ELIZABETHAN STEREO TUNER AMPLIFIER

This compact Tuner Amplifier gives you full medium wave and V.H.F. coverage and FM stereo. With inputs for your turntable and tape recorder. It has rotary tuning, Volume, Balance, Bass and Treble controls and push button selection switches for Phono/tape FM Stereo, FM mono, Medium wave and A.F.C. has built-in stereo beacon and switched headphone socket.

Technical Specifications
15 transistors, 11 diodes, integrated circuit.
Power output 8 watts. Size of tuner amplifier: 4" x 10" x $15\frac{1}{2}$" approx. Finished in selected rosewood veneer with brushed aluminium front panel and matching controls.

£29.00
+p & p £1.50

NEW!

THE 'COMPACT'

EASY BUILD SPEAKER KIT

A compact bookshelf speaker system giving a high electro accoustic efficiency for the low powered amplifier.
The professional finish can be obtained with the minimum of tools, the infinite baffle type enclosures come ready mitred and professionally finished, simply apply glue, fold up around baffle board, and fix together with masking tape till glue dries.
The cabinet measures 12"x9"x5" deep approx finished in simulated teak, incorporating a quality 7"x4" elliptical speaker, power handling 4 watts, flux density 30,000 maxwells, impedance 8-15 ohms nominal, voice coil dia $\frac{3}{4}$" magnet size $2\frac{7}{8}$" approx.

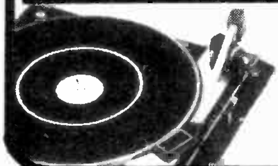
£6.00
pair inclusive.P & P £1.70

EASY TO BUILD SPEAKER KITS

These superb simulated teak-finished speaker kits have been specially designed by RT-VC for the cost-conscious hi-fi enthusiast who wants top quality speakers but doesn't want to spend the earth. Built to EMI's exacting specification, these new RT-VC speaker kits (350 type kit) incorporate 13" × 8" woofer, $3\frac{1}{4}$" tweeter and matching crossover.
Easily put together with just a few basic tools.
Specification (each speaker): Impedance 8 ohms. Power handling 15 watts RMS (30 watts peak). Response 20—20,000 Hz. Size 20" × 11" × $9\frac{1}{2}$" approx. Comparable built units (EMI LE3) sold elsewhere for over £45 pair.

£22.00 pair complete +£5.20 p & p.
Complete with crossover Components and circuit diagram

BSR DECKS WITH PLINTHS AT FANTASTIC REDUCTIONS



MP 60 Type *(illustrated)* *Less Cartridge*	**£16·00**	p & p £1·50
C141 *(not illustrated)* *Auto. with Cue Fitted Stereo Cartridge*	**£12·00**	p & p £1·50
C123 *(not illustrated)* *Auto. with Stereo Crystal Cartridge*	**£10·00**	p & p £1·50

All plinths finished in matching Teak veneer.

EMI 350 KIT

£7.25 +£1.20 p & p.
Complete with crossover Components and circuit diagram

System consists of a 13" × 8" approx. woofer with a 3" tweeter, crossover components and circuit diagram. Frequency response: 20 Hz to 20 KHz. Power handling 15 watts RMS into 8 ohms. (Peak 30 watts.)

RTVC*

VISCOUNT IV STEREO SYSTEM

NEW!

System 1a. £69.00

The new 20+20 watt Stereo Amplifier incorporating the latest silicon transistor solid state circuitry, the RT-VC VISCOUNT IV gives you a powerful 20 watts RMS per channel into 8 ohms. Superb teak-finished cabinet, with anodised fascia to harmonise with any decor. Polished trim and knobs.
The VISCOUNT IV has a comprehensive range of controls — volume, bass, treble, balance, mono/stereo, mode selector, and scratch filter.
Front panel socket for stereo headphones. And a host of sockets at the rear — for left and right speakers, tape recorder, auxiliary, tuner, disc and microphone.
SPECIFICATION: 20 watts RMS per channel 40 watts peak. Suitable 8-15 ohms speakers. Total distortion @ 10 watts better than 0.2%. Six switched inputs: 1. Magnetic P.U. — 3 millivolts @ 47 K ohms (R.I.A.A.); 2. Crystal/ceramic P.U. — 50 millivolts @ 50 K ohms (R.I.A.A.); 3, 4, 6. Tape Tuner/Aux. — 140 millivolts @ 50 K ohms (flat frequency response); 5. Microphone — 3 millivolts @ 50 K ohms (flat frequency response).
CONTROLS: Push button ON/OFF, stereo/mono, scratch filter, 6 position rotary selector. Individual rotary controls for treble, bass, balance and volume. Headphone socket, tape out socket. Aux. mains output. **Frequency response:** 25 Hz to 25 KHz @ full rated output. **Signal to noise ratio:** better than −50 dB on all inputs. **Tone control range:** Bass ±15 dB @ 50 Hz; Treble ±12 dB @ 10 KHz. **Power requirements:** 200-250V A.C. mains @ 60 watts. **Approx. size:** $15\frac{1}{4}$" × 3" × 10".
MP60 type deck with magnetic cartridge, de luxe plinth and cover.
Two Duo Type IIa matched speakers — Enclosure size approx. $19\frac{1}{2}$" × $10\frac{3}{4}$" × $7\frac{3}{4}$" in simulated teak. Drive unit 13" × 8" with 3" tweeter. 15 watts handling. 30 watts peak.
Complete System with these speakers £69.00 +£6.50 p & p.

System 2. £85.00

Viscount IV amplifier (As System 1a)
MP60 type deck (As System 1a)
Two Duo Type III matched speakers — Enclosure size approx. 27" × 13" × $11\frac{1}{2}$". Finished in teak simulate. Drive units 13" × 8" bass driver, and two 3" (approx.) tweeters. 20 watts RMS, 8 ohms frequency range — 20 Hz to 18,000 Hz.
Complete System with these speakers £85.00 +£7.60 p & p.

PRICES: SYSTEM 1a

Viscount IV R103 amplifier	£27.50+£1.90 p & p.
2 Duo Type IIa speakers	£30.00+£6.50 p & p.
MP60 type deck with Mag. cartridge de luxe plinth and cover	£22.00+£3.30 p & p.
Total if purchased separately:	£79.50

Available complete for only: £69.00 +£6.50 p & p.

PRICES: SYSTEM 2

Viscount IV R103 amplifiar	£27.50+£1.90 p & p.
2 Duo Type III speakers	£46.00+£7.50 p & p.
MP60 type deck with Mag. cartridge de luxe plinth and cover	£22.00+£3.30 p & p.
Total if purchased separately:	£95.50

Available complete for only £85.00 +£7.60 p & p.

Scotland and the Orkneys P & P Surcharge
System 1a £1.75 System 2 £3.50

DIGITAL DISPLAY

IT certainly seems that the era of the quartz controlled digital wrist watch is with us and the price war is going to make them a much more attractive proposition than their mechanical counterpart. Added to their apparent advantages are their novelty value, the "one upmanship" value to their current owners (their status symbol will not last for much longer) and the fact that the constructor with reasonably average ability can make his own from the several attractively priced kits that are now available.

We wonder, however, if the excitment over these devices is a little premature. In their present form are they really a good substitute for their mechanical cousins? We think that the present generation of digital watches leaves a lot to be desired and while we admire the technological achievements in bringing this revolution about we hope that in the next year or so matters might be improved.

For example, do they really tell us the time we require? When we look at our present day wrist watches we are usually making a mental calculation as to "how long we have to wait to catch a train" or "if the bus went five minutes ago what time should we return if they run every 45 minutes". We seldom need to be told the precise time and would rather have an indication of the time difference between now and a future or past event. The conveniently divided face of a conventional watch shows us, at a glance, in multiples of five minutes exactly what we are after without any form of arithmetic calculation—15 minute periods are even easier to assess. On the other hand a digital watch requires us to carry out a definite arithmetic calculation which, although simple, is open to error. If you haven't got a digital watch make a mental note to check elapsed time on one of the public digital displays at a railway station and then see how much easier it is with your antique analogue display wrist watch

We see two possible solutions to this problem. The first most obvious one is a totally different type of display which simulates a conventional watch face. Admittedly the technical problem is enormous and, at the present time the cost would be prohibitive. One would require at least sixty positions of display elements running radially round the face and then one should be able to select the length and positions of any two elements to depict the hour and minute hands. The numerical value of the positions round the clock face could be engraved in the case material or, conceivably, these could be made to light up as miniature LED displays. A second type of display which might be more practicable in the light of current manufacturing costs is a couple of "Line of Light" displays each one made up of 60 dots.

Our second solution would be to make more use of the logic capabilities of LSI integrated circuits. Rather than build calculators into a wrist watch would it not be better to have a chip which will accept a specified time from a miniature keyboard? The display would immediately show the difference in time (either positive or negative) between now and then. While we like the arithmetic nicety of our second solution we cannot, honestly, see it catching on because of the inconvenience factor.

It would be interesting to hear if readers have any views on this subject and at the same time it would be nice if someone could explain to us the value of a digital wrist watch that automatically compensates for leap years on a four year cycle when the batteries run down every year!

LIONEL E. HOWES—*Editor*

NEWS...

PRACTICAL WIRELESS MAGAZINE REQUIRES A TECHNICAL EDITOR

If you feel that you are the person to fill this challenging and rewarding position write to the **Editor, Practical Wireless, IPC Magazines Ltd., Fleetway House, Farringdon Street, London EC4 4AD.**

Radio Licence Fees

THE Wireless Telegraphy (General Licence Charges) (Amendment) Regulations 1975 were laid before Parliament to apply from 1 December, 1975, an 'across-the-board' increase of 60% to all fees for the standard radio licences, except broadcast receiving licences. Fees for standard radio licences have remained unchanged since 1968.

Standard-form licences are specified in the Schedule to the Wireless Telegraphy (General Licence Charges) Regulations 1968. They include licences which authorise the transmission and reception of radio by ships, aircraft, mobile radio-telephones, radio-microphones, radio-paging devices, radars, radio beacons, radio amateurs and model control.

The Home Office states that the increases are now necessary because the income from fees is no longer sufficient to cover the cost of licensing and administering the particular uses of radio.

The new rates are as follows: Private Mobile Radio £6·50 for the first two stations and £3·60 for each subsequent station. Ships £5·50; Aircraft £4; Model Control £2·40 (5 years); Amateur £4·80; Induction Communication £4·80 (5 years); Induction Communication (with return speech) £6·50; Radio Paging £7·20; Radio Paging (27MHz) (with return speech) £16; Radio Paging (UHF systems) (with return speech) £26·40; and Radio Microphone £4·80.

BARRIE Electronics telephone number was printed incorrectly in both the December and January issues. It should have read 01-488-3316/7/8. We apologise for any inconvenience caused.

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

Oui Oui

THE next Paris Components Show, or to give it the correct title, Le Salon des Composants Electroniques, will be held at the Parc des Expositions, Porte de Versailles from April 5th to 10th, 1976.

Eagle Laboratories

THE TEST and development laboratories at Eagle International of Wembley have recently been acoustically treated and re-equipped with new Bruel & KJaer instruments at a cost of £12,000. These instruments are the standard for acoustic and electro-acoustic measurements anywhere in the world.

Eagle International are manufacturers and distributors of high-fidelity, in-car, public address, intercom and test equipment and a wide range of electrical and electronic components. The new laboratory instruments will enable the most accurate measurements of frequency response, signal-to-noise ratio, distortion, etc., to be made on amplifiers and tape recorders. Comparison measurements can be made on loudspeakers and microphones. The effect of acoustic treatment in the laboratories has been to reduce the reverberation time at 1kHz from 2·0 seconds to less than 0·2 seconds.

Picture shows Percy Gander, Technical Director of Eagle International, testing an Eagle A2006 Amplifier on the Bruel & KJaer instruments in the re-equipped laboratories at Precision Centre, the company's Wembley headquarters.

Heard but not seen

3M has recently put into full-scale operation its new tape manufacturing facility at Gorseinon, near Swansea. The £3½m scheme includes an automatic cassette assembler known as the 'Snowflake', and a number of cassette winders known as 'Raindrops'. These, coupled with the firm's tape coating machine, are now producing a range of cassettes which exhibit marked improvements over the previous hand-assembled models.

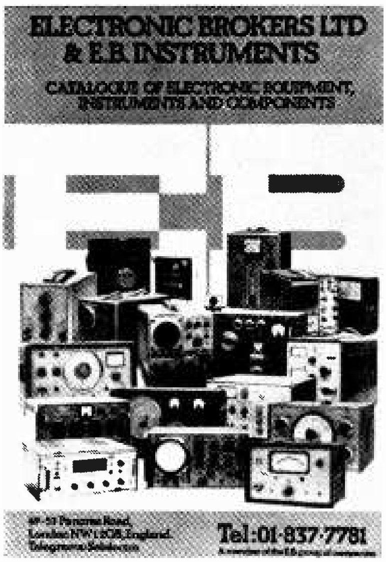
Scotch Dynarange, New High Energy, Chrome and dual-layer Classic cassettes are now all manufactured on 3M's automatic assembly lines. The mechanics are common to each range within the Scotch family . . . . 3M's Recording Materials Division is so confident about the trouble-free operation of its cassettes that it is currently calling them "The Jambusters" in a national retail campaign which highlights their jam-free properties.

Detailed improvements in Scotch cassette design include the following: (1) Larger, permanently fixed one-piece pressure pad for better head-to-tape contact and signal uniformity; (2) Posi-Trak backing—a tape back-coating process for a smooth wind and reduction of static-induced dust attraction which can lead to annoying drop-outs (3) Fixed polished metal guideposts which eliminate the mechanical movement associated with nylon wheels and so reduce wow and flutter.

In addition, 3M claims that its ultrasonic welding technique produces a warp-free housing for the tape. The company points out that the 'Snowflake' machine will accept only components that are made to very fine tolerances, and will in fact physically reject any part which is below specification. No fewer than 25 quality control checks are made during cassette manufacture, including the tests made during manufacture of the tape itself.

Any Scotch cassette found to be faulty will be replaced immediately by the retailer under 3M's no quibble guarantee. *Recording Materials Division, 3M United Kingdom Limited, 380-384 Harrow Road, London W9 2HU Tel: 01-286 6044.*

E.B. Catalogue



If you would like a copy of this instrument catalogue send 50p (UK) £1 (overseas) to Electronic Brokers Ltd., 49-53 Pancras Road, London NW1 2QB. *It will prove invaluable to schools, colleges, universities and covers items from Transfer Oscillators to Pen Recorders and Distortion Measuring Equipment to Multimeters.*

High and Mighty

MEMBERS of the South West Face British Everest Expedition took with them a Hacker Super Sovereign RP75MB five-band receiver. It was supplied by Hackers in a special weather protective casing.

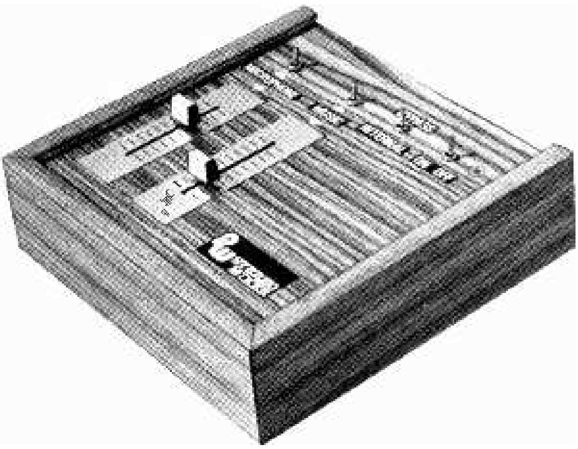
Semicomps move

SEMICOMPS Limited have moved to new premises at Wellington Road, London Colney, St. Albans, Herts, AL2 1EZ. Telephone: Bowmans Green 24522. S.C.S. Components, the division responsible for sales to the amateur and TV service industry, will move at the same time to the above address.

Coincidental with the move is the installation of an L 8500 Burroughs computer programmed to handle all functions of the Company other than stock control. This machine is being installed in anticipation of an up-turn in business activity during 1976 and will enable at least a 50 per cent increase in orders without the need for additional staff.

2 CHANNEL STEREO MIXER

A. Joyce C.Eng MIERE



THE majority of stereo music centres have the facility for recording via a microphone, or from either a radio, disc player or auxiliary sources. The facility of microphone recording is usually under-employed, as results at recording especially with music accompaniment are usually poor. If an extra record player or other source is used for this purpose, the difficulties of correct balance and room acoustics become very evident and impair the results obtained.

Attempts at making tapes for home movie accompaniment etc. prove to be difficult due to the editing and mixing limitation. However, if a tape deck is chosen as the additional alternative source, and a mixer unit is constructed, all the drawbacks are overcome. The ability to feed the input of the tape deck into the music centre, and vice-versa, enables one to edit tapes in both directions, although it must be said that unit matching may be necessary. The ability to use the source to act as an accompaniment to the microphone, requires the use of a mixer, and in either editing or mixing, all re-recordings are achieved electronically and are relatively unaffected by room acoustics. The unit described here, was designed with all of these requirements in mind.

CIRCUIT CONSTRUCTION

It would be fairly easy to evolve a printed circuit board for the amplifiers, but the plain veroboard and terminal pin method was chosen, since this permits easy alteration to component values for experimentation, and places no restrictions on the physical size of components. Two 0·1in matrix plain veroboard panels 140 x 45mm are used, with one being employed for the microphone amplifier, Fig. 1,

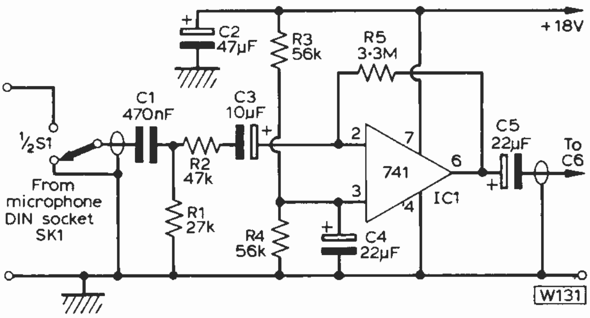


Fig. 1: Circuit diagram of one of the microphone amplifiers. The other is identical, but its components have been given the suffix 'a', in the component list.

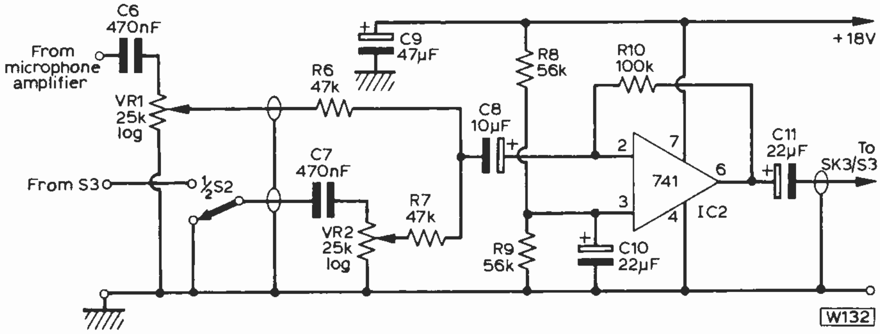


Fig. 2: The mixer amplifier shown left has two inputs. The music input feeding direct from the DIN socket, and the microphone input feeding via the mic. amplifier. Again the second channel is identical with components suffixed 'a'.

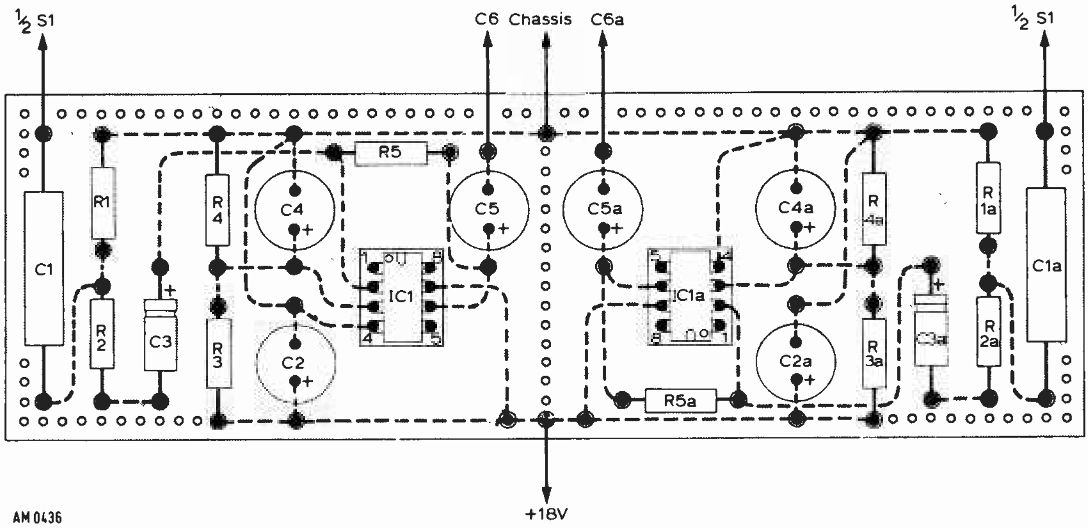
and the other for the mixer amplifier, Fig. 2. Both having right and left channels, the left channels being virtually mirror images of the right channels. The earth rails are kept to the bottom of the boards so that they are near to the chassis connections. The positive rails are mounted near to the top of the boards so that a cross wire from the power supply suitably connects the positive supply to the boards.

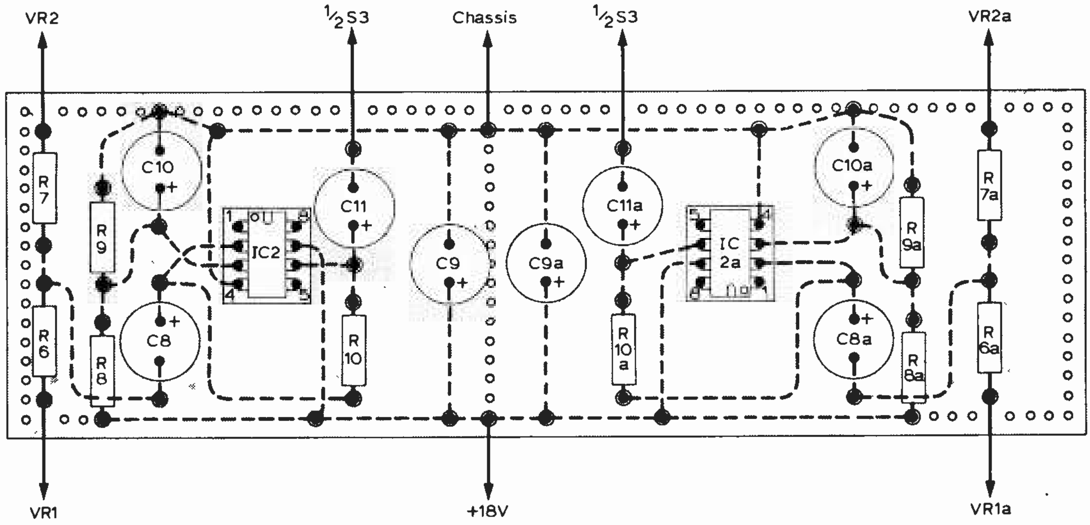
When starting the construction, it is advisable to place the components on the board and then push in the terminal pins as dictated by the spacing. The component wires may then be given a loop around the pin and the surplus cut away. When all the particular wires to a pin have been made, soldering can take place. After the veroboard wiring has been completed a thorough check should be made, and if all is OK, they should be put to one side for future chassis mounting. All inter-amplifier connections and switching leads Fig. 3, are made with screened cable, the outer of which is earthed. Colour coding of the leads is employed to assist in checking and/or fault finding.

The power supply unit Fig. 4, is constructed on the chassis which is to be described later. The transformer has two sets of LT windings which should be paralleled to obtain the 15-0-15V output. The bridge rectifier is bolted to the smoothing capacitor bracket, while the regulator transistor is clamped to the aluminium screen with its connecting pins facing inwards. The screen incidentally, acts as a very useful heat sink. An LED was added in the prototype, and connected in series with an appropriate resistor. The value of which determines the intensity of light output and current drain on the supply.

AMPLIFIER GAINS AND UNIT MATCHING

The gains of the amplifiers are determined by the ratio of the feedback resistors, (R5 and R10 in Figs. 1 and 2,) to that of the input impedance (approx. 50kΩ). The mixer amplifier values given will have a voltage gain of two, and the microphone amplifiers a





Almost all of the components are mounted on the two plain Veroboards. The top board contains the microphone amplifier while the lower one contains the mixer amplifier. These boards are shown full size.

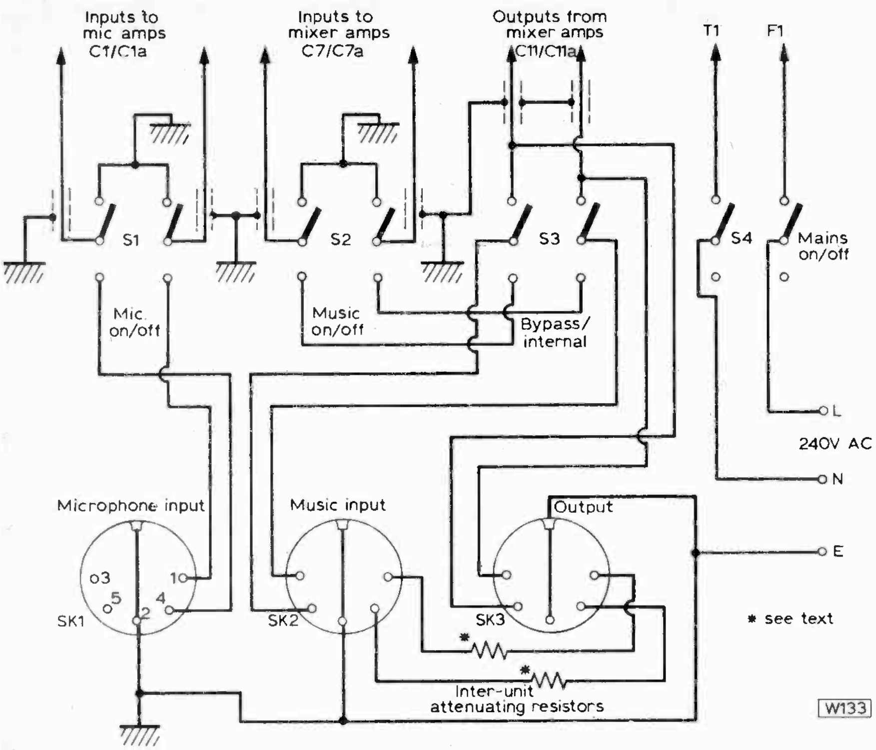


Fig. 3: Inter-amplifier connections and switching leads. Screened cable is used from the switches to the boards, and from the slider pots to the boards.

voltage gain of 66. Some alteration of these values may be necessary depending upon the input levels, although a higher voltage gain for the microphone amplifiers is not advisable, as the frequency response of the output may suffer.

Values are not given for the inter-unit attenuating resistors, as these should be selected to satisfy the input/output levels and impedances of the basic units.

CHASSIS CONSTRUCTION

The top and rear of the unit acts as the chassis, with all the components mounted underneath. It is made from 20SWG aluminium sheet 256 x 200mm, bent at right angles to form a top 204mm x 200mm, with a back about 52mm in depth. This then slides into the base retaining case from the rear, along the side top-edge grooves. It holds itself by the front and side grooves and may be secured with screws in the side back edge cut aways, or into an additional back strut fixed on the hardboard base. This forms a solid box construction with easy chassis access.

The component parts which require basic chassis mounting are placed on the underside of the top panel section to achieve a reasonably spaced layout, Fig. 5. Their positions are marked, and the slots for the slider potentiometers are cut. The holes for the end brackets of these pots are additionally used for

★ components list

Resistors

R1/R1a	27kΩ	R6/R6a	47kΩ
R2/R2a	47kΩ	R7/R7a	47kΩ
R3/R3a	56kΩ	R8/R8a	56kΩ
R4/R4a	56kΩ	R9/R9a	56kΩ
R5/R5a	3·3MΩ	R10/R10a	100kΩ
All ¼W 10%		R11	1·5kΩ

VR1 25kΩ slide tandem log. potentiometer
VR2 25kΩ slide tandem log. potentiometer

Capacitors

C1/C1a	470nF 100V poly.
C2/C2a	47μF 40V elect.
C3/C3a	10μF 40V elect.
C4/C4a	22μF 40V elect.
C5/C5a	22μF 40V elect.
C6/C6a	470nF 250V DC poly.
C7/C7a	470nF 250V DC poly.
C8/C8a	10μF 40V elect.
C9/C9a	47μF 40V elect.
C10/C10a	22μF 40V elect.
C11/C11a	22μF 40V elect.
C12	4700μF 40V elect.
C13	4700μF 40V elect
C14	220nF 100V poly
C15	470nF 100V poly

Semiconductors

MVR1	7818KC voltage regulator
D1	TIL209 LED
Br1	BY164 Bridge rectifier or similar
IC1/IC1a	741
IC2/IC2a	741

Miscellaneous

F1, 100mA fuse. T1, 6VA miniature mains 0-15, 0-15V (RS Components). S1, S2, S3 and S4, DPDT sub-miniature toggle switches. SK1, SK2 and SK3. 5-way 180° DIN sockets. Veroboard, 0·1in. matrix 140 x 45mm plain type 2 off. Fuse holder. 2 Slide control knobs and bezels. Screened cable. Lead through terminal pins. 4 IC 8pin sockets. 20SWG aluminium sheet. Wood for cabinet.

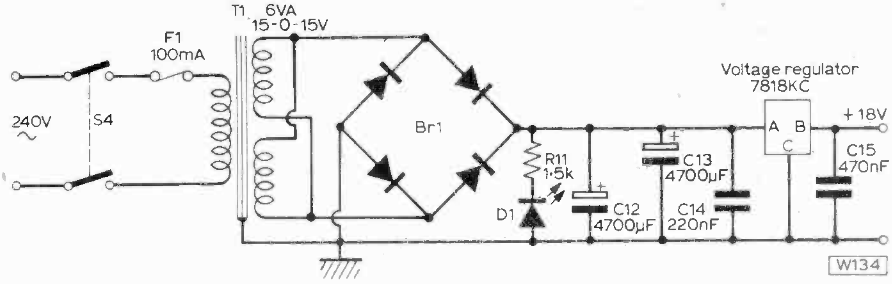


Fig. 4: Regulated power supply circuit diagram. The transformer T1, is a 6VA 0-15V, 0-15V 240V type with the two secondaries wired in parallel. C12 and C13 may be substituted for a single 10,000µF electrolytic.

securing the veroboard panels in a vertical position. This minimises top panel drill holes, while the screwheads are ultimately concealed by adhesive bezels.

The holes for the power supply screen fixing, and holes for sockets, pilot lamp, switches, fuse and mains lead are now marked and drilled, and the wood effect formica or adhesive contact vinyl.

The top and sides of the aluminium chassis may also be covered in the wood effect vinyl and the self-adhesive slider bezels put on top of this before the knobs are finally fitted and general labelling carried out.

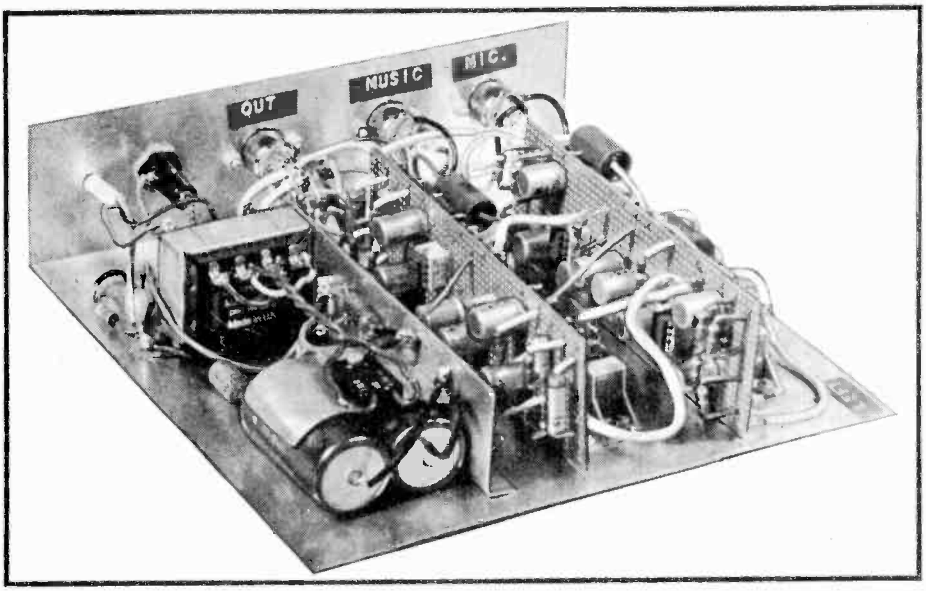


Fig. 5: Internal photograph showing component layout, board positioning and power supply. The voltage regulator is mounted on the aluminium screen adjacent to the transformer and smoothing capacitors.

fixed components mounted. The power supply smoothing capacitors are now secured by a clamp fixed to the internal screen which also holds the regulator transistor. The veroboard panels are now mounted and a check made that sufficient clearance still exists. All inter-board and switch connections can now be made, with a final check being made before power is applied.

CASE CONSTRUCTION

The case size of the prototype was pre-determined by making it identical in size to the tape deck, and in this instance was 215mm x 220mm by 10mm deep. The retaining case of the unit has a hardboard base, with 12mm thick wooden sides and front. These are rebate grooved 6mm from the inside top edges. The sides only are additionally cut away at the back to a depth equal to the rebate groove. The front and sides are then glued and pinned at the corners and base. A finish can be applied to the case, by either using

SUBSCRIPTION SERVICE

Due to escalating costs the Company regrets it is no longer able to continue to provide a subscription service for Practical Wireless magazine. Current subscriptions will be continued until they expire, but no new subscriptions can be accepted by IPC.

Subscribers should place an order with their local newsagents so that they may continue to receive their magazine on a regular basis.

PW 'Easybuild' STEREO DISCO SYSTEM

PART 3 A.C. AINSLIE* & C. TOMS†

IN THIS the final part of the P.W. Disco system articles, we will look at construction of the cabinet, interwiring and construction of the mains and mixer panels, fault finding and use of the Disco.

MIXER CONSTRUCTION

The photographs and drawings clearly show details of mixer construction (Fig. 11). As noted before, tandem pots are required for stereo, together with a balance control and mono/stereo switch. A mono mixer would use single gang pots and would not have either the balance control or the mono/stereo switch.

The drawings are for a stereo mixer but for clarity only one section of each of the tandém controls has been shown. The wiring for the second channel is simply duplicated.

The chassis for the mixer is a piece of 1½mm (1/16in) double-sided copper laminate which is earthed, and screens the input circuitry. All earth connections are simply made by soldering directly to the copper.

The completed mixer is so simple that a visual check should reveal any faults.

MAINS PANEL

To reduce the possibility of hum pickup, the mains switching, fuses and light modulator controls are mounted on a separate mains panel which is situated at one end of the sloping console panel well away from the mixer (Fig. 12).

On/off switches for the amplifier and sound-to-light unit are mounted on the mains panel together with their two respective fuses, the light modulator intensity control, and three over-riding switches, one for each light channel. These switches short out the thyristor in each channel giving full output of each colour for special effects.

PANEL PREPARATION

Both the mixer and mains panel can be conveniently made from 1·5mm (1/16in) fibreglass laminate. After drilling all necessary holes the panel can be covered with non-glossy white 'Fablon' and lettering applied with Letraset. A thin spraying of clear polyurethane or Letracote gives the surface some protection. The Fablon is cut away with a modelling knife to expose the component mounting holes. When fixing the controls to the panel a washer should be used underneath the pot nut to prevent the Fablon pulling when the nut is tightened.

PLINTH ASSEMBLY

Arrangements have been made for a complete cabinet kit to be available in knock-down form as shown in the diagram (Fig. 13). Constructors who enjoy woodwork can prepare the pieces as shown in the cutting list. Attention must be paid to the long mitre joints of the panels E, F and G. These

The two turntables mounted in the deck board with the front panel attached ready for joining to the plinth assembly.

*Consultant †W.K.F. Electronics

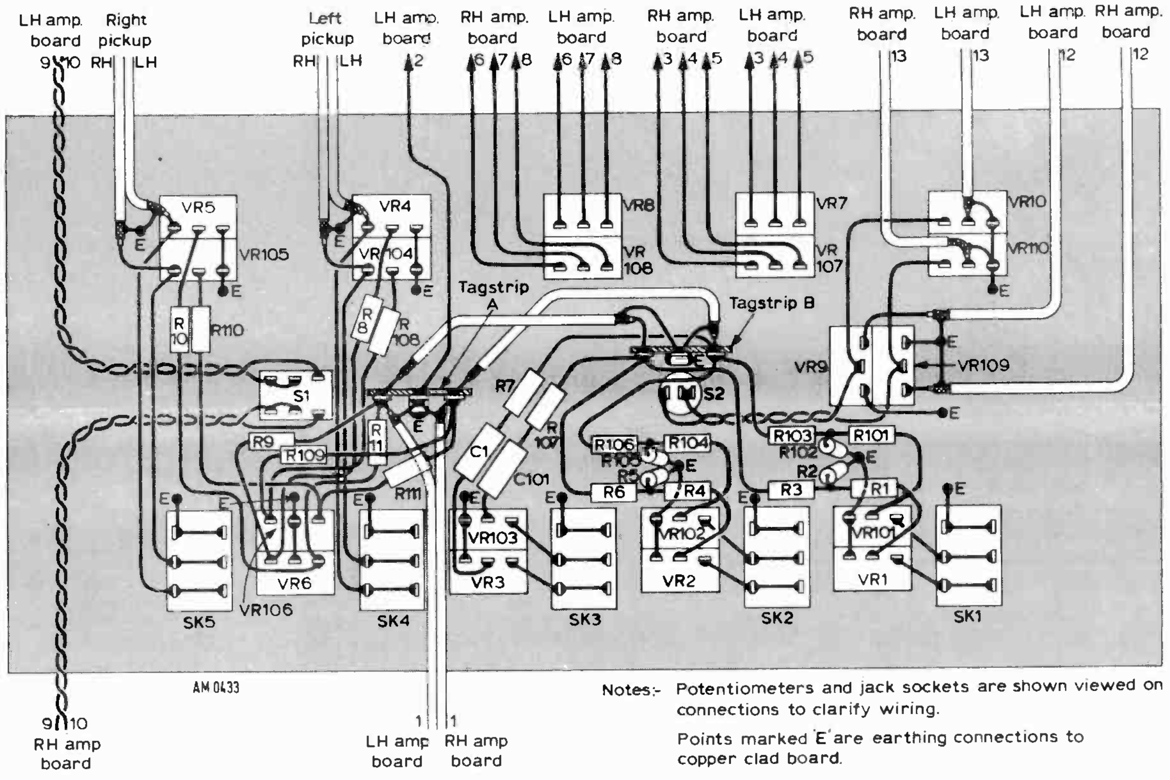


Fig. 11: Construction of the mixer, made from double-sided copper board, one of the sides being used as a common earth plane.

must be cut very accurately and the mitre angle maintained to ensure that the edges mate.

Assembly is quite straightforward and is summarised in the steps below. 1in x 1in timbers are used for all right-angled joints.

1. Screw side panels G to baseboard C.
2. Screw lampholder panel D to baseboard C and side panels G.
3. Screw panel A to baseboard C and side panels G, first cutting out for the spot bulbs.
4. Screw panel F to baseboard C and side panels G.

At this stage all the electronics should be installed.

A professional finish can be ensured by using countersunk mirror screws which have brightly chromed flat heads. The three lampholders for the light display are fixed to panel D spaced as shown in the diagram so that the reflectors will coincide with the apertures in the front panel.

The light modulator p.c.b. is mounted on 25mm (1in) stand-off insulators as shown in the photograph. The mains wiring between the p.c.b. and the lampholders and switches is twisted lightly together to reduce radiated interference.

The plinth base is drilled for large ventilation holes and the power transistor heatsinks (two for stereo) are mounted directly above. By spacing the heatsinks 38mm ($1\frac{1}{2}$in) from the bottom of the plinth, plenty of space is left for free circulation of cooling air. Although by no means essential a small instrument cooling fan could be set into the base to provide additional draught.

Stand-off insulators are used to mount the amplifier boards adjacent to the heatsinks.

INTERWIRING

Both the mixer and mains panels are now fitted on to the control panel using small chrome-plated wood screws. The control panel is then dropped in place. Screened cable is used for the connections between the mixer and amplifier boards. The braidings should all be connected together and earthed at one end—this is most easily done at the mixer.

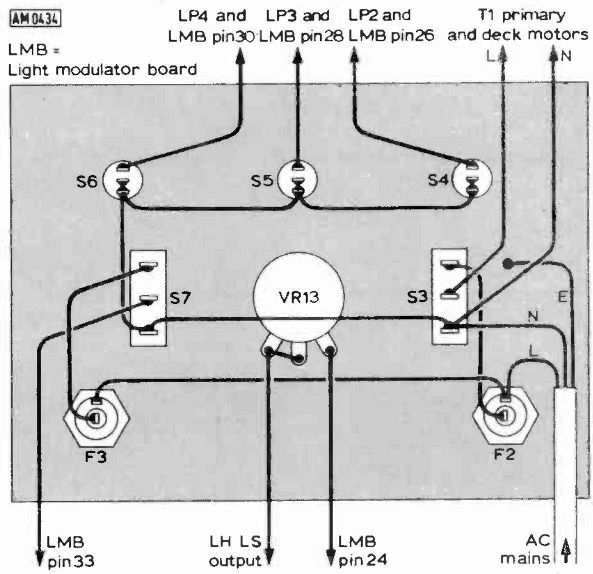


Fig. 12: Interwiring of the mains panel. This again is made from double-sided copper laminate board.

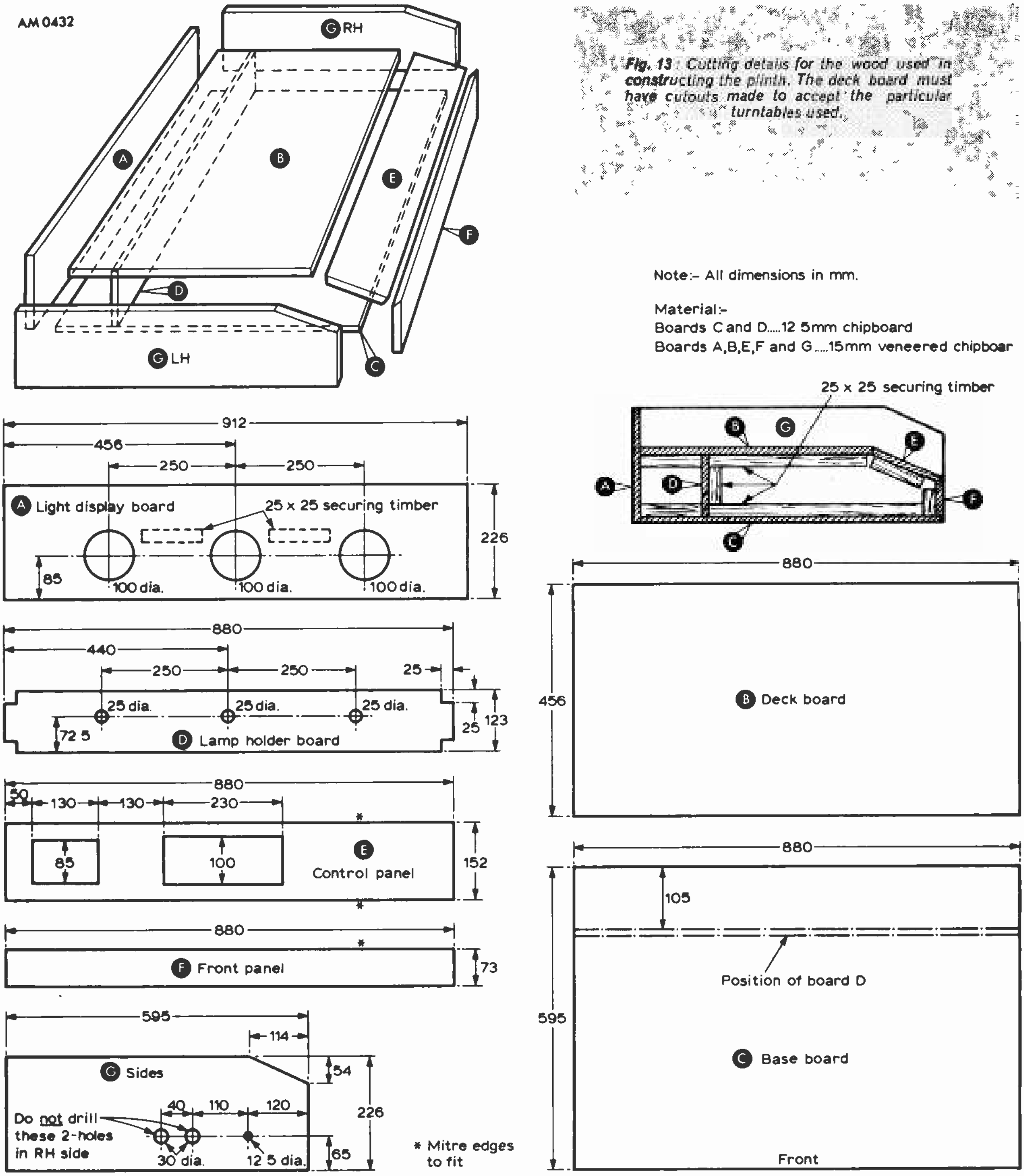


Fig. 13: Cutting details for the wood used in constructing the plinth. The deck board must have cutouts made to accept the particular turntables used.

Next the mains panel is carefully connected, taking great care to check the connections against the circuit diagrams. When dealing with mains voltages there must not be the slightest possibility of an error occurring.

The mains earth goes from the input plug to the light modulator board and the main earth point. The following earth returns should all be taken direct to this earth point: power supply negative; right-hand amplifier power earth; left channel speaker return; right channel speaker return; turntable metalwork.

A short link of heavy gauge flexible wire connects the left-hand amplifier power earth to the corresponding point on the right-hand p.c.b. The earth connection from the mixer is also connected to the right-hand amplifier earth.

It is at this stage that the unit can be tested if the separate sections have not already had bench tests. Adjustments are made as detailed earlier.

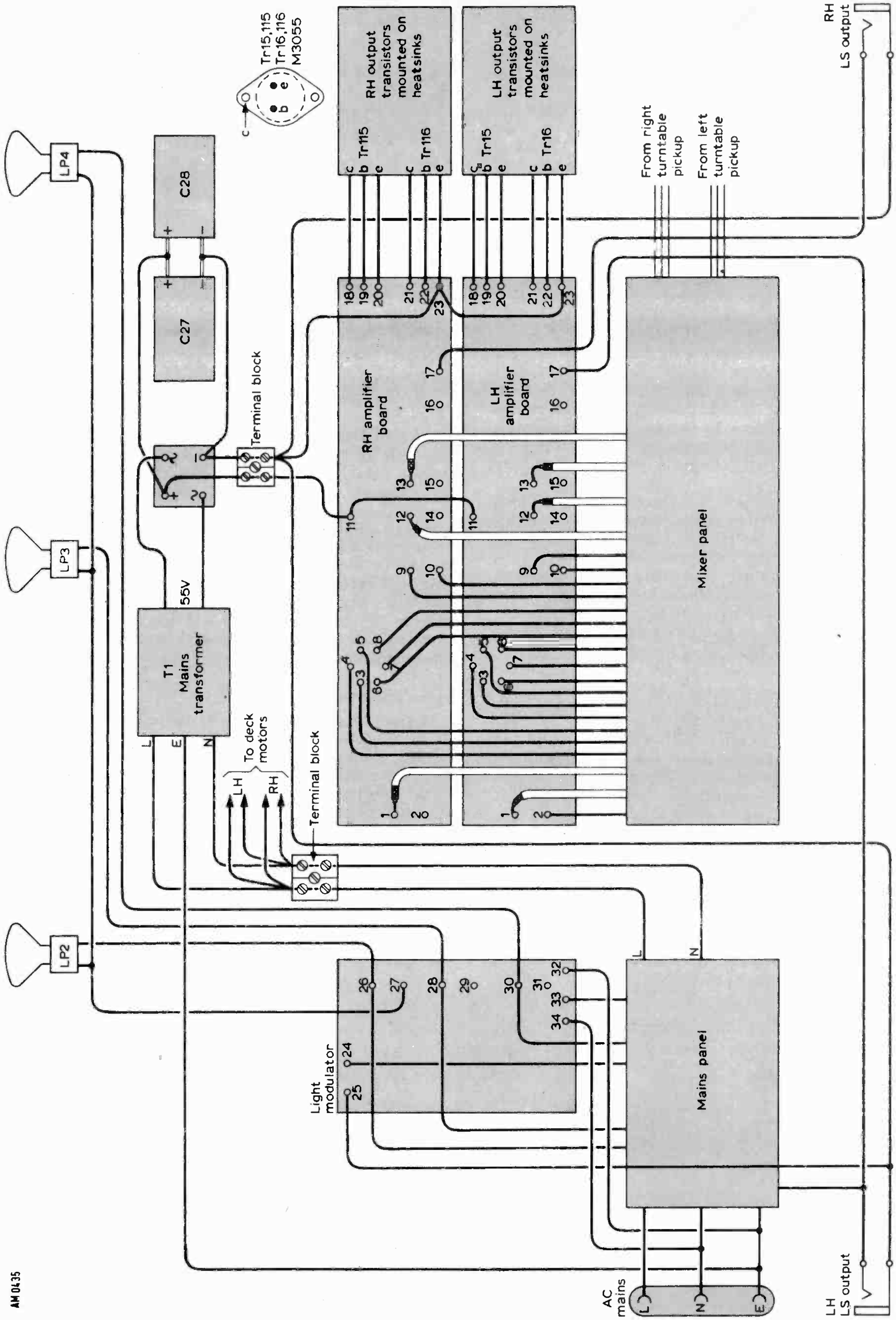


Fig. 14: Interwiring details for the complete stereo Disco console. For connections from mixer use screened lead earthed at mixer end only. Speaker output socket common leads should be taken to the common earth point provided by the terminal block near D2.

All that now remains is to cut out the plinth top panel to suit the two turntables and screw it to the back panel, A. The two decks are mounted in the plinth and wired to both mains and the mixer. The plinth top panel simply screws to the rest of the console. The control panel can be secured after the final tests.

The pickup cartridges are mounted as in the deck manufacturer's instructions and the turntables set to the required tracking weight for the cartridge (4g for the 9TAHC).

EXTERNAL INPUTS

External inputs are provided for TAPE (150mV), MICROPHONE (4mV), AUXILIARY (300mV) and two external pickups, PU1 and PU2 (20mV).

The TAPE and AUX inputs will accept the outputs from most radio tuners, cassette or tape recorders and any other equipment offering a "line" output. Equipment such as TV receivers and certain radios and record players have live chassis power supplies and no attempt should be made to connect these to the inputs of the Disco Console, or indeed to any other equipment.

The microphone input is intended for use with medium quality dynamic types. Should any tendency towards bass boom be noticed, then the bass boost switch can be set at the "off" position.

The pickup inputs are effectively in parallel with the pickup cartridges installed in the console and serve as external pickup sockets or as outputs for feeding to a headphone monitor amplifier for cueing or, Pre Fade Listen (PFL).

MIXING

Operation of the Mixer is self-explanatory and the layout of the control panel assist easy operation. Each input has an associated LEVEL control which is used to adjust the overall balance between inputs and for smooth selection of one or other input.

The CROSS FADE control is used to swing from one turntable to the other for a smooth change of record. At intermediate positions of the control the two turntables are mixed.

The BALANCE and VOLUME controls are used together with the BASS and TREBLE controls to adjust the sound level and tone for the room. Adjustment of the BALANCE control may be necessary to compensate for differing loudspeaker efficiencies on each channel.

The completed Disco system.

OPERATION OF THE DISCO CONSOLE

The amplifier used in this design will deliver its maximum power of 100W into a load of 4Ω. Naturally speakers of adequate power rating should be used if the unit is to be played loud and a number of speakers can be combined on each channel to achieve the required impedance. For example, two 8Ω 50W loudspeakers or four 15Ω 25W speakers in parallel would be suitable.

To minimise power loss the connecting cable should be heavy duty. When several speakers in different cabinets are to be paralleled, least power loss will occur if the parallel connections are made near to the Console. In this way the length of cable carrying the combined speaker currents will be reasonably short.

LOUDSPEAKER

Heavy duty loudspeaker drive units suitable for Disco applications are widely advertised in the electronics magazines. Generally a single unit is designed to cover a fairly wide frequency response and additional tweeters are rarely used: high power tweeters are very expensive. Sealed infinite baffle enclosures are usually employed, the constant volume air damping serving to restrain cone movement. To reduce internal resonance or "boxiness" the internal walls are lined with wadding to absorb any reflections.

When two or more drive units are fitted in a cabinet it is important to connect them *in phase* so that the cones move together. Otherwise the air damping will not be effective. Phasing can be simply

continued on page 857

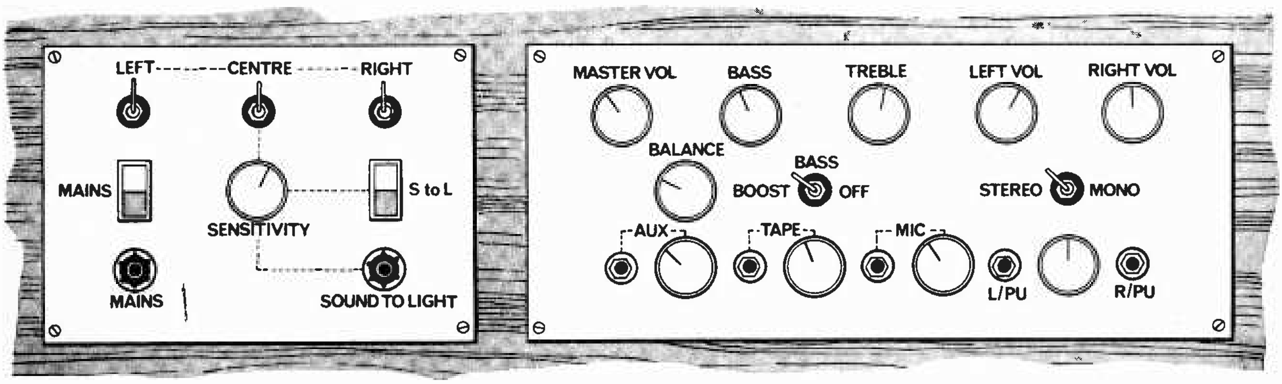


Fig. 15: Layout of the controls on the front of the mixer and mains panels which are mounted on the sloping front panel of the Disco console.

Radio Break-through

A look at interference in Hi-Fi equipment .... Part 1

H. LEEMING G3LLL, FSERT, T. Eng. (CEI)

A GLANCE at the problem pages in the various audio magazines soon indicates two complaints which have become uncomfortably common with audio equipment in the last few years. The first problem is the unwanted break-through of radio stations, the second being "noises off" originating from refrigerators and other thermostatically controlled devices. Several articles have appeared in which these problems and possible cures have been discussed, but what has not been pointed out is that these problems originate from **the same deficiencies in the audio system** in that it is too sensitive to radio frequencies.

NATURE OF INTERFERENCE

It may come as a surprise to realise that refrigerators generate radio waves, but when pioneers such as Marconi were spanning the Atlantic the power they fed into the aerial system was generated by a spark, and the code they sent consisted of what we would now consider to be little more than bursts of interference. Whilst 'fridges and switches and other units which generate sparks radiate over a wide frequency range, Marconi's "interference" was concentrated as much as possible around one frequency by means of a tuned circuit, but the principle is the same.

Obviously it should be possible to suppress refrigerators and light switches to stop them interfering with audio equipment, but this is rather a pointless operation as it still leaves the audio equipment wide open to any other radio waves which are strong locally.

High fidelity amplifiers (if they are to be worthy of the name) must amplify small signals over a wide range of frequencies until they are powerful enough to operate the loudspeakers, and a good case can be made out (in the interest of minimum distortion and best transient response etc.) for having the frequency range over which they operate somewhat wider than the normal audio range.

The frequency response of an amplifier is, perhaps, something with which the advertiser can impress the uninitiated, and hence even before the "transistor invasion," we started to see specifications such as "flat from 1c/s to 1Mc/s." The fact that some of these units also produced cannon-like crashes from every switch or thermostat in the house, and brought through a local radio amateur or taxi radio operator seemed to be ignored in the interests of progress! Valiant attempts were made to pass the problem on to the refrigerator manufacturers, station operators, Post Office engineers or anyone else who would hold it in their lap with the hope, perhaps, that if the problem was ignored long enough it would go away!

Radio frequency interference (RFI) has, however, refused to go away, and with the advent of the printed circuit board and the transistor, the situation has certainly not improved, much domestic audio equipment being far too sensitive to any form of electromagnetic radiation. With the numbers of refrigerators, freezers, central heating systems and radio transmitters of all kinds mushrooming at the same time as sales of inadequately protected audio equipment, it looks like things are going to get considerably worse before they get better!

Fortunately some of the more enlightened audio manufacturers have sat up and taken notice, and it is to be hoped that their efforts, perhaps urged on with the threats which recent legislation seems to hold over the retail trade, will eventually result in more adequately protected equipment. In the meantime it is hoped that the following will put the matter in perspective and hopefully help readers to cure troubles with existing installations and perhaps even influence designers of audio equipment.

SOME THEORY

Before the audio content can be extracted from an amplitude modulated (AM) radio wave it has to be detected. In the detector stage of a receiver the active device, usually a diode, is connected so as to be non-linear. However all valves and transistors will detect radio waves to some extent if they are subjected to a strong enough signal, pushing them on to the non-linear part of their characteristics.

Compare the circuit of a simple crystal receiver with that of the first stage of a transistorised amplifier, Fig.1. Here the similarity is very apparent, particularly if it is remembered that the transistor is only a development of old-fashioned crystal diode. The complete crystal set naturally incorporates an

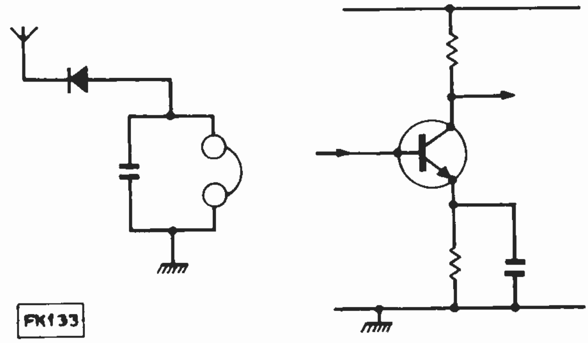


Fig. 1: A simple untuned crystal receiver, left, can be compared with a typical transistor audio amplifier stage.

aerial and a tuned circuit to enable one to select the required station. The audio system does not deliberately incorporate either, but any wire will act as an aerial and in the absence of tuning any strong local signals are picked up on the, often, too generous speaker, pick-up, tape, mains or other interconnecting leads.

It is possible to fit filter chokes to the various leads and, in most cases, to cure RFI troubles even where an inadequately protected amplifier is involved. On the basis that protection is better than a cure we shall look at basic amplifier design and see what can be done by the manufacturer. Service engineers and the more knowledgeable enthusiast will see the possible modifications that may be incorporated in existing equipment.

The writer would warn that alterations to the circuit panels of amplifiers should only be undertaken by those who have the experience and test equipment needed to sort out any difficulties that may arise. Radio amateurs in particular are warned that it is bad policy to undertake internal modifications to other people's equipment as one tends then to be automatically blamed for any subsequent faults that may arise.

SIGNAL HANDLING CAPABILITIES

Before a stage can detect radio frequencies it has to be pushed to the non-linear part of its characteristic. Stages which are designed to handle a few millivolts of audio are therefore much more likely to act as unwanted detectors than are driver and output stages which will handle much larger signals without overloading. Improvements in transistor technology have tended to extend the frequency response of all small audio transistors well into the VHF range so that their improved characteristics have made the problem worse. This is a point worth remembering should an old amplifier suddenly develop RFI problems after it has been serviced, as it is just possible that by replacing an old transistor with a modern type, unwanted VHF or UHF reception may occur where it was not previously evident.

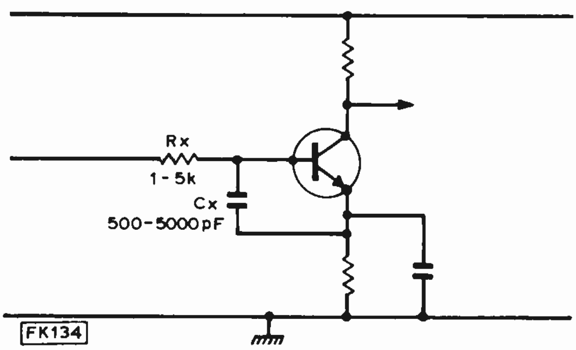


Fig. 2: A resistor and capacitor connected as shown here can frequently eliminate interference from an audio stage.

Most unwanted noises in amplifiers tend to originate in the input stages not because these stages make the most noise, but because the input stages are followed by a great deal of amplification and hence the smallest inputs are greatly magnified. The same argument applies to RFI problems as the smallest amount of signal detected in, say, the pick-up input stage will still produce a very considerable sound from the loudspeaker. Fig. 2 shows how RFI protection can be added to such a stage. Note that the sensitive part of the transistor is the base/emitter junction so the capacitor must be connected as shown and **not between base and chassis.**

CAPACITORS

Capacitors in practice possess inductance, and even resistance, as well as the required capacity. Maximum possible effectiveness in reduction of RFI susceptibility would necessitate a perfect capacitor soldered in with zero length leads. In practice the best type of capacitor to use is the disc ceramic and if this is soldered in with the shortest possible leads the inductance and resistance will be small enough to make it effective up to the VHF range. The best value of capacitor is a compromise as it is desirable not to affect the response of the amplifier at the higher audio frequencies.

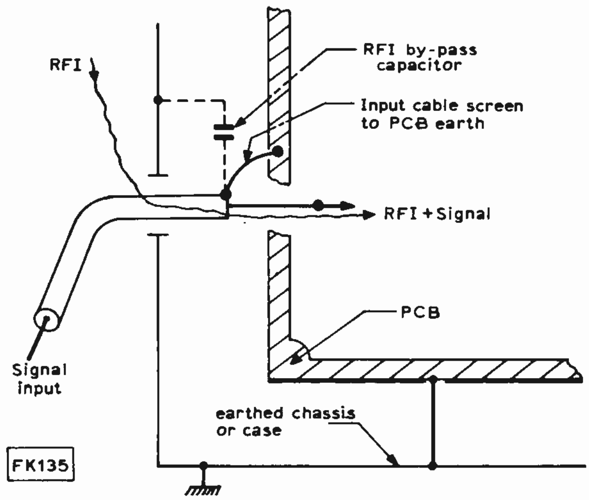
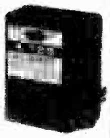


Fig. 3: RFI is often introduced into amplifiers via input cables when their screening is not properly earthed. Capacitor shown dotted should be fitted to all such cables.

When modifying a stereo amplifier it is as well to add the capacitors in one channel only so that any adverse effect on the frequency or square-wave performance can be judged by comparison with the unmodified channel. Usually it is best to fit the largest values of capacitors possible without affecting the audio response unless the RFI is above 5 MHz or so when there is no need to fit a capacitor more than a few hundred pF. Remember, that to be effective at the higher frequencies the leads **must** be very short, as an inch of connecting wire will add enough inductance to make the capacitor completely ineffective in the VHF region.

Above 100 MHz or so it becomes increasingly impossible to make Cx (Fig.2) effective and here Rx comes into its own. If Rx is several hundred times the input impedance of the transistor unwanted VHF and UHF signals will be reduced in proportion. In cases of trouble with break-through of radar, or other extremely high frequency signals, the length of lead from Rx to the transistor and Rx itself may even act as an aerial. In these extreme cases a cure can usually be effected by slipping a few ferrite beads on to the base lead of the transistor. This modification converts the lead into an RF choke and can be quite effective in the VHF range as well.

POWER UNIT Type A126



Supplying 6, 7·5 or 9 Volt DC at 200 mA.

In moulded case forming a 2 pin 5A mains plug.

2 metre output lead with 4-way multiplug giving 2·1 and 2·5 mm sockets and 3·5 mm plugs.

Price £2·30. Post 10p. plus 25% VAT

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″ £3·20 Post 10p. Price 4″ £4·00 Post 10p. Lamps 60p per set. plus 8% VAT

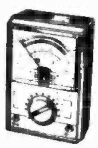
¼ watt CARBON FILM RESISTORS

¼ watt at 70°C E 12 range 10 Ω—1M Ω 5% tol above 470 K Ω 10% tol at 95p per 100. plus 25% VAT

C1000 MULTIMETER

Special Offer

Compact General Purpose Mini Multimeter. Input Resistance 1000 ohms per volt



Ranges:
AC Volts 0–15, 50, 250, 1000 V
DC Volts 0–10, 50, 250, 1000 V
DC Current 0–1 mA 0–100mA
Resistance 0–150K ohms
Size 60 × 24 × 90 mm

Complete with Batteries, Test Prods, Instructions. Special price £3·35 Post 30p. plus 8% VAT

C1001 MULTIMETER

Input Resistance 20,000 ohms per volt
Overload protection
150 μA movement, clear scale
Ranges—AC Volts 0–10, 50, 250, 1000V
DC Volts 0–5, 25, 125, 500, 2500V
DC Current 0–50 mA
Resistance 0–60 Kohms, 0–6 Mohms
Decibels −20 to +22 dB.
Carrying Case, Test Prods and Batteries included.
Size: 11·5 × 8·3 × 2·7 cm.
Price £9·85. Post 20p. plus 8% VAT

TRANSFORMERS

ADD 8% VAT ON ALL TRANSFORMER PRICES

CASED TRANSFORMERS

Housed in smart resin-coated steel cases, with 3-core power cable and outlet socket, fused primary winding. Isolation types are fitted with 3-pin outlet sockets, and are available with 110 volt or 240 volt output. (Please state). Auto types are fitted with 2-pin flat style sockets up to 500 VA. 3-pin sockets from 750 to 3000 VA. See Auto and Isolation sections for prices.

SAFETY ISOLATING

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

VA (watts)	Ref No.	Price Cased £	Price Plugs 2 Pin + 1 Earth	Price Open £	Post £
20	148	5·25	0·98	3·75	0·72
60	149	9·03	0·98	4·70	0·72
100	150	9·87	0·98	5·35	0·85
200	151	12·29	0·98	8·61	0·97
250	152	13·81	0·98	10·31	1·18
350	153	16·54	0·98	12·50	1·28
500	154	18·38	0·98	14·31	1·44
750	155	28·72	1·25	22·12	O.A.
1000	156	37·44	1·25	30·57	O.A.
1500	157	44·37	1·25	34·98	O.A.
2000	158	52·45	2·95	38·91	O.A.
3000	159	77·18	2·95	61·51	O.A.

12 & 24 Volts Prim. 200–240V.

Amps 12V	Amps 24V	Ref. No.	Price £	Post £
0·3	0·15	242	1·66	0·34
0·5	0·25	111	1·60	0·46
1	0·5	213	1·90	0·61
2	1	71	2·47	0·61
4	2	18	3·07	0·62
6	3	70	4·50	0·72
8	4	108	5·11	0·85
10	5	72	5·63	0·85
12	6	116	5·80	0·85
16	8	17	7·26	0·97
20	10	115	10·96	1·18
30	15	187	14·06	1·36
40	20	232	15·63	O.A.
60	30	226	17·70	O.A.

30 Volts

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

Amps	Ref. No.	Price £	Post £
0·5	112	2·04	0·61
1	79	2·57	0·66
2	3	3·91	0·72
3	20	4·80	0·85
4	21	5·58	0·85
5	51	6·75	0·95
6	117	7·52	0·97
8	88	9·93	1 18
10	89	10·27	1·18

AUTO TRANSFORMERS

VA Watts	Ref. No.	Price Cased £	Price Plugs 2 & 3 pin	Price Open £	Post £
Tapped at 115, 220, 240 Volts					
20	113	4·31	0·25	1·88	0·61
Tapped at 115, 200, 220, 240 Volts					
150	4	6·99	0·25	4·28	0·72
200	65	7·67	0·25	5·21	0·78
300	66	8·67	0·25	6·11	0·85
500	67	11·82	0·25	9·48	1·18
750	83	14·31	0·95	11·30	1·28
1000	84	18·38	0·95	14·35	1·44
1500	93	23·26	0·95	19·22	O.A.
2000	95	35·07	1·80	25·49	O.A.
3000	73	50·61	2·35	34·87	O.A.

50 Volts

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

Amps	Ref. No.	Price £	Post £
0·5	102	2·71	0·61
1	103	3·58	0·76
2	104	5·30	0·85
3	105	6·10	0·85
4	106	7·97	1·08
6	107	12·93	1·18
8	118	13·75	1·44
10	119	17·79	1·86

60 Volts

**Prim. 230–240V.
Sec. 24, 30, 40, 48, 60V.**

Amps	Ref. No.	Price £	Post £
0·5	124	2·51	0·72
1	126	3·75	0·72
2	127	5·36	0·85
3	125	7·91	0·97
4	123	9·20	1·18
5	40	10·22	1·18
6	120	12·10	1·36
8	121	15·74	O.A.
10	122	20·10	O.A.
12	189	18·87	O.A.

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	1·56	0·34
0–6	0–6	500	500	234	1·56	0·34
0–6	0–6	1000	1000	212	2·12	0·46
9–0–9	—	100	—	13	1·60	0·34
0–9	0–9	330	330	235	1·62	0·34
0–8–9	0–8–9	500	500	207	1·69	0·46
0–8–9	0–8–9	1000	1000	208	2·79	0·46
15–0–15	—	40	—	240	1·55	0·34
0–15	0–15	200	200	236	1·56	0·34
20–0–20	—	30	—	241	1·55	0·34
0–20	0–20	150	150	237	1·56	0·34
0–15–20	0–15–20	500	500	205	2·88	0·58
0–20	0–20	300	300	214	2·03	0·61
0–20	—	3500	NO SCREEN	1116	3·45	0·97
20–12–0–12–20	—	700 (D/C)	—	221	2·50	0·61
0–15–20	0–15–20	1000	1000	206	2·85	0·72
0–15–27	0–15–27	500	500	203	3·16	0·58
0–15–27	0–15–27	1000	1000	204	4·55	0·72

PLASTIC CASED SILICON BRIDGE RECTIFIERS

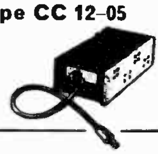
One Amp	Two Amp	Four Amp	Six Amp
50 P.I.V. 20p	50 P.I.V. 35p	100 P.I.V. 55p	50 P.I.V. 65p
100 P.I.V. 25p	100 P.I.V. 40p	200 P.I.V. 59p	100 P.I.V. 70p
200 P.I.V. 28p	200 P.I.V. 45p	400 P.I.V. 65p	200 P.I.V. 80p
600 P.I.V. 30p	400 P.I.V. 50p	600 P.I.V. 75p	400 P.I.V. 90p

ADD 10p P & P PER ORDER plus 25% VAT

PLEASE ADD VAT AS SHOWN

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 £4·05. Post 30p. + 25% VAT



MINIATURE NEONS

6mm dia., 12mm length leads length approx. 20mm. Recommended ballast resistor 150K ohms for 240 Volt operation Price: Packet of 10 for 60p. Postage 15p. plus 8% VAT

A.S.P. LTD.

DEPT PW9, SIMMONDS ROAD, WINCHEAP, CANTERBURY, KENT. Tel: (0227) 52436

Send 25p for Catalogue

PROFESSIONAL AUDIO MODULES

We invite the serious constructor of quality PA, disco and mixer systems to consider the merits of our modular audio circuits which feature

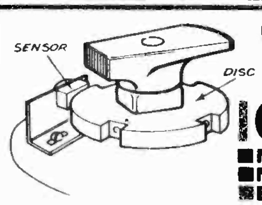
VERSATILITY QUALITY ECONOMY

MS12X POWER MODULE: A double amplifier conservatively rated at 50 + 50W stereo, or 100W mono (bridge connected). Price £12·50 (+ 8% VAT).

MODULO MIX. A series of pre-amp modules which may be combined to meet most mixer requirements.

For full details, send sae to:

PETER STYLES ELECTRONICS
48 Thorncliffe Road, Oxford



Capacitor Discharge IGNITION

- MAXIMUM PERFORMANCE
- MAXIMUM ECONOMY
- EASY COLD START

SYSTEM I

Professional photoelectric ignition using L.E.D. light source and reflective disc. This machined aluminium disc gives a timing accuracy far superior to other methods and is simple to fit. Unit housed in diecast box 4½" x 3½" x 2¼" Price £18.80 (Kit £16.80) State car/model/measurement across cam lobes.

SYSTEM II

Contact breaker model as above less sensor. Price £12.80 (Kit £10.80) M/C Twin unit Price £15.00. S.A.E. for descriptive leaflet – ALL UNITS IN STOCK. Mail orders to CDI Electronic Systems Ltd, 275 Vale Road, Ash Vale, Aldershot, Hants. Demonstration/Callers to Hillside Motors, 292 Carshalton Road, Carshalton, Surrey. telephone 01-642 9973.

Besides protecting the individual sensitive stages of an amplifier, it is also advisable to restrict the ways that radio frequencies can gain entrance to the circuit boards of amplifiers, especially in the low level stages. Naturally on any properly installed equipment one would expect all pick-up, tape, radio and any other low level connections to be well screened, but as will be seen this screening is not at all effective at the radio frequencies with which we are concerned.

As an examination of most amplifiers will show, the "earthy" side of the input socket is not connected to chassis but is returned to the main printed circuit panel. This is done to achieve a one-point earth arrangement in the interest of minimum hum. Fine as this arrangement may be from a hum point of view, it is very unsatisfactory as far as RFI is concerned, as radio frequency signals which are present on the outside of the screen of the connecting cables go down to earth via the amplifier's printed circuit panel. Printed circuits can have quite an appreciable impedance at radio frequencies which results in radio frequency voltages being developed across the board and, likely as not, being injected into the sensitive stages of the amplifier, Fig.3.

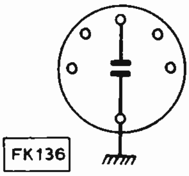


Fig. 4: After treatment of transistors all input sockets should have by-pass capacitors fitted with the shortest possible leads.

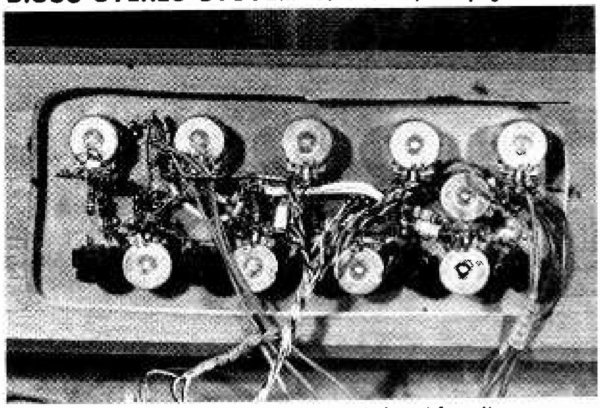
Fortunately there is a simple remedy for this problem, this being to connect a capacitor from the earthy side of each input socket directly to chassis, as shown. Once again the value of the capacitor will be somewhat of a compromise, a few hundred pF being the best at the higher frequencies, and perhaps say $0{\cdot}1\mu F$ or so if troubles are due to a station on the long waves. In practice a disc ceramic capacitor of about $0{\cdot}01\mu F$ connected with the shortest possible leads between the earthy side of the input sockets and chassis will be found quite effective at most frequencies.

THE SUGDEN A21 AMPLIFIER

Several years ago the Sugden A21 stereo amplifier did not contain very much RFI protection. It gave excellent sound quality and sold well but retailers, such as my company, found that customers were complaining of hearing calls from local radio amateurs, taxi stations or clicks and plops from thermostats and electric lights. Fortunately James Sugden, the designer, was (unlike some who could be named!) only too anxious to improve his product in any way possible. A high power amateur radio transmitter was used to carry out some tests. The results of these tests were that capacitors were added between base and emitter of each of the four transistors in the preamplifiers, and one added directly behind each of the input sockets, Fig.4. PW

TO BE CONCLUDED

DISCO STEREO SYSTEM—*continued from page 850.*



The completely interwired mixer panel viewed from the rear.

checked by connecting a 4·5V battery across the speaker terminals and seeing that both cones move in the same direction.

Phasing is also important when connecting a number of cabinets to the console and it is useful to colour code loudspeaker leads to eliminate guesswork —the usual code is that when the red lead is positive the cone moves outwards.

With an output power of 100W per channel, this Disco Console is capable of producing very high sound levels and apart from the general nuisance aspect it should be remembered that research has shown that regular exposure to high sound levels can be damaging to the hearing mechanism.

With the best will in the world it is possible to construct a piece of equipment which turns out to be faulty on 'switch-on'. Any faults in the pre-amp section can be easily traced but the power amplifier poses some problems as it is a DC coupled design.

To reduce the possibility of damage three 24V 12W bulbs can be connected in series in place of the 2A DC fuse during testing. The lamps will limit the short circuit current to a relatively safe 500mA, while still giving virtually the full supply voltage if the amplifier is not drawing excess current. Under no signal conditions the amplifier should operate with Tr15 emitter (Tr16 collector) at half supply voltage. Tr11 emitter should be at almost full supply voltage.

When a new amplifier has been put together using 'off-the-shelf' components which may have been stored a while it may be that the electrolytics are not properly formed, giving rise to an initial surge at 'switch-on' which may damage Tr9 or Tr10. To reduce the possibility of damage in this way only fresh electrolytics should be used, otherwise stored components should be formed before use.

Note: In the components list in Part 1, under Power Amplifier, Miscellaneous, the heatsinks specified should be as follows: R.S. Type 154 heatsinks for Tr11, Tr111, Tr13, Tr113, Tr14, Tr114; and TO3 insulating kits for Tr15, Tr115, Tr16, Tr116.

Also it has been found that an improvement in performance is obtained by increasing R19 to 560Ω.

In Fig. 2 C13 should be $10\mu F$ as stated in the components list.

In the Light Modulator components list, p 782 January 1976, C30 should be $8\mu F$ and C32 should be $0{\cdot}5\mu F$ as in Fig. 5, p 783.

NOTE: In Part 2 Fig. 5, bottom of secondaries of T2, T3 and T4 should go to cathodes of SCR's and not to anodes (neutral) line. In Fig.6 C11 should read C12 and vice versa.

HOTLINES ON RECENT DEVELOPMENTS

THE U115B

ONE of the dreams of amateur radio set builders was a radio which was contained on a single chip. One popular path to this dream was the ZN414 IC which contains a very useful t.r.f. approach. I hear that a new chip will shortly be introduced to professional set manufacturers which could be of great interest to home constructors. The magic number to remember is U115B.

The U115B is reported to contain, on its 2mm^2 surface, all the major functional bits and pieces for an a.m. receiver plus an f.m. demodulator. It appears that the only components external to this IC are the various tuned circuits—tuning capacitor and coil, i.f.t's, etc. and a potentiometer to control volume although it is also reported that certain discrete devices are also needed for the f.m. circuitry. If one was only interested in a.m. then presumably very few external components would be required to build a superhet receiver.

One problem often associated with this type of chip is that there is only sufficient drive available at the output to give very small power, and further stages of audio amplification are commonly needed. Not so with the U115B. The chip contains tuner, local oscillator, mixer for a.m. reception, demodulator ditto, i.f. stage, a.f. amplifier, and an f.m. demodulator. The range for acceptable working voltage is very wide; from 3V to 11V, and the twist in the tail is that it will provide 800mW into 8Ω which, of course just conveniently happens to be one of the standard impedances for loudspeakers.

L.E.D. DISPLAYS

Digital displays are now commonplace and are employed in a wide variety of applications. Those which use the l.e.d. approach usually require some form of driver stage to literally drive the l.e.d. arrays and some form of memory is also often employed too. I was pleased to note that one manufacturer is marketing an l.e.d. array in which the numbers are formed by a series of l.e.d's arranged in a dot pattern. That in itself is not, of course, so special. However, something else is built in on the same chip—all the necessary decode and drive circuitry. If that isn't enough, a memory is also included and the whole thing has just eight pins in a dual in-line configuration.

The display itself is almost 0·3in. high and it is also TTL compatible. All you (the user) have to do is simply to address the device directly with a four-line BCD input. I fear that before very long, even more circuitry will end up on the chip—perhaps even the user will find himself there one day.

CQ!

Early Amateur radio stations comprised a transmitter, receiver and frequency meter. The latest commercial stations offered to the Amateur are compact, table-top units which house all these separate items in a single package. I see that an instrument manufacturer has followed this approach and now offers an oscilloscope, digital multimeter and a digital counter all in a single, compact case. It really is a very desirable property, but I will not mention further details (a) because of lack of space, (b) so's not to make you discontented with what you have and (c) the price would ruin your New Year. Keep smiling!

ENERGY

I note with interest that in the US much work is bubbling on the photocell front. Energy from the sun, and with no moving parts is a great attraction—and the energy so gained is free—my life. Of course, one hears lots of rumours about cell efficiencies etc. but practical details are harder to come by. However, I hear that one array of cells on order (to be delivered shortly) will provide some 40kW of energy. Elsewhere I hear that a number of companies in the US are ready to supply panels of cells around 6 x 4ft providing some 5½W per square foot. There is even mention of 50-cent cells by 1980.

While on the subject of power, hands up if you've heard about the latest in long-life batteries. Not those that your dealer is always trying to "cell" you (sorry, pun intended) but those using nickel and hydrogen. These new beasties are claimed to offer up to four times the watt/hours per pound as is currently available from state-of-the-art nickel-cadmium cells. No further information at present but sufficient to say that the US military are already designing these batteries into their satellite programme. Definitely batteries that will be out of this world!

AHH SO!

Damn clever those Chinese—but are the Japanese even more clever? Certainly one electronics company is trying hard to prove that this is the case. Early in 1976, one Japanese company is to launch what is thought by many (including mistress Ginsberg) to be the most elaborate channel selection device ever. It has been developed specially for use with colour televisions and it allows the owner/viewer to programme in his selection of chosen TV programmes for the day. The readout on the TV screen itself displays the time selected and the channel selected at that particular time. Once programmed, the device will automatically select or tune the appropriate channel at the correct time. Up to 16 programmes can be selected and "dialled" in.

The circuit is rumoured to contain a chip which is only just over 5mm^2 and contains nearly 8,250 transistors. No mention of price but what with extra sophistication driving the prices up, plus more than a little help from inflation, I really do wonder if The Six Million Dollar Man will be watched on the Six Million Dollar TV Set!

Ginsberg

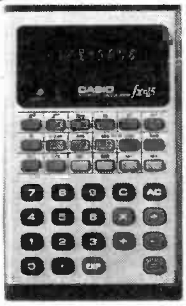
BARCLAY ELECTRONICS
MONEY SAVERS

CBM SR7919D

- 8 digit or 5 digit + 2 exponent
- Sine, Tan, Cos and their inverse
- Natural Logs, Common Logs, Anti Logs
- Square Root
- Reciprocals
- Y^x
- x^2
- π
- Register Exchange
- Memory plus
- Store Recall
- Sign Change
- Algebraic Logic

ONLY **£12·50** +8% VAT

1 year Manufacturer's Guarantee CBM mains adaptor. Please add £2·50 to total



THE NEW POCKET SIZE CASIO FX-15 FULL SCIENTIFIC WITH BRIGHT SCREEN DISPLAY

Only 2·98cm deep
8·8cm wide
14·6cm high
Sexagesimal/Decimal conversion Scrament from 1039 to 10-39

- 10 figure mantissa
- 2 figure exponents
- 2 sign display
- Common logs, natural logs and antilogs
- Memory
- Memory + −
- Reciprocals
- Square roots
- π
- Automatic constant
- Exponent key
- Y
- Clear last entry
- Mean and standard deviation, also polar rectangular co-ordinates can be worked out using the appropriate formulæ
- Floating point
- Positive feel keyboard
- Degrees
- 25 hour battery time
- Own carry case
- Algebraic logic
- Full 1 year manufacturer's guarantee
- Cos, Sine, Tan and their Inverse

FUNCTION FOR FUNCTION THIS IS UNBEATABLE

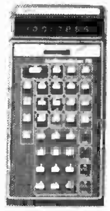
ONLY **£24·90** +8% VAT

If mains adaptor required, please add £3 to total

NOVOUS 4515 100 STEP PROGRAMMABLE

The new 4515 (by National Semiconductors) 100 step programmable is the answer to those ridiculous prices one had to pay for a machine that could do what this beautifully made machine can do, and it costs a fraction of what it should cost.
The programming is simple to operate, and many different programmes can be contained at the same time. Constant and variable factors can be inserted when or where you want. You can correct mistakes, and even skip out programmes out of a number of other programmes.

This is truly an unbeatable machine



- 8 digit
- Common and natural logs, and anti log
- Sine, Cos, Tan and their inverse
- Reciprocals
- Y
- x^2
- 3 level stack
- π
- Register exchange
- Sign change
- Memory
- Memory + x^2
- Degree radian conversion
- Rechargeable (Recharger included in price)
- Vinyl case (full instruction manual)

OUR PRICE **£39·50** +8% VAT including recharger

If you need scientific notation, then the Novous 4525 is your answer.
8 digit +2 exponent 100 step programmable +4 roll stack and everything else the 4515 has.

ONLY £59·90 +8% VAT

Full one year manufacturer's guarantee

SCIENTIFIC ORDINARY RANGE OF CALCULATORS

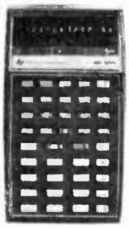
ALGEBRAIC

	£
CBM 4148 12 digit +2 exp.	39·95
TEXSAS SR16 8 digit +2 exp	31·50
TEXSAS 50A 10 digit +2 exp	43·50
TEXSAS 51A 10 digit +2 exp	63·50
ROCKWELL 51R 8 digit conversion	27·50
ROCKWELL 63R 8 digit +2 exp.	29·99
ROCKWELL 61R 8 digit	27·50
SINCLAIR OXFORD 300 5 digit +2 exp.	21·95
CASIO FX101 8 digit + 2 exp	£27·73
CASIO FX15 6 digit + 2 exp	£24·03
CASIO FX10 6 digit + 2 exp	£19·95

REVERSE POLISH LOGIC

	£
SINCLAIR Scientific 5 digit 2 exp.	11·50
NOVOUS 4510 8 digit mathematic	19·50
NOVOUS 4515 8 digit mathematic. 100 step programmable	39·50
NOVOUS 4520 8 digit 2 exp 4 roll stack	34·50
NOVOUS 4525 8 digit 2 exp. 4 roll stack. 100 step programmable	59·90
NOVOUS 6010 8 digit conversion	21·50
NOVOUS 6020 8 digit financial	33·50
NOVOUS 6025 8 digit financial. 100 step programmable	59·90
NOVOUS 6030 8 digit statistical	38·00
NOVOUS 6035 8 digit statistical. 100 step programmable	59·90

	£
DECIMO VATMAN green	9·75
SUPER VATMAN green, M, %	14·95
ROCKWELL 8R	7·50
ROCKWELL 20R, M, %	12·50
ROCKWELL 21R, M, %	14·80
ROCKWELL 31R, √	16·95
ROCKWELL 51R, Metric	27·50
NOVOUS 850	6·50
NOVOUS 826	7·90
NOVOUS QUIZ KID	8·95
TEXSAS +1200	7·50
TEXSAS +1250	9·95
TEXSAS SR10	19·95
CBM 774D	5·80
CBM 766D	6·40
CBM 976D	8·75
CBM 887D, M, %	9·50
CBM 976R, M, %	10·95
CBM 989R	12·90
SINCLAIR CAMBRIDGE	8·75
SINCLAIR CAMBRIDGE Memory	11·95
SINCLAIR OXFORD 100	8·95
SINCLAIR OXFORD 200	13·95



ONE OF THE MOST ADVANCED CALCULATORS Texas SR50A

The SR-50 is the full function portable slide rule calculator. Complex scientific calculations are solved as easily as simple arithmetic problems. The SR-50 features an algebraic keyboard with single function keys for easy problem solving.

- 10 digits + 2 exponents
- Deg/Rad Switch
- 0 through 9 Digit Keys
- Decimal Point Key
- π Pi Key
- EE Enter Exponent Key
- +/− Change Sign Key
- CE Clear Entry Key
- C Clear Key
- + Add Key
- − Subtract Key
- × Multiply Key
- ÷ Divide Key
- = Equals Key
- x^2 Square Key
- $\sqrt{x}$ Square Root Key
- $1/x$ Reciprocal Key
- $x!$ Factorial Key
- sin Sine Key
- cos Cosine Key
- tan Tangent Key
- arc Inverse Trigonometric Key
- hyp Hyperbolic Function Key
- D/R Angle Change Key
- log Common Logarithm Key
- lnx Natural Logarithm Key
- e^x e to the xth Power Key
- y^x y to the xth Power Key
- $\sqrt[x]{y}$ The xth Root of y Key
- x:y Exchange Key
- STO Store Key
- RCL Recall Key
- Σ Sum and Store Key

Although correct at time of going to press prices may be subject to alteration without notice. Please add 8% VAT to total plus 55p postage.

DIGITAL WATCH

POSSIBLY THE MOST ACCURATE FULL 6 FUNCTION L.E.D. QUARTZ CRYSTAL WRISTWATCH ON THE MARKET TODAY

This offer can continue only to the 31st Dec

- **FULL 6 FUNCTIONS** (do not confuse with cheaper 2, 3 or 4 function watches)
- Single button operation
- Displays hours, minutes, seconds, month, date of month
- **ULTRA ACCURATE** to less than 1 second a week
- Easily readable, bright L.E.D. display
- Automatic 3 second **HOLD** and **FADEOUT** display
- **AUTOMATIC COMPUTERIZATION** for 28, 30 and 31 day month.
- Top quality stainless steel.
- Manufacturer's full 1 year guarantee.
- Arrives in free presentation gift box.
- Includes **BEAUTIFUL MATCHING STAINLESS STEEL BRACELET.**
- Replace battery only once a year.
- Water and shock resistant.
- Anti-magnetic.
- Silent.

ONLY **£29·50** +8% VAT

PHONE CALLS AND PERSONAL CALLERS WELCOME
MONDAY-THURSDAY BETWEEN 2 and 5 p.m.

To: **BARCLAY ELECTRONICS** Dept. 2PE
STANLEY HOUSE, 1115 FINCHLEY ROAD, LONDON N.W.11

Please send me ....

with/without optional mains adaptor. I enclose cheque/money order

total value £ .... including 55p to cover packing.

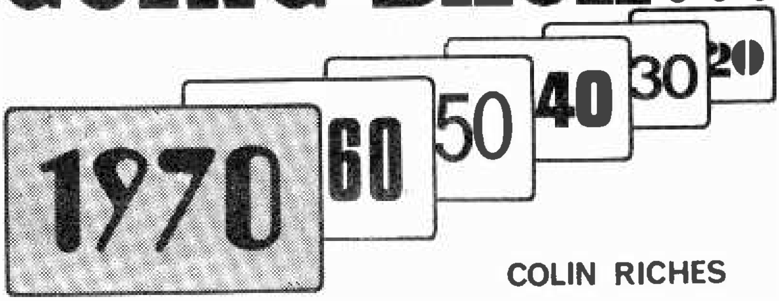
NAME ....

ADDRESS ....

SCOOP! AUDIO MAGNETIC GOLD LABEL BLANK CASSETTES—Price per box of ten: C60 £3·00, C90 £4·20, C120 £5·40. Post 22p per order

ALL GOODS ARE FULLY GUARANTEED. IF NOT SATISFIED MONEY REFUNDED IF RETURNED UNDAMAGED WITHIN 7 DAYS

GOING BACK...



COLIN RICHES

Faraday Lecture

THE 1975-76 Faraday Lecture, organised by the Institution of Electrical Engineers, is being given by F. Howard Steele, Director of Engineering at the Independent Broadcasting Authority. His lecture, "The Entertaining Electron", unravels the technical mysteries of television.

The first presentation of the Lecture took place in The City Hall, Cardiff on Monday, November 24th at 6.30 p.m.

Mr. Steele is assisted by two deputy lecturers: Alan James, the IBA's Network Manager and Dr. Boris Townsend, Head of the IBA's Engineering Information Service.

Each year the Institution of Electrical Engineers invites an eminent electrical or electronic engineer to present the Faraday Lecture. The Lecture was instituted in 1924 to commemorate Michael Faraday, the British physicist who in 1831 discovered electro-magnetic induction and so set in motion a whole new industry.

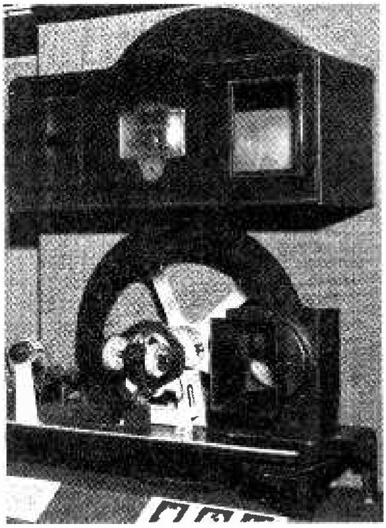
The lecture tour programme is as follows: Birmingham, The Town Hall, 26-27 January, 1976; London, The New London Theatre, 3, 4, 5, 6 February, 1976; Exeter, The Great Hall, Exeter University, 26 February, 1976; Bradford, St George's Hall, 9 March, 1976; Nottingham, The Albert Hall, 11 March, 1976; Liverpool, Philharmonic Hall, 19 March, 1976; Manchester, Free Trade Hall, 22-23 March 1976; Glasgow, The Kelvin Hall, 21 April, 1976; Edinburgh, The Usher Hall, 23 April, 1976; Newcastle, The Newcastle City Hall, 27 April, 1976; Portsmouth, The Guildhall, 4 May 1976.

The presentation follows the Faraday tradition in its many practical demonstrations and working models—but it also borrows from television production techniques in exploiting audio-visual aids including film, video-tape and large screen television displays.

The Lecture makes full use of a special, complex mobile stage in explaining both the technology and the role of engineering in the production and presentation of television programmes.

The latest technological developments that may help to mould the shape of television during the coming decade are explained in a manner that seeks to make them understandable and meaningful to the interested lay-man, in an informative yet entertaining manner.

The Lecture ranges over the developments of the technology, from the earliest Baird 30-line television, to optical waveguides, quadraphonic sound and Oracle teletext.



Baird's 'Televisor'
—Science Museum Photograph.

Modern colour television operations will be explained with the aid of film and video-tape recordings, with some of the first displays to be given in the United Kingdom by means of a new "large-screen" television display system.

The advances made possible in the unfolding pattern of television technology with the aid of computers will be emphasised by teletext, by the latest DICE standards conversion and by such applications on adaptive aerials that adjust under the control of a small computer to minimise interference from several different sources.

The mobile stage will permit a series of demonstrations in which the aim will be to show how science and engineering have become so much a part of everyday living that the viewer takes the technology virtually for granted—but technologists continue to seek new ways of using "the entertaining electron" to create ever more convincing illusions and to expand home entertainment systems into new and exciting fields.

Tickets for the Lecture are free and are available from *Mrs. B. Newman, IEE, Savoy Place, London, WC2R 0BL.* The Lecture lasts approximately 1¼ hours.

Baird Television 1930

THE "Televisor" (see left) was manufactured by the Plessey Company for Baird Television and was priced at 25 guineas. It was intended for reproduction of Baird's 30-line transmissions which the BBC radiated on an experimental basis from 1929 onwards.

The picture signal from the owner's radio receiver varied the brightness of a special neon lamp having a rectangular luminous electrode. The lamp was viewed through the 30 small holes arranged in a spiral round the outside of the large disc which rotated at 125 revolutions per second. This form of scanning had been patented by Nipkow in 1884.

A magnifying lens in front of the disc increased the effective picture size to about 50×75mm.

The motor driving the disc was synchronised by means of a cogged wheel on its shaft which was in between the pole-pieces of an electromagnet energised by the picture signal.

Dear Sir,

letters

Electronic plumber

Working on the principle of "fools rushing in, etc." and realising all that was needed was a good plumber with a small blowlamp I had a go at the Tele-Tennis project. I went a bit mad with the ferric chloride bottle but after a couple of attempts the boards were made and the thing worked. All praise for the clear instructions which I realise must frustrate the pundits as even I was able to cope.

There is one problem arising. Now, being an electronics expert, as acknowledged by my daughters, they consider that a small organ of a couple of octaves would be a piece of cake by Christmas! So what about it, PW?

—**P. J. Gale** (Aylesbury)

P.S.—Yes! The kids are better at the damned game than me!

(Thank you for the few kind words Mr. Gale, your wish was granted in the January issue. We hope it will make a suitable Christmas project for very many of our readers. Incidentally, we think you are being just a bit too modest about your constructional abilities!)

Short thanks

I would like to thank the gentleman who sent me 'PW' July 72 for which I asked in your CQ column.

He did not enclose name and address but it was postmarked Leeds.

Incidentally, I have on three occasions replied to a "CQ" offering assistance to a query but in no case have I received an answer.—**W. G. Philpott** (Rye, Sussex).

Boost your signal

Reading your October issue of *PW*, I noticed the article on a signal booster for portable radios. I lost no time in constructing a mock-up of the design and can confirm its efficiency. However, I think you will find that it is unnecessary to amplify the output of the coil if a reasonably good aerial is used. If the coil is made to a similar design as the ferrite rod aerial in the I.C. tuner (also in the supplement) all that is necessary is for the unit to be positioned, with the core aligned with that in the set. I find it desirable to wind this coil in such a way that it tunes from 200 to 550m when the aerial and earth are connected to the extra ends. There will be some signal loss if taps, separate coupling coil or series capacitor are employed. This means finding the number of turns by experiment.

I have not yet tried the long waves, but I think the results should be similar, though I suppose the coupling would not be quite so efficient.

I feel sure your readers would be glad to know that signal boosting can be obtained this way without the complication of transistors and associated extra components.—**K. H. Smith** (Ross-on-Wye).

What price progress?

Derek Bell's notes in the December issue of Practical Wireless (Shortwave broadcasts, p701), about the oldest set in regular use, prompts me to write about an Amplion "Delegate" which my wife bought at a jumble sale a year ago, for twenty pence.

Having replaced a broken dropper resistor, and receiving nothing but a cultured hiss, I was led, by intuition and experience to the oscillator/mixer valve, where however, voltages seemed normal. Replacing the valve gave no joy. After hours of cogitating, I was reduced to quite purposeless poking at the valve-holder tags with a plastic knitting needle. Suddenly, the set burst into life, but died again when the prod was removed.

When the valve-holder was broken open, I found that the interior connection had corroded away. If I had done what the books say, and measured the voltages at the valve pins, instead of the valve-holder tags, I should have been all right!

The only clue to the age of the set, is the marking of the various Radio 4's as "London Regional", "North Regional", and Radio 2 as "Light". It uses a barretter (imagine!), and is contained in a lovely inlaid walnut rectangular cabinet $330 \times 205 \times 165$mm. The speaker is hidden behind a beautiful set of tiny louvres. It is a little cracker; the aerial socket is connected to the outer braiding of a disused TV aerial, and on SW, the Voice of America may easily be received. I think it has a wider frequency response than most modern portable AM receivers, and is in regular daily use.

One wonders just where miniaturisation has taken us; this set uses five large valves, whopping IF transformers, large air coils, and a barretter to boot. Yet in size, it is no larger than the average modern portable set.

H. Padmore (Blackpool)

Socket-to-me

At the time of writing, one of your advertisers, CT Electronics, has for sale small signal TO18 (BC107/8/9) transistor sockets. After having purchased a fair number of these sockets, I've found a simple way of modifying them for 4 and 6 lead IC's like the μA703 used in the SW Pre-amplifier September '75.

The correct socket for this device costs around 35p, but the 'CT' sockets cost $4\frac{1}{2}$p each. Two are required for each four or six lead device.

To construct these, file the 'open' edge of the socket until the two small pips on the underside are half removed. The filed edges of the two sockets should now be Araldited together making a single unit. This arrangement will hold the IC tightly with a little careful bending of the leads, and is of course very much cheaper.—**M. J. Shepherd** (Canvey Island).

Snap in our TUNER CASSETTE

IN NEXT MONTH'S PRACTICAL WIRELESS

Have you ever wished that you could get some radio programmes on your cassette player? Build this simple tuner unit and load it into your player whenever you get fed up with your tapes.

also:

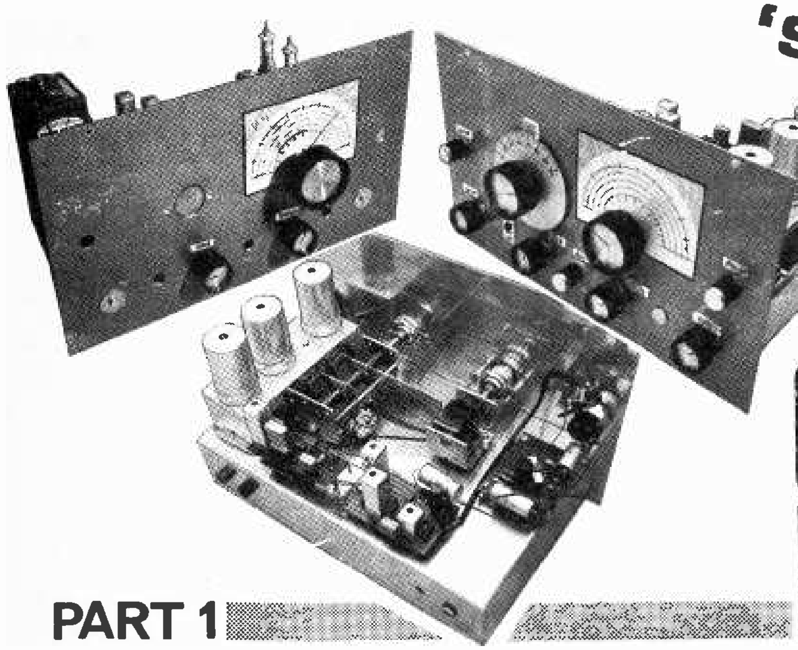
CMOS Crystal Calibrator &

Using seven cheap CMOS devices this calibrator provides outputs to well above 30MHz from a 1MHz crystal. Decade dividers provide outputs down to 1Hz if required, for checking counters and other digital circuitry at speeds slower than normal.

UP-DATED HOME TELEPHONE EXCHANGE

ALL THE REGULAR FEATURES

ON SALE IN FEBRUARY



'STEP BY STEP' GENERAL COVERAGE RECEIVER

PART 1

F.G.R

THIS receiver covers approximately 500kHz to 30MHz and is constructed so that it can be developed by the addition of extra stages, which in turn give better reception and extra facilities such as the reception of CW and SSB. Because a large, comprehensive receiver has circuitry which can represent quite a long period spent on construction, before it is finished and can be operated, there is considerable advantage in beginning with a simpler circuit, to which further stages can be added. A working receiver is then obtained quickly. Difficulty in locating a fault in a relatively complicated receiver is also avoided, as the working of extra stages will be checked as they are added.

CIRCUIT DETAILS

Shown in Fig. 1 is a block diagram of the whole circuit, but only stages 2, 3, 5 and 7 need be wired initially to obtain a receiver of good general performance. A brief description of the function of each section in Fig. 1 should be of help in understanding how the receiver is improved as optional stages are added.

(1) The RF amplifier is a protected dual-gate FET giving a worth-while increase in sensitivity. Being tuned the RF stage also helps to eliminate second channel interference. An RF gain control is fitted as strong signals can overload the mixer.

(2) FET mixer, to which the aerial may be taken directly when making the basic receiver. Output from this stage is at the intermediate frequency of 1·6MHz.

(3) FET separate oscillator. It must be noted that the devices in stages (1), (2) and (3) use **valve** type coils, **not** transistor types.

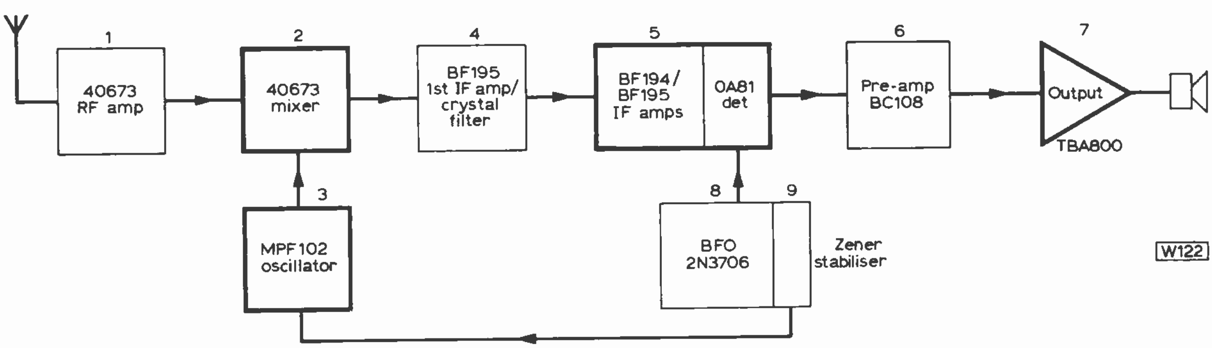
(4) An optional intermediate frequency stage to increase sensitivity and selectivity. It can be used as a crystal filter with a single crystal and phasing capacitor. The maximum selectivity obtainable with such a circuit is high, but selectivity is easily degraded or the crystal cut out to provide optional levels of selectivity, and for the reception of AM.

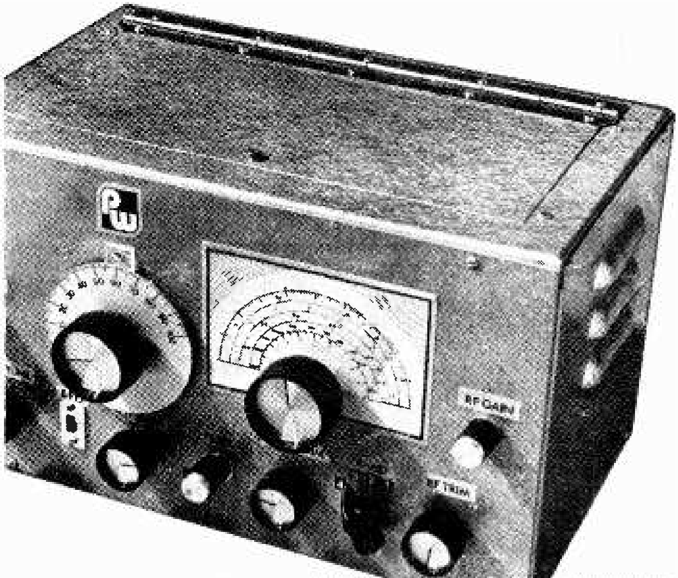
(5) This section has two IF amplifiers, with five 1·6MHz tuned circuits. So there are seven tuned circuits in all when (4) is used giving the IF section good skirt selectivity to reject unwanted signals.

(6) This is an optional pre-amplifier to boost audio signals, and may not be felt necessary in some cases.

(7) An audio IC which requires few components and gives sufficient loudspeaker volume from a 9V battery supply. As with any receiver having considerable gain it is of course, possible to overload

Fig. 1: below, is a block diagram to show the functions of the various stages. Those stages in heavy outline are the essential ones for the basic receiver. Fig. 2, right, is the circuit for the first three stages but the RF stage, Tr1, can be omitted initially, as explained in the text.





AYER G3OGR

This simple-to-build design makes life very easy for those building their first receiver. The set is soon operational on any required range with just one set of coils. Further optional stages can be added, one at a time, finishing off with the switching of the four ranges to provide coverage of the medium wave band and all the short wave bands.

Facilities provided by the complete receiver include:

RF Amplifier ● Bandspread Tuning ● Beat Frequency Oscillator ● Crystal IF Filter ● Noise Limiter ● Mains Power Supply Unit.

output (or even other) stages, so the gain and volume controls have to be operated in a sensible manner.

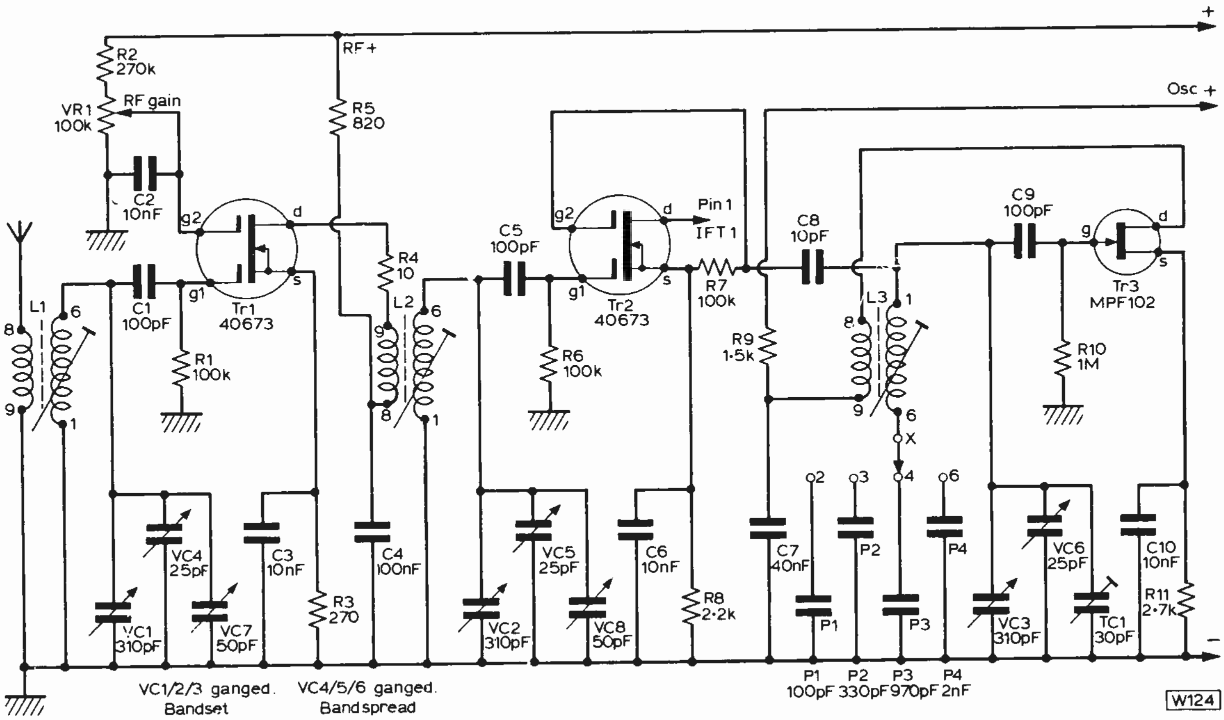
(8) The beat frequency oscillator/carrier oscillator allows reception of CW and SSB signals. As an envelope detector can give satisfactory CW and SSB reception, in addition to AM, when the relative strengths of CW/SSB on the one hand, and BFO on the other, are suitable, this type of detector is provided in section (5).

(9) A regulated supply for the oscillators is not essential but avoids frequency modulation effects, particularly when the extra stages or BFO are in use.

TUNING ARRANGEMENTS

A 3-gang capacitor tunes stages (1) (2) and (3). Layout is arranged to allow addition of a ganged bandspreading capacitor later, which is useful for Amateur or other narrow short wave bands. To obtain best performance without banks of pre-set trimmers, stages (1) and (2) have panel trimmers. These allow the peaking up of weak signals at any frequency and with almost any aerial.

The bands covered are approximately as follows



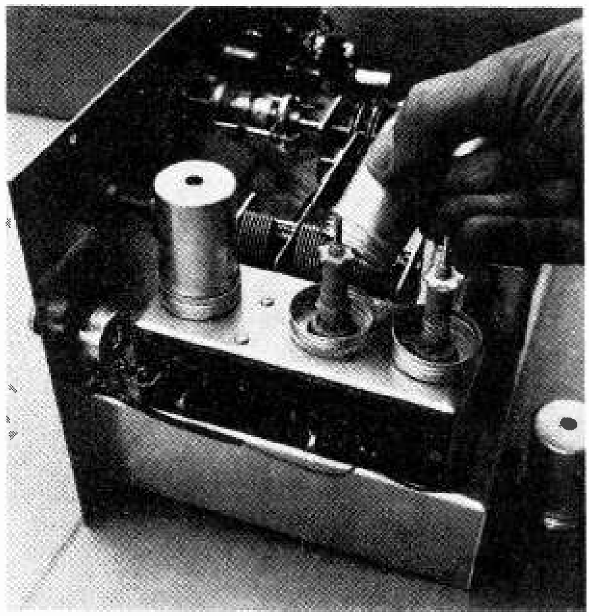
("Range 1" being the maker's long wave band, which is omitted):

Band 1 (Range 2)	1500 to 500kHz
Band 2 (Range 3)	1·7 to 5·0MHz
Band 3 (Range 4)	5·0 to 12MHz
Band 4 (Range 5)	13 to 30MHz

Coverage may be adjusted to include the 1500-1700kHz sector, but it should be understood that instability must be expected around the 1·6MHz region in this case, the receiver IF.

Bandchanging is by plug-in coils. Advantages of this are the simplicity plus avoidance of a multi-way switch. There is also no need to purchase coils for bands not wanted. A set of coils can be changed in a few moments, and even this is not necessary if most interest is in one particular range of frequencies. However, the layout is arranged so that bandswitching can be added later, the switch and coils occupying the space below the RF/mixer/oscillator assembly.

It is not necessary that the optional stages are added in the order in which they are described, as some other combination might be preferred. For example, the BFO could be added to sections 2, 3, 5 and 7, instead of later.



View of the RF-Mixer-Oscillator unit of Fig. 2. The aluminium containers in which the coils are supplied are used as screening cans.

METALWORK

Assuming that the bandspreading and other extra controls will be fitted eventually, it is best to punch or drill for these at the beginning. Unused holes in the panel can be covered, or have the controls only installed. The layout of units will be seen from Fig. 3. The panel is 12×7in and the chassis is $10\frac{1}{2} \times 6\frac{1}{2} \times 2$in. Place panel and chassis together and mark the holes on the chassis. To fit the cabinet the panel edge is about $\frac{3}{8}$in below the chassis. Panel and chassis are held together by the controls, or initially, by bolts with large washers.

The bandsetting and bandspreading capacitors have their spindle centres $3\frac{3}{4}$in apart. Bolt the main tuning capacitor directly to the chassis. Slotted or enlarged holes, with washers, will allow the exact position to be adjusted a little, if necessary, to line up with the drive correctly. As the bandspreading capacitor is smaller it is raised with 4BA nuts so that its shaft is at the same height. Small holes can be drilled in the chassis later, provided metal fragments are not allowed to fall into the capacitors or other components, but large holes should be made before mounting any parts.

The cabinet could be prepared later. Punch or cut holes (at least 1in in diameter) opposite aerial, earth and speaker sockets. If the top is to be made to open, to reach plug-in coils or the battery, either of two methods can be used. Both have been found satisfactory, but the second takes longer.

(1) (The easy way!) Drill out the six rivets which hold the top to back and sides. Pivot the top by two 6BA bolts through the side rivet holes near the

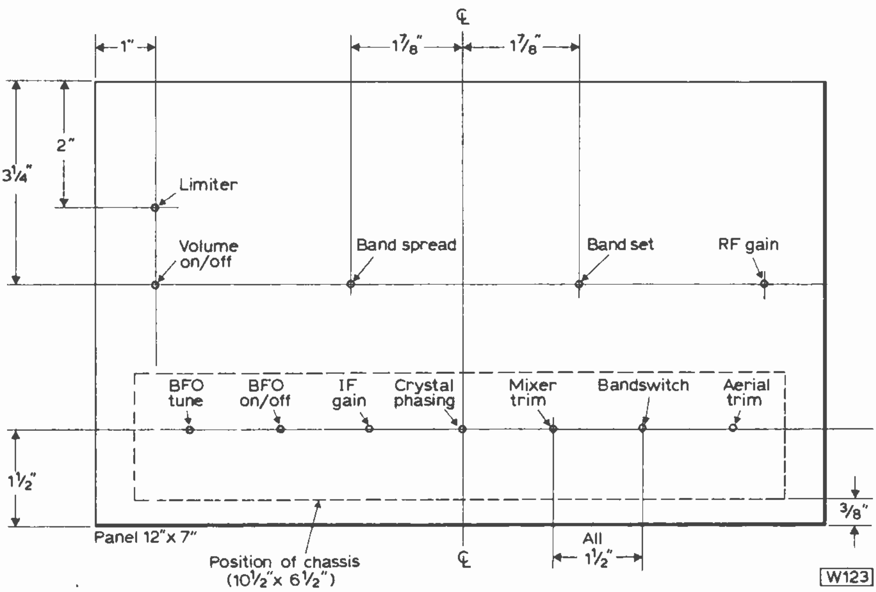


Fig. 3: Details for marking out the front panel. Most of the holes will be ⅜in. diameter but check with actual components used. It is advisable to drill all the holes from the start even if the optional stages are not added until later. After fitting the chassis to the panel check that they fit into the cabinet properly.

★ components list

RF—MIXER—OSCILLATOR

Resistors

R1 100kΩ	R5 820Ω	R9 1·5kΩ
R2 270kΩ	R6 100kΩ	R10 1MΩ
R3 270Ω	R7 100kΩ	R11 2·7kΩ
R4 10Ω	R8 2·2kΩ	VR1 100kΩ linear pot.

Capacitors

C1 100pF	C6 10nF	P1 100pF	5%
C2 10nF	C7 40nF	P2 330pF	5%
C3 10nF	C8 10pF	P3 970pF (500 + 470)	5%
C4 100nF	C9 100pF		
C5 100pF	C10 10nF	P4 2nF	5%

VC1-2-3 3 x 310pF (Jackson Type L) gang
VC4-5-6 3 x 25pF (Jackson Type 00) gang
VC7 VC8 50pF air-spaced variable (Jackson Type C804)
TC1 30pF Beehive or ceramic trimmer

Semiconductors
Tr1 40673 Tr2 40673 Tr3 MPF102

Inductors
L1-L2-L3 Miniature plug-in coils, valve type, (Denco) L1 Blue L2 Yellow L3 White (Ranges as required)

Miscellaneous
Valveholders B9A, 3-off. Flanged runner, universal chassis, 8 x 2in. Plain panel 5 x 2in. (Home Radio). Tuning drives:—Bandset, Jackson 4103 or similar; bandspread, Jackson slow motion drive 4511/DRF with dial 3in. dia. (Home Radio). Cabinet 12 x 7 x 7in. type W and chassis 10½ x 6½ x 2in. type K (H. L. Smith, 287 Edgware Road, London W2.) Knobs. Insulated sockets for aerial and earth. Jack socket for headphones or speaker, see text. Plain veroboard 0·15in. 5 x 2in. Note:—Cabinet type W includes panel.

BASIC IF AMPLIFIER

Resistors

R12 47kΩ	R15 390Ω	R18 10kΩ
R13 1kΩ	R16 120kΩ	R19 1kΩ
R14 330kΩ	R17 27kΩ	

Capacitors

C11 8μF 6V	C14 200μF 10V
C12 10nF	C15 10nF
C13 100nF	

Semiconductors
Tr4 BF194 Tr5 BF195 D1 OA81

Miscellaneous
IFT1, type IFT18/1.6. IFT2, type IFT18/1.6. IFT3, type IFT17 (all Denco). Plain veroboard 0·15in. 3 x 1¾in.

AUDIO AMPLIFIER

Resistors
R20 56Ω R21 1Ω VR2 100kΩ log. pot with switch S1.

Capacitors

C16 1μF 6V	C19 100μF 10V	C22 250μF 10V
C17 4·7nF	C20 330pF	C23 470μF 10V
C18 75pF	C21 2·2nF	C24 100nF

Miscellaneous
IC1 TBA800. Plain veroboard 0·15in. 2¾ x 2in. For power supply circuit:—R22 220Ω R23 1kΩ (or 3·3kΩ see text) C25 1000μF 10V.

BEAT FREQUENCY OSCILLATOR

Resistors
R24 270kΩ R25 270Ω

Capacitors

C26 250pF	C28 4·7nF
C27 400pF	C29 6·8pF

VC9 10pF air spaced variable (Jackson C804)

Miscellaneaous
Tr6 2N3706 or similar D2 6·2V 400mW zener. S2, miniature slide on-off switch. Coil former 7mm with core. Plain veroboard 0·15in. 2⅜ x 1⅛in.

CRYSTAL FILTER

Resistors

R26 120kΩ	R29 330Ω
R27 39kΩ	R30 270kΩ
R28 150Ω	VR3 100kΩ linear pot.

Capacitors

C30 470pF 1%	C32 100nF
C31 470pF 1%	C33 100nF

VC10 25pF air spaced variable (Jackson C804)

Miscellaneous
Tr7 BF195. IFT4, IFT18/1·6 (Denco). Crystal 1·6MHz, and holder, HC6U preferred. Extension shaft, coupler and bush. Plain veroboard 2¾ x 1in.

AUDIO PRE-AMPLIFIER

Resistors
R31 5·6kΩ R32 1·8MΩ R33 8·2kΩ R34 5.6kΩ

Capacitors
C34 100nF C35 100μF 10V

Semiconductor
Tr8 BC108

All resistors are ¼ or ½W 5 or 10%

back. Fit a small knob or terminal head to lift the lid, which closes on the side flanges of the case.

(2) Mark off about 1in from the sides, front and back. Drill small holes to start a metal saw and cut out this piece. Clean the edges with a file, and fit a cabinet hinge (or two small hinges) at the back. The opening part rests on two 6×1in strips bolted inside and projecting into the aperture. Fit a lifting knob.

RF, MIXER AND OSCILLATOR

The circuit of these stages is shown in Fig. 2. The RF stage can be omitted, as described, but is included here so that the method of connecting it is clear. If the RF stage is not used, connect the aerial to 9 of coil L2, taking pin 8 to chassis. Tr1 and all components up to C4 and R5 are then not required.

VC1/2/3 is the ganged capacitor for main tuning, while VC4/5/6 is for bandspreading. Capacitors VC7 and VC8 are panel trimmers to peak the aerial circuit L1 and mixer circuit L2. With the oscillator trimmer TC1 set at about half capacitance, no other trimmers need be fitted.

A "Blue" coil is used for L1, a "Yellow" coil for L2, and a "White" (1·6MHz osc.) coil for L3. P1 to P4 are individual padders, automatically in circuit for each range. Pin X of the "White" coils is different for each range, so that only the required padder is

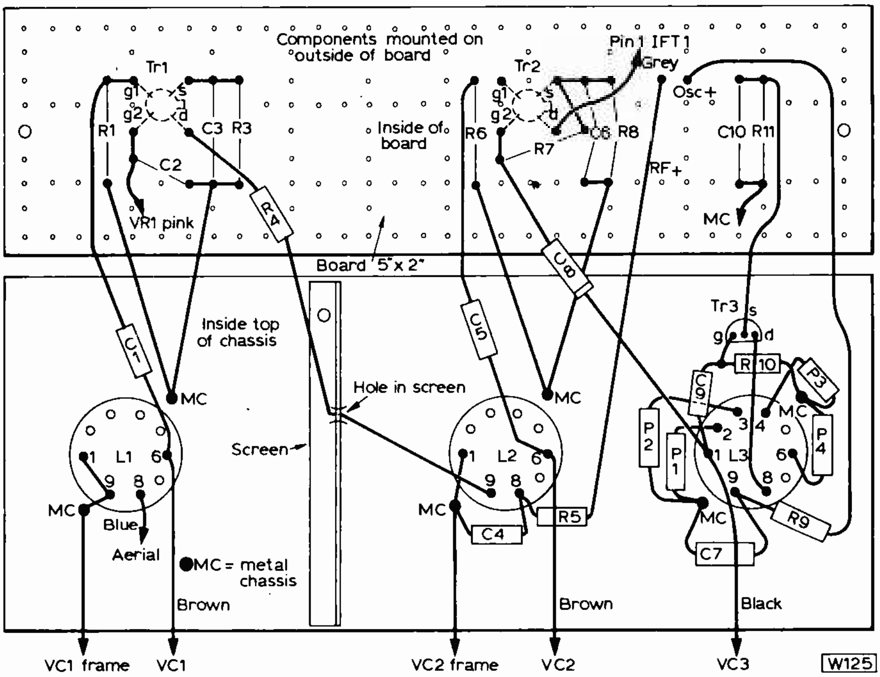


Fig. 4: Layout of parts in the RF-Mixer-Oscillator unit as viewed from the inside with the veroboard folded back for clarity. All leads should be kept as short as possible. NOTE: if the 40673 transistors are received with a wire shorting ring round the leadouts this should not be removed until the unit is about to be tested.

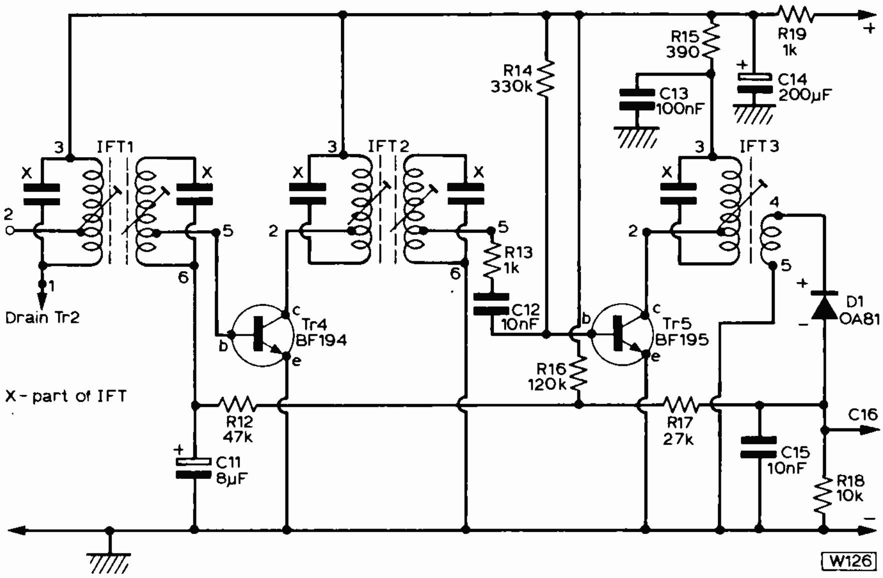
actually in circuit. Potentiometer VR1 controls Tr1 gain by changing the gate 2 voltage. Tr3 is the separate oscillator and it can be supplied either from the 9V line, or from a zener stabilised circuit, when the BFO is fitted.

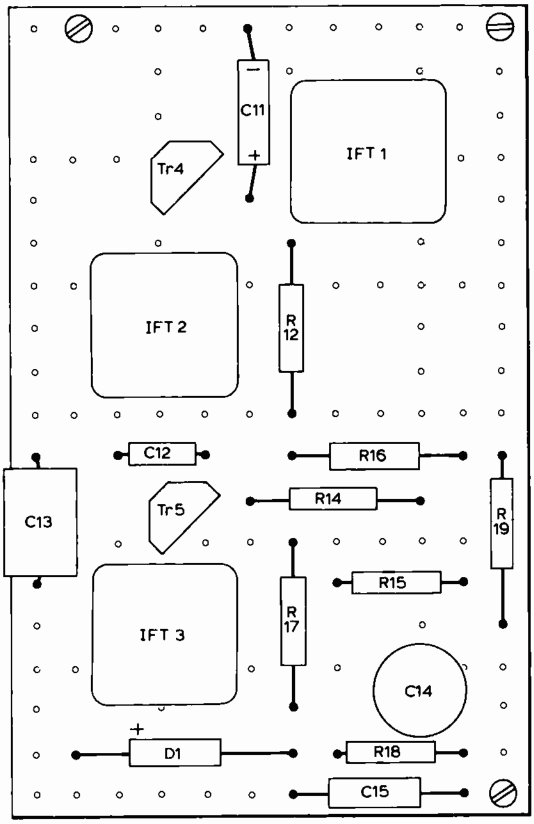
It will be realised that three coils (Blue, Yellow and White) are used for any one band, but that coils need not be obtained for bands not required. Range 4 is best for general short wave reception, while Range 2 can be omitted if no MW reception is wanted. Range 3 coils would cover both LF Amateur bands, 80 and 160m. Coverage on each band depends on the core setting of L3 and all cores are adjusted so that some threaded rod projects. With TC1 suitably adjusted. VC7 and VC8 should peak signals near the high frequency end of a band (VC1/2/3 nearly open). The cores of L1 and L2 are then set so that little re-adjustment of VC7 or VC8 will be needed near the low frequency end of the band (VC1/2/3 nearly closed).

Some misadjustment of L1 or L2 will cause no loss of efficiency, provided VC7 or VC8 is not fully open, or fully closed for best results. As initial wrong positioning of L1 or L2 cores, or VC7 or VC8 can result in complete loss of signals, check these if needed when first using a new range of coils. Subsequently, if L3 or TC1 is adjusted to obtain correct coverage, readjust the aerial and mixer to suit.

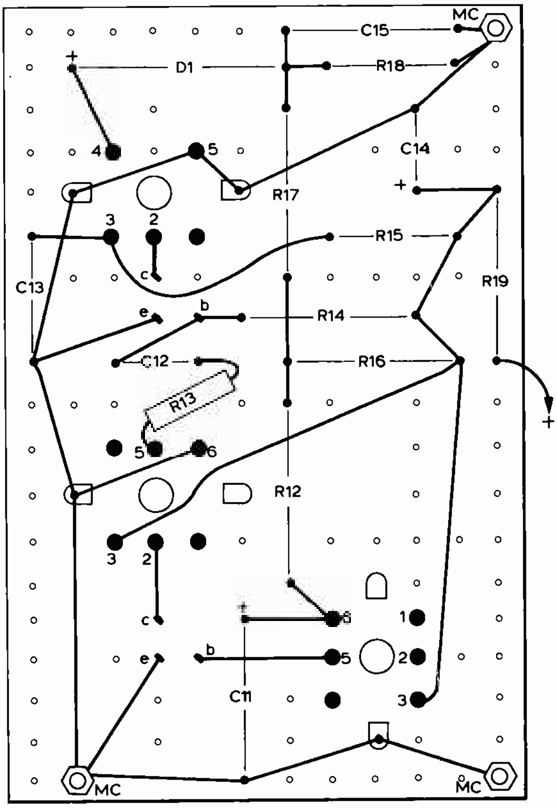
It should be noted that the IF transformers are

Fig. 5: Circuit of the IF amplifier stages and detector diode D1. Ensure that the diode is connected the right way round. Fig. 6: on the next page, shows the component and wiring sides of the IF amplifier board. Check that the BF194 goes into the Tr4 position and the BF195 into the Tr5 location.





Board 3"x 1¾"



W127

pre-aligned to 1·6MHz by the maker, so their cores should be left alone, except for a final small adjustment. The aerial, mixer and oscillator coils, however, are supplied in metal cans and for this reason are not set, and the cores must be screwed so that several turns of rod project, as described.

To leave the chassis clear below, the coil holders are fixed to the top of a metal frame 5×2×1½in high, see photograph. This is readily made by taking an 8×2in flanged "universal chassis" side and cutting a 90-degree portion out of each flange 1½in from the ends, so that a right-angled bend can be made. Secure a piece of 0·15in matrix plain perforated board with 6BA bolts. Wiring can then be carried out as in Fig. 4. The board is shown flat so that the wiring can be seen. Bolt a 2×1½in metal screen between aerial and mixer coil holders (it can be cut from a spare universal chassis side) and fit a coil can lid at each holder position. This is done by punching valveholder holes in the lids and holding them with the bolts which secure the coil-holders.

Fig. 4 shows the lead-outs for the RF mixer, and oscillator devices. "MC" points are tags bolted to the box. Connections should be short and direct and wiring and components for the aerial and RF circuits should be clear of Tr1 drain and later tuned circuit components. It is helpful to put short pieces of coloured sleeving on the FET leads, say red for drain, white for gate 1, brown for gate 2, and leave source leads bare.

Leads for external circuits are required, and may also be colour coded for easy identification later. A wire (blue) from pin 8 L1 is long enough to pass through the chassis to the aerial socket. Leads run from pin 6 of L1 (brown), pin 6 of L2 (brown) and pin 1 of L3 (black) to VC1, VC2 and VC3. A lead (pink) from Tr1 G2 circuit runs to VR1. A connection (grey) goes directly from drain of Tr2 to the IF amplifier. Positive circuit connections can be made to pins or by flying leads. Two leads run from MC tags at L1 and L2, Fig. 4, to the rotor contact plates of the ganged capacitor, to provide short RF circuits.

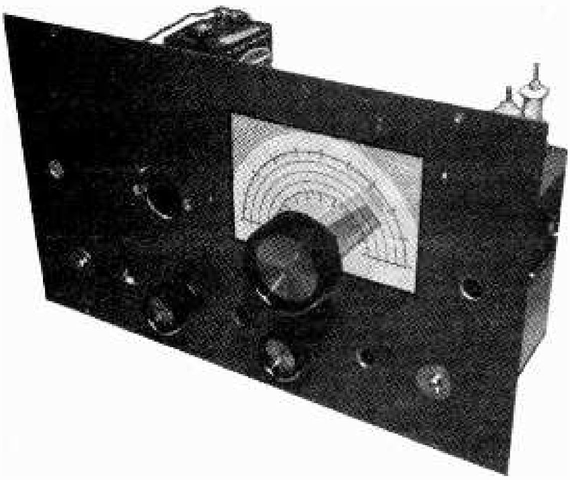
When this unit is finished it is placed near the ganged capacitor when it can be tilted sufficiently to allow soldering the leads to VC1/2/3. These should be as short as possible. The unit is set in position on the chassis and secured with self-tapping screws from below. Cut down Tr1 G2 lead and solder to VR1. R2 is soldered directly to VR1. A lead from VR1 runs to positive on the board.

A vertical screen was found necessary between RF and mixer leads to the bandspreading capacitor, when this was fitted, see photographs. It can be cut from a universal chassis runner. Wires running down from the tuning capacitor to the panel trimmers should also be clear of each other. Trimmer TC1 is soldered to stiff leads from VC3.

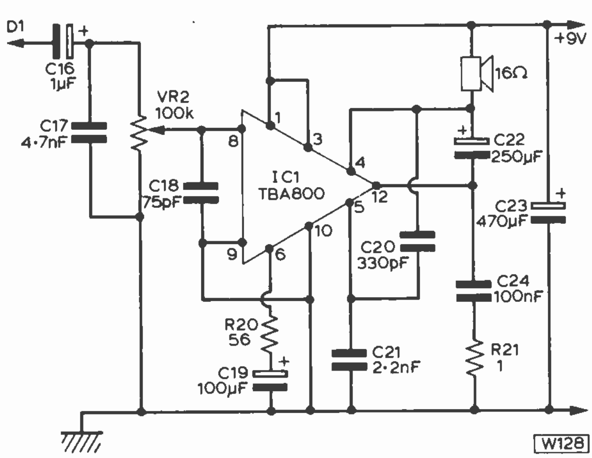
When coils are fitted, small holes in the top of the screening cans allow the cores to be adjusted. Screening of all the coils is essential when the RF stage is fitted. The possibility of the RF stage becoming unstable as the RF gain control is advanced depends somewhat on frequency, as well as on loading by the aerial and the shielding mentioned is to prevent this.

BASIC IF AMPLIFIER

This is unit (5) in Fig. 1 and employs the circuit in Fig. 5. The mixer drain will be connected to pin 1 of IFT1. When the additional IF amplifier is made,



Front view of the receiver with only the basic stages fitted. The unused holes can be blanked off. They also act as a strong incentive to complete the optional stages.



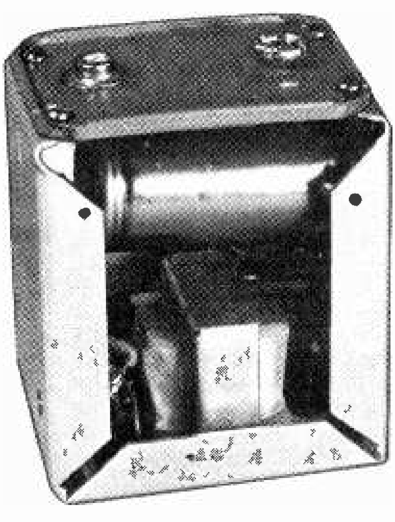


Fig. 7: centre, is the circuit of the TBA800 audio output stage. Capacitor C17 is connected directly across VR2 and C16 is wired directly between D1 and VR2 so they do not appear in Fig. 8. Initially, test and align the receiver with a battery for power. Later a mains power unit can be built and used for routine listening. Such a unit is shown in the photograph above and details of its construction will be given next month.

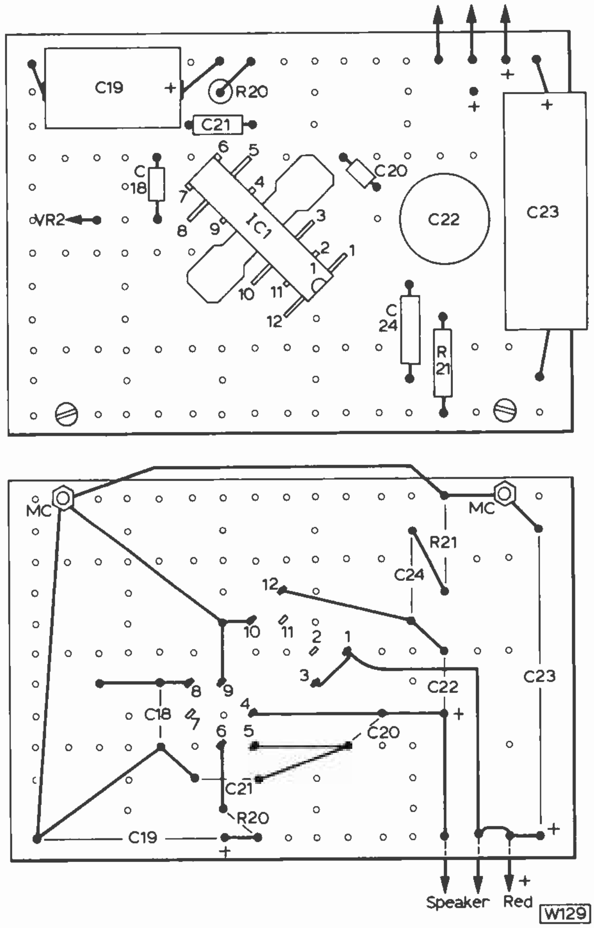
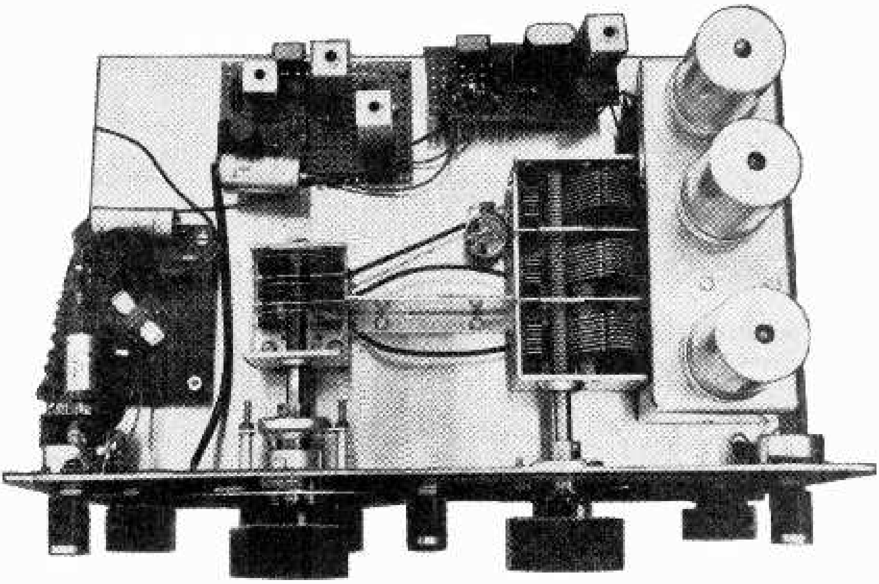


Fig. 8: The circuit of the audio stage Fig. 7 is laid out on veroboard as shown here. The holes in the board may need enlarging slightly to take the pins of the IC. Note that the socket for the loudspeaker, fed from this board, must be completely isolated from the panel.

this connection is removed. The mixer drain is then connected to the IFT of the extra stage and the collector circuit of this stage is taken to pin 2 of IFT1 in Fig. 5.

In Fig. 6 is shown the assembly and wiring of the IF amplifier. First drill three holes for the 6BA bolts MC and the lower core access holes of IFT1 and IFT2. The IF section is located behind the band-spread capacitor. Place the bare board on the chassis and mark or drill the holes mentioned. Components are then fitted as shown in Fig. 6. The three MC tags are secured with ½in bolts. Extra nuts on these allow the board to be mounted so that leads clear the chassis. External connections can be made on the board or leads.

When this section is fitted and working a slight adjustment to the cores may be necessary, for best results. Use a correctly shaped tool (such as the Denco TT5) as a wedge-shaped blade may crack the cores so that they jam. Clip a 10kΩ/V or similar high-resistance meter, set to the 2·5 or 10V range, from diode negative to chassis. Tune in a stable signal correctly (a BBC local MW transmission is suitable) and adjust VC7 and VC8 for maximum meter reading. Then rotate the five cores of the IFTs a little either way, as required, to give the best meter reading.



Plan view of the completed receiver with all stages fitted. The small board to the right of the IF amplifier board is the extra IF stage with a crystal filter to be described next month. The smaller gang capacitor to the left is for bandspreading.

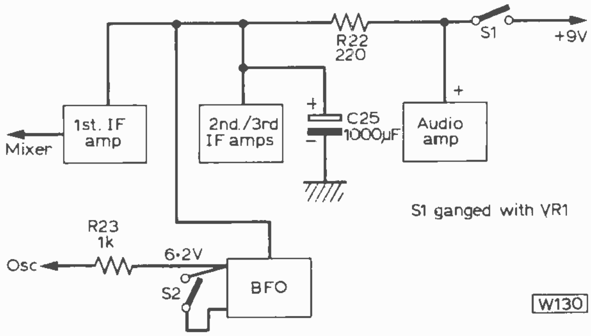
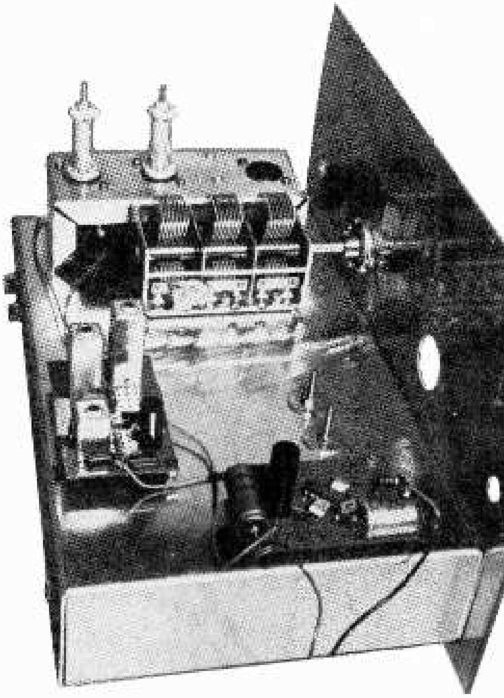


Fig. 9: Details of the battery supply circuit. The stabilised supply at 6·2V is part of the BFO circuit and can be used to feed the first oscillator stage if required. The photograph below is the back of the basic receiver with the audio board in the foreground, the IF amplifier at left centre and the mixer and oscillator assembly at the far end.



AUDIO AMPLIFIER

Fig. 7 shows the circuit of this section which is wired on a separate board, as in Fig. 8. This is prepared and fitted to the chassis near VR2, in a similar way to the IF board. Though a 1Ω resistor is not difficult to obtain two 2·2Ω resistors in parallel can be used instead. **Note that the speaker output jack socket contacts must both be isolated from the metal chassis.** This requires a socket of all-insulated type, or with a "dead" bush, or the use of insulating washers. An alternative is a pair of separate sockets for wander plugs.

This stage should take about 8 to 10mA, rising to 20 to 30mA with average volume. The TBA800 tabs are bent up to clear the board, but are not soldered to a heat sink. An 8Ω speaker may be used, but current drain is a little higher than when a 15Ω unit is connected.

BATTERY CIRCUIT

Fig. 9 will be of assistance in wiring the battery circuit. Battery positive goes to the switch on the volume control VR2. A lead from here runs to positive on the audio amplifier. The board has a spare positive pin, to which a 220Ω resistor is soldered, and the lead from here runs to the positive pin provided on the IF amplifier board. A 1000µF 10V capacitor is connected from this pin to a chassis tag. When the 1st or additional IF stage is fitted, this positive point supplies it also, as in Fig. 9.

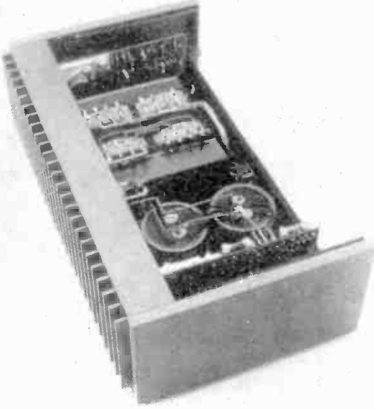
When the BFO is not fitted, supply the oscillator stage Tr3 via a 3·3kΩ resistor from the positive tag of the IF board (1000µF capacitor positive). This point also supplies the RF and IF gain controls. When the BFO is fitted, it provides a 6·2V stabilised point, which is connected to the BFO switch, as in Fig. 9. This point also supplies the oscillator Tr3 via a 1kΩ resistor. This resistor, and the 3·3kΩ resistor mentioned, is additional to the resistor in the RF/mixer/oscillator assembly, so that it can be easily changed when the stabilised circuit is available.

NEXT MONTH:—ADDING THE BFO, EXTRA IF STAGE WITH CRYSTAL FILTER, INTRODUCING BAND-SWITCHING.

PRODUCTION LINES

colin riches

'CURRENT DUMPING' QUAD AMPLIFIER



Quad announced their 'current dumping' amplifier a short time ago and we can now show a picture of the unit. 'Current dumping' describes a new technique used in the output stages.

Essentially, a current dumping amplifier comprises a heavy-duty high power amplifier (the current dumper) which provides nearly all of the current drawn by the load—and a high quality low power amplifier which provides the control. These are so arranged that any error in the high power section is exactly compensated by an error signal from the low power section. Thus performance is solely dependent upon the low power amplifier, which can be made very good indeed.

Since the output device linearity is not important, biasing is unnecessary and crossover and thermal tracking problems disappear. The output devices themselves need not be matched thus allowing inherently more reliable types to be employed.

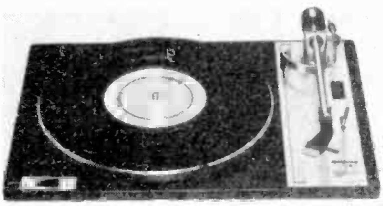
The Quad 405 is the first practical realisation of this new circuit technique. Designed to drive modern low efficiency loudspeakers, the 405 has an output of 100W per channel into 8Ω with a claimed total distortion of less than 0·01% at mid frequencies.

The Quad 405 costs £115 plus VAT. *Quad, The Acoustical Manufacturing Co. Ltd., (Dept. P.W.), Huntingdon, PE18 7DB.*

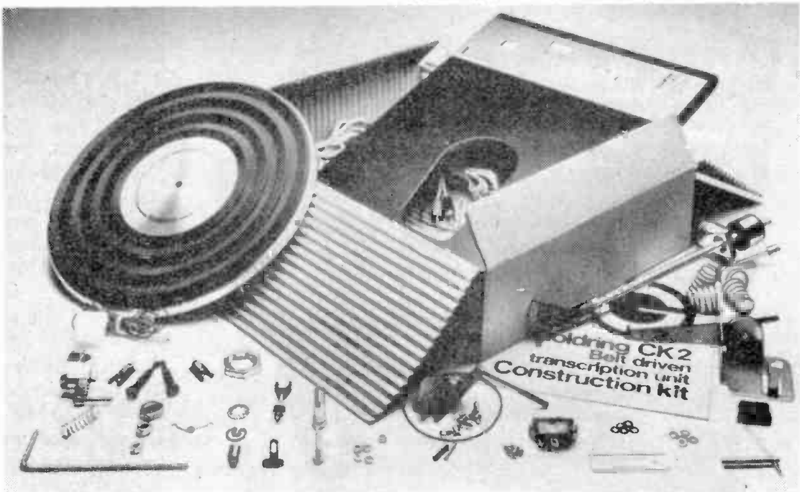
GOLDRING DECK KIT

A belt-driven turntable constructional kit has recently been announced by Goldring Limited.

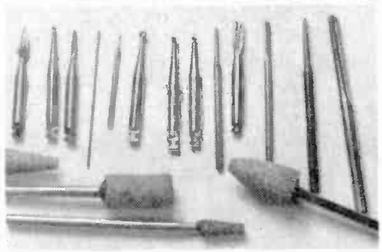
Called Model CK2, it comes complete with detailed instructions so putting it all together is fairly simple. The deck has two speeds ($33\frac{1}{3}$ and 45 RPM) selected by a rocker switch. Simplified belt coupling to a small low-speed synchronous motor reduces rumble. Wow and flutter is said to be kept within a 0·15%. The pickup arm is counterbalanced with adjustable stylus pressure from 0·5g. There is a removable plug-in shell and an anti-skate device.



The kit, which is an easy-to-assemble version of the G.102 Turntable assembly, costs £27. Further information may be obtained from *Goldring Limited, (Dept. P.W.), 10 Bayford Street, Hackney, London, E8 3SE. Telephone 01-985-1152.*



12V MINI DRILL



Precision Petite Ltd. of Teddington market a miniaturised drill (125mm in length) for 12V operation which has been designed for comfortable holding in the hand thus enabling extremely precise work to be carried out—even drilling holes of some tenths of a millimetre. A very comprehensive range of tools and accessories ranging from grindstones to milling and routing burrs is available and the firm will be pleased to supply full details on receipt of a stamped addressed envelope.

The drill on its own costs £7 with postage and packing of 35p and a drill stand for vertical drilling is **£3·75** (+58p post and packing). A complete kit of accessories—comprising 30 tools costs £15·01 (p.p. 75p) and a transformer for mains operation if required is priced at £5·50 (p.p. 75p). *—Precision Petite Limited, (Dept. P.W.) 119a High Street, Teddington, Middlesex, TW11 8HG. Tel. 01-977-0878.*

AMPLIFIER KITS

Our advertisers Radio Component Specialists of Croydon tell us that they have released a new amplifier in kit form. Called the RCS 'Minor' 10W amplifier, it comes in two versions—mono or stereo. The mono kit uses 13 semiconductors and the stereo version 22 semiconductors. Volume, bass, treble and mains on/off controls are mounted through the front panel which has white lettering on a black background.

The specification reads: 10W into 8 ohms; 7W into 15 ohms. Response =20Hz to 30kHz with distortion at less than 0·5%. Noise = −60dB. Input, up to 200mV. Size of completed unit, 240mm x 75mm x 50mm (9½ x 3 x 2in.).

The kit comes complete with full instructions, printed circuit board, fascia panel and all components. The mono version is £12·50 and the stereo version £20 (VAT included). Postage on either kit is 45p.—*Radio Component Specialists, (Dept. P.W.) 337 Whitehorse Road, Croydon. Tel. 01-684 1665.*

HEATHKIT WIND INDICATOR

The Heathkit ID-1590E Digital Electronic Wind Speed and Direction Indicator kit features a bright 2-digit planar gas discharge readout to display wind speed. During construction, one picks out the two readout modes one requires from three available—miles, knots or km per hour. A switch on the rear panel chooses either of two selected modes and front panel lights show which is in use. A rear-panel switch and controls on two circuit boards calibrate the ID-1590E.

The wind direction indicator uses incandescent bulbs to mark 8 principal compass points. Two adjacent bulbs light at the same time to indicate an intermediate direction.

Installation is said to be very simple—the remote transmitter boom clamps onto any 1 to 1·5in. rooftop TV aerial mast and is connected to the receiver unit with optional cable. The kit for the ID-1590E costs £49 including 8% VAT and delivery within the UK. Cables come in three lengths—50ft (£5·30), 100ft. (£9·20) and 150ft. (£14·30). *Heath (Gloucester) Limited (Dept. P.W.), Bristol Road Gloucester, GL2 6EE.*

STEREO CAR RADIO

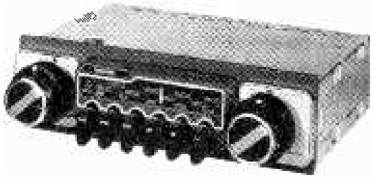
Radiomobile Limited, announce an AM-FM stereo car radio, model 1190 FMS. It employs a six button tuner, combined with manual tuning, facilitating simple pre-setting of any 3 FM, 2 Medium wave and 1 Long wave station. Amplifier produces 5 watts per channel and a bass/treble tone control is provided. A balance control allows adjustment from left to right channels. The FM stereo tuner employs Active Interference Rejection—a complete circuit module.

Automatic Frequency Control circuitry provides spot-on tuning and a DIN socket provides the facility of accepting the input from a stereo tape deck.

Technical Specifications:

Power supply: 12V negative earth; current consumption: 0·5A (up to 2·5A at maximum output).

Tuning ranges (Minimum): FM: 87·5—104·5MHz, MW: 525—1620kHz, LW: 150—275kHz. Semiconductors: 70 (41 transistors, 3 integrated circuits, 26 diodes). Speaker impedance: 1·75—3·5 ohms per channel. Tape socket sensitivity: 30mV for 5 watts output per channel. Further details and latest prices from *Gill Turner, Radiomobile, Good Relations Ltd., (Dept. P.W.) Kimbolton House, 117 Fulham Road, London, S.W.3.*



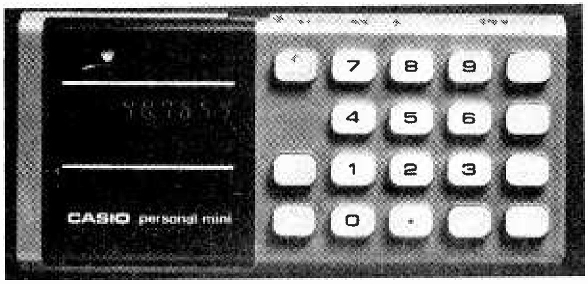
The Radiomobile 1190 AM/FM radio.

CASIO CALCULATORS

Casio, the multi-million pound Japanese calculator and electronics group, has established a subsidiary company in the U.K. known as Casio Electronics Co. Ltd. The firm's primary aim is to market a range of low-cost pocket calculators and a recently developed electronic watch.

In Japan, Casio claim to have 54% of the domestic market and claim that they are the world's largest manufacturer in this field. This new UK subsidiary joins similar organisations in Germany and the USA.

One of the firm's most successful calculators is the Casio Personal Mini which has already sold over 5 million units in three years. This model divides up to 6 digits, adds, subtracts and multiplies up to 12. Should the wrong button be pressed, pressing the 'correct' (C) button automatically cancels the previous instruction. There is also a 4-way constant facility. The readout is on a green digitron tube panel, unnecessary zeros being suppressed. An LSI chip is employed and power consumption is 0·2W. Provision is made for a mains PSU but the Personal Mini has its own internal batteries which give about 10 hours' continuous use. (HP11's).



The Casio Personal Mini calculator. Recommended price £6·95, but some of our advertisers are offering them for under £5!

At the other end of the range is the FX-101 10-digit scientific calculator with independent memory and scientific notation. It handles a broad range of calculations up to $10^{\pm 99}$, and has a very impressive specification. Recommended price of the Personal Mini is £6·95—but see P.W. adverts for discount prices. Full details may be obtained on the whole range of Casio equipment from *Mr. R. G. Rayner, General Sales Manager, Casio Electronics Co. Ltd., (Dept. P.W.) 28 Scrutton Street, London, EC2A 4TL.*

The Black Watch – using the unique Sinclair-designed state-of-the-art IC.

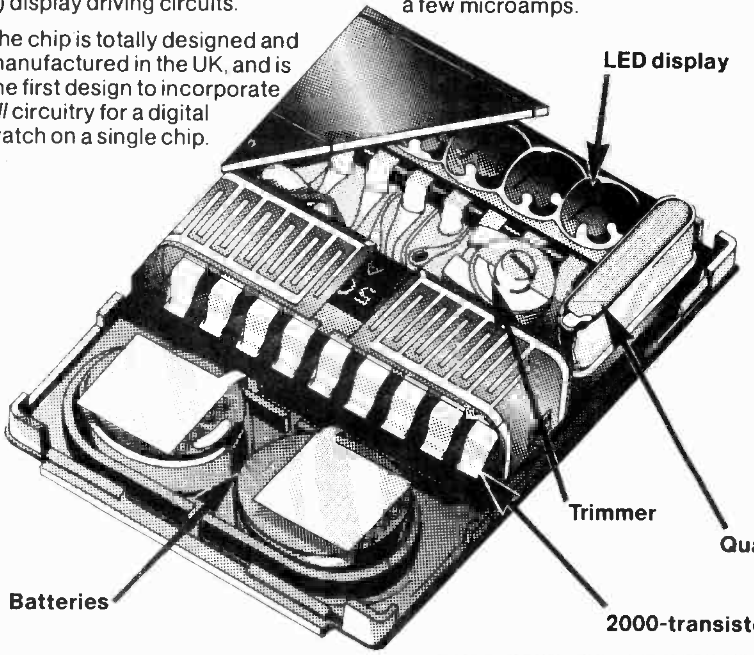
The chip...
The heart of the Black Watch is a unique IC designed by Sinclair and custom-built for them using state-of-the-art technology – integrated injection logic.

This chip of silicon measures only 3 mm x 3 mm and contains over 2000 transistors. The circuit includes

a) reference oscillator
b) divider chain
c) decoder circuits
d) display inhibit circuits
e) display driving circuits.

The chip is totally designed and manufactured in the UK, and is the first design to incorporate *all* circuitry for a digital watch on a single chip.

...and how it works
A crystal-controlled reference is used to drive a chain of 15 binary dividers which reduce the frequency from 32,768 Hz to 1 Hz. This accurate signal is then counted into units of seconds, minutes, and hours, and on request the stored information is processed by the decoders and display drivers to feed the four 7-segment LED displays. When the display is not in operation, special power-saving circuits on the chip reduce current consumption to only a few microamps.



Complete kit £17.95!

The kit contains
1. printed circuit board
2. unique Sinclair-designed IC
3. encapsulated quartz crystal
4. trimmer
5. capacitor
6. LED display
7. 2-part case with window in position
8. batteries
9. battery-clip
10. black strap (black stainless-steel bracelet optional extra – see order form)
11. full instructions for building and use.

All you provide is a fine soldering iron and a pair of cutters. If you've any queries or problems in building, ring or write to the Sinclair service department for help.

Take advantage of this no-risks, money-back offer today!
The Sinclair Black Watch is fully guaranteed. Return your kit within 10 days and we'll refund your money without question. All parts are tested and checked before despatch – and correctly-assembled watches are guaranteed for one year. Simply fill in the FREEPOST order form and post it – today!

Price in kit form: £17.95 (inc. black strap, VAT, p&p).

sinclair

**Sinclair Radionics Ltd,
London Road, St Ives,
Huntingdon, Cambs., PE17 4HJ.
Tel: St Ives (0480) 64646.**
Reg. no: 699483 England. VAT Reg. no: 213 8170 88.

To: Sinclair Radionics Ltd, FREEPOST, St Ives, Huntingdon, Cambs., PE17 4BR.

Please send me — Total £

.... (qty) Sinclair Black Watch kit(s) at £17.95 (inc. black strap, VAT, p&p). ....

.... (qty) black stainless-steel bracelet(s) at £2.00 (inc. VAT, p&p). ....

* I enclose cheque for £.............................., made out to Sinclair Radionics Ltd and crossed.

* Please debit my *Barclaycard/Access/American Express account number

....

Name ______________________

Address ______________________

____

PW2

Please print. FREEPOST – no stamp required. *Delete as required

SIMPLE ULTRASONIC SYSTEM

IF one wishes to control a relay from a remote unit without the use of any connecting wires, one must utilise some form of wave signal which travels between a transmitter and a receiver. Radio waves and microwaves are very suitable for this purpose, but the equipment required is usually fairly complex and expensive and a licence must be obtained before the equipment can be used. Another possibility involves the use of light waves which fall on a photosensitive cell. In this case the main problem is that the system is also sensitive to daylight. Sound waves can be used, but the region is then rather unpleasant to work in and the equipment responds to spurious noises.

ULTRASONICS

Ultrasonic communication utilises waves in the air which are just like sound waves except that their frequency is so high that one cannot hear them. This article describes a very simple transmitter unit and receiver unit which can be used for the remote control of a relay in the receiver. The relay closes when 40kHz waves from the transmitter fall on a transducer in the receiver.

Although ultrasonic transmitter and receiver units have been published from time to time, the units to be described here have the advantage that very simple circuits are employed; the only active devices required are a single IC in each of the two units.

The maximum range at which satisfactory operation can be attained is generally of the order of 10m. It is not possible to quote an accurate value for the range, since it varies considerably with the presence of reflecting objects. The range is considerably greater in an indoor corridor than in the open air, since the walls of the corridor reflect the waves towards the receiver unit. The waves are attenuated as they pass through the air and this limits their maximum range for reliable control.

TYPICAL APPLICATIONS

Ultrasonic beams can be used to operate a relay and the closing of the relay contacts can then be used to perform any desired switching operation. For example, an ultrasonic transducer can be mounted on the front bumper of a car. When the driver reaches his home, a pulse from the transmitter is used to actuate a relay which automatically opens the garage doors without the driver leaving his seat. When the car is taken out of the garage, a similar pulse can be used to close the doors. Another use for a very small ultrasonic unit could be for the remote switching of radio or television channels from an arm-chair, where the coil turret of a receiver is made to rotate one step each time a pulse is received from the transmitter.

If one wishes to communicate with one's neighbour, it is illegal to connect the two houses with wires, since this would infringe the Post Office monopoly (Post Office Act, 1969, Section 24.1). However, the writer has obtained confirmation from the Post Office that the use of ultrasonic waves for communication does not infringe their monopoly and no licence is required. Therefore transmitted waves could be modulated and sent in the form of morse signals.

Finally, the equipment described here could also be employed as an intruder alarm. If the beam passes across a corridor, any interruption of the beam by an intruder will cause the relay to open and this can be used to sound an alarm. The intruder will not detect the ultrasonic beam, so if the alarm sounds at a remote point, the intruder will have no means of knowing that his presence has been detected.

TRANSDUCERS

The ultrasonic transmitting transducer used in this project generates ultrasonic waves in the air when a suitable alternating voltage is applied across its terminals. This voltage may be a square or a sine wave, but the frequency must be close to the resonant frequency of the transducer. A similar transducer is used in the receiver, and when ultrasonic air waves strike this receiver a voltage at the uultrasonic frequency appears across the transducer terminals. This voltage is generally very small (typically ranging from about 50μV to 100mV) and must therefore be amplified considerably in the receiver unit before it can be used to control a relay.

The transducers themselves act like a small loudspeaker and a small microphone which will operate only near to their resonant frequency. They have the same circuit symbol as a loudspeaker. A miniature transducer type SE05B has been chosen for use in this equipment and it is available in two types which are designated "4OT" and "4OR". The SE05B-4OT type should be used in the transmitter and the SE05B-40R in the receiver. Although the equipment will function with the 4OT and 4OR units interchanged or with two units of the same type, optimum results can be expected only if the 4OT

BRIAN DANCE M.Sc

unit is used in the transmitter and the 40R unit in the receiver.

The 40T and 40R units have an identical appearance, being mounted in small aluminium cases about 1cm in diameter by 1cm in length. One of the two connecting pins at the back of the device is connected to the metal case, which should be earthed.

Internally the transducers contain piezoelectric ceramic bimorph plates which resonate mechanically at the 40kHz ultrasonic frequency. Another type of transducer which operates at 25kHz is available from the same supplier and is suitable for use in the same type of circuit, but the frequency of oscillation of the transmitter circuit must be reduced by increasing C2 or R3 of Fig. 1. Air trans-

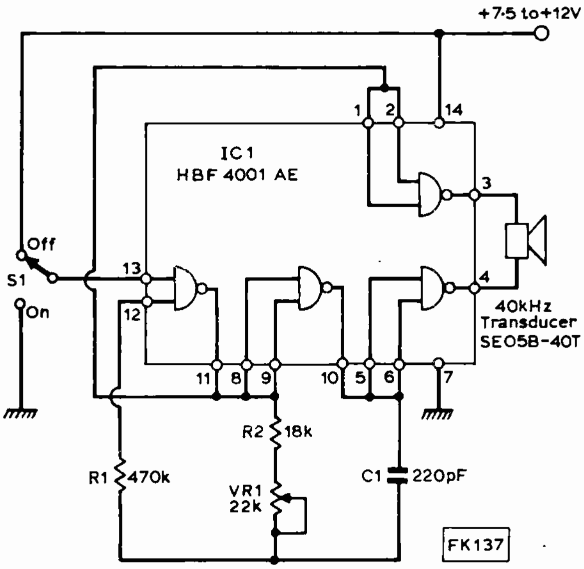


Fig. 1: Schematic of the HBF4001AE integrated circuit, showing the four two-input NOR gates. This IC is used as the heart of the transmitter.

ducers are not normally used at frequencies above about 100kHz, since the attenuation of the waves in air increases with frequency and efficiency of energy transfer to and from the air becomes smaller at higher frequencies.

TRANSMITTER LOGIC

An oscillator circuit is required which will feed a 40kHz signal at a level of a few volts to the transducer. A simple transistor astable circuit can be used, but the use of an IC simplifies the design.

The transmitter circuit used in the prototype is shown in Fig. 1. It employs the SGS-ATES HBF 4001 AE COS/MOS quad 2-input NOR gate. The two NOR gates on the left hand side form a square wave oscillator, the frequency of which can be varied by means of VR1. The two NOR gates on the right hand side are buffer amplifiers which drive the transducer in push-pull. All of the NOR gates in the device are interchangeable, so the pin connections shown in Fig. 1 can be varied considerably if one wishes. The transmitter can be switched on and off by a switch in the supply line where a current of about 6mA flows in the case of an 11V supply. However, it may be more convenient to use the switching system shown, where the current through S1 is very minute. The switching can also be performed by a logic signal applied to pin 13 in the circuit shown.

COS/MOS devices have input impedances of the order of a million megohms and are therefore susceptible to damage by electrostatic charges. The manufacturers recommend that:

1. The device leads should be kept in contact with conductive material except when they are connected in a circuit.
2. Soldering iron tips should be earthed.
3. Devices should not be removed or inserted into circuits whilst the power is applied.
4. Signals should not be applied to unused inputs when the power is not applied.

In practice, however, the devices are well protected, although its wise to obey the rules to avoid disappointment. Its also wise to employ a mica or polystyrene capacitor for C2 of Fig. 1 or a ceramic type with a tolerance of not more than ±20%.

RECEIVER

The IC used in the receiver is the ULN-2212 manufactured by Sprague Electric Ltd. This is a 16 pin DIL device which has been developed for use in television sound systems; it contains an IF amplifier, an electronic volume control and a 1W audio power amplifier. In the application being described, the 40kHz signal from the transducer is amplified by the IF section of the device and then converted into a steady voltage. This voltage is fed to the input of the power amplifier section which can provide enough output current to control a large relay. Thus the use of this device greatly simplifies the external circuitry.

The receiver circuit is shown in Fig. 2. The transducer signal is fed to the internal differential amplifier connected to pins 10 and 11. The resistor R2 keeps the bias at pin 10 at about the same value as that at pin 11, and C2 decouples pin 11 so

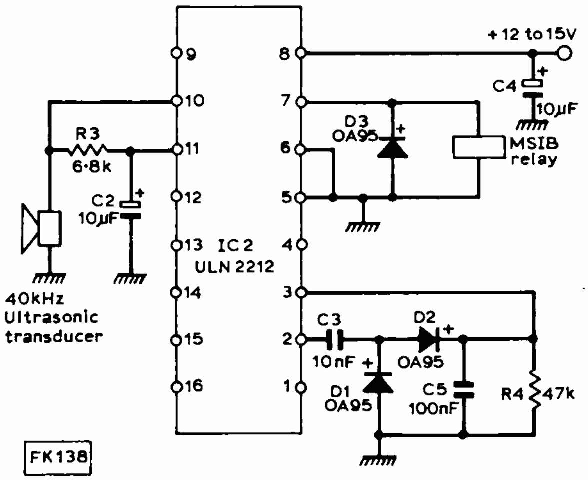


Fig. 2: The Ultrasonic receiver chip, ULN2212 shown here, contains an IF amplifier, electronic volume control, and a 1W audio amplifier.

that there is very little 40kHz voltage at this point. The 40kHz amplifier incorporates its own limiter circuit, so the output is almost constant for input signals exceeding about 200μV at pin 10.

The 40kHz output can be taken from pin 16, but an output signal of larger amplitude is obtainable from pin 2. The electronic volume control circuit is connected inside the device between pins 16 and 2. The output from pin 2 is connected via C3 to the diode pump circuit of D1 and D2. When C3 discharges, the current passes through D2 into C5. It then charges again via D1 during the other part of the 40kHz waveform. Thus the upper end of C5 becomes positive when an ultrasonic signal is falling on the receiver transducer.

POWER AMPLIFIER

The input of the power amplifier is connected to pin 3 and the output to pin 7. In the application for which the ULN-2212 is intended, an audio signal is capacitively coupled to pin 3 and this pin is at a slightly positive potential (about +2V). In this case, the output at pin 7 is half the supply line voltage.

The presence of R4 in the input circuit to the power amplifier reduces the potential at this non-inverting input, and the output at pin 7 falls to a fraction of a volt when no ultrasonic signal is present. The relay therefore remains open. If an ultrasonic signal now falls on the transducer, the output from the diode pump biases pin 3 to a potential more positive than its quiescent value. The ouput voltage rises to about +11 to +13V and the relay closes. It will open again whenever the ultrasonic signal is interrupted.

When the current ceases to flow through the relay coil, a relatively high transient voltage is developed across this coil owing to its inductance. This transient voltage is short circuited to earth by the diode D3. If this diode is omitted, the transient voltage may possibly damage the IC. The absolute maximum supply voltage which may be fed to the device is 18V, but it is wise to keep the supply voltage below this value to avoid the possibility of damage. The ULN-2212 incorporates a circuit which provides automatic shutdown of the power stage if the silicon chip becomes excessively hot. The supply current with the relay open is about 35mA, but this increases considerably when the relay closes, the value depending on the type of relay. The output current from pin 6 is automatically limited to 800mA by the internal circuit of the IC and this protects the device from damage if the output is earthed.

RELAY TYPE

The relay chosen for the prototype is the economical Keyswitch type MS1B with a 12V 26mA coil. Its contacts can switch 5A at up to 250V AC and this is adequate for most applications, since it represents 1·25kW. The direct current which can be controlled by this relay is smaller than the alternating current, since alternating voltages fall to zero twice per cycle and this breaks any arc which is formed.

The ULN-2212 can however, provide enough output current to control a large relay which may require about 120mA at 12V. However, it is wise to mount such a relay away from the receiver transducer, since the vibrations may cause a malfunction.

SETTING UP

The frequency of the transmitter may be set to approximately the optimum value by adjusting VR1 with a plastic tool, so that the transmitter unit takes a maximum current from the power supply. It is then delivering maximum power to the transducer. This current varies with the power supply voltage to the transmitter, being typically about 3·5mA ($7\frac{1}{2}$V supply), 5mA (9V supply), 7mA ($10\frac{1}{2}$V supply), 9mA (12V supply) and 11mA ($13\frac{1}{2}$V supply). The transmitter output power and, therefore, the maximum range of satisfactory operation falls considerably if the transmitter power supply voltage is reduced below $7\frac{1}{2}$V.

A final adjustment of VR1 may be made by connecting a 20kΩ/V meter across R1. If the receiver is switched on, the voltmeter should read about $1\frac{1}{2}$V. If the two transducers are facing each other and the transmitter is switched on, the reading should increase to about 3V. The transducers are then separated and turned so that they no longer face each other and the meter reading will start to fall. VR1 is then adjusted for maximum reading.

The transducers can be obtained from Hall Electronics, 48 Avondale Road, London E17 8JG for £3·75 per pair inc. VAT and p/p. The ULN2212 is available from Phoenix Electronics, 139 Havant Road, Drayton, Portsmouth PO6 2AA for £3·50 inc. VAT and p/p. The HBF4001AE is available as the CD4001AE from advertisers. PW

CORRECTION

SIMPLE HOME PROJECTS—3 December 1975
Random Number Selector

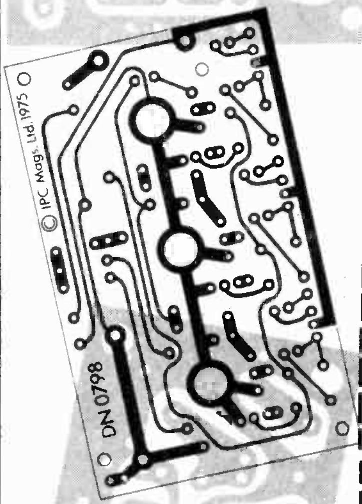
In the circuit diagram, pins 3 and 7 on IC2 should also be connected to pin 11. This may be done by a solder bridge as shown here at 'y'.

A link is also required between the points marked 'x' and this is made on top of the PCB. It can be clearly seen in the photograph of the finished unit, immediately to the right of capacitor C2, centre bottom.

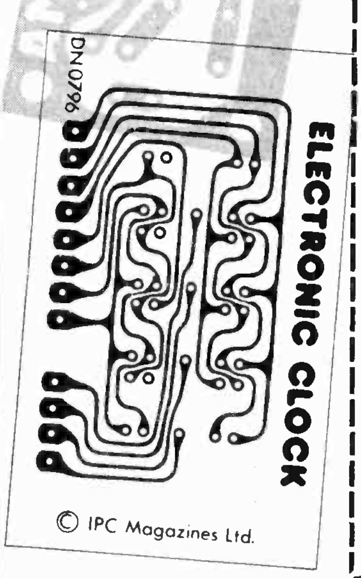
Enlarged section of the PCB showing solder bridge at 'y' and wire link on top of the board at 'xx'.

EDITORIAL ANNOUNCEMENT

NEW! PRACTICAL WIRELESS PCB SERVICE FOR READERS



As a result of continued requests from readers we are happy to announce the start of a printed circuit board service for projects published in Practical Wireless. A list of PCBs now available, plus ordering coupon, will be found below. The list will be extended as new PCBs are made available. Generally the boards will be of epoxy glassfibre, drilled and roller-tinned. For the time being PCBs for projects published in PW before December 1975 are not available through this new service



To:- READERS PCB SERVICES, PO BOX 11, WORKSOP, NOTTS

Please supply PCB/s as indicated by tick/s in box/es

Issue	Project		Ref	Price	
Dec 75	Radio-Pickup Link		DN0792	0·98 + 10 p/p	☐
Dec 75	Random Number Selector		DN0793A	0·98 + 10	☐
Dec 75	Sound-To-Light Display		DN0798	1·15 + 10	☐
Dec 75	12V PA System		DN2/JM	0·98 + 10	☐
Dec 75	Disco System, Amplifier				
	(2 required)	SRBP each	AM0421	3·40 + 18	☐
		glassfibre each	AM0421	4·10 + 18	☐
Dec 75	Disco System, Light Modulator		AM0423	2·70 + 18	☐
Jan 76	Music Box	SRBP	DN1/JM	2·25 + 18	☐
		glassfibre	DN1/JM	3·00 + 18	☐
Jan 76	Emergency Light Unit		AM0419	3·50 + 18	☐

Post and packing is for one board. For each additional board add 4p to the 10p or 18p rate as applicable. Prices include VAT.

Remittances with overseas orders must be sufficient to cover despatch by sea or air mail as required.

I enclose Postal Order/Cheque No.......................... for £................. made payable to READERS PCB SERVICES.

NAME..

ADDRESS ....

....

.... Post Code ....

Any correspondence concerning this service must be addressed to READERS PCB SERVICES and not to the Editorial offices.

I.C. OF THE MONTH

Number 56 SIGNETICS SD6000 VHF RF AMP/MIXER

THE use of integrated circuits has enormously simplified the design of VHF receivers, but at present discrete components are still employed in the front-end unit, since no suitable ICs for use at about 100MHz are available. The development of the new SD6000 IC by Signetics for use as a VHF amplifier and mixer therefore marks an important step in FM receiver design.

The SD6000 is encapsulated in a normal 8 pin dual-in-line plastic package and can be used to design tuners which have a better performance than the best of those which employ bipolar devices.

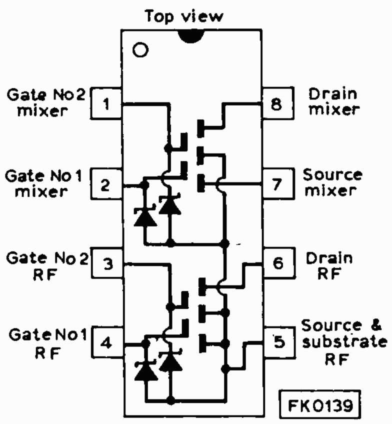


Fig. 1: Internal view of the SD6000 showing the protective zener diodes, the two dual-gate MOSFET devices, and the pin connections.

INTERNAL CIRCUIT

As shown in Fig. 1, the SD6000 contains two dual-gate MOSFET devices. These are 'N' channel enhancement components made by ion implantation and the special D-MOS (Diffused Metal Oxide Silicon) technique used to fabricate the earlier Signetics D-MOS discrete devices. Each of the gates is protected by a zener diode which will bypass to the substrate (pin 5) any static or other voltages more positive than +25V or more negative than −0·3V. No special precautions are required when handling the SD6000 or when soldering it into a circuit.

The two devices are positioned in the package in such a way that coupling between them is minimised. This assists stability and minimises radiation of the local oscillator signal from the aerial. The D-MOS fabrication technique enables precisely controlled channels, less than 1 micron long, to be produced with extremely low parasitic capacitances, the resulting D-MOS devices being ideal for VHF use. Although the internal construction of D-MOS devices differs from that of other enhancement MOSFETs, the principles of operation are the same.

ADVANTAGES

Dual-gate D-MOS devices have inherently linear characteristics, wide dynamic range and excellent cross-modulation characteristics. They provide high gain and have a very low noise figure. The feedback capacitance from drain to gate is only about 0·03pF. Gate leakage currents and drain to source leakage currents are typically 1nA, whilst the maximum permissible drain current is 50mA.

A PRACTICAL CIRCUIT

The SD6000 has been specifically designed for use in the RF amplifier and mixer stages of high performance FM receivers, but it will doubtless find other VHF applications. A typical FM front-end circuit with a ganged tuning capacitor for a signal frequency range of 88MHz to 108MHz is shown in Fig. 2, but varicap diode tuning has also been employed with the device.

The circuit provides a typical power gain of 30dB at 100MHz, the typical noise figure being only 2·5dB (maximum noise figure 3dB). Commercially available tuner units seldom have a noise figure of less than 6 to 7dB, whilst some have a much higher noise figure. Both the noise figure and the available gain of the RF stage are fairly independent of the drain

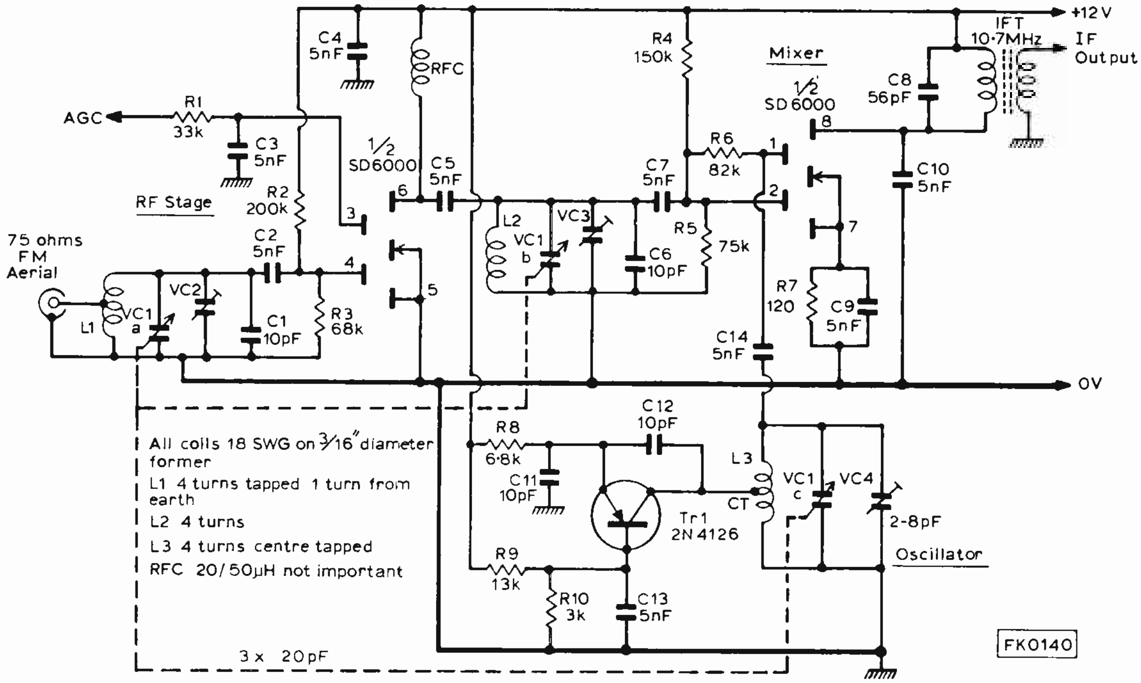


Fig. 2: A typical circuit for an FM tuner using the SD6000 in the RF and mixer stages. The above circuit covers a frequency range from 88MHz to 108MHz.

current provided that the latter exceeds about 7mA, see Fig. 3.

The bandwidth of the RF amplifier is about 2·5MHz at the −3dB point and that of the mixer 300kHz, the latter value being mainly controlled by the properties of the tuned circuit in the output transformer. AGC is applied to the second gate of the RF stage (pin 3); the 50dB typical operating range of the AGC is extremely wide. The change of gain with the gate 2 voltage at 100MHz is shown in Fig. 4 for the case where gate 1 is at +10V and the drain to source potential is 15V.

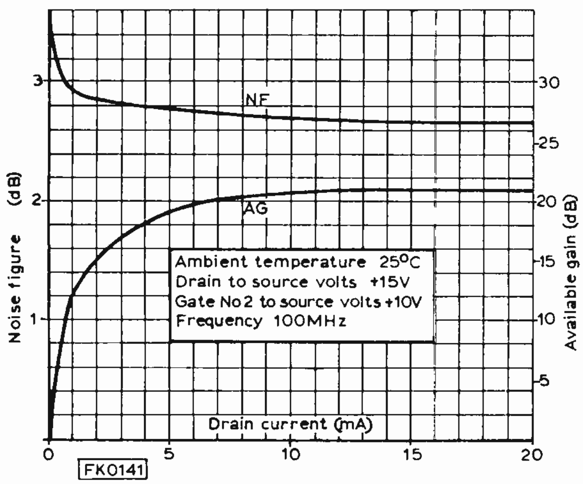


Fig. 3: Graph of the noise figure and available gain of the RF stage plotted against the drain current.

A PNP 2N4126 provides the oscillator voltage to gate 2 of the mixer through C14, the signal voltage from the RF stage being applied to gate 1. This type of circuit enables very high isolation to be obtained between the local oscillator circuit and the input and hence reduces radiation from the oscillator frequency. The oscillator stability is about 40kHz/V change in the supply line and +10kHz/°C temperature change.

The typical conversion gain of the mixer stage plotted against the drain current is shown in Fig. 5, the high and constant conversion gain of 19dB being obtained at drain currents of 4 to 11mA. As in the case of the RF stage, the D-MOS construction of the mixer provides excellent cross modulation performance and very low noise. The conversion transconductance is typically 10mmhos.

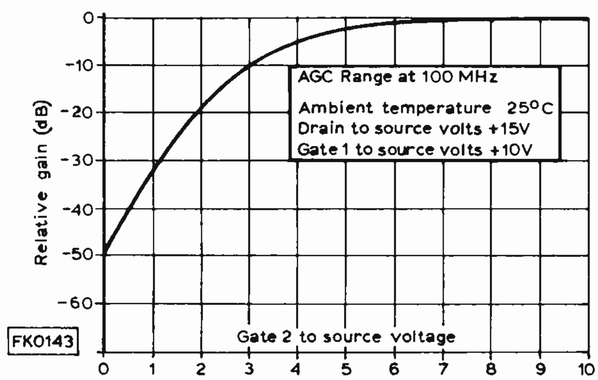


Fig. 4: Curve of the AGC characteristic of the RF gain. The 50dB gain change is equivalent to a change of voltage gain of 316 times.

PRECAUTIONS

When using the SD6000, it should be remembered that the absolute maximum value of the drain to source current is the unusually low one of 50mA.

continued on page 890

ON THE AIR

AMATEUR BANDS

by Eric Dowdeswell G4AR

MY comments in the December issue, on honesty in log-keeping, seem to have met with quite a lot of support. **P. B. Flatman** of Ipswich, back on the bands after a three year break, always makes a point of hearing the callsign of a station twice, preferably phonetically, before putting it in his log. He admits that some of the entries in his earlier logs just could not have been heard, although they had been entered in all good faith at the time. 'P.B.' also got going on one of my own pet 'hates', namely the amateur who asks the DX station for his callsign several times and then gives the DX 'S9+20dB'! Mistakénly, of course, he thinks the flattery will somehow persuade the DX to send the QSL card by return of post!

In the same way, a station in a CW contest will give a report of 599 to every station worked. Why? Because 599 sent in the shortened form is ..... -. -. and it saves a lot of time which can be important when working 50 or 60 stations an hour. The fact that the information is quite false seems to be overlooked in the race for points and more points. But, getting back to the 'S9=20dB' phobia, more rubbish is spoken on and about 'S' meters than anything else. Why do people place such implicit faith in a meter that does nothing more than show a rise or a fall in signal strength? There must be at least six factors affecting its readings and no two locations are going to have the same factors so why do operators think that S9 on a FT101 in John O'Groats is the same as S9 on a different FT101 in Cornwall? A lot of rubbish!

Martin Kessel (Stoke-on-Trent) has been inactive due to revision work for the RAE, which I trust he has now duly passed. He's been trying to get a one valve regen set going on the 2m band but in defence of our hobby and his local viewers I trust he never succeeds! **Philip Williams** BRS35031 of Bridgnorth enjoyed the lift on 2m in late October, as did many other readers, copying many stations deep into Europe with his TC7 Mk II with the G8AEV converter and an 8-element yagi at 20ft at a QTH which is 200ft a.s.l.

Alan Rae, recently GM8GRO, went on to take the Morse test and is now GM4ENN and sporting a Swan transceiver on the HF bands. It's always good to lose readers from this column in this way! **Alan Doherty** BRS34968 (Portrush Co. Antrim) comments on the fantastic aerial systems being used by PA0GMW on 80m in the search for DX. Alan uses a G5RV for the HF bands and a 132 centre-fed wire for the LF's. Any more detailed info on the GMW aerial farm would be welcome. Alan reports cards received from KM6EA, HI8XKP, YB0ABV, among many others.

Mike Bennett (Slough) picked up a couple of rare ones in VK9XX on Christmas Island and FR7ZL/G on the Glorieuses Is. on 15 and 20m respectively. **Paul Barker** (Sunderland) has been busy swopping his SSB hat for his SSTV one as conditions allowed, finding EA3ADW and 9K2DO excellent copy in the latter mode on 20m and LU2JC and W1BGW on 15m. **Tim Charles** (Colchester) has been looking for ZL3RB on 160m following reports of successful QSOs with Europe but getting up on sked is a problem with Tim! He has now heard 21 countries on Top Band, the latest being 9H1CG. He has been hearing all continents on 80m plus his first JA's on the band, peaking between 15-1600, so presumably they are coming over the pole. Tim also mentions PA0GMW working the west coast Americans on the long path in the middle of the afternoon, plus KH6 and many JA's. This is on 80m, by the way! GMW's secret is now revealed, it's Quads on 80m. Yes, in the plural! Tim is another who, hopefully, will have passed his RAE, taken on December 1st.

Barry Middleton G4DBS asks me to reveal all, about the Lincoln Short Wave Club G3IXH, of which he is Hon. Sec. More members are wanted, particularly younger ones, so trot off to the Lecture Room, Lincoln Astronomical Society, Westcliffe Street, off Burton Road, Lincoln at 1930 any Wednesday. The club operates a net on 2m at 2000 hours every Thursday with G4DBS and G4DFH as control stations and again on Sundays at 1100 hours on 80m or 3700kHz to be precise, with G3TOA in charge.

Neil Whiteside A8859 (Hitchin) also enjoyed the exceptional conditions on 2m and commented upon the number of Continentals working through the repeater GB3PI. **Stephen Budd** A8713 (Worthing) caught VX9A on Sable Island for a new country, now approved as such by the ARRL although any normal person would call it VE1! QSLs to VE3GMT. **Andrew Swiffin** A8603 (Cheadle) now has a Pye Ranger for 4m and is busy building the PW 2m converter so it looks as though he has got fed up with HF bands! Actually he has been round all the bands from 15 to 80m with good effect.

Steve Cottis A8961 (Harrogate), aged 14, was told he was too young to join the local RAE course. Rubbish, said I, and told him to get in there and insist upon his rights. Good heavens, 14 year olds

ON THE AIR

are passing the RAE and Morse test every day, or so it seems! However, this does not mean that I go along with the present system which I have always believed to be an utterly futile examination. It ought to be linked to a practical examination but more of this anon.

Log extracts

A. Swiffin:—**80m** OE2SCL/YK **15m** TJ1EZ (QSL PA0EZ) YB1AB ZS3BK 5T5BJ 5X5NK

S. Budd:— **20m** YJ8AN VX9A FK8CJ VR4DX **15m** CR9AJ PZ9AJ VX9A ZD8AA 4W1AF 9N1MM **10m** FH8CY 9Q5SW

N. Whiteside:— **2m** HB9AMH/P IB6BTI OZ60L SM7WT

T. Charles:— **160m** K1PBW **VE1BCZ W2PV W9LI 9H1CG 80m** FP8CT HP3AU JA1ERK **UA9CM** VS6DO ZL3LV **20m VP2GM 2m DM2CZI** HB9ZF **SM6BZC SP5JC**

M. Bennett:— **20m** BV2B FG0MM FR7ZL/G 8R1X **15m** VK9XX 9N1MM **10m** C9MIF

P. Williams:— **2m** DJ6GO DC1QD PA0JHW

P. Flatman:— **15m** EA9FC FM7AQ KZ5AS FR7BE TG9MP ZS4AW **20m** FY0BHI 9X5PT

M. Kessel:— **80m** 9X5SP 5L7F 9H1C

A. Doherty:— **160m** EA8CR **80m** JA1JRK 5L7F 9Y4NP **40m** JA1DJL JX2HK **20m** KG4GG PZ1DR VP8HZ VK1SD VX9A VE8RE 6W8FP **SSTV 20m** EA3ADW I2PHO 9K2DO OE8TWK **15m** LU2JC W1BGW

All stations are SSB except those in bold which are CW.

BROADCAST BANDS

SHORT WAVE BROADCASTS

by Derek Bell

OUR COLUMN this month opens with a letter from someone who derives more enjoyment than most of us from roaming the world via the short wave spectrum. This is **John Buxton** of Shepton Mallet who is disabled and therefore has many hours of the day and night to pass away. As a change from sending logs, since his present set is so poorly calibrated, John sends a chatty letter urging a listen to "Beat of the Drum" on Voice of Turkey, Sundays around 2215 on 9515. It is, says John, a very funny show. I can perhaps help John, because there is an organisation that is set up to help just such DXers as John. This is Handicapped Aid Programme run by Ted Hindle, 13 Thirlmere Road, Preston, Lancs. Not only does this worthy cause help the handicapped DXer with equipment but would like surplus equipment from anyone who cares to help. This gear is checked over and then sent to someone in need.

By the time this is read the new schedules will have settled down. **Paul Cowburn** from Leyland writes that the following have been announced:—

Radio Israel 2000 on 9815 7412 7395
Radio Finland 1400 1830 2030 on 11755 6120 9550
Radio R.S.A. 2050 to 2150 on 15155 11900 9525 7270

No doubt there are a few more which I will pass on as they come to hand.

Andrew Walker of Leeds asks for advice on when to send International Reply Coupons. As a rule-of-thumb I always recommend that IRCs be sent to stations that rely on donations, such as religious or charity stations, but a great many state or commercial stations ask for IRC's and one has to hope to hear the stations themselves insist on IRCs in their chat.

Recently this column featured "National Public Radio" and your scribe confessed to being puzzled by this station. Both **A. Harris** of London and **Stewart Fenwick** of Clackmannan write to enlighten us. It seems that this phrase is used in the news broadcasts of the American Forces Radio and Television Service. Stewart, in fact, sends the address as NPR 20/25 M Street, North West Washington, DC, 20036 USA.

Niels Montanana raises the old question of how one identifies a foreign language when one does not speak it? The solution is to have one or two key phrases in the old memory box and I suppose that the one most stations use is the equivalent of "This is so-and-so calling". The following quick course of language lessons may help:—

French "Ici Radio so-and-so"
German "Hier ist Radio so-and-so" (Pron. "hear isst")
Portuguese "Aqui Radio etc (Pron. "ah key")
Russian "Govorit Moskva" (Pron. gov-or-it)

Holland, by the way, uses a similar phrase to the German one.

David Lovatt, the proud new owner of a Codar CR70A, has latched on to a station that perplexes him, namely Radio Television Ivorienne. This is a French language station that serves the Ivory Coast Republic and comprises five transmitters the largest one being a hundred kilowatter transmitting on 1241 and 11920 in English from 1830 to 1955.

David has had a QSL from the Turin standard frequency station on 5000 with 5kW. Such stations are very good for calibrating the set since there is an electronic tick every second exactly on the frequency.

Roy Patrick from Mackworth, Derby, writes to let us know that IBRA Radio is now sending a special QSL for the Malta relay programme Radio Mediterranean. Roy uses a Trio 9R59DS with the ever faithful Joystock aerial and he is a tropical bands fan and, although a little late, the following may well be worth noting:—

Radio Rumbos, Venezuela, 4970 late evenings or 0500.
Ecos del Torbes 4980 evening or early morning
Radio Continenta 5030 evenings or early morning

so if you are an early bird or night owl why not try for one of the hundreds of South Americans.

From Rugely, Staffs, in fact from the QTH of **John Godwin**, comes news that HCJB Quito are to build a 500kW transmitter in order to beam the gospel into the USSR. Also, John says, Radio Sri Lanka are now putting out a show for the UK every evening on 15120 from 1900 to 2000. The clue to

ON THE AIR

identification is a jazz version of "Tea for Two", used as a link. For QSLs write to Sri Lanka Broadcasting, Colombo, Sri Lanka.

With a pre-war HRO plus his Joystick aerial John set out bright and early searching for VLT9 Papua on 9520, but, to his delight, he happened on Radio New Zealand on 9540 with its service for the Pacific Islands. The best times, John says, are between 0800 and 0900 from this 7·5kW station.

As a change from the winter of the UK let us turn to a DXer who has his 130 foot long wire secured "half way up a coconut tree". This is **E. M. Sivaguru** of Port Dickson, Malaysia, who has a Philips B5XO6T. He logs such DXotics as:—

11500 Radio Nederland, Tananarive relay, at 1520
11860 Voice of Free China, Taiwan, at 1405
153925 Voice of Phophecy, India, at 1615
17810 FEBC, Radio Int. Manila, at 1630

and has a quiet chortle at the UK radio twiddler who has to listen hard for Australia, NZ or suchlike southern hemisphere transmitters which E.M. can pull in, as they say, "on a piece of wet string".

Turning now to QSLs **John Higginbotham** has harsh words to say about Radio Baghdad who it seems are sending out QSLs and "skeds" together but the skeds are for 1974! **J. W. Farrer** sends a list of the reply times from various broadcasters and tops is Radio Australia with an airmail reply taking 105 days, while Radio Finland takes 10 days and our own BBC World Service takes 25 days.

Some time ago news reached your column that Radio Israel was to start a DX show. **P. K. Gulati** has sent in the first report on this show. It is aired on 15100 every Saturday night at 2030 and another DX show mentioned is that of Radio Austria on 9690 every Sunday at 0915 and repeated at 1805 on the same frequency.

It is time to wind up so wishing you 73s for 76 I will close apologising for those letters that space has ruled out due to the very heavy postbag this month.

BROADCAST BANDS

MEDIUM WAVE DX

by CHARLES MOLLOY

PAUL BOOKBINDER writes from Maidenhead with news of his first transatlantic DX on the medium waves. Using a Grundig Satellit 1000 with built-in ferrite rod aerial he logged WINS on 1010kHz at 0300. "Reception was good but only lasted about ten minutes; very interesting to hear local domestic news and traffic reports direct from New York". Paul, who is building a medium wave loop aerial has been active on the long waves too and has received a QSL card from Kiev, Ukraine on 209kHz. Congratulations Paul on a fine achievement, you should really pull in the DX once your loop is in use.

Glyn Morgan of Tredegar, Gwent, has been having trouble with his HA230 communications receiver. He is temporarily using an Astrad VEF 17 transistor portable with internal aerial for his DXing and his catches include WCBS in New York City on 770kHz, Tenerife in the Canary Islands on 620kHz and an unidentified Arabic station on 863kHz (probably Ksar-es-Souk, Morocco). Glyn prefers to use his Astrad in its portable form to take advantage of the directional effect of the internal aerial. A ferrite rod aerial behaves in the same way as a loop. Interference is reduced and there is often an improvement in signal-to-noise ratio too but the loop has much greater pick-up which makes it more suitable for the serious DXer. Hope your HA230 is soon back in service Glyn though you seem to be doing very well without it.

More news of transatlantic medium wave DX comes from **Samuel White** who lives in Larne in Northern Ireland. Using a Strad 553W receiver with a 60ft. long outdoor aerial he heard CJON in St John's in Newfoundland on 930kHz "quite clear at good volume". Reception on the lower frequencies is now better than it has been for many years owing to the approach of the minimum of the current sunspot cycle. DXers may agree with **Lawrence Bennett** of Bristol who writes "Because of the recent poor conditions on shortwave I decided to try my hand at Medium Wave DXing". Lawrence has received a number of good QSL cards and souvenirs from German stations and he mentions a book on DXing issued by Sender Freies Berlin, 566kHz. You have to null-out Athlone on the same channel to receive this one.

Twelve-year-old **Michael Walker** of Leeds has got hold of an old 6 valve Emud receiver which is of German origin. He used it with a 30ft. outdoor aerial to hear Sweden Calling DXers from Radio Sweden on 1178kHz. Michael received a QSL card and a copy of the DXers Newsletter issued by this programme. The English version of Sweden Calling DXers is broadcast weekly on a Tuesday at 2300 and often includes items of interest to the medium wave DXer.

An interesting letter comes from **F. A. Ainsley** of Hartlepool in Cleveland who confesses to being a keen medium wave DXer both in Australia and England. He has been experimenting with loop and vertical aerials and has managed to combine the two at the input of his homemade receiver in such a way as to produce a single null similar to that obtained when direction finding equipment is in the Sensing mode. With this null pointing towards Europe he managed to log WCBS in New York City on 770kHz, WINZ in Miami and WBT in Charlotte, North Carolina.

BROADCAST BANDS
Short Wave reports by the 15th of the month to Derek Bell c/o 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 25th of the month to Eric Dowdeswell G4AR, Silver Firs, Leatherhead Road, Ashtead, Surrey, KT21 2TW.

STILL AVAILABLE!

REPRINTS OF PW's

TEXAN 20 + 20W IC STEREO AMPLIFIER

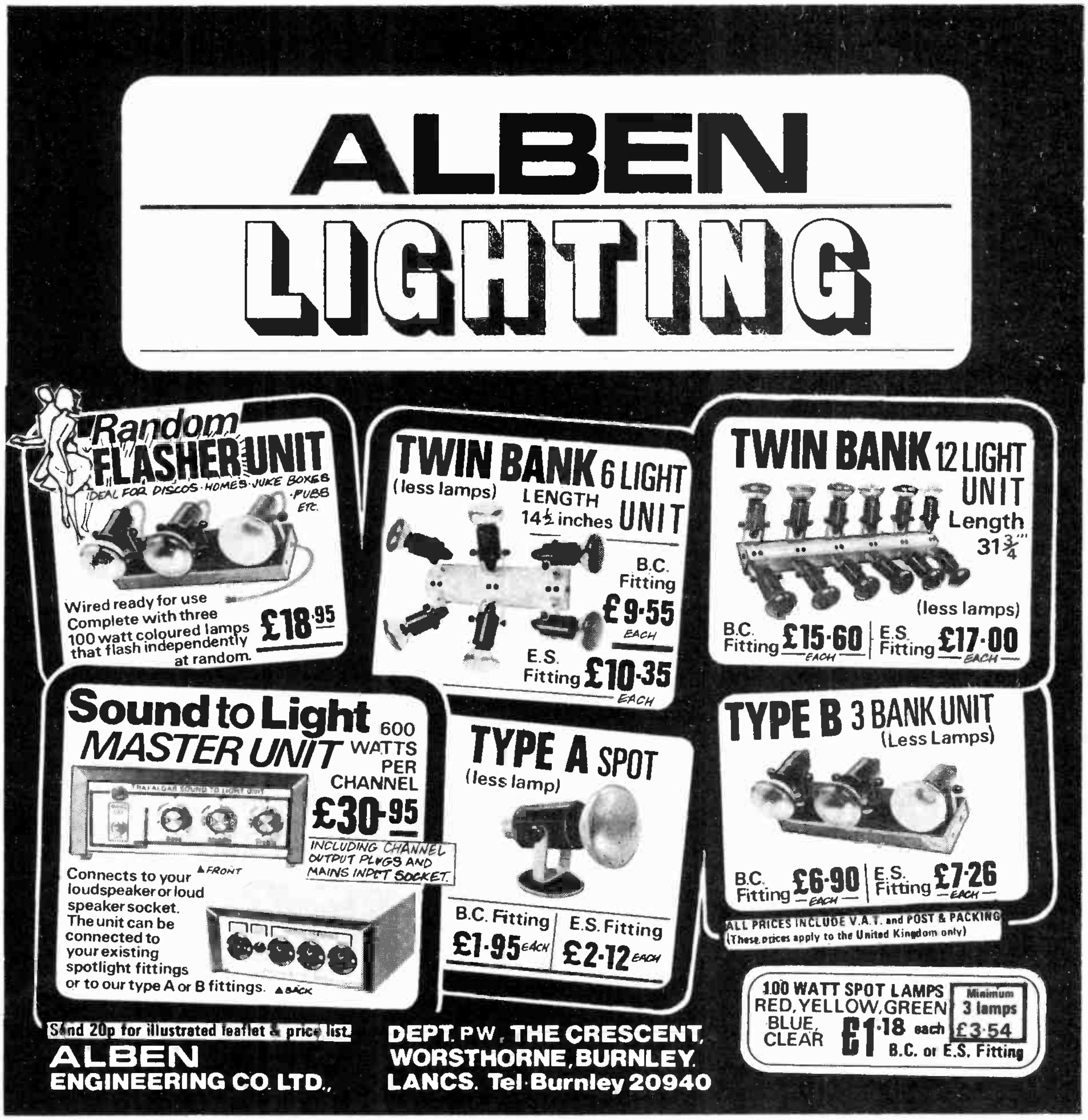
May-August 72

Send 30p + 10p (post and packing) to: Chief Cashier (PW Texan), IPC Magazines, Tower House, Southampton Street, London, WC2E 9QX

OUR "CQ" COLUMN

From time-to-time we have some CQ requests for back-numbers. **Please help us to help you**, if you want a "CQ" published, and you can do that by following the style on page 793 of the January 1976 issue when you write to us. Please keep CQ's as short as possible.

CQ's should be sent to THE "CQ" COLUMN, Practical Wireless Editorial, Fleetway House, Farringdon Street, London, EC4A 4AD.



"I MADE IT MYSELF"

Imagine the thrill you'll feel! Imagine how impressed people will be when they're hearing a programme on a modern radio you made yourself.

Now! Learn the secrets of radio and electronics by building your own modern transistor radio!

Practical lessons teach you sooner than you would dream possible.

What a wonderful way to learn—and pave the way to a new, better-paid career! No dreary ploughing through page after page of dull facts and figures. With this fascinating Technatron Course, you learn by building!

You build a modern Transistor Radio . . . a Burglar Alarm. You learn Radio and Electronics by doing actual projects you enjoy—making things with your own hands that you'll be proud to own! No wonder it's so fast and easy to learn this way. Because learning becomes a hobby! And what a profitable hobby. Because opportunities in the field of Radio and Electronics are growing faster than they can find people to fill the jobs!

No soldering—yet you learn faster than you ever dreamed possible.

Yes! Faster than you can imagine, you pick up the technical know how you need. Specially prepared step-by-step lessons show you how to: read circuits—assemble components—build things—experiment. You enjoy every minute of it!

You get everything you need. Tools. Components. Even a versatile Multimeter that we teach you how to use. All included in the course. AT NO EXTRA CHARGE! And this is a course anyone can afford. (You can even pay for it by easy instalments).

So fast, so easy, this personalised course will teach you even if you don't know a thing today!

No matter how little you know now, no matter what your background or education, we'll teach you. Step by step, in simple easy-to-understand language, you pick up the secrets of radio and electronics.

You become a man who makes things, not just another of the millions, who don't understand. And you could pave the way to a great new career, to add to the thrill and pride you receive when you look at what you have achieved. Within weeks you could hold in your hand your own transistor radio. And after the course you can go on to acquire highpowered technical qualifications, because our famous courses go right up to City & Guilds levels.

Send now for FREE 76 page book—see how easy it is—read what others say!

Find out more now! This is the gateway to a thrilling new career, or a wonderful hobby you'll enjoy for years. Send the coupon now. There's no obligation.

POST TODAY FOR FREE BOOK

To: ALDERMASTON COLLEGE
DEPT. CPW 14, READING RG7 4PF — CPW14

Also at our London Advisory Office, 4 Fore Street Avenue, Moorgate, London, EC2Y 5EJ Tel: 01-628 2721

Yes I'd like to know more about your course. Please send me free details—plus your big, 76-page book that tells about all your courses.

Name ....

Address ....

POST CODE ....

BIET

HOME OF BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

SOUTHERN VALVE COMPANY

P.O. Box 144, BARNET, Herts.

Telephone: 01-440 8641. Mail order only. Most leading makes

ALL NEW & BOXED VALVES (subject to availability)

AZ31	72p	EZ40/1	59p	PD500	£2·50	UL84	48p
DY86/7	40p	EZ80	38p	PFL200	81p	UY85	37p
DY802	46p	EZ81	33p	PL36	67p	U25	80p
EB91	21p	GY501	£1·30	PL81	55p	U26	78p
ECC81	39p	GZ30	49p	PL81A	60p	U191	80p
ECC82	37p	PC86	70p	PL82	42p	6/30L2	80p
ECC83	37p	PC88	70p	PL83	51p	6BW7	75p
ECC85	44p	PC97	44p	PL84	51p	6F23	80p
ECC88	52p	PC900	54p	PL500	83p	6F28	75p
ECH42	80p	PCC84	44p	PL504	83p	6V6	52p
ECH81	40p	PCC85	48p	PL508	£1·10	10F1	75p
ECH83	90p	PCC88	69p	PL509	£1·75	20L1	92p
ECH84	57p	PCC89	55p	PL519	£3·10	20P4	98p
ECL80	57p	PCC189	58p	PL802	£2·00	30C1	44p
ECL82	51p	PCF80	44p	PY33	57p	30C15	86p
ECL83	75p	PCF82	55p	PY81/3	41p	30C17	88p
ECL86	46p	PCF86	64p	PY88	45p	30C18	£1·35
EF80	33p	PCF200	98p	PY800	45p	30F5	86p
EF85	41p	PCF801	55p	PY801	45p	30FL1	£1 08
EF86	57p	PCF802	57p	PY500	£1·10	30FL2	£1·08
EF89	35p	PCF805	£1·35	PY500A		30L1	44p
EF183	41p	PCF806	60p	UBF89	44p	30L15	86p
EF184	41p	PCF808	£1·25	UCC85	51p	30L17	£1·10
EH90	62p	PCH200	86p	UCH42	80p	30P12	86p
EL34	90p	PCL82	41p	UCH81	46p	30P19	£1·00
EL41	64p	PCL83	55p	UCL82	46p	30PL1	£1·50
EL84	38p	PCL84	52p	UCL83	64p	30PL13	87p
EL90/1	48p	PCL85	64p	UF41	75p	30PL14	£1·30
EM84	49p	PCL805	70p	UF89	46p	30PL15	£1·30
EY51	52p	PCL86	55p	UL41	80p	30P4MR	99p
EY86/7	40p	PCL200	£1·30				

We offer return of post service. Post free over **£10·00.**
Many other types available.

Items in stock at time of going to press but subject to possible market fluctuations if unavoidable.

TRADE. Representative will call West Country & S. Wales.

Enquiries s.a.e. DISCOUNT PRICES, CWO only.

One valve post **7p**, each extra valve **6p** (maximum **50p**) LISTS s.a.e. please.

ELECTROVALUE

The good components service

In relatively few years, Electrovalue has risen to a position of pre-eminence as mail-order (and industrial) suppliers of semi-conductors, components, accessories, etc. There are wide ranges and large stocks to choose from as well as many worthwhile advantages to enjoy when you order from Electrovalue.

CATALOGUE 8 NOW READY

Enlarged to 144 pages. New items. Opto-electronics, Diagrams of components, applications, I.C. circuits, etc. Better than even No. 7. Post free 40p, including voucher for 40p for spending on order over £5 list value.

DISCOUNTS

On all C.W.O. mail orders, except for some items marked NETT
5% on orders list value £10 or more — 10% on orders list value £15 or more

FREE POST & PACKING

On all C.W.O. mail orders in U.K. over £2 list value. If under, add 10p handling charge.

PRICE STABILIZATION POLICY

Prices are held and then reviewed over minimum periods of 3 months—With effect from Jan. 1975.

QUALITY GUARANTEE

On everything in our Catalogue—No manufacturer's rejects, seconds or sub—standards merchandise.

ELECTROVALUE LTD

All communications to Section 1/2. **28, ST. JUDES ROAD, ENGLEFIELD GREEN, EGHAM, SURREY TW20 0HB.** Telephone Egham 3603, Telex 264475. *Shop hours 9-5.30 daily, 9-1 pm Sats.*

NORTHERN BRANCH: 680, Burnage Lane, Burnage, Manchester M19 1NA. Telephone (061) 432 4945. *Shop hours Daily 9-5.30 pm; 9-1pm Sats*

SPECIAL PRODUCT REPORT

sinclair OXFORD~300

THE "Oxford" series of calculators is Sinclair's bid to increase their penetration of the calculator market. The Oxford 300 is aimed at the growing "electronic slide rule" market and it looks like being a success.

The pocket-size scientific calculator field was pioneered by Hewlett Packard, closely followed by Texas Instruments who have become market leaders in the US. Hewlett Packard's HP35 was the first machine on the market which, competitively priced, virtually overpowered the existing calculator market overnight and made H-P a great deal of money. Since the launch of the HP35 in 1972, the market has expanded to allow prices to fall until today simple calculators start at under £10. Most of the scientific calculators are in the £50 to £150 range, so at £30 plus 8% VAT, the Sinclair Oxford 300 is worth a close examination.

Sinclair have produced three models in the Oxford range, the 100, 200 and 300, in an attempt to capture the market of calculator users from schoolboys and housewives, through commercial and business users, to scientists and engineers. They hope to claim a 35% share of the market by the end of 1975.

CONSTRUCTION

The Oxford 300 consists of a keyboard, a printed circuit board containing the main circuits and a display unit. The keyboard has 19 keys and a switch, all mounted on a paxolin assembly fitted into the case. The keys have a nice positive feel, making a click when operated. Replacement of a faulty keyboard would take enough time to be significant in cost.

The calculating power is contained in a single integrated circuit soldered, together with an interface IC and a few other components on to a neat printed circuit board which is mounted on plastic pillars and retained by three push fit pop studs. With only 17 connections, this board is easily changed but, since it contains the computing IC replacement would be expensive. The display unit is welded to the case and is the most difficult part to remove. The general standard of construction inside this calculator may be described as top domestic quality.

PACKAGING

Whilst one can be reasonably enthusiastic about the Oxford 300's internal construction, the same cannot be said about the outside packaging. According to Sinclair, "final styling of the Oxfords was determined by an exhaustive market research exercise in which a number of alternative case styles were researched for their modern and professional appearance, convenience and customer acceptability", The others must have been bad for this black case can only be described as dull.

A second criticism is the on/off switch, disguised as a function button on the main keyboard. It is a slider switch, rather difficult to operate and a potential failure point. A degree/radian switch is fitted on the back of the case in a position much more suitable for an on/off switch. Swapping these two switches would seem to be both logical and more functional.

The keyboard is of the dual function type in which a "function" key is used to obtain the alternative functions. This type of keyboard has the advantage that price is kept to a minimum as opposed to the discrete function keyboard which may have 40 or more keys for the same capability. The necessity of using a function key in an algebraic machine not only increases the number of operations necessary when performing calculations but it also means that considerable care has to be exercised as well.

The Oxford range is not designed with pocket use in mind although they should fit the average size pocket. The display is angled in such a way that it can be read with the machine on a desk. The keys are larger than most pocket calculators making desk top operation easier.

All three calculators in the range are mains or battery operated and should not be confused with the rechargeable battery facilities offered on more expensive machines.

FACILITIES

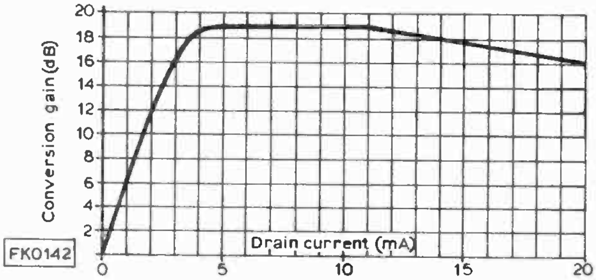
Algebraic logic is used as opposed to reverse Polish scientific notation as employed in the Sinclair Scientific calculator. This simplifies operation for the average user since calculations are carried out in the same way as they are written down. The Oxford provides a constant facility on all four arithmetic functions. There is also a very flexible memory with M+ (add to memory), M− (subtract from memory), MEx (exchange display and memory), MC (memory clear) and MR (memory recall) functions available. Trig functions sin, cos, tan and arcsin, arccos and arctan are provided with a switch to select either degree or radian operation. Other functions provided are log $_e$x, e^x, $\sqrt{x}$, $1_e x$ and a π key. There is no x^2 function which can be rather frustrating at times although squaring can be carried out using the constant facility.

Sinclair provide an adequate booklet showing examples of how to use the calculator. The display gives results in eight digit floating decimal point format or in scientific notation with a five digit mantissa and a two digit signed exponent. Numbers can be entered in either notation, the machine automatically adjusting the notation when the operation key is pressed. There is a machine clear and a last entry clear facility provided by pressing the clear key either once or twice. Each of the four arithmetic functions has the ability to store a constant so that if, for example k x a=is entered then subsequent numbers may be multiplied by k simply by pressing say b= to give k x b.

CONCLUSION

The Oxford 300 is a powerful little package that will appeal to many users at the price offered. The functions provided are more than adequate for the run of the mill scientific problem and the algebraic notation certainly makes it easier to use than the Sinclair Scientific. PW

Fig. 5: Graph of the mixer unit conversion gain, plotted against drain current.



Readers may wish to use a power supply during their experiments which will not give more than 50mA, to prevent possible damage to the SD6000. The absolute maximum permissible drain to source voltage is 20V.

As with all VHF circuits, precautions must be taken when using the SD6000 to keep all wires carrying radio frequencies very short. The writer found the SD6000 circuits he has tried reasonably immune from spurious oscillation, but nevertheless beginners are strongly advised to experiment at lower frequencies before moving to the 100MHz region.

The use of the SD6000 will enable FM tuners, including car radio VHF receivers, to be made which have a better performance and somewhat simpler circuitry than those which have been available up to now.

The SD6000 is available from Chromasonic Electronics, 56 Fortis Green Road, London N10 3HN for £1·22 plus 20p p/p.

BI-PAK SEMICONDUCTORS

PO BOX 6
WARE, HERTS.

POSTAGE & PACKING
Please add 25p. Overseas add extra for airmail
Minimum order 75p.

GREAT WINTER SALE!

ADD VAT 8%

SUCH REDUCED PRICES—IT'S CRIMINAL

74 SERIES TTL IC's

Type	Quantity 1 £ p	Quantity 100 £ p	Type	Quantity 1 £ p	Quantity 100 £ p	Type	Quantity 1 £ p	Quantity 100 £ p
7400	0·08	0·07	7448	0·70	0·68	74122	0·42	0·40
7401	0·12	0·09	7450	0·12	0·10	74123	0·58	0·50
7402	0·10	0·09	7451	0·12	0·10	74141	0·62	0·60
7403	0·12	0·09	7453	0·12	0·10	74145	0·70	0·65
7404	0·10	0·09	7454	0·12	0·10	74150	1·30	1·25
7405	0·10	0·09	7460	0·12	0·10	74151	0·65	0·60
7406	0·28	0·25	7470	0·26	0·24	74153	0·65	0·60
7407	0·28	0·25	7472	0·22	0·20	74154	1·30	1·25
7408	0·14	0·10	7473	0·26	0·22	74155	0·65	0·60
7409	0·14	0·10	7474	0·27	0·23	74156	0·65	0·60
7410	0·08	0·07	7475	0·44	0·40	74157	0·90	0·80
7411	0·20	0·18	7476	0·28	0·25	74160	0·95	0·85
7412	0·20	0·18	7480	0·40	0·35	74161	0·95	0·85
7413	0·26	0·25	7481	0·95	0·90	74162	0·95	0·85
7416	0·28	0·25	7482	0·72	0·62	74163	0·95	0·85
7417	0·27	0·24	7483	0·80	0·68	74164	1·20	1·10
7420	0·10	0·09	7484	0·85	0·80	74165	1·20	1·10
7422	0·25	0·23	7485	1·20	0·95	74166	1·20	1·10
7423	0·26	0·24	7486	0·30	0·25	74174	1·00	0·90
7425	0·26	0·24	7489	2·70	2·50	74175	0·95	0·85
7426	0·26	0·24	7490	0·38	0·32	74176	1·00	0·95
7427	0·26	0·24	7491	0·60	0·50	74177	1·00	0·95
7428	0·36	0·34	7492	0·43	0·35	74180	1·00	0·95
7430	0·12	0·10	7493	0·38	0·35	74181	2·00	1·80
7432	0·25	0·22	7494	0·45	0·40	74182	1·00	0·90
7433	0·35	0·32	7495	0·58	0·50	74184	1·50	1·40
7437	0·25	0·22	7496	0·68	0·63	74190	1·40	1·30
7438	0·25	0·22	74100	1·00	0·90	74191	1·40	1·30
7440	0·12	0·10	74101	0·30	0·25	74192	1·10	1·00
7441	0·64	0·58	74105	0·30	0·25	74193	1·10	1·00
7442	0·60	0·52	74107	0·30	0·25	74194	1·00	0·95
7443	0·95	0·90	74110	0·50	0·45	74195	0·75	0·70
7444	0·95	0·90	74111	0·80	0·75	74196	1·00	0·95
7445	0·75	0·55	74118	0·90	0·82	74197	1·00	0·95
7446	0·95	0·85	74119	1·30	1·20	74198	1·90	1·80
7447	0·68	0·65	74121	0·26	0·25	74199	1·80	1·70

Devices may be mixed to qualify for quantity price. (TTL 74 series only) data is available for the above series of I.C.'s in booklet form. Price 35p.

I.C. SOCKETS

BPS8 **9p.** BPS14 **10p.** BPS16 **11p.**

LINEAR IC

741P 8PIN **20p.**

TIMERS

NE555 **42p.** DUAL NE556 **85p.**

TRANSISTORS

Type	Price
AC128	10p
AC153K	18p
AC176K	20p
AC153/176K MP	38p
AC187K	20p
AC188K	18p
AC187K/188K MP	38p
OC71	9p
BC107	6p
BC108	6p
BC109	6p
BC118	8p
BC154	20p
BC147	8p
BC148	8p
BC149	10p
BC157	12p
BC158	10p
BC159	10p
BC169C	7p
BC170	5p
BC171	5p
BC172	5p
BC182 L & K	10p
BC183	10p
BC184	12p
BC212 L & K	10p
BC213	10p
BC214	12p
BC251	6p
BC327	12p
BC328	12p
BC337	11p
BC338	11p
BF115	10p
BF167	10p
BF173	10p
BF198	12p
BF199	12p
BF194	9p
BF195	9p
BF196	11p
BF197	11p
BF257	22p

Type	Price
BF258	26p
BF259	30p
BFX29	18p
BFX84	15p
BFX85	20p
BFX86	16p
BFY50	15p
BFY51	15p
BFX52	15p
BFY53	14p
2N696	10p
2N697	11p
2N706	6p
2N706A	6p
2N708	7p
2N1613	15p
2N1711	15p
2N1893	18p
2N2217	15p
2N2218	14p
2N2218A	15p
2N2219	14p
2N2219A	15p
2N2221	14p
2N2221A	15p
2N2222	14p
2N2222A	15p
2N2369	12p
2N2369A	12p
2N2904	12p
2N2904A	13p
2N2905	13p
2N2905A	13p
2N2906	10p
2N2906A	12p
2N2907	11p
2N2907A	13p
2N2926G	9p
2N2926Y	8p
2N3053	15p

Type	Price
2N3055	40p
2N3702	8p
2N3703	8p
2N3704	9p
2N3705	8p
2N3706	8p
2N3707	7p
2N3708	7p
2N3709	7p
2N3710	7p
2N3711	7p

F.E.T.
2N3819 12p

Type	Price
2N3903	8p
2N3904	8p
2N3905	9p
2N3906	9p
2N4058	8p
2N4059	8p
2N4060	9p
2N4061	9p
2N4062	9p
2N5172	9p

UNI-JUNCTION
UT46 = TIS43 20p

Type	Price
ZTX300	5p
ZTX500	8p
ZTX107	5p
ZTX108	5p
ZTX109	5p

DIODES

Type	Price
OA10	15p
OA47	5p
OA85-OA81	5p
OA91	5p
OA200/BAX13	5p
OA202/BAX16	5p
IN914	4p

Type	Price
IN4148	4p
IN4001	3p
IN4002	4p
IN4003	4p
IN4004	5p
IN4005	5p
IN4006	6p
IN4007	7p

S.C.R.'s
1A/50V TO5 15p
1A/400V TO5 25p
5A/50V TO66 25p
5A/400V TO66 40p

VOLTAGE REGS.
L129 (UA7805) 85p
L130 (UA7812) 85p
L131 (UA7815) 85p

L.E.D.
TIL209/FLV117 RED
5 for 50p

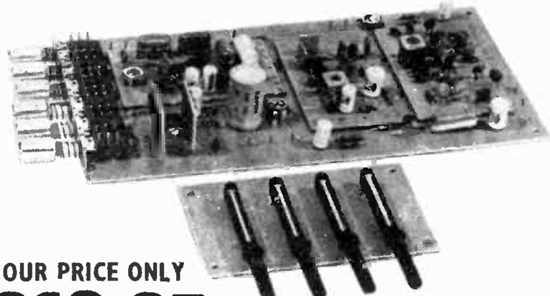
PCB MARKER PENS 65p

BI-PAK

High quality mono and other

NEW

STEREO FM TUNER



Fitted with Phase Lock-loop

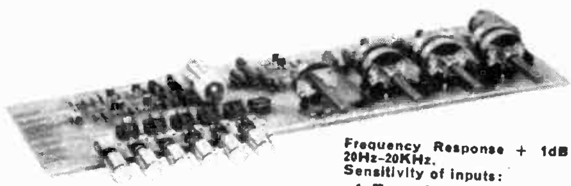
★ FET Input Stage
★ VARI-CAP diode tuning
★ Switched AFC
★ Multi turn pre-sets
★ LED Stereo Indicator

Typical Specification:
Sensitivity 3μ volts
Stereo separation 30db
Supply required 20–30v at 90 Ma max.

OUR PRICE ONLY
£19.95

The 450 Tuner provides instant programme selection at the touch of a button ensuring accurate tuning of 4 pre-selected stations, any of which may be altered as often as you choose, by simply changing the settings of the pre-set controls.
Used with your existing audio equipment or with the BI-KITS **STEREO 30** or the **MK60** Kit etc. Alternatively the **PS12** can be used if no suitable supply is available, together with the Transformer **T461**.
The S450 is supplied fully built, tested and aligned. The unit is easily installed using the simple instructions supplied.

STEREO PRE-AMPLIFIER PA 100



A top quality stereo pre-amplifier and tone control unit. The six push-button selector switch provides a choice of inputs together with two really effective filters for high and low frequencies, plus tape output.

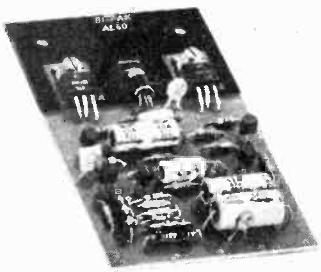
Frequency Response + 1dB 20Hz–20KHz.
Sensitivity of inputs:
1. Tape Input 100mV into 100K ohms
2. Radio Tuner 100mV into 100K ohms
3. Magnetic P.U. 3mV into 50K ohms

P.U. Input equalises to R1AA curve within 1dB from 20Hz to 20KHz. Supply 20-35V at 20mA. Dimensions—299mm × 89mm × 35mm.

OUR PRICE **£13.50**

MK60 AUDIO KIT: *Comprising: 2 x SPM80, 1 x BTM80, 1 x PA100, 1 front panel and knobs. 1 Kit of parts to include on/off switch, neon indicator, stereo headphone sockets plus instruction booklet.* **COMPLETE PRICE £27·55** *plus 62p postage.*
TEAK 60 AUDIO KIT: *Comprising: Teak veneered cabinet size 16¾" x 11½" x 3¼", other parts include aluminium chassis, heatsink and front panel bracket plus back panel and appropriate sockets etc.* **KIT PRICE £9·20** *plus 62p postage.*

AL 60



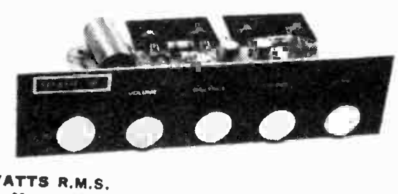
25 Watts (RMS)

● Max Heat Sink temp. 90C. ● Frequency response 20Hz. ● Distortion better than 0·1 at 1kHz. ● Supply voltage 15-50v. ● Thermal Feedback. ● Latest Design Improvements. ● Load—3,4,5, or 16ohms. ● Signal to noise ratio 80db. ● Overall size 63mm. 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.

ONLY **£3.95**

STEREO 30 COMPLETE AUDIO CHASSIS



7 + 7 WATTS R.M.S.
The Stereo 30 comprises a complete stereo pre-amplifier, power amplifiers and power supply. This, with only the addition of a transformer or overwind will produce a high quality audio unit suitable for use with a wide range of inputs i.e. high quality ceramic pick-up, stereo tuner, stereo tape deck etc. Simple to install, capable of producing really first class results, this unit is supplied with full instructions, black front panel, knobs, mains switch, fuse and fuse holder and universal mounting brackets enabling it to be installed in a record plinth, cabinets of your own construction or the cabinet available. Ideal for the beginner or the advanced constructor who requires Hi-Fi performance with a minimum of installation difficulty (can be installed in 30 mins.).

TRANSFORMER £2·45 plus 62p p & p
TEAK CASE £3·65 plus 62p p & p.

£15.75 *P & P 45p.*

Stabilized Power Supply Type SPM80

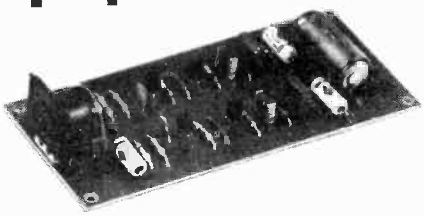
SPM80 is especially designed to power 2 of the AL60 Amplifiers, up to 15 watts (r.m.s.) per channel simultaneously. With the addition of the Mains Transformer **BMT80**, the unit will provide outputs of up to 1·5A at 35V. Size: 63mm, 105mm, 30mm. Incorporating short circuit protection.

INPUT VOLTAGE	**33-40V. A.C.**
OUTPUT VOLTAGE	**33V. D.C. Nominal**
OUTPUT CURRENT	**10mA-1·5 amps**
OVERLEAD CURRENT	**1·7 amps approx.**
DIMENSIONS	**105mm × 63mm × 30mm**
TRANSFORMER BMT80	**£2·60 + 62p. postage**

£3.00

modules for Stereo audio equipment

MPA 30



Enjoy the quality of a magnetic cartridge with your existing ceramic equipment using the new Bi-Pak M.P.A. 30 which is a high quality pre-amplifier enabling magnetic cartridges to be used where facilities exist for the use of ceramic cartridges only. Used in conjunction are 4 low noise, high gain silicon transistors. It is provided with a standard DIN input socket for ease of connection. Supplied with full, easy-to-follow instructions.

£2.65

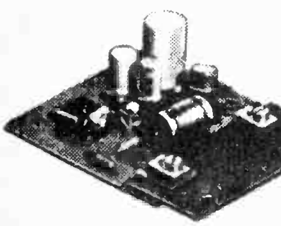
VAT ADD 25%

POSTAGE & PACKING

Postage & Packing add 25p unless otherwise shown. Add extra for airmail. Min. £1·00

AL10-20-30

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 home. Harmonic Distortion Po = 3 watts f = 0·25% Load Impedance 8-16ohm

Frequency response ± 3dB Po = 2 watts 50Hz-25KHz
Sensitivity for Rated O/P—Vs = 25v. RL = 80ohm f=1KHz 75mV. RMS. Size: 75mm x 63mm x 25mm.

AL10 3w R.M.S. **£2.30** AL2; 5w R.M.S. **£2.65** AL30 10w R.M.S. **£2.95**

NEW PA12 £6.50

NEW PA12 Stereo Pre-Amplifier completely redesigned for use with **AL10 20 30** Amplifier Modules. Features include on/off volume. Balance, Bass and Treble controls. Complete with tape output.
Frequency Response 20Hz-20KHz (−3dB)
Bass and Treble range ±12dB
Input Impedance 1 meg ohm
Input Sensitivity 300mV
Supply requirements 24V. 5mA
Size 152mm x 84mm x 33mm

PS12

Power supply for **AL10/20/30, PA12, S450** etc. Input voltagr 15-20v A.C. Output voltage 22-30v D.C. Output Current 800 mA Max. Size 60mm x 43mm x 26mm.

Transformer T538 £2.30

BI-PAK

P.O. BOX 6, WARE, HERTS

YOU DESERVE A BIGGER SALARY

"I earn more thanks to ICS"

Thousands of people have said it. Now it's your turn. ICS point the way to the better future you know you deserve.

Personal Tuition
Whether you need a basic grounding or tuition to complete your technical qualifications, ICS offer expert guidance from fully qualified tutors. You take the road to a better life at your own pace, in your own home, with the backing of the world's most experienced home study school.

Guaranteed success
ICS offer all examination students guaranteed tuition until successful. Plus expert advice on exam techniques. Make sure of your future with ICS. Choose the right course now.

City and Guilds Certificate
Make sure you get your Certificate with ICS:
Telecommunications Technicians
Radio TV and Electronics Technicians
Electrical Installations Technicians
Electrical Installation Work
Radio Amateurs
Also MPT Radio Communications Certificate

Technical Training
ICS offer a wide choice of non-exam courses designed to equip you for a better job in your particular branch of electronics, including:
Electronic Engineering & Maintenance
Computer Engineering & Programming
Radio TV & Audio Engineering & Servicing
Electrical Engineering, Installations & Contracting
Self Build Practical Radio Kits

Colour TV Servicing
Technicians trained in TV servicing are in constant demand. Learn all the techniques you need to service Colour and Mono TV sets through new home study course approved by leading manufacturer.

QUALIFY FOR A NEW CAREER
Home study courses also available for leading professional examinations and diploma courses for over 200 business and technical subjects including:

Accountancy	Engineering	Motor
Administration	Farming	Personnel
Advertising	Heating	Purchasing
Air Conditioning	Management	Sales
Building	Marketing	Storekeeping
Catering	Mechanical	Work Study

G.C.E. 60 subjects at 'O' and 'A' levels.

POST OR PHONE TODAY FOR FREE BOOKLET

I am interested in ....
Name ....
Address ....
....

ICS

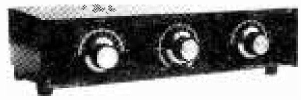
To: International Correspondence Schools, Dept. No. 777P, Intertext House, LONDON SW8 4UJ or telephone: 01-622 9911 (all hours)
Accredited by CACC.

CODAR®

TELECOMMUNICATIONS AND ELECTRONIC EQUIPMENT MANUFACTURERS

AERIAL TUNER UNIT

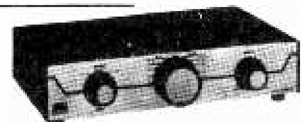
★ R.Q.80



This new CODAR A.T.U. tunes 1·5–30MHz and is designed to match random length single wire aerials from a few feet of indoor aerial to long outdoor wires to the receiver.
Hi-Q low loss air spaced CODARCOIL Inductor with no less than 10 position tapping switch and tuned by two air spaced variable capacitors, gives exceptionally wide range of matching to all types of receivers.
Compact size, handsome low slim line cabinet 9" x 5" x 2½". Ready for use.
Price £10·00 (carr. free) + £2·50 VAT.

★ P.R.40

R.F. PRESELECTOR



Will substantially improve receiver performance over 1·5/35 MHz. Three switched bands, Codar-coil low-loss airspaced inductor with F.E.T. and wide band R.F. amplifier gives outstanding performance. A must for the keen S.W.L.
Price £11·00 (carr. free) + £2·75 VAT.

★ CODAR COIL-PACK

Complete unit, 550 KHz–30 MHz in 4 switched bands. Fitted Aerial trimmer. Aligned, tested, ready for use. Suitable for valve or F.E.T. Mixer/Osc. As used in the CR70A. Full instructions included.
Price £7 (carr. free) + £1·75 VAT.

ILLUSTRATED LEAFLETS FREE ON REQUEST
(STAMP APPRECIATED)
EXPORT—FREE QUOTES ON REQUEST
WORLD WIDE MAIL ORDER.

★ C.R.70A COMMUNICATION RECEIVER

£39·00 (carr. free) + £9·75 VAT.

General coverage communication receiver. Ideal for the keen S.W.L. Tunes 550 KHz–30 MHz with no gaps, in four switched bands. For 200–240 A.C. it only requires an aerial and 2/8 ohm speaker to bring the world right into your home. Please note: This set is hand built to order and due to the very large number of orders delivery is now approx. 10 weeks.
Royal National Life-boat Institution . . . . . "our 4 CR70A receivers have proved very satisfactory" . . . . . .

★ NEW MINI CLIPPER SHORT WAVE KIT

Tunes 550 KHz–30 MHz complete coverage with 4 miniature plug-in coils. Receives AM/CW/SSB. Electrical bandspread. Output for low impedance headphones or any 2/8 ohm speaker (optional extras). Full step by step pictorial instructions, simple to build, Printed circuit board.
A quality Codar-Kit, 12 month guarantee. The ideal low cost starter Kit for the beginner S.W.L. to enjoy the fascinating hobby of long distance listening and collection of colourful Q.S.L. cards from all parts of the world! (Size and appearance similar to the RQ80).
Price complete (less PP6 battery) £10·80 (carr. free) + £2·70 VAT.

★ MULTIBAND—6 SHORT WAVE KIT

Tunes 550KHz–30MHz complete coverage with 4 miniature plug-in coils. Receives AM/CW/SSB. Separate electrical bandspread. Main tuning calibrated, vernier slow motion drive. Output for any external 2/8 ohm loudspeaker. Headphone jack. World-wide reception. Handsome styling, metal cabinet. Full pictorial instructions, easy to build, printed circuit board.
Price complete (less PP6 battery) £16·56 (carr. free) + £4·14 VAT.

CODAR AERIAL-KIT

50' stranded copper Aerial wire, plus 25' insulated lead-in wire, 4 insulators, leaflet hints and tips on types of aerial.
Price £2·40 (post free) + 60p VAT.

Special discounts for Senior Citizens, Disabled, Educational. Send for details. S.A.E.

Pay by ACCESS/BARCLAYCARD.
Quote No. clearly on Order.

CODAR® TELECOM LTD.

UNIT 2 - BURRELL BUILDINGS
CHURCHILL INDUSTRIAL ESTATE - LANCING - SUSSEX
TEL: 090-63-61901

NO HIDDEN EXTRAS!

ALL PRICES INCLUDE V.A.T.

Transistors	
AC128	22p
AC176	26p
AD161	51p
AD162	51p
BC107	12p
BC108	12p
BC109	12p
BC109C	21p
BC148	14p
BC149	15p
BC158	16p
BC169	16p
BC169C	17p
BC177	23p
BC178	26p
BC179	26p
BD241A	57p
BD242A	73p
BD243A	81p
BD244A	88p
BFY51	26p
OC45	17p
OC71	26p
OC72	26p
OC81	36p
ZTX300	15p
ZTX500	15p
2N706	16p
2N1711	17p
2N2926	12p
2N3053	21p
2N3055	48p
2N3702	15p
2N3704	15p
2N3707	9p
2N5777	51p

C-mos	
CD4000AE	19p
CD4001AE	19p
CD4002AE	19p
CD4007AE	19p
CD4009AE	52p
CD4010AE	52p
CD4011AE	19p
CD4012AE	19p
CD4013AE	52p
CD4014AE	94p
CD4015AE	94p
CD4016AE	52p
CD4017AE	94p
CD4018AE	94p
CD4019AE	52p
CD4020AE	£1·04
CD4022AE	89p
CD4023AE	19p
CD4024AE	72p
CD4025AE	19p
CD4026AE	£1·60
CD4027AE	52p
CD4028AE	83p
CD4029AE	£1·06
CD4030AE	52p
CD4035AE	£1·09
CD4040AE	99p
CD4042AE	78p
CD4043AE	94p
CD4044AE	87p
CD4046AE	£1·24
CD4049AE	52p
CD4050AE	52p
CD4051AE	87p
CD4056AE	£1·22
CD4060AE	£2·50

THYRISTORS		
CR1/051C	1 amp 50 v	68p
CR1/401C	1 amp 400 v	89p
BTY79/400R	6 amp 400 v	£2·49
BT106	1 amp 700 v	£1·42
IRC20	1·3 amp 200 v	78p
2N3228	5 amp 200 v	99p
2N3525	5 amp 400 v	£1·18
2N4441	5 amp 50 v	79p
2N4444	5 amp 600 v	£2·49

TRIACS		
T2700D	6 amp 400 v	£1·14
T4700B	15 amp 200 v	£1·28
T4700D	15 amp 400 v	£1·48
T2800D	7 amp 400 v	£1·01
T2800M	8 amp 600 v	£1·50
2N5756	2·5 amp 400 v	£1·02

FET's	
MPF102	46p
MPF103	42p
MPF104	64p
MPF105	42p
2N3819	32p
TIS88A	55p
2N5245	88p
2N5457	42p
2N5458	64p
2N5459	42p
3N128	83p
3N140	£1·04
3N141	93p
40468A	50p
40602	52p
40673	59p

UJT's	
2N2646	64p
2N4871	54p
2N6027	65p
BRY39	75p
IR2160	93p
TIS43	41p

BUNDLES	
11 x 741/8DIL	£3
100x741/8DIL	£25
8 x RED LEDS	£1
100 x RED LEDS	£10
100 x 1N4148	£3
500 x 1N4148	£12
4 x 2N3055 (Type)	£1

TTL	
7400	11p
7402	11p
7404	11p
7405	11p
7408	20p
7410	11p
7413	27p
7447	96p
7472	24p
7473	31p
7474	31p
7475	51p
7476	40p
7490	55p
7492	68p
7493	53p
7495	68p
74121	40p
74141	72p
74154	£1·46

LINEAR IC's,	
741/8DIL	33p
747/14DIL	£1·10
748/TO5	53p
CA3018	94p
CA3018A	£1·08
CA3028A	£1·03
CA3035	£1·78
CA3046	91p
CA3048	£2·74
CA3052	£2·11
CA3080	£0·61
CA3088E	£1·61
CA3089E	£2·52
CA3123E	£1·82
MC1303L	£2·07
MC1307P	£1·79
MC1310P	£2·86
MC1330P	£1·04
MFC4000B	92p
MFC6040	£1·49

OTHER POPULAR ITEMS	
1 Watt Zeners	16p
BZY88 Zeners	11p
RED LEDS	14p
TBA810S 7 watt IC	£1·29
741/TO5 op. amp	65p
CA3401E Quad op. amp	84p
IC Pin Sockets (1000)	£7·00
IC Pin Sockets (100)	£1·00
¼ w & ½ w Carbon Resistors	1p
Metal Oxide Resistors	5p

BARGAIN PACK £3

A generous assortment of semiconductors and other components and accessories

ARROW for

- OVERSEAS
- EDUCATIONAL
- GOVERNMENT

★ IMPORTANT ★

OUR NEW TRADING POLICY MEANS THE PRICE YOU SEE IS THE PRICE YOU PAY
NO V.A.T. TO ADD
POSTAGE, ETC. FREE IN UK

ARROW SERVICE PLUS TOP QUALITY PRODUCTS BY RETURN. FURTHER DETAILS ⟶

VAT Reg. 246 0626 72

I enclose PO/Cheque for 10p
NAME ....
ADDRESS ....
ARROW ELECTRONICS LTD
DEPT. PW18,
7 COPTFOLD ROAD
BRENTWOOD
ESSEX

ARROW ELECTRONICS LTD.

DEPT. PW 18, 7 COPTFOLD ROAD
BRENTWOOD, ESSEX CM14 4BN
Tel. 0277 219435 Telex 99443

Co. Reg. No. 1062424

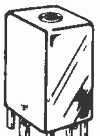
Crescent Quality Components

BARGAIN CAPACITOR 2,000MFD at 50v. DC wkg. Size — 2" × 1½" diameter. Tag ended. All new and unused. Our price 35p. + 25%.

BARGAIN PROJECT BOX
A plastic box with moulded extrusion rails for PC or Chassis panels with metal front plate fitted with four screws (all supplied).
An ideal box to give a small project a professional finish.
SIZE (internal) 81mm × 51mm × 28mm.
OUR PRICE 40p. + 8%

JB11D STEREO JUNCTION BOX
The most popular stereo junction box. Facility for two pairs of headphones and two speakers. 3 position switch selects headphones, loud-speakers or both. A bargain at £2·50 +25%

DENCO I.F. TRANSFORMERS



IFT.11. Midget IF transformers suitable for use with valves 'NEOSID' Iron dust core tuning, complete with screening can 78p Size—2·5m.m Square × 49m.m. Please State:- 465K/c. 1·6M/c. or 10·7 M/c.

IFT.13. Miniature IF transformer wound on ferrite pot core with adjustable core tuning complete with screening can 70p Size—11m.m square × 18m.m. 470K/c.

IFT.14. Miniature last IF transformer as above. 70p

IFT.16. Miniature IF transformer SPEC as above but 1·6 M/c. 62p

IFT.17. Miniature last IF transformer as above. 64p

IFT.18. 465K/c or 1·6M/c. Double tuned transformer complete with screening can. 82p Size—11m.m square × 38m.m.

IFT.15. A 10·7M/c IF transformer, Double tuned complete with screening can. 75p + 25% VAT Size—21m.m high × 11m.m square.

DENCO TRANSISTOR TUNING COILS

Coils for Transistor Superhets and Converters suitable for chassis or B9A base mounting.
T. COILS
BLUE: Aerial coil with base input winding
YELLOW: Interstage R.F. coil with cplgs
RED: Oscillator coil for 465Kc/s I.F.
WHITE: Oscillator coil for 1·6Mc/s I.F.

RANGE	1.T	2.T
Mc/s METRES	0·15–0·4 2000–750	0·515–1·545 580–194

RANGE	3.T	4.T	5.T
Mc/s METRES	1·67–5·3 180–57	5–15 60–20	10·5–31·5 28–9·5

PRICE: BLUE: Range 1 – 86p; Ranges 2–5 – 74p
YELLOW: Range 1 – 86p; Ranges 2–5 – 74p
RED: Ranges 1–5 – 74p
WHITE: Ranges 1–5 – 74p + 25% VAT

Clock Chip +8%
CT7001 MOS/LSI Digital Clock/Calendar Chip Plus full Circuits and Information leaflet £5·95
Circuits and Information Sheet 25p
Lit 704 Led Display for above £1·10
Or 4 for £4·20

POTENTIOMETERS All types 1" and less diameter

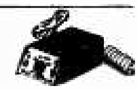
Singles		Dual	
5K	Log or	5K	
10K	Lin Less	10K	
25K	Switch	25K	Less
50K	17p each	50K	Switch
100K		100K	53p each
250K	Double	250K	+25%
500K	Pole	500K	
1M	Switch	1M	
2M	37p each	2M	

MAINS TRANSFORMERS
Open Type Double Wound Continuously Rated, two hole fixing clamp with colour coded flying leads, varnish impregnated. Approx. size: 1½" × 1½" × 1½" high Fixing centres: 2⁵⁄₃₂".
TR1 20–0–20v 100 m/a
TR2 12–0–12 v 100 m/a — All
TR3 9–0–9 v 100 m/a — 240 Volt
TR4 6–0–6 v 100 m/a — Primary
TR5 3–0–3 v 100 m/a
Our Price £1·23 each +8%

ANTEX SOLDERING IRONS AND SPARES
X25 25 watt = £2·45
X25 Spare Element = £1·20
X25 Spare Bits No. 50, 51, 52 = 44p each
C240/2 15 watt = £2·45
C240/2 Spare Element = £1·10
C240/2 Spare Bits No. 2, 3, 6 = 32p each
ST3. Soldering Iron Stand Suitable for all models = £1·10
+ 8% VAT

LOW PRICE TRANSISTORS
BF303B = 15p — TIP42A = 75p
AC142K = 25p — OC75 = 22p
BC149B = 15p — AA129 = 6p
+ 25% VAT

POWER SUPPLY UNITS +8%



PP1 switched 3, 4½, 6, 7½, 9 and 12 volts at 500 m/a, with on/off switch and pilot light. Size: 130mm × 55mm × 75mm. ONLY £4·00
PP2 Switched 6 – 7½ – 9 volt Battery Eliminator. Approx. size 2¾" × 2¼" × 3¼". Ideal for cassette recorders £3·25
PP3 Car converter. From 12v Pos. or Neg. to = 6 – 7½ – 9 volt. Easy to fit and transistor regulated £2·90

VEROBOARD +8%

	·1	·15	Plain ·15
2½ × 3¾	38p	28p	18p
2½ × 5	41p	41p	20p
3¾ × 3¾	41p	41p	
3¾ × 5	47p	49p	34p
17 × 2½	1·24p	93p	69p
17 × 3¾	1·69p	1·32p	97p
17 × 5	2·16p		1·37p

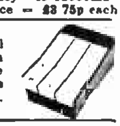
Pin insertion tool 81p
Spot face cutter 59p
Pkt 36 pins (state ·1 or ·15) 30p

LOUDSPEAKERS +25%
2½" 8 ohm 60p
2½" 40 ohm 60p
2½" 80 ohm 60p
5" 8 ohm ceramic £1·25
6½" 8 ohm dual cone ceramic £2·50
10" 8 ohm dual cone ceramic £3·75
8" × 5" 8 ohm Perman't Magnet £1·60

LOW VOLTAGE STEREO AMPLIFIER
8 Transistor Stereo Amplifier with Vol'e, Base, Balance and Tone Controls. Approx. 3 watts into 8 ohm per channel needs a 9/12 volt DC supply and is complete on a 2½" × 7½" P/C board.
Ideal for domestic record players, etc. A Bargain at £5 + 25% VAT.

10-INCH 8 OHM DUAL CONE
Manufactured by "ELAC" to a very high standard these loudspeakers are a real bargain
SPEC:—Size = 10" Dual Cone.
Power = 10 Watts
Frequency = 40-12000Hz
+25% Our Price = £3 75p each

MAINS KEYNECTOR



Keynector connects any Electrical Equipment to the mains supply in seconds. Ideal for bench, garage demonstrations, etc. Multi connections can be made (max. load 13A fused). £3·25p. +8%

ALUMINIUM BOXES +8%
Metal project boxes give your work a professional finish

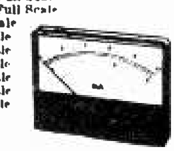
	L	W	H	
AB7	2¾	5¼	1½	54p
AB8	4	4	1½	63p
AB9	4	2¾	1½	54p
AB10	4	5¼	1½	63p
AB11	4	2¼	2	54p
AB12	3	2	1	45p
AB13	6	4	2	69p
AB14	7	5	2½	84p
AB15	8	6	3	99p
AB16	10	7	3	£1·35
AB17	10	4½	3	£1·08
AB18	12	5	3	£1·20
AB19	12	8	3	£1·50

ABS PLASTIC BOXES +8%
Handy boxes for construction projects. Moulded extrusion rails for P.C. or chassis panels. Fitted with 1mm front panels.
1005 – 105mm × 73mm × 45mm – 55p
1006 – 150mm × 75mm × 47mm – 72p
1007 – 184mm × 124mm × 60mm – £1·28
1021 – 106mm × 74mm × 45mm (sloping front) – 55p

TELESCOPIC AERIAL
Nine section fully swivelling telescopic aerial with 4BA single bolt fixing or two hole fixing bracket.
Fully extended = 43" Fully closed = 7"
Our Price 50p + P/P + VAT @ 25%

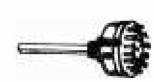
LOW NOISE LOW PRICE CASSETTES +8%
Good quality tape in well made screw type cassettes. Presented in single plastic cases.
C60 – 31p C90 – 42p C120 – 53p
10% Discount on ten or more cassettes of one type

CLEAR PLASTIC PANEL METERS
Size 59mm × 46mm × 35mm these meters require a 38mm hole for mounting.



ME6 = 0 to 50 micro amp Full Scale
ME7 = 0 to 100 micro amp Full Scale
ME8 = 0 to 500 micro amp Full Scale
ME9 = 0 to 1 m/a Full Scale
ME10 = 0 to 5 m/a Full Scale
ME11 = 0 to 10 m/a Full Scale
ME12 = 0 to 50 m/a Full Scale
ME13 = 0 to 100 m/a Full Scale
ME14 = 0 to 500 m/a Full Scale
ME15 = 0 to 1 amp Full Scale
ME16 = 0 to 50 volts
ME17 = 0 to 300 volts A.C. Full Scale
ME18 = "S" Meter
ME19 = "VU" Meter
OUR PRICE £3·00 +8%

WAFER SWITCHES



1 Pole 12 Way
2 Pole 2 Way
2 Pole 3 Way
2 Pole 4 Way
2 Pole 6 Way
3 Pole 4 Way
4 Pole 3 Way
27p each + 8%

SCOOP PURCHASE
MW—LW—FM STEREO TUNER
We supply a MW—LW—FM—Stereo Tuner fully wired and aligned on a 6" × 4" × 1½" printed board, plus the Ferrite Aerial and switch which you connect following our complete instructions.
Now you only need a 9-12 volt D.C. supply and you can feed this tuner into any Stereo Amplifier.
FANTASTIC VALUE AT £7·00 + 25% VAT

MINIATURE RELAYS
Brand new range of British made Relays. Size 1¾" × 1" × ⅞". All two changeovers with 250v 1·5A contacts and suitable for fitting on ·1m Veroboard.

Type	Volts	Current	Ohms
27/A	12v	17M/A	700
21/A	12v	28M/A	430
12/A	6v	33M/A	185

All £1·30 each —

IC EXTRACTION TOOL
Saves damage to Valuable IC's
ONLY 40p + 8% VAT

TWO WAY STEREO ADAPTOR
Stereo jack plug to two stereo line sockets complete with 110 mm of cable. For plugging two stereo inputs into one. A Bargain at 65p. + 25%

CABLE LESS SOLDERING IRON WAHL "ISO–TIP"
★ Completely Portable
★ Heats in 5 seconds
★ Solders up to 150 joints or more per charge
★ Recharges automatically in its own stand
★ No AC leakage or induced current to damage delicate components
★ Heats to 700 deg. F
★ Fine Tip for delicate and general purpose soldering
★ Only 8" long and weighs just 6 ozs.
OUR PRICE £9·75 +8% (spare bits are available)

FERRIC CHLORIDE
Anhydrous ferric chloride in double sealed one pound poly packs.
Our Price 65p + P/P + VAT @8% per lb.

3 KILOWATTS PSYCHEDELIC LIGHT CONTROL UNIT

Three Channel Bass. Middle. Treble. Each channel has its own sensitivity control. Just connect the input of this unit to the loudspeaker terminals of an amplifier, and connect three 250V up to 1000W lamps to the output terminals of the unit, and you produce a fascinating sound-light display. (All guaranteed).
£18·50 plus 75p P. & P. + 8%

BARGAIN TRANSFORMERS
12-0-12 volt 500m/a
240 volt primary transformer bargain.
approx size =60mm x 40mm x 50mm
fixing centres =75mm
Our Price =£1·20 +8%

P.C. ETCHING KIT
This kit contains all that the constructor will need to etch the circuits of his own design
Contents — Plastic etching dish.
Sample copper clad board.
Laminate Cutter.
1 lb Ferric Chloride.
Large Plastic Spoon.
Etch Resist Pen.
Full Etching Instructions.
Complete and Big Kit Value at £3·75p +8%

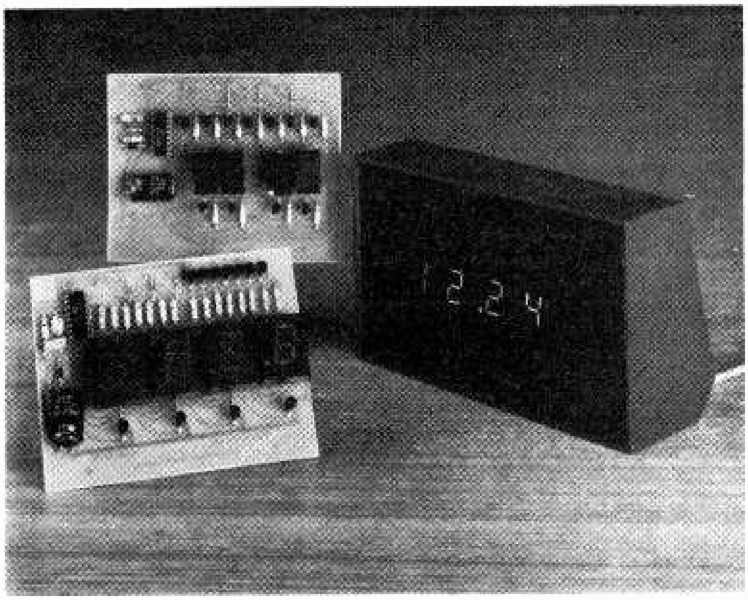
VAT—All prices are excluding VAT. Please add to each item the VAT rate indicated.

CRESCENT RADIO LTD. P.W.
All mail to No. 1 ST. MICHAELS TERRACE
WOOD GREEN, LONDON N22 4SJ.
Phone: 01-888 4474

U.K. POSTAGE 50p UNLESS OTHERWISE STATED

Callers Welcome at 15 Mayes Road & 13 South Mall, Edmonton N9.

Greenbank Electronics Established 1970



The illustration shows the two P.C.B. kits already assembled, one has 8mm high digits, the other has 16mm high digits. Also shown is an example of a completed clock.
Free on request: Data on AY-5-1224 and MK50253 clock chips, 4 and 6 digit alarm clock suggested circuits, quartz crystal timebase, and L.E.D. displays, (If you can send an S.A.E., it makes things a little easier for us).

DIGITAL CLOCK

P.C.B. KITS FROM

£9·35 (plus 10p post and VAT @ 8%)

Features:—

- ★ High quality fibreglass P.C.B. 112 × 89mm (both types), a suitable case is available as illustrated, or you can make your own.
- ★ All components mount on one side of the board for neatness and simple construction.
- ★ AY-5-1224 chip and L.E.D.s 'plug-in' for easy assembly and servicing.
- ★ Uses L.E.D. display (believed to have the longest life time of all electronic display types known at present).
- ★ A single 12V, 500mA, 50 Hz supply is the only input required (e.g. our 2 × 6V Min. Tr., see below).
- ★ Full eight page instructions provided, and back up assistance if you need it—success guaranteed! Suitable for even the absolute beginner.
- ★ Easily converted to give additional 4 range 'stop-watch' facility, for e.g. darkroom timer.
- ★ All parts available individually at no increase in price—buy only what you need.
- ★ An excellent idea for a most acceptable gift.

CLOCK/'STOPWATCH' P.C.B.s
Type 1224-704E/PCB for 8mm high display 95p. Type 1224-747E/PCB for 16mm high display 95p.

COMPONENT KITS
Include: P.C.B., AY-5-1224 Chip, 4 L.E.D. digits, transistors, diodes, resistors, capacitors, mounting socket pins, full instructions. Ref: 1224-704E/Kit (8mm high digits) **£9·35**
Also, as above but using 16mm high digits (P.C.B. is same size). Ref: 1224-747E/Kit **£12·59**
(Either P.C.B. kit can be supplied assembled and tested for an additional 75p)

CLOCK CHIPS
AY-5-1224 4 digit **£3·66** MK 50253 4/6 digit alarm **£5·50**
(CT 7001 discontinued)

L.E.D.s (Please check availability)
DL-Series 7 seg. displays, common anode and common cathode types: 0·3" single digits, 'Economy' **70p**, 'Prime' **£1·48**; 0·5" double digits, 'Economy' **£1·80**, 'Prime' **£3·75**; 0·6" single digits, 'Economy' **£1·50**; 'Prime' **£2·45**, 0·2" single red L.E.D. indicator **12p**

MINIATURE TRANSFORMERS
6VA Types with 240V primary, approximate dimensions W.45mm H.38mm D.40mm, fixing centres 53·5. Secondary voltages available: 2 x 4½V, 2 x 6V, 2 x 12V, 2 x 15V, 2 x 20V, all same price **£1·52**.

CMOS
Popular types 4001, 4011 gates **15p** (Range is being extended—send for list.) New CA 3130 R.C.A. COS/MOS op-amp **75p**.

ANTEX SOLDERING IRONS
C.240 15 watt miniature type **£2·45**. X.25/240 25 watt **£2·45**.

Terms: C.W.O. Add VAT to all prices at 8%. Post etc., U.K. 10p per order, export 75p (no VAT). All orders processed on day of receipt

GREENBANK ELECTRONICS (Dept. W1P)
94 New Chester Road, New Ferry, Wirral, Merseyside, L62 5AG, England. Tel:—051-645 3391

So you want to save money and be sure of quality as well ?

AUTOLUME
Automatic side light switch to keep you within the law. See price list **£4·98 Inc. V.A.T.**

VARIWIPE
Controls wipers stroke by stroke as required. Easy to fit. See P.W. Dec. Details in price list. **£5·98 Inc. V.A.T.**

ELECTROWINK
Car flash unit for caravan, emergencies, etc. Electronic. No mods. needed to your car. See our price list. **£4·48 Inc. V.A.T.**

S.A.E. brings full latest list. Everything over £3 sent postal paid.

RESISTORS
E12 values 10Ω to 10MΩ. Mostly carbon film, some good quality composition, ⅛, ¼ watt supplied as available. **·8p ea. 100 one value 60p.** ½ watt, 5% carbon film, **1p ea, 100 one value 75p.**

CAPACITORS
Small **electrolytics**, 1µF to 50µF, up to 50V, supplied as available **4p each.** Others too numerous to list. **Min. ceramics,** most values to 10n, 50V **1·5p each.** Polyester, polystyrene and others.

TRANSISTORS
Good quality marked, tested by TI, Ferranti, Micro Electronics, but with unfamiliar numbers. Will replace popular types such as BC107, 108, 109, 177, 178, 179, 207, 204, 182, 212, etc. **7p each.**
100 PNP or **NPN** for **£5·50.**
50 PNP and **50NPN** for **£5·60. BARGAIN BAGS**
100 assorted resistors, ⅛ to ½ W, mostly carbon film, all good quality. **60p each.**
100 asstd small electrolytics. £2·50
100 asstd. miniature ceramics £1·00.

SCIENTRONICS

40, HIGH ST., SOMERSHAM, HUNTINGOON, CAMBS., PE17. 3JA. Tel: Somersham 0487 4321

PRACTICAL WIRELESS T.V. SOUND TUNER

IF Sub-Assembly (G8) **£6·80.** P & P 55p.
Mullard ELC1043 Varicap UHF Tuner **£4·20.** P & P 30p.
3-way Station Control Unit **£1·20.** P & P 25p.
6-way Station Control Unit (Special Offer) **£1·00.**
Resistors, Caps, Semiconds etc. **£5·22.** P & P 55p.
Printed Circuit Board **£1·00.** P & P 25p.

Add 25% VAT to price of goods. P & P all items 65p.

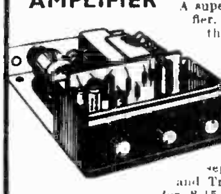
Callers welcome at shop premises.

MANOR SUPPLIES

172 WEST END LANE, LONDON NW6

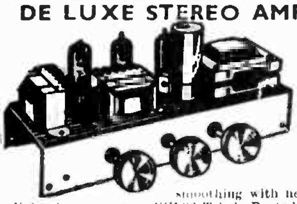
(Near W. Hampstead Tube Stn.) Tel. 01-794 8751

SUPERSOUND 13 HI-FI MONO AMPLIFIER



A superb solid state audio amplifier. Brand new components throughout. 5 silicon transistors plus 2 power output transistors in push-pull. Full wave rectification. Output approx. 13 watts r.m.s. into 8 ohms. Frequency response 12Hz 30KHz ± 3db. Fully integrated pre-amplifier stage with separate Volume. Bass boost and Treble cut controls. Suitable for 8-15 ohm speakers. Input for ceramic or crystal cartridge. Sensitivity approx. 40mV for full output. Supplied ready built and tested, with knobs, escutcheon panel, input and output plugs. Overall size 3" high × 6" wide × 7½" deep. AC 200/250V. **PRICE £15·00.** P. & P. 85p.

DE LUXE STEREO AMPLIFIER



A.C. mains 200-240 v. Using heavy duty fully isolated mains transformer with full wave rectification giving adequate smoothing with negligible hum. Valve line up: 2 × ECL86 Triode Pentodes. 1 × EZ80 as rectifier. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approximately 300mV for full peak output of 4 watts per channel (8 watts mono), into 3 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11"w × 4"d. Overall height including valves 5". Ready built & tested to a high standard. £12·50. P.&P. 95p.

ALL-PURPOSE POWER SUPPLY UNIT 200/240v. A.C. input. Four switched fully smoothed D.C. outputs giving 6v. and 7½v. and 9v. and 12v. at 1 amp on load. Fitted insulated output terminals and pilot lamp indicator. Hammer finish metal case overall size 6" × 3½" × 2¼". Ready built and tested. **PRICE £6·35** P. & P. 85p.

VYNAIR & REXINE SPEAKERS & CABINET FABRICS app. 54 in. wide. Our price £1·80 yd. length. P. & P. 35p per yd. (min. 1 yd.). S.A.E. for samples.

HARVERSON'S SUPER MONO AMPLIFIER

A super quality gram amplifier using a double wound fully isolated mains transformer, rectifier and ECL82 triode pentode valve as audio amplifier and power output stage. Impedance 3 ohms. Output approx. 3·5 watts. Volume and tone controls. Chassis size only 7in. wide × 3in. deep × 6in. high overall. AC mains 200/240v. Supplied absolutely Brand New completely wired and tested with good quality output transformer. P. & P. 85p BARGAIN PRICE **£5·00**

BRAND NEW MULTI-RATIO MAINS TRANSFORMERS. Giving 13 alternatives. Primary: 0–210–240v. Secondary combinations 0–5–10–15–20–25–30–35–40–60v. half wave at 1 amp. or 10–0–10, 20–0–20, 30–0–30v. at 2 amps full wave. Size 3in. long × 3½in. wide × 3in. deep. Price £2·75 P. & P. 75p.

MAINS TRANSFORMER. For power supplies.
Pri. 200/240v. Sec. 9–0–9 at 500 mA. £1·35. P. & P. 35p.
Pri. 200/240v. Sec. 12–0–12 at 1 amp. £1·50. P. & P. 55p.
Pri. 200/240v. Sec. 10–0–10 at 2 amp. £2·20. P. & P. 70p.

GENERAL PURPOSE HIGH STABILITY TRANSISTOR PRE-AMPLIFIER

For P.U. Tape, Mike, Guitar, etc. and suitable for use with valve or transistor equipment. 9-18v. battery or from H.T. line 200/300v. Frequency response 15Hz–25KHz. Gain 26dB. Solid encapsulation size 1¼" x 1¼" x ¾". Brand new complete with instructions. Price £1·50. P. & P. 15p.

STEREO-DECODER

SIZE 2" x 3" x ½" ready built. Pre-aligned and tested. Sens. 20-560 mV for 9-16V neg. earth operation. Can be fitted to almost any FM VHF radio or tuner. Stereo beacon light can be fitted if required. Full details and instructions (inclusive of hints and tips) supplied. £6·25 plus 20p. P. & P. Stereo beacon light if required 45p extra.

QUALITY RECORD PLAYER AMPLIFIER MK. II

A top quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, and rectifier. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7in. wide × 3in. deep × 6in. high. Ready built and tested. PRICE £6·50, P. & P. 90p. ALSO AVAILABLE mounted on board with output transformer and speaker. PRICE £7·75, P. & P. £1.

HARVERSONIC MAINS OPERATED SOLID STATE STEREO FM TUNER

Enjoy fabulous stereo radio at this fabulous low introductory price!

Designed and styled to match our 10 + 10 amplifier but will suit any other standard stereo amplifier. The design incorporates the very latest circuitry techniques with high-grain, low noise I F stages. Automatic frequency control to "lock-on" station and prevent drift. IC stereo decoder for maximum stereo separation. L.E.D. for stereo beacon indicator. Nominal output of tuner 100mV. Approximate size 12½" wide × 8" deep by 2½" high. Supplied ready built, fully tested and fully guaranteed (not available in kit form).

Price £27·50 Post and Packing £1·20.

LATEST ACOS GP91/1SC mono compatible cartridge with t/o stylus for LP/EP/78. Universal mounting bracket. £1·75 P. & P. 18p.

CERAMIC STEREO CARTRIDGE. Universal Mounting brackets and turnover stylus. 70mV per channel output. ONLY £2·06 + 18p P. and P.

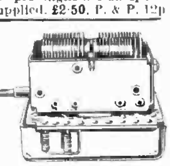
SONOTONE 9TAHC COMPATIBLE STEREO CARTRIDGE T/O stylus Diamond Stereo LP and Sapphire 78. ONLY £2·62 P. & P. 10p. Also available fitted with twin Diamond T/O stylus for Stereo LP. £3·18, P. & P. 18p.

LATEST CRYSTAL T/O TEREO / COMPATIBLE CARTRIDGE for EP/LP/Stereo/78. £1·98 P. & P. 18p.

LATEST T/O MONO COMPATIBLE CARTRIDGE for playing EP/LP/78 mono or stereo records on mono equipment. Only £1·75, P. & P. 18p.

SPECIAL OFFERS

Mullard LP1159 R.F.-I.F. Double Tuned Amplifier Module for nominal 470 KHz. Size approx. 2⅜" × 1¼" × ⅜" 7·6 Volt + earth. Brand new pre-aligned. Full specification and connection details supplied. £2·50, P. & P. 12p



Pye VHF/FM Tuner Head covering 88-108 M/Hz. 10·7 M/Hz I.F. output 7-8 Volt + earth. Supplied pre-aligned with full circuit diagram and connection details. Beautifully made with precision-geared FM and 323 Pf + 323Pf A.M. Tuning Gauge only £3·50 + P. & P. 35p.

PRECISION MADE

Push Button Switch bank. 8 Buttons giving 16 S/P C/O interlocked switches plus 1 Cancel Button Plus 3 d/p c/o. Overall size 5" × 2½" × 1". Supplied complete with chrome finished switch buttons £1·50 ea + 10p P. & P

HI-FI LOUDSPEAKER SYSTEM MK II

Beautifully made, simulated teak finish enclosure with atttactive slatted front. Size 16½" high × 10½" wide × 9" deep (approx.). Fitted with E.M.I. Ceramic Magnet 13" × 8" bass unit, H.F. tweeter unit and crossover. **AVAILABLE IN NOMINAL** 4 Ohm, 8 Ohm or 16 Ohm impedance (state which).

OUR PRICE £12·50 each Carr. £1·60.

Cabinet Available Separately £7·50, Carr. £1·20.
Also available in 8 ohms with EMI 13" × 8" bass speaker with parasitic tweeter £11·00, Carr. £1·60.

LOUDSPEAKER BARGAINS

5in. 3 ohm £1·45, P. & P. 35p. 7 × 4in. 3 ohm £1·69, P. & P. 48p. 10 × 6in. 3 or 15 ohm £2·50, P. & P. 75p. E.M.I. 8 × 5in. 3 ohm with high flux magnet £2·06, P. & P. 50p. E.M.I. 13½ × 8in. with high flux ceramic magnet with parasitic tweeter 3, 8 or 15 ohm £4·12, P. & P. 85p. E.M.I. 13 × 8in. 3, 8 or 15 ohm with inbuilt tweeter and crossover network £5·50, P. & P. 95p.
E.M.I. tweeter. Approx. 3½". Available 3 or 8 or 15 ohms, £2·00 + 25p, P. & P.

"POLY PLANAR" WAFER-TYPE, WIDE RANGE ELECTRO-DYNAMIC SPEAKER

Size 11⅝" × 14 11/16" × 1 3/16" deep. Weight 19oz. Power handling 20W r.m.s. (40W peak). Impedance 8 ohm only. Response 40Hz-20kHz. Can be mounted on ceilings, walls, doors, under tables, etc., and used with or without baffle. Send S.A.E. for full details. Only £7·68 each. P. & P. 70p.
Now also available 8". 10 watts, r.m.s. 20 watt peak 40 Hz-20,000 Hz. Overall depth 1". Ideal for Hi-Fi or for use in cars £5·18 + 40p p. & p.

HARVERSONIC SUPERSOUND 10 + 10 STEREO AMPLIFIER KIT

A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistors in the first five stages on each channel resulting in even lower noise, level with improved sensitivity. Integrated pre-amp with Bass, Treble and two Volume Controls. Suitable for use with Ceramic or Crystal cartridges. Very simple to modify to suit magnetic cartridge—instructions included. Output stage for any speakers from 8 to 15 ohms. Compact design, all parts supplied including drilled metalwork high quality ready drilled printed circuit board with component identification clearly marked, smart brushed anodised aluminium front panel with matching knobs, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of. Brief specification; Power output: 14 watts r.m.s. per channel into 5 ohms. Frequency response ±3dB 12-30,000 Hz Sensitivity: better than 80mV into 1MΩ. Full power bandwidth: ±3dB 12-15,000 Hz. Bass boost approx. to ±12dB. Treble cut approx. to −16dB. Negative feedback 18dB over main amp. Power requirements 35v. at 1·0 amp. Overall Size 12"w. × 8"d. × 2½"h.

Fully detailed 7 page construction manual and parts list free with kit or send 25p plus large S.A.E.

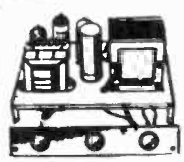
AMPLIFIER KIT	£15·00	P. & P. 55p
(Magnetic input components 33p extra)		
POWER PACK KIT	£5·35	P. & P. 85p
CABINET	£5·35	P. & P. 75p

(P. & P. only £1·00 if all units purchased at same time).
Full after sales service

Also available ready built and tested £32·50. P. & P. £1.

Note: The above amplifier is suitable for feeding two mono sources into inputs (e.g. mike, radio, twin record decks, etc. and will then provide mixing and fading facilities for medium powered Hi-Fi Discotheque use, etc.

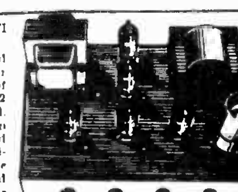
3-VALVE AUDIO AMPLIFIER HA34 MK II



Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7¾"w. × 4"d. × 4¾"h. Incorporates ECC83, EL84, EZ80 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm speaker. Separate volume control and now with improved wide range tone controls giving bass and treble lift and cut. Negative feedback line. Output 4½ watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only £7·75. P. & P. 85p.

HSL "FOUR" AMPLIFIER KIT. Similar in appearance to HA34 above but employs entirely different and advanced circuitry. Complete set of parts, etc £6·50 P. & P. 85p.

10/14 WATT HI-FI AMPLIFIER KIT



A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3-15 Ω speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet 25p + SAE (Free with parts)' All parts sold separately. ONLY £12·00 P. & P. £1·25. Also available ready built and tested £16·50 P. & P. £1·20.

SPECIAL OFFER Limited number of the latest BSR C141RI Auto/Manual changer de-luxe. Lightweight tubular arm, cue-ing lever bias compensator £14·00 + £1·10 p. & p.

Prices include VAT at Current Rate

Open 9.30–5.30 Monday to Friday. 9.30–5 Saturday Closed Wednesday.

All prices and specifications correct at time of press and subject to alteration without notice.

HARVERSON SURPLUS CO. LTD.

(Dept. P.W.) 170 HIGH ST., MERTON, LONDON, S.W.19 Tel.: 01-540 3985

A few minutes from South Wimbledon Tube Station.

SEND STAMPED ADDRESSED ENVELOPE WITH ALL ENQUIRIES

(Please write clearly)

PLEASE NOTE: P. & P. CHARGES QUOTED APPLY TO U.K. ONLY. P. & P. ON OVERSEAS ORDERS CHARGED EXTRA.

PRICES INCLUSIVE OF VAT

Add 20p p & p—NO OTHER EXTRAS

Overseas Customers only:
Deduct 5% for order over £20.
Post free for orders over £10.

TTL BY TEXAS

7400	13p	7483	86p
7401	15p	7484	103p
7402	15p	7485	130p
7403	17p	7486	32p
7404	17p	7489	291p
7405	17p	7490	43p
7406	41p	7491	81p
7407	39p	7492	48p
7408	17p	7493	43p
7409	22p	7494	81p
7410	15p	7495	70p
7412	25p	7496	84p
7413	34p	74107	32p
7414	65p	74121	32p
7416	32p	74122	52p
7420	15p	74123	73p
7422	19p	74141	70p
7423	36p	74151	77p
7425	33p	74153	92p
7427	40p	74154	164p
7430	15p	74155	82p
7432	28p	74156	82p
7437	28p	74160	107p
7440	15p	74161	107p
7441	70p	74162	107p
7442	64p	74163	107p
7447	81p	74164	130p
7448	75p	74166	136p
7450	16p	74175	92p
7453	17p	74180	108p
7454	18p	74181	322p
7460	16p	74182	89p
7470	29p	74185	140p
7472	27p	74190	155p
7473	32p	74192	130p
7474	32p	74193	130p
7475	48p	74194	116p
7476	32p	74195	83p
7480	54p	74198	214p
7481	103p	74199	197p
7482	75p		

CMOS LOGIC

4000	19p	4016	54p
4001	19p	4017	123p
4002	19p	4018	247p
4009	67p	4022	182p
4011	19p	4023	22p
4013	55p	4024	125p

OP AMPS

301A	Ext Comp 8 pin DIL	48p
709	Ext Comp 8/14 pin DIL	30p
710	Diff Comp 14 pin DIL	54p
741	Int Comp 8/14 pin DIL	27p
747	Dual 741 14 pin DIL	76p
748	Ext. Comp 8 Pin DIL	40p
776	Prog. OpA TO 99	153p
CA3130S	CMOS OpA 8 Pin DIL	108p
LM3900	Quad OpA 14 Pin DIL	75p
MC1458	Dual OpA 8 Pin DIL	75p
NE536T	FET OpA TO 99	300p

LINEAR ICS

CA3028	Diff. Cascade Amp	112p
CA3046	5 Transistor array	62p
CA3048	Quad low noise Amps	250p
CA3089E	FM IF System 16 DIL	250p
CA3090E	FM Stereo Decoder	200p
ICL8038CC	VCO Funct. Gen	300p
ICL8038BC	VCO Funct. Gen	600p
LM380	2W Audio Amp	115p
LM381	Stereo Pre Amp	200p
M252	Rhythm Gen	1100p
MC1310P	FM Stereo Dec.	220p
MC1312/4/5	SQ Quad Dec.	1375p
MFC4000B	¼W Audio Amp	85p
MFC6040	Electronic Attenuator	112p
NE555	Timer 8 Pin DIL	48p
NE556	Dual 555 14 Pin DIL	108p
NE561B	PLL with AM Demod	350p
NE562B	PLL with VCO	350p
NE565	PLL	216p
NE566	PLL Funtion Gen	180p
NE567	PLL Tone Decoder	180p
2567	Dual 567	400p
SN72733	Video Amp	150p
TBA800	5W Audio Amp	112p
TBA810	7W Audio Amp	125p
TBA820	2W Audio Amp	100p
XR2240	Prog/Timer Counter	400p
ZN414	TRF Radio Receiver	140p

Basic data sheet at 10p each + SAE

MM5314	Clock IC 24 Pin DIL	460p

LOW PROFILE SKTS BY TEXAS
8 Pin 15p, 14 Pin 15p, 16 Pin 16p, 24 Pin 54p

VOLTAGE REGULATORS (PLASTIC)

723	1 Amp	+ve		−ve	
14 Pin DIL 48p	5V	7805	150p	7905	215p
	12V	7812	150p	7912	215p
Data Sheets on	15V	7815	150p	7915	215p
Vol. Regs. 10p	18V	7818	150p	7918	215p
each	24V	7824	150p	7924	215p

OPTO ELECTRONICS

		Seven Seg. Displays		LEDS	
OCP70	33p				
OCP71	120p	3015F	130p	TIL209	16p
ORP12	54p	MAN 3M	65p	(Red)	
ORP60	70p	DL704	160p	TIL211	34p
ORP61	65p	DL707	160p	(Green)	
2N5777	43p	DL747	250p		

SCR-THYRISTORS

1A 50V TO5	43p
1A 100V TO5	45p
1A 400V TO5	56p
3A 100V Stud	53p
3A 400V Stud	81p
7A 100V TO5+HS	87p
7A 400V TO5+HS	97p
16A 400V Plastic	200p
16A 600V Plastic	250p

OTHERS

BT106 1A 700V Plastic	150p
C106D 4A/400V	59p
2N4444 8A/600V	200p
TO66 2N3525 5A/400V	98p
TO92 MCR101 ½A/15V	27p
2N5060 ·8A/30V	38p
2N5062 ·8A/100V	45p
2N5064 ·8A/200V	50p

TRIACS

	100V	400V	500V
3 Amp	92p	120p	130p
6 Amp	95p	150p	180p
10 Amp	117p	180p	200p
15 Amp	156p	220p	270p

OTHERS

40430	110p
40486	110p
40669	105p
BR100	25p

BRIDGE RECTIFIERS

1A 50V	27p
1A 100V	30p
1A 400V	34p
1A 600V	37p
2A 50V	37p
2A 100V	44p
2A 400V	56p
2A 600V	60p
4A 100V	65p
6A 100V	70p

DIODES

BY100	31p	1N914	4p
BY126	15p	1N4001	6p
BY127	15p	1N4004	7p
OA47	9p	1N4007	8p
OA70	10p	1N4148	5p
OA79	9p	**ZENERS**	
OA81	9p	3·3v to 33v	
OA85	11p	400mW	11p
OA90	7p	1W	22p
OA95	9p	**OTHER**	
OA200	7p	AEY11	54p
OA202	9p	BB105	33p
		ZIJ	120p

TRANSISTORS

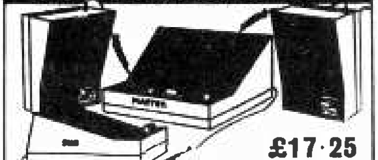
AC126/7	13p	BU105	175p	2N2484	32p
AC128	12p	BU108	312p	2N2904/5	22p
AC141/2	20p	MJE340	49p	2N2926RB	9p
AC176	12p	MJE2955	167p	2N2926O	10p
AC187/8	14p	MJE3055	70p	2N2926YG	11p
AD149	46p	MPSA06	37p	2N3053	18p
AD161/2	39p	MPSA12	62p	2N3054	43p
AF114/5	17p	MPSU06	78p	2N3055	54p
AF116/7	17p	MPSU56	98p	2N3442	151p
AF139	35p	OC28	70p	2N3702/3	14p
AF239	43p	OC35	70p	2N3704/5	14p
BC107/8	10p	OC71	20p	2N3706	12p
BC109C	11p	OC72	25p	2N3707	14p
BC147/8	9p	OC83	35p	2N3708/9	11p
BC149	10p	TIP2955	76p	2N3773	275p
BC157	11p	TIP29A	50p	2N3866	75p
BC158/9	13p	TIP30A	60p	2N3904	22p
BC169C	15p	TIP31A	56p	2N3905/6	22p
BC177	20p	TIP32A	63p	2N4058	19p
BC178	17p	TIP33A	97p	2N4060	19p
BC179	20p	TIP34A	124p	2N4289	25p
BC182/3	12p	TIP35A	243p	40361	41p
BC184	14p	TIP36A	297p	40362	43p
BC187	32p	TIP41A	70p	40410	59p
BC212	14p	TIP42A	76p	40411	243p
BC213	12p	ZTX108	11p	40594	81p
BC214	17p	ZTX300	16p	40595	92p
BCY70	20p	ZTX500	19p	**FETS**	
BCY71	24p	ZTX504	60p	BF244	45p
BD131	39p	2N697	14p	MPF102	37p
BD132	43p	2N698	32p	MPF103/4	37p
BD135	54p	2N706	13p	MPF105	37p
BD139	79p	2N708	19p	2N3819	27p
BD140	87p	2N930	19p	2N3820	71p
BF115	24p	2N1131/2	19p	2N3823	54p
BF167	25p	2N1306	30p	2N5457	32p
BF173	27p	2N1613	22p	2N5458/9	32p
BF194	12p	2N1711	22p	3N128	81p
BF195	10p	2N1893	32p	3N140	92p
BF257	34p	2N2219	22p	3N141	81p
BFR39/40	37p	2N2221/2	22p	40603	63p
BFR79/80	37p	2N2369	15p	40673	54p
BFX84	28p			**UJT's**	
BFX85/6	27p			TIS43	34p
BFX87	22p			2N2160	90p
BFX88	26p			2N2646	38p
BFY50	17p			2N4871	37p
BFY51	16p			**PUJT**	
BFY52	17p			2N6027	60p
BRY39	39p				
BSX19/20	17p				

MAIL ORDER ONLY
GOVT/
COLLEGE ORDERS WELCOME

MINIMUM ORDER £2·00
(OFFICIAL ORDER £5·00)
VAT INVOICE SUPPLIED

TECHNOMATIC LTD. est. 1971
54 SANDHURST ROAD, LONDON NW9
VAT No. 227079263 Tel. 01-204 4333

4-STATION INTERCOM



£17·25

Solve your communication problems with this 4-Station **Transistor Intercom** system (1 **master** and 3 **Subs**), in robust plastic cabinets for desk or wall mounting. Call/talk/listen from **Master** to **Subs** and **Subs** to **Master**. Ideally suitable for Business, Surgery, Schools, Hospitals and Office. Operates on one 9V battery. On/off switch. Volume control Complete with 3 connecting wires each 66ft. and other accessories. P. & P. 75p.

MAINS INTERCOM NEW MODEL

No batteries—no wires. Just plug in the mains for instant two-way, loud and clear communication. On off switch and volume control. **Price £31·24** per pair P. & P. 75p.

NEW! AMERICAN TYPE CRADLE

TELEPHONE AMPLIFIER

ONLY **£12·95** VAT £1·04

Latest transistorised Telephone Amplifier with detached plug-in speaker. Placing the receiver on to the cradle activates a switch for immediate two-way conversation without holding the handset. Many people can listen at a time. Increase efficiency in office, shop, workshop. Perfect for "conference" calls: leaves the user's hands free to make notes, consult files. No long waiting, saves time with long-distance calls. On/Off switch, volume. Direct tape recording model at £13·95 + VAT £1·12 P. & P. 70p, 10-day price refund guarantee.

WEST LONDON DIRECT SUPPLIES (PW2)
169 KENSINGTON HIGH STREET, LONDON, W8

FREE Brochure on New KITS

Whether professional, student, teacher or amateur, the field of electronics can open up a new world for you.

CROFTON don't just sell kits, we offer you a technical back up service to ensure your success

The following is a selection of some of the more popular kits

- ★ Mullard CCTV Camera
- ★ PE CCTV Camera
- ★ PE Rondo Quadraphonic Four Channel Sound (Designer Approved)
- ★ Electronic Ignition
- ★ Sound Operated Flash
- ★ P.W Tele-Tennis Game
- ★ U.H.F Modulator
- ★ Bench Power Supply
- ★ Wobbulator
- ★ All ETI Top Projects
- ★ Many of the Elektor Projects

NOTE PCBs for most published projects available to order

CROFTON ELECTRONICS LTD
Dept 9, 124 Colne Road, Twickenham, Middx. 01 898 1569

MARION 0442 62757

MHI CLOCK KITS

Contents: Clock chip, driver chip, PC board.

MHI-5309	BCD & 7 seg. Reset to zero	£7·35
MHI-5311	BCD output—TTL interfacing, printers	£7·35
MHI-5314	7 segment output	£6·60
MHI-5318	External digit selection	£7·35
MHI-5378	Car/boat clock. Quartz crystal timing source	£15·10
MHI-50250	7 seg. Alarm & snooze. 12Hr+60Hz/24Hr+50Hz	£8·35
MHI-50253	7 seg. Alarm & snooze. 12Hr+50Hz/24Hr+60Hz	£8·35
MHI-50204	Hrs, mins, secs & 1/10 secs. Stop, start reset	£14·00
MHI-50395	Up/Down counter. 6 Decade	£19·50
MHI-50396	Up/Down counter. HHMMSS	£19·50
MHI-50397	Up/Down counter. MMSS.99	£19·50
MHI-7001	Time, date, alarm & sleep. 7 seg output	£10·00

MHI DISPLAY KITS

Contents: Litronix LED displays & PC board.

MHI-707/4 (digit)	0·3"	£6·60
MHI-707/6	0·3"	£9·50
MHI-727/4	0·5"	£8·50
MHI-727/6	0·5"	£12·00
MHI-747/4	0·6"	£9·80
MHI-747/6	0·6"	£14·70

MHI case (Please include 25p p. & p.) £2·95

Economy LEDS: DL707E 70p, DL727E 180p, DL747E 150p.

NEW CATALOGUE NOW AVAILABLE

TERMS: CWO, Access, Barclaycard (simply quote your number and sign). Credit facilities to Accredited account holders.

BYWOOD

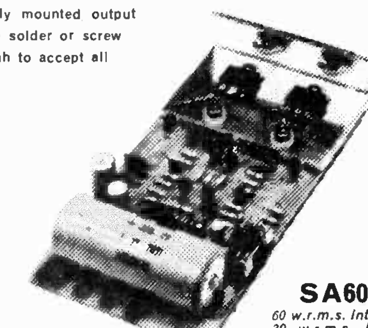
68 Ebberns Road, Hemel Hempstead, Herts HP3 9QRA
VAT: All prices exclude VAT (8%) P/P: 15p.

SAXON
ENTERTAINMENTS LTD

SYSTEM 7000
professional standards · realistic prices

THE NEW POWER AMPLIFIERS

Three brilliant new power modules employing the same circuitry, using 10 transistors, three diodes and one zener diode with electronic over temperature cutout as well as normal thermal protection, load line short circuit and incorrect load protection, integrally mounted output capacitor. Fused D.C. supply terminal. May be solder or screw connected. The input impedance is high enough to accept all types of mixer having an output of 250 mV.



New features—new performance standards

- ★ New 90°C overtemperature cutout (electronic not mechanical).
- ★ New integral output capacitor, no external components required for normal operation.
- ★ Short circuit load line type protection with twin summing amplifiers.
- ★ Inherently open circuit proof.
- ★ Input sensitivity −10 dBm (240 mV into 50k) ie suitable for most mixers. Response 30Hz to 40KHz ±1dB.
- ★ Typical distortion 0·4% Noise −80 dB.
- ★ Suitable for all public address, discotheque, and group applications.
- ★ Fused supply terminal.
- ★ Single supply line (split supply not required.)
- ★ Compatible with all other Saxon units

SA608
60 w.r.m.s. into 8Ω 30 w.r.m.s. into 15Ω. Texas 15A output transistors.
£11·50

SA308
30 w.r.m.s. into 8Ω 15 w.r.m.s. into 15Ω basic circuit identical to SA 1208 10A Plastic O/P transistors
£9·00

SA1208
120 W.R.M.S. INTO 8Ω
60 w.r.m.s. into 15Ω Glass fibre printed circuit board. 15A output transistors
£16·00

SYSTEM 7000 DISCO CONTROL UNIT

- ★ Mono or stereo.
- ★ 2 Deck and one tape inputs, individually controlled plus L/R deck fader (ineffective at central).
- ★ Wide range bass and treble controls plus separate MIC volume bass and treble controls. Overall master control.
- ★ Continuously variable autofade depth and threshold.
- ★ Five position monitoring switch with two mute positions—ample headphone power.
- ★ Complete, cased with all terminations by plug/socket etc.
- ★ Noise −80 dB Response 20Hz-50 kHz ± 1dB.
- ★ Stainless steel escutcheon, boldly designed.

Mono **£28·50**
Stereo **£45·00**

Send for full descriptive leaflet.

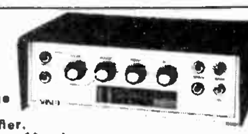
IN MODULAR FORM
Assembled in P.C.B. Similar characteristics to above. Ideal for constructors.
Mono **£18·50** Stereo **£27·50**

THE NEW POWER SUPPLIES

- ★ One piece, ready to wire assembly with integral glassfibre pcb.
- ★ Grain oriented laminated transformers for compactness.
- ★ Facilities for preamp supply.
- ★ Fully fused.
- ★ Size of all models 10 x 8 x 13cm. (PM1202 16cm)

PM1201	95 V for one SA1208	£11·00
PM1202	95 V for two SA1208	£14·00
PM602	65 V for one or two SA 608	£9·00
PM302	45 V for one or two SA 308	£7·50

MINOTAUR AMPLIFIER

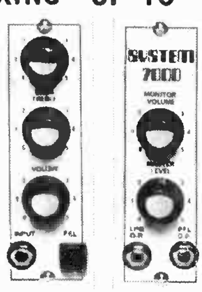


100 w.r.m.s. into 8Ω
- ★ Two mixed inputs, wide range bass & treble controls
- ★ May be operated as a slave amplifier.
- ★ Extremely compact (27cm × 16cm × 10cm).
- ★ Fully protected against all incorrect* loads and short circuits.

**Except minotaur (anodised aluminium).*
£47·50

SYSTEM 7000 MODULAR MIXING—UP TO 20 CHANNELS

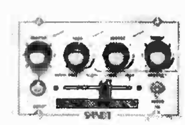
Complete versions of the IM7001 and IM7200 modules shown in our advertisement make a professional quality versatile mixer to *your* requirements using these modules mono and stereo inputs may be combined.



- ★ The mixing modules split mono signals.
- ★ Each input module has own monitor switch.
- ★ Stainless steel panel on 15cm × 5cm matrix (approx.).
- ★ Input equalisation for all types of signal inc. magnetic cartridge.
- ★ Complete system may comprise twenty channels, mono or stereo with ample monitoring power.
- ★ May be patched in with disco mixers or minotaur amplifier.

Mono Input Module **£8·50** Stereo Input Module **£12·00**
Mono Mixer Module **£8·50** Stereo Mixer Module **£12·00**
Power Supply Unit for up to 20 Modules **£7·50**

SYSTEM 7000 LIGHTING CONTROL UNIT



- ★ 1000 WATTS PER CHANNEL SOUND LIGHT *AND* SEQUENTIAL *AND* OVERRIDE.
- ★ Individual control of bass, middle and treble.
- ★ Master control for easy adjustment.
- ★ Plug/socket terminations throughout.
- ★ Slider control for function, allows sound/light, sequencing or combination of both.
- ★ Stainless steel front panel to match disco control unit.
- ★ Electronic override eliminates clicks.
- ★ Negligible input power

£35·00

SAXON SUPERFECT LIGHT UNIT
The Modular version of ST7000 Light Control Unit.
Sequential display with variable speed. Continuously variable function display with no signal. Carries 1000 watts per channel. Separate bass, middle, treble and master audio controls, etc., etc.
£19·75

SAXON SOUNDLITE
Our outstandingly successful 3000 watt unit in modular form.
£13·50

GUARANTEE
All Saxon Entertainments' modules and units are guaranteed for 12 months from date of purchase.

TERMS OF BUSINESS
Phone orders to 01-684 6385 for C.O.D. payment or by Access or Barclaycard.
Ordering by post, make cheques, postal orders payable to Saxon Entertainments Ltd., crossed, or send Access or Barclaycard No.
Shop hours—Monday to Saturday 9.0 a.m. to 5.00 p.m.
Prices subject to alteration without notice.

TRADE ENQUIRIES TO
Norman Rose Electrical Ltd.
London—phone 01-837 9111 Birmingham 021-236 4710
Manchester—phone 061-273 1498 Bradford 0274 24008

PRICES INCLUDE CARRIAGE & PACKING, BUT V.A.T. AT 8% MUST BE ADDED TO VALUE OF ALL ORDERS • S.A.E. WITH ALL ENQUIRIES

SAXON ENTERTAINMENTS LTD. 327 WHITEHORSE ROAD, W. CROYDON, SURREY CRO 2HS
Telephone: Sales 01-684 0098; Service 01-684 6385

RETURN OF POST MAIL ORDER SERVICE

R.C.S. 10 WATT AMPLIFIER KIT

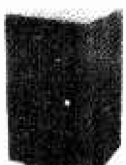
This kit is suitable for record players, tape play back, guitars, electronic instruments or small P.A. systems. Two versions are available. A mono kit or a stereo kit. The mono kit uses 13 semiconductors. The stereo kit uses 22 semiconductors with printed front panel and volume, bass and treble controls. Spec. 10 watts output into 8 ohm, 7 watts into 15 ohms. Response 20 CPS to 30 K/CS. input 100 M.V. high imp. Size 9½in. × 3in. × 2in.

Mono kit **£12·50** Stereo kit **£20** post 45p.

ELAC 10 inch

Dual cone plasticised roll surround. Large ceramic magnet. 50-16,000 cps. Bass resonance 55 cps. 8 ohm impedance. 10 watts **£5·50**

TEAK VENEER HI-FI SPEAKER CABINETS
Fluted Wood Fronts



MODEL "A". 20 × 13 × 12in. For 12in. dia. 10in. speaker. **£12·50** Post 75p

MODEL "B". 16 × 10 × 9in. For 13 × 8in. or 8in. speaker. **£6·95** Post 45p

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

BAKER RECOMMENDED 12 inch Enclosure 4 cubic ft. HI-FI CABINET £21·50. Carr. £2 each. Few only. Size 30 × 20 × 12in. Teak Finished Fluted Front.

TEAKWOOD LOUDSPEAKER FRONT GRILLS
Modernise your cabinets with the Grooved look. Sizes—18¼" × 10¼"—75p. 10¼" × 7¾"—45p.

BARGAIN 4 CHANNEL TRANSISTOR MONO MIXER

Will mix Microphone, records, tape and tuner with separate controls into single output 9 volt battery operated. **£5·20**
STEREO VERSION OF ABOVE £6·85.

R.C.S. STEREO FM TUNER

This completely cased mains powered Hi-Fi Tuner with brushed aluminium facia is British made using the latest circuitry. Bargain **£30** Post 45p.

BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built with volume, treble and bass controls. 18 volt battery operated. **£3·95**

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 10½ × 8½ × $\frac{1}{16}$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)
ALL POST PAID—Discounts for quantity.

BAKER MAJOR 12" £11·50

Post 50p
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 25 watts. NOTE: 3 or 8 or 15 ohms must be stated.

Module kit, 30-17,000 c/s with tweeter, crossover, baffle and instructions. **£14·50**

Please state 3 or 8 or 15 ohms. Post 80p

"BIG SOUND" BAKER SPEAKERS

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

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

GROUP "25" 12in. 30 watt 3, 8 or 15 ohms. **£8·95** Post 40p

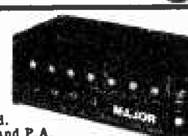
GROUP "35" 12in. 40 watt 3, 8 or 15 ohms. **£10·50** Post 40p

GROUP 50/12in. 60 watt 8 or 15 ohms **£14·50** Post 80p

GROUP "50" 15in. 75 watt 8 or 15 ohms. **£19·50** Post 80p

Group + PA Cabinets in stock
Send for Leaflet.

BAKER 50 WATT ALL PURPOSE TRANSISTOR AMPLIFIER



All purpose transistorised.
Ideal for Groups, Disco and P.A.
4 inputs speech and music. 2 way mixing. Output 8/15 ohm. a.c. Mains. Separate treble and bass controls. Guaranteed. **£49** Carr. £1·00
Deluxe 100 watt model as illustrated £65, also available in Heavy Wooden case £75.

NEW 'DISCO 100 WATT' £55

ALL PURPOSE AMPLIFIER CHASSIS Carr. £1.
2 inputs, 4 outputs separate volume treble and bass controls. Ideal disco amplifier chassis

PW SOUND TO LIGHT DISPLAY
Complete kit of parts with R.C.S. printed circuit. Three 1000 watt channels. As featured in December Practical Wireless. **£12·50** CABINET extra £3.

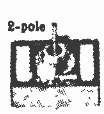
THE "INSTANT" BULK TAPE ERASER & HEAD DEMAGNETISER.

Suitable for cassettes, and all sizes of tape reels. A.C. mains 200/250V. Leaflet S.A.E. **£4·35** Post 30p

QUALITY LOUDSPEAKER ENCLOSURE

Teak veneered ⅝in thick wood cabinet. Size 18¼in × 18¼in × 8¼in. 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 8¼inch Woofer. £8·50 Carr. 85p.
Rosewood Version £9·50 Carr. 85p.
Baffle could be cut to take larger speaker.

E.M.I. GRAM MOTOR **£1·25** Post 30p.
120v. or 240v. A.C. 2,400 rpm. 2-pole 70mA. Size 2¼ × 2¼ × 2¼ in.



E.M.I. TAPE MOTOR **£2·00** Post 30p
4 pole, 240 v. 135 mA. 1200 rpm. Spindle $\frac{3}{16}$ in diameter. 120v version £1. (Illustrated) Size 3¼ × 2¼ × 2¼in.

BAKER HI-FI SPEAKERS
HIGH QUALITY — BRITISH MADE

REGENT
12in. 20 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.

£10·50 Post 40p

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.

£13·50 Post 40p

SUPERB
12in. 25 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.

£17·00 Post 80p

AUDITORIUM
12in. 35 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.

£15·50 Post 80p

AUDITORIUM
15in. 45 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.

£19·50 Post 80p

Hi-Fi Enclosure Manual containing plans, designs, crossover data and cubic tables. 60p. Post 8p.

CUSTOMERS FREE CAR PARK

OPEN 9-6. WEDNESDAY 9-1. SATURDAY 9-5. Closed for lunch 1-15—2-30

SPECIALISTS 337 WHITEHORSE ROAD . CROYDON

(Exports Remit cash and extra postage.)

Buses 50, 68, 159. Rail Selhurst

Telephone 01-684-1665

Practical Wireless Classified Advertisements

The pre-paid rate for classified advertisements is 14p per word (minimum 12 words), box number 35p extra. Semi-displayed setting £12·00 per single column inch. All cheques, postal orders, etc., to be made payable to PRACTICAL WIRELESS and crossed "Lloyds Bank Ltd." Treasury notes should always be sent *registered post*. Advertisements, together with remittance, should be sent to the Classified Advertisement Manager, PRACTICAL WIRELESS, IPC Magazines Ltd. Fleetway House, Farringdon Street, London, EC4A 4AD for insertion in the next available issue. (01-634 4451).

Receivers and Components

BRAND NEW COMPONENTS BY RETURN: Electrolytics—16V, 25V, 50V—0·47, 1·0, 2·2, 4·7, 10 mfds.—5p. 22, 47—5½p. (50V—6p) 100—7p. (50V—8p), 220—8p. (50V—10p), 500—11p. (50V—16p), 1000/25V—18p. Subminiature bead-type tantalums—0·1/35V, 0·22/35V, 0·47/35V, 1·0/35V, 2·2/35V, 4·7/35V, 10/20V, 22/16V, 47/6V, 100/3V.—11p. Mylar Film 100V.—0·001, 0·002, 0·005, 0·01, 0·02.—3p. 0·04, 0·05—3½p. Mullard tubular polyester 400V E6 series 0·001-0·022—3½p. 0·033-0·1—4½p. Mullard miniature C333 ceramics 63V E12 series 2%, 1·8 pf.-47 pf.—3p. 56 pf.-330 pf.—3½p. Polystyrene 63V E12 series 10 pf.-1000 pf.—3p. 1200 pf.-10,000 pf—4p. Miniature Highstab. carbon film resistors ⅓W E12 series 5% 1Ω-10MΩ. (10% over 1MΩ) 1·2p. Postage 10p. Prices VAT Inclusive. The C.R. Supply Co., 127, Chesterfield Road, Sheffield S8.

BETA DEVICES
MANUFACTURERS BRANDED PRODUCTS

TRANSISTORS		DIODES & RECT		BRIDGE RECT.	
AC187/8 PR	0·40	IN914	0·04	1A 100v W01	0·20
BC107/8/9	0·09	IN4148	0·04	1A 200v W02	0·22
BC109C	0·11	BY127	0·14	1A 600v W06	0·30
BC147/8/9	0·10	IN4001/2	0·05	25A 200v	£2·00
BCY70/71/72	0·18	IN4003/4/5	0·06	**ZENERS**	
BFX86/7/8	0·20	IN4006/7	0·08	BZY88c 3·3-33v 5%	0·09
BFY50	0·18	IN5401	0·11	1 watt 6·8-200v 5%	0·15
BFY51/52	0·12			**L.E.D.**	
2N1132	0·25	3015F	1·00	209-RED	0·17
2N1711	0·25	DL747	2·45	LED CLIP	0·02
2N2646	0·30	TBA800	0·90	**OP. AMP. IC's**	
2N2905A	0·21	555 Timer	0·50	709C TO99	0·30
2N3053	0·14	**D.I.L. SOCKETS**		709C D.I.L.	0·30
2N3055	0·38	8 Pin	0·12	741C TO99	0·36
OC28	0·45	14 Pin	0·12	741C D.I.L.	0·36
OC35	0·35	16 Pin	0·14	723C D.I.L.	0·80
OC26	0·45			747C D.I.L.	0·85
OC36	0·85	ADD 17% V.A.T.		748C D.I.L.	0·36
TIP41A	0·74				
TIP42A	0·90				

NEW CAP-PAC 1 **NEW**
CONTENTS:—AL ELECTROLYTIC CAPACITORS

10mf	16V	6 pcs
22mf	16V	3 pcs
47mf	16V	3 pcs
100mf	16V	6 pcs
25mf	25V	3 pcs

Value £1·65
Now **£1.00** (inc. VAT)

C.W.O. PLUS P.P. 15p TO
BETA DEVICES,
4, Highbridge Street,
Waltham Abbey, Essex.

SCOOP! 10mfd/12V 10/20p. 100/£1. 10mfd/70V 22mfd/50V 10/25p 100/£1·25. 100mfd/16V 1000mfd/6V 10/30p 100/£1·50. 1N4002/4p. 1N4004/5p. 1N4007/6p. 1N914/4p. 1N4148/4p. BRIDGES 1A/200V 2/50p. 2A/200V 2/65p. TRANSISTORS, Plastic BC107/8/9 10p. ZTX300/500 14p. ZTX304/504 22p. TIP3055/45p. TIP2955/64p. METAL CAN BC107/8/9 12p. 2N3055/73p. LED'S W/Clips TIL209/Red 16p. Green, Orange, Yellow, 21p. I.C.'S 8 pin/741 25p. 555/49p. P. & P./20p. AUDIO-OPTICS, 19, Middleway, Chinnor, Oxon.

VALVES

Radio-TV Industrial Transmitting
2200 Types. 1930 to 1975, many obsolete. List 20p. S.A.E. for quotation. Postal export service. We wish to purchase all types of new and boxed valves. Wholesaler's, Dealer's, etc., stocks purchased.

COX RADIO (SUSSEX) LTD., The Parade, East Wittering, Sussex. West Wittering 2023

TRIACS (plastic) 10A/400V 67p (3+ 64p), DIAC 19p, NE555 44p, 13×BC148 80p*, 10×BC158 80p*, LEDs 0·2in dia, red 20p, yellow, amber, green 25p. 300W dimmer kit £1·95. P&P 15p, add 8% VAT (*25%). TK Electronics, 106 Studley Grange Road, London W7 2LX.

BULK OFFERS

1N4001	£2·50	BC148	£5·00	BF458	£30·00
1N4002	£2·80	BC149	£6·00	BFW43	£12·00
1N4003	£3·20	BC157	£6·00	BFX88	£14·00
1N4004	£3·50	BC158	£6·00	BFY64	£12·50
1N4005	£3·90	BC159	£8·00	BSX20	£9·00
1N4006	£4·30	BC161	£10·00	BSY95A	£6·00
1N4007	£4·70	BC172	£6·00	OC36	£30·00
1N4148	£2·20	BC267	£6·00	OC81D	£4·00
AC128	£10·00	BC328	£10·00	PBC108	£5·00
AC176	£12·00	BC548	£6·00	2N3055	£28·00
BC107	£7·00	BD131	£16·00	2N3442	£75·00
BC108	£7·00	BF152	£10·00	2N5294	£21·00
BC109	£7·00	BF173	£14·00	NE555V	£38·00
BC118	£5·50	BF181	£20·00	741C	£19·00
BC119	£12·00	BF244B	£13·00	7440	£6·00
BC126	£12·00	BF194	£6·00	SN76660	£22·00
BC139	£14·00	BF195	£6·00		
BC147	£8·00	BF197	£6·00		

All prices per minimum quantity of 100
All full spec. marked devices
Ferric Chloride £38 per 100 1lb bags.
Miniature mains transformers. 100mA sec: 6-0-6V £5·80/10; 9-09V £6·30/10; 12-0-12V £6·80/10.
Min. cer. plate caps 33pF 2% £7/1000
100pF 2% £7·50/1000
Siemens polystyrene 470pF 5% £8·00/1000.
100µF 40V £4/100. 470µF 25V £6/100. 47µF 63V £4/100. 10µF 16V £2·50/100
PP3 Batt. snap connector £4/100.
Crystal mic. inserts, 1¼" Dia. £20/100.
Coax back to back connectors £4·20/100.
Coax. plugs £4·70/100. 5 pin 180° DIN plugs £8/100; sockets £5·50.
H61 Texas Light Sensor £32/100.
10µH chokes, £3/100.
Honeywell V3 microswitches £9/100.
400mW Zeners, 6V8 8V2 9V1 10 11 12 13 13V5 15 16 20 22 24 27 & 30V, All £5/100.
Lamps: 10V ·2A MES £3/100; 18V 70mA min. flange £4/100.
Vero offcuts £2·85lb 10lbs £26·00.
Minimum Order £5; Carr. Free. Add VAT at the appropriate rate S.A.E. enquiries, List.

JUNIPER ELECTRONICS (PW2)
PO Box 61, Southampton SO9 7EE

ENTHUSIASTS OF RADIO 1920 to 1945! For, components, valves, service sheets & complete receivers, contact us. Monthly newsheet available upon receipt of S.A.E. Tudor Rees, 64, Broad St., Staple Hill, Bristol, BS16 5NL. 0272 565472.

WENTWORTH RADIO
1A WENTWORTH CT.,
ALSTON ROAD,
BARNET. HERTS.
TELEPHONE No. 01-440-0409

TBA520Q	£2·20	R2010B	£1·80	IN4148	£0·05
TBA550Q	£3·00	SN76227N	£0·80	2N3055	£0·41
TBA750Q	£2·15	BT106	£8·95	TIP29C	£0·34
TBA990Q	£2·85	BC107/8/9	£0·09	TIP30C	£0·46

COMPONENTS, UNITS, VALVES, SEND S.A.E. FOR LISTS.

MINIMUM ORDER 75p. P&P 5p. per ITEM. MINIMUM 15p. PLUS 25% VAT.

ALL PRICES SUBJECT TO FLUCTUATION.

COMPONENTS GALORE, pack of 500 assorted Radio, TV and Electronic components, a real bargain at a realistic price. Send only £1·50 c.w.o. This applies only to United Kingdom and Ireland. Overseas prices by arrangement. Caledonian Components. PO Box 3, Glenrothes, Fife, Scotland.

Precision Polycarbonate Capacitors

All High Stability – extremely Low Leakage

440V AC RANGE

Value (µF)	Dimensions (mm) L	D	Price each
0·1µF	27	12·7	51p
0·15µF	27	12·7	59p
0·22µF	33	16	64p
0·25µF	33	16	67p
0·33µF	33	16	75p
0.47µF	33	19	80p
0·5µF	33	19	87p
0·68µF	50·8	19	93p
1·0µF	50·8	19	£1·03
1·5µF	50·8	25·4	£1·21
2·0µF	50·8	25·4	£1·44

63V DC RANGE

Value µF	±1%	±2%
0·01µF & 0·1µF	66p	49p
0·22µF; 0·33µF;	67p	50p
0·47µF	67p	50p
0·68µF	74p	53p
1·0µF	82p	62p
1·5µF	89p	71p
2·2µF	96p	75p
3·3µF	£1·15	82p
4·7µF	£1·62	£1·13
6·8µF	£1·96	£1·38
10µF	£2·40	£1·95
15µF	£3·22	£2·79
22µF	£4·28	£3·68

TANTALUM BEAD CAPACITORS—Value available: 0·1, 0·22, 0·33, 0·47, 0·68, 1·0, 2·2, 3·3, 4·7, 6·8µF at 15V/25V or 35V; 10·0µF at 16V/20V or 25V; 22·0µF at 6V/10V or 16V; 33·0µF at 6V or 10V; 47·0µF at 3V or 6V; 100·0µF at 3V. ALL at 12p* each; 10 for £1·10*, 50 for £5·00*, 100 for £9·00*.

TRANSISTORS *V* **I.C.'s**

BC107/8/9	9p	*BC212/212L	14p	2N3702/4	11p
*BC114	12p	*BC213/213L	11p	2N3055	50p
*BC147/8/9	10p	*BC214/214L	11p	OC71/2	12p
*BC153/154	12p	*BF194/5	12p	NE555Timer	61p
*BC157/8/9	12p	BFY50/1/2	20p	741C 8pin DIL	32p
*BC182/182L	11p	AF178	30p	ZN414	£1·15
*BC183/183L	11p	AF234	38p	SN76013ND	£1·50
*BC184/184L	12p				

POPULAR DIODES—1N914 6p, 8 for 45p, 18 for 90p; 1N916 8p, 6 for 45p, 14 for 90p; 1844 5p, 11 for 50p, 24 for £1·00. 1N4148 5p, 6 for 27p, 12 for 48p; 1N4001 6½p; 002 6p; 003 6½p; 004 7p; 005 7½p; 006 8p; 007 8½p

LOW PRICE ZENER DIODES—400mW. Tol. ±5% at 5mA. 3V; 3V3; 3V6; 4V7; 5V1; 5V6; 6V2; 6V8; 7V5; 8V2; 9V1; 10V; 11V; 12V; 13V; 13·5V; 15V; 16V; 18V; 20V; 22V; 24V; 27V; 30V; 33V. All at 7p each, 5 for 33p, 10 for 65p, 50 for £3·12. SPECIAL OFFER: 100 Zeners (may be mixed) for £6·00.

RESISTORS—High stability, low noise carbon film 5%, ¼W at 40°C, ⅓W at 70°C. E12 series only—from 2·2Ω to 2·2MΩ. ALL at 1p* each, 8p* for 10 of any one value, 70p* for 100 of any one value. SPECIAL PACK: 10 of each value 2·2Ω to 2·2MΩ (730 resistors) £5*.

SILICON PLASTIC RECTIFIERS—1·5 amp, wire-ended DO27: 100 P.I.V. 7p (4 for 26p); 400 P.I.V. 8p (4 for 30p).

BRIDGE RECTIFIERS—2½ amp: 200V 40p; 350V 45p; 600V 56p.

SUBMINIATURE VERTICAL PRESETS—0·1W only: All at 5p* each 50; 100; 220; 470; 680 ohm; 1K; 2K2; 4K7; 6K8; 10K; 15K; 22K; 47K; 100K; 250K; 680K; 1M; 2M5; 5M.

PLEASE ADD 20p POST AND PACKING ON ALL ORDERS. EXPORT—ADD COST OF SEA/AIRMAIL.

Add 8% VAT to all items except those marked with * which are 25%

Send S.A.E. for additional stock lists.
Wholesale price lists available to bona fide companies.

MARCO TRADING (Dept. W2),
The Old School, Edstaston, Nr. Wem, Shropshire.
Tel: Whixall 464/465 (STD 094 872)
(Propra. Minicost Trading Ltd.)

COMMUNICATIONS RECEIVER modules. Small superhet circuit boards requiring only controls and tuned circuits. 9 volt. Mosfet mixer, IC IF, BFO, Prod. Det. Excellent AM/CW/SSB results reported by delighted users. From £11·50. SAE details. PR Golledge Electronics, Millend, Stonehouse, Glos.

SURPLUS BARGAINS, genuine Mullard, Mazda valves; transistors; components. Special offer, 5 channel audio mixer electronics by leading manufacturer. SAE Home Electronics, (PW) Homestead, Canvey Road, Canvey Island, Essex. Ref PW.

MULTIBAND RADIOS. Grundig Satellit, 13 band, £158. BF8 Unit, £15. Koyo marine, aircraft, PSB, FM, SW1/2, MW, LW, £55. Multi 5 (MW, FM, SW, aircraft, PSB), £17. Sharp (MW/aircraft), £13. Langtons, High Street, Rocester, Staffs. Sae lists.

NEW AND TESTED DEVICES
Hundreds of items available.

10 BC183L Type-T092	75p	3 Jack Sckts 3·5mm	45p
10 BC213L Type T092	75p	ZN414 IC Radio ea.	£1·36
10 BC108 Type-T018	75p	Zeners, 2-33V's ea.	9p
10 BC262 Type-T018	75p	TTL, 7400/1/2/3/4	17p
15 IN914 Diodes	75p	IN4001 50V 1A ea.	6p
7-2N2926 Mixed Gain	75p	IN4002 100V1A ea.	7p
5 BC107 New marked	75p	IN4006 800V1A ea.	13p
6 Led's TIL 209	75p	IN4148 Signal Diode	6p

No extras, satisfaction guaranteed, sae for lists. All enquiries welcome—Overseas deduct 8% VAT.

RELTRAN LTD. (Dept PW)
PO Box 18, Camberley, Surrey.

500 COMPONENTS. Resistors, capacitors, diodes, transistors, pots, coils, etc. Identified, formed leads, fall-out, and surplus. Good value at £1·60. All inclusive (U.K. postal rates only). CWO please to L. Penseney, PW Bankhead Farm, South Queensferry, West Lothian.

Educational

C AND G EXAMS

Make sure you succeed with an ICS home study course for C and G Electrical Installation Work & Technicians Radio/TV/Electronics Technicians, Telecomms Technicians and Radio Amateurs.

COLOUR TV SERVICING

Make the most of the current boom! Learn the techniques of servicing Colour and Mono TV sets through new home study courses, approved by leading manufacturers.

TECHNICAL TRAINING

Home study courses in Electronics and Electrical Engineering, Maintenance, Radio, TV, Audio, Computer Engineering and Programming. Also self-build radio kits. Get the qualifications you need to succeed.

Free details from:
INTERNATIONAL CORRESPONDENCE SCHOOLS,
Dept. 778P, Intertext House, London SW8 4UJ. Or Phone 01-622 9911 (All Hours)

GO TO SEA as a Radio Officer. Write: Principal, Nautical College, Broadwater, Fleetwood FY7 8JZ.

TELEVISION TRAINING

16 MONTHS' full-time practical and theoretical training course in Radio and TV Servicing (Mono and Colour) for beginners with GCE (or equivalent) in Maths, and English.

13 WEEKS' full-time Colour TV Servicing course. Includes 100 hours practical training. Mono revision if necessary. Good electronics background essential.

NEXT SESSION commences on April 20th.

Prospectus from: London Electronics College, Department B2, 20 Penywern Road, London SW5 9SU. Tel. 01-373 8721.

Service Sheets

SERVICE SHEETS—COLOUR TV MANUALS

Service Sheets for Black and White TV, Radios, Record Players and Tape Recorders 50p.
Please send large Stamped Addressed Envelope.
We can supply manuals for most makes of Colour Television Recievers.
B.R.C. PYE ECKO PHILIPS ITT/KB SONY G.E.C. HITACHI BAIRD ULTRA INVICTA etc.
Please send a Stamped Addressed Envelope for a prompt reply.

G. T. TECHNICAL INFORMATION SERVICE
10 DRYDEN CHAMBERS, 119 OXFORD ST., LONDON WIR 1PA
MAIL ORDER ONLY

BELL'S TELEVISION SERVICES for service sheets, manuals & books on radio/TV etc. Service sheets 50p plus SAE. Service sheet catalogue 25p. Back issues of magazines from April '74 onwards cover price plus 12p post. Free booklists on request. SAE with enquiries please to B.T.S., 190 Kings Road, Harrogate, Yorkshire. Telephone Harrogate (code 0423) 55885.

SERVICE SHEETS for Radio, TV, Tape Recorders, Stereo, etc., with free fault-finding guide, 50p and SAE, Hamilton Radio, 47 Bohemia Road, St. Leonards, Sussex.

LARGE SUPPLIER OF SERVICE SHEETS

(T.V., RADIO, TAPE RECORDERS, RECORD PLAYERS, TRANSISTORS, STEREOGRAMS, RADIOGRAMS, CAR RADIOS)
ALL AT 50p EACH

"PLEASE ENCLOSE LARGE S.A.E WITH ALL ENQUIRIES & ORDERS"
Otherwise cannot be attended to
(Uncrossed P.O s please, original returned if service sheets not available.)

PLEASE NOTE
We operate a "by return of post" service. Any claims for non-delivery should be made within 7-days of posting your order.

C. CARANNA
71 BEAUFORT PARK
LONDON, N.W.11 6BX

We have the largest supplies of Service Sheets (strictly by return of post). Please state make and model number alternative.

Free TV fault tracing chart or TV list on request with order.

Mail order or phone 01-458 4882

NO OVERSEAS MAIL PLEASE

SERVICE SHEETS, radio, TV etc. 10,000 models. Catalogue 24p, plus SAE with orders, enquiries. Telray, 154 Brook Street, Preston PR1 7HP.

Situations Vacant

MEN! £90 p.w. can be yours

Tens of thousands of new computer personnel needed over the next few years alone. Now for the first time anybody (no special qualifications are needed) can train outside the computer industry for an exciting career as a computer operator in only 4 weeks. It can pay around £35 p.w. as a starter and can reach over £90 p.w. We subscribe to the code of practice for Computer schools of the National Computing Centre—a non-profit organisation which was set up and sponsored by the British Government. Write without obligation for FREE details TODAY.

London Computer Operators Training Centre
C26, Oxford Hse., 9-15 Oxford St. W1. Tel: 01-734 2874

Wanted

WE BUY New Valves, Transistors and clean new components, large or small quantities, all details, quotation by return. WALTON'S, 55 Worcester Street, Wolverhampton.

TOP PRICES PAID for NEW VALVES and TRANSISTORS

popular T.V. and Radio types.

KENSINGTON SUPPLIES (C),
367 Kensington Street, Bradford 8, Yorkshire.

RADIO & TELEVISION SERVICING books wanted from 1963-64 edition onwards. £2·00 paid per copy by return of post. Bell's Television Services, 190 Kings Road, Harrogate, N. Yorks. Tel: Harrogate 55885.

Ladders

LADDERS. Varnished. 25½ ft extended. £24·05, carriage £1·40. Leaflet, aluminium ladders and loft stairways. Tel: Telford 586644.

For Sale

DISCOLIGHTS. Best! Cheapest! Reliable! Bumper catalogue: Aarvak Electronics, 12a(P) Bruce Grove, N17 6RA. 01-808 8923.

COPPER CLAD LAMINATE FOR PRINTED CIRCUITS
Single sided 1/16" paper base—1·5p/sq. inch.
Single sided 1/16" glass-epoxy—2·0p/sq. inch.
Any rectangular sizes cut to your requirements.
Please send cash with order.
Price includes postage and packing.
From: **SIMTECH ENGINEERING LTD**
Dedham Road, Ardleigh, Colchester, Essex, C07 7QA
Telephone 0206 230133

MICROPHONES: AKG D202EI, £45·00; AKG D190C or E, £20·00; AKG D224, £60·00; Sennheiser MD211N, £45·00. All brand new and boxed. Please add 25% for VAT. All other AKG and Sennheiser mikes, SAE for quote. J. J. Francis (Wood Green), Ltd., Manwood House, Matching Green, Harlow, Essex. Tel: Matching 476.

Books and Publications

T.V. CIRCUIT DIAGRAM/MANUALS

2 volumes cover all the colour chassis from early dual standards to date. Similarly 1 volume covers all black and white. Fantastic value; big, beautiful binders; full size circuits with matching layouts; durable hard-wearing pages, each volume **£8·50** plus 50p carriage. Workshop Manual contains both COLOUR for only **£15** plus £1 carriage.

All these manuals fully cross referenced to the **McCourt Comprehensive Repair Manuals**—Updating service available. Parts manual @ **£1·50** lists T.V. chassis with circuit references and manufacturers stock numbers—a tremendous collection.

Get these now, cut the cost of repairs, the only all embracing T.V. system ever devised from the distributors—

T.V. TECHNIC, 76 CHURCH ST., LARKHALL, LANARKS, ML9 1HE
or your usual suppliers.

The COMPREHENSIVE TV REPAIR MANUALS
The ELECTRONICS BUILD THEM YOURSELF Series

Technical Books – Radio & Electronics

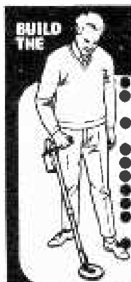
World's Radio & TV Stations (International Edit).	£0–70
Audio Amplifiers	£0–75
Boys Book of Crystal Sets	£0–35
Television Timebase Circuits.	£1–20
Radio TV and Industrial Tube & Valve Equiv	£0–70
How to get the best out of your Tape Recorder	£1–70
Practical Electronic Science Projects	£0–85
Jack Darr's Service Clinic.	£1–60
Transistor Circuits for Modern Test Equipment	£0–70
Modern Tape Recording Handbook	£0–85
1st Book of Transistor Equiv. and Substitutes	£0–50
Hi Fi, PA & Disco Amplifier Design Hndbk.	£0–87
Radio Servicing Problems	£0–75
Electronic Circuits for the Amat Photographer	£0–70
52 Projects using IC 741 or Equivs	£0–85
TV Fault Finding	£1–15
Transis Circuits for Rad. Control'd Models	£0–50
Practical Stereo & Quadrophony Handbook	£0–85
Radio Amateur Operator's Handbook	£0–85
Coil Design & Construction Manual	£0–60
Radio TV & Electronics Data Book	£0–70
79 Electronic Novelty Circuits	£0–85
The Complete Car Radio Manual	£0–85
Radio Technicians Bench Manual	£3–40
Servicing Transistor Radio Receivers.	£0–95
1st Book of Hi Fi Loudspeaker Enclosures	£0–70
2nd Book of Hi Fi Loudpeaker Enclosures.	£0–70
Manual of Electronic Circuits for the Home.	£0–65
Modern Crystal Set Circuits for Beginners.	£0–45
Electronic Novelties for the Motorist.	£0–60
2nd Book of Transistor Equiv. & Substitutes.	£1–10
Handbook of Electronic Musical Novelties.	£0–60
Transistorised Novelties for Hi Fi Enthusiast.	£0–45
Fault Location Exercises in Rad. & TV Vol.1.	£1–00
Fault Location Exercises in Rad. & TV Vol.2.	£1–60
Colour TV Picture Faults.	£2–80
Practical Transistor Novelty Circuits	£0–50
Boys Book of Practical Radio & Electronics	£0–70
Radio Receiver Construction using ICs & Transis.	£0–70
ICs & Transistor Gadgets Construction Handb'k	£0–70
Integrated Circuits Equiv. & Substitutes Hbk.	£0–85
Audio Technicians Bench Manual	£3–40
Improving your Hi-Fi	£3–40
Guide to Printed Circuits	£3–40
Diode Characteristics Equiv & Substitutes	£1–10
WORLD RADIO TV HANDBOOK 1975	£3–90

All prices include Postage & Packing

RADIO BOOK SERVICE
40 Elwill Way, Beckenham BR3 2RZ

Miscellaneous

Miscellaneous—cont.



BUILD THE **TREASURE TRACER MK III** Metal Locator

- Varicap tuning
- Britain's best selling metal locator kit; 4,000 sold
- Weighs only 22oz. Fitted with Faraday shield.
- Speaker and earphone operation
- Knocks down to only 17in.
- Prebuilt search coil assembly
- Thoroughly professional finish
- As seen on BBC1 and BBC2 TV
- You only need soldering iron, screwdriver, pliers and snips
- Five transistor circuit

Send stamped, addressed envelope for leaflet

Complete Kit **£12·50** Post 85p + £1·09 VAT 8% — Built & tested **£17·50** Post 85p + £1·49 VAT 8%

MINIKITS ELECTRONICS,
6a CLEVELAND ROAD,
LONDON, E18 2AH (Mail order only)

ENAMELLED COPPER WIRE

S.W.G.	1 lb reel	½ lb reel
10 to 19	2·40	1·35
20 to 29	2·45	1·40
30 to 34	2·60	1·50
35 to 40	2·85	1·60

All the above prices are inclusive of postage and packing in U.K.

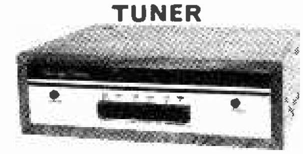
COPPER SUPPLIES
102 Parrswood Road, Withington, Manchester 20 Tel: 061-445 8753

DO-IT-YOURSELF loudspeakers for hi-fi are our speciality. Full range of components and accessories including chassis speakers, crossovers, sound absorbent, grille fabrics etc. always available. We stock the fabulous value Helme speaker kits complete with full and easy instructions) also Peerless and Wharfedale kits. Just about the lowest prices anywhere! Send 8½p stamp for bargain list to: Audioscan, Dept. PW275, 4 Princes Square, Harrogate, North Yorkshire.

THE SCIENTIFIC WIRE CO

Copper - Nickel Chrome - Eureka - Manganin Wires.
Enamelled - Silk - Cotton - Tinned Coverings.
No minimum charges or quantities.
Trade and Export enquiries welcome.
S.A.E. Brings List.
P.O. BOX 30, LONDON, E4 9BW

THE P.E. 'VARICAP' STEREO PUSH BUTTON TUNER



Using the latest Mullard modules for R.F. and I.F. circuits—pre-aligned for ease of construction—this KIT has an F.M. tuner with stereo decoder, push button tuning, self regulated power supply, etc., etc., for highest quality reproduction.

Price £34·50
inc. V.A.T. P & P

S.A.E. for FREE brochure

We also still supply ALL components for the P.E. 'GEMINI' STEREO AMPLIFIER. Send 55p + 9p P&P for a full constructional booklet containing performance details, specification assembly instruction and fault finding guide.

ELECTRO SPARES
Dept. P.W.
288, Ecclesall Road, Sheffield, S11 8PE

RADIO. Learn from the beginning. 16 vintage circuit diagrams, receivers and transmitters with notes. £1. Allister, 58 Wavell Road, Maidenhead, Berks, SL6 5AD.

BARGAIN COMPONENTS, Brand New: 309K 5v 1A reg. £1·20; 380 2W AF amp. 98p; 555 timer 49p; 565 PLL £2·40; 723 reg. 40p; MANI 7 seg. LED £1·80; MAN3M 7 seg. LED 48p; 5314 clock £3·85; 1N4005 600V, 1A diode 5p; SAE lists. Mail order only, minimum £1.

All prices inclusive.

MELLOW ELECTRONICS
5 Sheepcot Drive, Watford, Herts, WD2 6DZ

PRINTED CIRCUITS and HARDWARE

Readily available supplies of Constructors' hardware, Aluminium sheet and sections. Printed circuit boards, top quality for individual or published designs. Prompt service. Send 15p for catalogue.

Ramar Constructor Services, Masons Road, Stratford on Avon, Warwicks. Tel. 4879

AERIAL WIRE. High quality PVC-covered multi-strand copper, 50ft, 75p (12p); 75ft, £1·12 (15p); 100ft, £1·48 (18p); 150ft, £2·25 (28p); 200ft, £2·88 (30p); 250ft, £3·60 (33p); 300ft, £4·30 (36p). P&P in brackets. Longer lengths available. SAE all enquiries. A1 Radio Components, 14 The Borough, Canterbury, Kent CT1 2DR.

TEXAN AMPLIFIER PARTS
Pack 1: Res. 80p. Pack 2/3: Caps. £3·56. Pack 5: Switches £1·50. Pack 6: Pots £1·50. Pack 7: Semi Conductors £8·25. P.C. Bd. £2·50. Chassis £3 (p.p. 50p). Case £3·50 (p.p. £1).
p.p. 25p. Tax extra 25%.

TELERADIO ELECTRONICS
325 FORE ST., LONDON N9. 807 3719

SEND S.A.E. FOR FURTHER INFORMATION AND DETAILS OF 1 WATT to 75W AMPLIFIERS & F.M. TUNERS.

PRINTED CIRCUIT BOARDS, ready drilled for immediate assembly. Prices inclusive of P&P etc: No extras. Practical Wireless PCB's: Disco Amplifier £3·60 each. Disco Light Modulator £2·90. TELE-TENNIS (6 PCB's) £3·70—Sound Effects £1·10—Ball Speed Control £1·10. Ferret Locator 85p. Derby £1·00. Electronic Clock £2·07. Easybuild Organ (2 PCB's) £5·80. Telephone Exchange £1·64. PRACTICAL ELECTRONICS PCB's: Joanna £1·25 each, all 14 £15·00. C.C.T.V. (2 PCB's) £2·18. Orion £2·26. I.C. Pulse Generator £1·37. Time Lapse Photography £1·40. Many Others Available: S.A.E. for lists.
PRODUCTION SPACE AVAILABLE for: P.C.B. Production, Silk-screen Printing, Tinning, P.C.B. Design and Modifications, Electroplating. Full Art/Graphic, Photographic and Design facilities. Production Estimates: By return upon submission of 'Rough's', Full Masters, Existing units or Circuit Diagram to: W.K.F. Electronics, Welbeck Street, Whitwell, Worksop, Notts. S80 4TW. Callers by appointment to 1-3, Station Road, Whitwell. Tel: Whitwell (Derbys) 695 or 544, STD Code 090974.

TRANSMIT!

★ Unique **TRANSMITTER/RECEIVER** Kit. No licence examinations or tests required to operate this transistorised equipment. Easy to build. Get transmitting. Send **£7·95** for yours now!

★ Psychedelic **MINI-STROBE** Kit. Take a pocket-sized lightning storm to Disco's & parties. 'Brain-freeze' 'em with vari-speed stop-motion flashes. Includes super case too. Send **£3·50** now!
(all prices include V.A.T., packing & postage.)

Send remittance to:

**BOFFIN PROJECTS,
4 CUNLIFFE ROAD,
STONELEIGH, EWELL, SURREY**
(Mail order U.K. only)
Or for more details, send 20p for lists

GLASS FIBRE P.C.B.'s. Send 1:1 master and 30p per board plus 7p per square inch tinned or plus 9p per square inch drilled and tinned. Discount for quantity. PROTO DESIGN, 4, Highcliffe Way, Wickford. Essex. SS11 8LA.

H. M. ELECTRONICS
275a FULWOOD ROAD, BROOMHILL, SHEFFIELD S10, 3BD.

BEC CABINETS (illus'd)

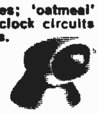
METAL CASES
DRY TRANSFER LETTERING

Send 15p for leaflets (Refundable)
Trade enquiries invited

LOW-COST IC MOUNTING for any size DIL package. 100 pin sockets, 50p. 7 and 8 hole plastic supports, 5p/pair. Quantity rates. SAE details and sample. Trial pack, 50p. (P&P 10p/order.) PKG Electronics, Oak Lodge, Tansley, Derbyshire DE4 5FE.

OVAL DIGITAL CLOCK CASES

Attractive stoneware pottery cases; 'oatmeal' glazed; suitable for most digital clock circuits that use 4 or 6 digit L.E.D. displays.
ONLY £3·60 inclusive
Send S.A.E. for full details of above and many others, to:



J. BARRIE-SMITH
56 Conifer Road, Coxford, Southampton, Hants. SO1 6FX.

Synthesiser "Sounds Supreme"
by Dewtron (25% VAT extra.)

Famous kits, e.g. waa-waa complete kit £4·50; Fuzz kit £6·50 P&P 25p under £10. Ring Modulator modules £11. "Mister Bassman" Bass Pedal Units and whole range of synthesiser modules, musical novelties, etc. Catalogue 20p from D.E.W. Ltd., 254 Ringwood Road, Ferndown, Dorset.

60KHz MSF RUGBY RADIO RECEIVER. Available in kit form or assembled unit. Details from Toolex, Bristol Road, Sherborne, Dorset.

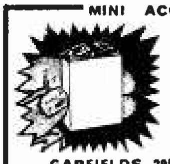
BUILD YOUR OWN

You are invited to send S.A.E. for lists of our very extensive range of high quality amplifier, pre-amps, F.M. tuners, instruments, Radiocontrol ignition units and many other kits. Please state requirements.

**TELERADIO ELECTRONICS,
325 FORE STREET, EDMONTON,
LONDON N9**

PROFESSIONAL GRADE Audio Mixers and Kits at realistic prices. Also preamps, power supplies compressors, voice operated autofades, slider faders, cabinets, consoles. SAE for catalogue: Partridge Electronics, 21/25 Hart Road, Benfleet, Essex, Ref: PW (or EE).

MINI ACCUMULATORS



**2 volt MULTI-USE Sealed Lead Acid Rechargeable Cells.
Size L450—1·4" x 1·1" x ·44". 3 for £2·15 inc. P. & P.
Size GA2—1·7" x 1·3" x ·5". 3 for £2·65 inc. P. & P.
Suits Fi-Cord**

GARFIELDS, 295 Rye Lane, London, S.E.15

BARGAIN PACK Electrolytic Capacitors. Unused and marked, good mixed selection. Price: 100 £1; P&P 15p (our choice). Etch your own circuit board. Printed circuit board, 10in x 5in, complete with etching compound and instructions, 85p. P&P 15p. Ferric chloride etching compound in 1lb packs net, complete with instructions, 40p. P&P 30p. Lancashire Mail Order, 6 William Street, Stubbins Ramsbottom, Bury, Lancs.

STYLI-CARTRIDGES

FELSTEAD ELECTRONICS (PW96)
Longley Lane, Gatley, Cheadle, Ches. SK8 4EE

Our new complete list with illus. stylus chart and best values in cartridges, cassettes, tape, audio leads, microphones, meters and multi-testers, phones, plugs, sockets and many useful accessories for radio, recording and hi-fi Yours FREE for S.A.E. Usual trustworthy service.

Most items available to callers in Manchester at **Trionix, 177 School Lane, Kingsway Cnr. 19**

LOUD 6V DC SIRENS for burglar alarms, etc., £1·20, add 18p postage. List 9p. Grimsby Electronics, 64 Tennyson Road, Cleethorpes, Humberside.

SUPERB INSTRUMENT CASES by Bazelli, manufactured from heavy duty PVC faced steel. Hundreds of people and industrial users are choosing the cases they require from our vast range, competitive prices start at a low 75p. Examples: width, depth, height, 8in x 5in x 3in, £1·55; 10in x 6in x 3in, £2·20; 10in x 8in x 3in, £2·75; 12in x 10in x 3in, £3·60; 8in x 4in x 4in, £1·80; 10in x 6in x 4in, £2·70; 12in x 8in x 4in, £3·60; 7in x 7in x 5in, £2·65; 8in x 10in x 6in, £3·60; 12in x 8in x 7in, £4; 12in x 12in x 7in, £4·40. Plus 62p postage and 8% VAT. Over 400 models to choose from. Prompt despatch. Free literature (stamp would be appreciated), Bazelli, Dept. No. 25, St. Wilfrid's, Foundry Lane, Halton, Lancaster LA2 6LT.

JAYBEE FOR KITS

AMTRON, JOSTYKIT, ETC.
Send S.A.E. for full information
JAYBEE ELECTRONICS, Sarum Farm Est. SARUM ROAD, WINCHESTER, HANTS
Telephone 0962-61806

RTTY FREQUENCY SHIFT CONVERTOR CV-89A/URA—8A. This must be the first quantity release of this most sought after Rtty Convertor. Brief description uses 15 BG9 & BG7 Valves, with a 2" C.R. Tuning Tube. Housed in Grey Alloy case size 17" x 5" x 15" deep. Input Supply fully filtered for interference. Requires 105-125 Volts A.C., A two position Selectivity or Filter Switch that enables to set up for any Narrow Shift from 10-200 Cycles, or any Wide Shift from 200 to 1000 Cycles. The Mean or Centre Frequency for the narrow shift is 1000 Cycles, for the wide shift is 2550 cycles. Normal Audio Input from Receiver 600 OHMS. The Convertor will operate with an input of 60 Microwatts to 60 Milliwatts or about −14 to + 18 DBM. Has internal Tone OSC Freq 595—1785 CPS. Mark Space Switch Normal or Reverse. Supplied in Good used condition, Checked complete, but not tested Electronically, £22·50. Carr £2·50 onwards.

We also have a few COMPARATORS CM-22A/URA—8A same colour and size, using 13 BG9 and BG9 Valves, made for use with above for Dual Diversity Reception. 105-125V A.C. Supply, Fully Filtered for interference. Used Good Condition, checked complete but not Tested Electronicaly. £10·00. Carr as above.

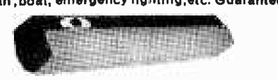
We have in stock a Clip on Fan Blower Cooler complete with Filter and Heat Switch that only switches on when Units get to a preselected Heat, Normally if units are used up to 24 hours a day. Housed in Alloy case £2·50. Post or Carr 50p.

TELEPRINTER CREED 7B. New or rebuilt as new by Gov. In original Gov Transit Case. Power 100-250V D.C., Few only at £22·50 ea Carr £3·50 or at cost.

SUPPLY UNIT 7 Input Voltage 12V D.C. or 100-250 A.C., Output 70-100 Volts 30M/A twice. 30-45V A.C. 40 M/A, 11·5-14V D.C., ·2 ·4 amps, in small Box. These are mainly for supplying Relay Voltage for the Teleprinters. Brand New at £3·50 Carr or Post £1·00. If possible collect Ex Warehouse by appointment, and save Carr cost also Delivery time. Terms Cash with order, VAT 8%. Phone Morley, Code 0532-531179. JOHNS RADIO, 424 BRADFORD ROAD, BATLEY, YORKS.

---

12 VOLT 21" 13 Watt Fluorescent Lighting (by Thorn/AEI) with diffuser & on/off switch. Ideal caravan, boat, emergency lighting, etc. Guaranteed.



£5·50 inc. VAT & Post. List price £7·02 inc. VAT
SALOP ELECTRONICS 23 Wyle Cop, Shrewsbury, Shropshire Tel. 53206

NICKEL CADMIUM cylindrical accumulators for dry battery replacement. Buy no more dry cells. F/Scp. S.A.E. brings full details by return. Sandwell Plant Ltd. 1 Denholm Road, Sutton Coldfield, West Midlands. 021-354 9764.

INDEX TO ADVERTISERS

Head Office and Warehouse
44A WESTBOURNE GROVE
LONDON W2 5SF
Tel: 727 5641/2/3

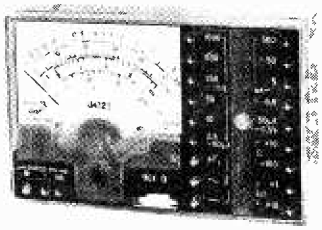
Z & I AERO SERVICES LTD.

Retail Shop
85 TOTTENHAM COURT ROAD
LONDON W1
Tel: 580 8403
Open all day Saturday

Please send all correspondence and Mail-Orders to Head Office

MULTIMETERS—MADE IN USSR

AC/DC MULTIMETER TYPE U4324
33 ranges covering D.C. current 60μA to 3A; AC current 300μA—3A; DC voltage: 0·6—1200V AC voltage: 3—900V Resistance: 500Ω—500kΩ Level: −10 to +12db Sensitivity: 20,000 o.p.v. DC. 4,000 o.p.v. A.C.
Instrument is powered by re-chargeable nickel cadmium batteries.
PRICE £10·65



AC/DC MULTIMETER TYPE U4323
Apart from usual multimeter facilities the instrument incorporates fixed frequency Audio (1kHz) and I.F. (465kHz) Oscillators. 22 ranges covering AC Voltage 2·5–1000V; D.C. Voltage 0·5–1000V; D.C. current 50μA to 500mA and resistance 0 to 1MΩ. Sensitivity 20,000 o.p.v. Oscillator output voltage—1V minimum.
PRICE: £9·20

AC/DC MULTIMETER TYPE U4315
42 ranges covering:
D.C. current 50μA–2·5A; A.C. current: 500μA–2·5A; AC/DC voltage: 1–1000V; Resistance 300Ω–500kΩ; Capacity up to 0·5μF; Transmission level: −15 to +2db; Sensitivity: 20kΩ/V DC, 2kΩ/V AC.
PRICE £11·25

PLEASE NOTE THAT NO OVERLOAD PROTECTION IS INCORPORATED IN ANY OF THESE INSTRUMENTS.

Full description of the above, as well as other instruments, is available in our illustrated 126-page catalogue, which also includes price list of comprehensive range of transmitting and receiving valves, semiconductors and passive components. Please send £0·20 for your copy.

All prices are exclusive of V.A.T. When remitting cash with order please add £1·00 per instrument for packing and postage and appropriate rate of V.A.T. (at present 8%) to the total. No C.O.D. orders accepted. Mail orders are dealt with within 48 hours.

FANE 'DISCO 60' L'SPEAKER

12" 60 watt R.M.S. Plasticised Linen Cone Surround. Large Tweeter Cone. Range 15Hz 15KHz. Extra High Sensitivity. Robust Cast Chassis.
WE CONSIDER THE 'DISCO 60' TO BE THE BEST SINGLE UNIT AVAILABLE FOR ITS PURPOSE. WE'RE SURE THAT YOU WILL TOO.
Impedance of 8Ω or 15Ω
The above is one of five

Rec. Price **£24·75** inc. VAT

SPECIALIST RANGE SPEAKERS

Each designed to produce the individual sound requirements for its particular purpose. Other units are as follows:—

	Rec. Price
12" **GUITAR 60L** for LEAD GUITAR	**£23·50** Inc. VAT
12" **GUITAR 60B** for use in multiples for BASS GUITAR	**£23·95** Inc. VAT
12" **PA60** for general purpose P.A.	**£23·50** Inc. VAT
15" **BASS 70** for BASS GUITAR	**£35·95** Inc. VAT

'POP' RANGE
POP 15 12" 15w £7·70
POP 33T 12" 33w £10·99
POP 50T 12" 50w £14·95
POP 50 12" 50w £14·95
POP 55/2 12" 60w £19·99
POP 60 15" 60w £22·95
POP 70 15" 70w £24·50
POP 100 18" 100w £38·95

Impedances 8Ω or 15Ω

Please send large S.A.E. for leaflets on above and other Fane Products

Distributors (Wholesale and Retail) **LINEAR PRODUCTS LTD. ELECTRON WORKS, ARMLEY, LEEDS**
Manufacturers enquiries to—**FANE ACOUSTICS LTD., 286 BRADFORD ROAD, BATLEY, YORKS**
Prices shown correct at 8-12-75

TRANSFORMERS

MAINS SAFETY ISOLATING Primary 240V. Sec. 120V or 240V. Please state which type you require.
All types are screened and Centre tapped to earth.

V.A. (watts)	OPEN TYPE £	P. & P. p	CASED TYPE £	SOCKETS 5 amp	SOCKETS 15 amp	CARR-IAGE	PLUGS FOR CASED TYPE complete set
50	3·70	62					
100	4·15	70					
200	7·00	80					
250	8·35	1·10					
350	10·20	1·18					
500	11·75	1·34	21·25	1	—	O.A.	1·20
750	17·50	O.A.	28·00	1	—	O.A.	1·20
1000	25·77	O.A.	36·27	2	—	O.A.	2·40
1500	29·25	O.A.	40·75	3	—	O.A.	3·60
2000	34·50	O.A.	48·00	1	1	O.A.	2·70
3000	53·00	O.A.	68·50	3	1	O.A.	5·10

CASED TYPES These are of extremely high quality to British Standard Specification, with resettable fused primary winding, and are fitted with covered outlet sockets. Housed in steel cases with carrying handles and 3ft of 3 core cable.

12V or 24V
Primary 240V
Please state which voltage

AMPS 12V	AMPS 24V	£	p
·5	·25	1·14	26
1	·5	1·40	45
2	1	1·95	45
4	2	2·45	52
6	3	3·50	52
8	4	3·90	65
10	5	4·35	65
12	6	4·70	78
16	8	6·15	80
20	10	8·85	1·00

MINIATURE TRANSFORMERS
Primary voltage 240V

Sec. volts	mA	PRICE	P & P
3–0–3	200	1·35	15
0–6 x 2	1A	1·60	45
0–9 x 2	330	1·35	26
0–9 x 2	500	1·63	45
0–9 x 2	1A	2·50	52
0–15 x 2	200	1·30	25
0–20 x 2	300	1·60	45
0–20 x 2	1A	3·00	52
0–15–27 x 2	1A	3·47	65

SPECIAL OFFER, from export order
Primary 0–110–120V x 2 Sec 0–32V x 2 2 amp £4·00 p & p 87p + V A T

We manufacture power Transformers to customers own special requirements, please send details of any Transformer you may require custom built.

PLEASE ADD 8% V.A.T. TO TOTAL PRICE

S. G. Wright's Ltd., Bishop House Works, Rylands St., BURNLEY, Lancs. BB10 1RG Tel. 26934

Published on approximately the 7th of each month by IPC Magazines Limited, Fleetway House, Farringdon Street, London EC4A 4AD. Printed in England by Index Printers, Dunstable, Beds. Sole Agents for Australia and New Zealand—Gordon and Gotch (Asia) Ltd.; South Africa—Central News Agency Ltd. PRACTICAL WIRELESS is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed of by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to V.A.T., and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever.

CHROMASONIC electronics

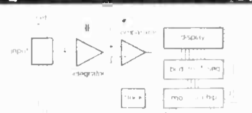
Dept. 1. 56, Fortis Green Road, Muswell Hill. London, N10 3HN. telephone: 01-883 3705

C-MOS

mix prices

	1-24	25-99	100up
CD4000AE	19p	17p	14p
CD4001AE	19p	17p	14p
CD4002AE	19p	17p	14p
CD4006AE	£1.59	£1.33	£1.06
CD4007AE	23p	19p	15p
CD4008AE	£1.75	£1.46	£1.17
CD4009AE	Use	CD4049	
CD4010AE	Use	CD4050	
CD4011AE	19p	17p	14p
CD4012AE	19p	17p	14p
CD4013AE	59p	50p	46p
CD4014AE	£1.75	£1.46	£1.17
CD4015AE	£1.75	£1.46	£1.17
CD4016AE	55p	48p	44p
CD4017AE	£1.29	£1.07	93p
CD4018AE	£1.89	£1.56	£1.25
CD4019AE	80p	66p	53p
CD4020AE	£1.97	£1.64	£1.31
CD4021AE	£1.75	£1.46	£1.17p
CD4023AE	19p	17p	14p
CD4022AE	£1.83	£1.53	£1.22
CD4024AE	£1.26	£1.05	84p
CD4025AE	19p	17p	14p
CD4026AE	£2.79	£2.32	£1.86
CD4027AE	98p	82p	65p
CD4028AE	£1.53	£1.28	£1.02
CD4029AE	£1.89	£1.56	£1.15
CD4030AE	71p	59p	47p
CD4035AE	£1.75	£1.46	£1.17
CD4040AE	£2.01	£1.69	£1.34
CD4042AE	£1.49	£1.24	99p
CD4046AE	£2.15	£1.79	£1.44
CD4049AE	69p	58p	46p
CD4050AE	69p	58p	46p
CD4051AE	£2.78	£2.32	£1.85
CD4052AE	£2.78	£2.32	£1.85
CD4056AE	£2.12	£1.76	£1.41
CD4060AE	£2.39	£1.99	£1.55
CD4066AE	£1.13	94p	75p
CD4068AE	28p	24p	19p
CD4069AE	28p	24p	19p
CD4070AE	28p	24p	19p
CD4071AE	28p	24p	19p
CD4077AE	71p	59p	47p
CD4081AE	28p	24p	19p
CD4082AE	28p	24p	19p
CD4085AE	£1.28	£1.06	85p
CD4086AE	£1.28	£1.06	85p
CD4093AE	£1.56	£1.20	£1.04
CD4099AE	£2.95	£2.46	£1.96
CD4511AE	£2.36	£1.79	£1.44
CD4528AE	£1.30	£1.08	87p

3½ DECADE DVM I.C.



This state-of-the-art MOS LSI chip contains all the logic necessary for a 3½ decade, dual slope integrating, automatic polarity detecting DVM. Supplied with free data and circuit booklet.

OUR PRICE ONLY £6.59.*

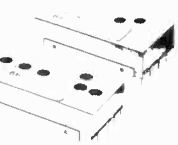
(Data and Circuit Booklets alone 20p.)

The AY-5-1224 tick-tock

Another marvel from G.I. A 16 pin 12-24 hr. Clock I.C. with 25 pin capability and low external parts count. Supplied with manufacturers detailed leaflet £3.95p* inc. VAT. (Leaflet alone 20p.) Full Kit (excluding case) available towards end of 1975. Phone Clive for details.

MULLARD MODULES

Still make the simplest, highly reliable F.M. tuner



LP1186	Varactor front end	£8.60
LP1185	I.F. Strip	£6.95
LP1400	Multiplex decoder	£9.02

I.C. SOCKETS

Pin Sockets, pins in strips of 100. Just snip off what you need. 65p per strip

Dual in line

8 pin 13p	24 pin 26p	105 8 pin 31p
14 pin 15p	28 pin 30p	
16 pin 15p	36 pin 39p	10 pin 35p

FREE CIRCUITS

Our 8 Page A4 Audio I.C. Booklet is supplied FREE with purchases of Linear I.C.'s worth £1, or more (35p. if sold alone) Contains circuits and pin connections

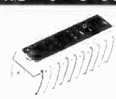
- 15 Amplifiers 250 mW to 20 watts
- 5 Audio Pre-Amplifiers
- 1 Tape Pre-Amplifier
- 1 Power Driver
- 1 Instrument Amplifier (Bifet)
- 1 General Purpose Mini Amplifier
- 1 D.C. Controlled Gain Control
- 1 Micro-mini radio (2 I.C.'s)

PHOTO-DARLINGTON

Vceo 25v 2N5777
Vcbo 25v
Vebo 8v
Ic 250 mA
Pd 200 mW
Hfe 2500

35p

LINE-O-LIGHT



NEW LED Linear Cursors each device contains 10 light emitting diodes in a 20 pin dual-in-line package. Ideal for solid state analogue meters or dials. Type 101 RED £2.76.* Complete with leaflet.

74 TTL

mix prices

	1-24	25-99	100+
7400	14p	12p	10p
7401	14p	12p	10p
7402	14p	12p	10p
7403	15p	13p	10p
7404	16p	13p	11p
7408	16p	13p	11p
7409	16p	13p	11p
7410	16p	13p	11p
7413	29p	24p	20p
7417	27p	22p	20p
7420	16p	13p	11p
7427	27p	22p	18p
7430	16p	13p	11p
7432	27p	22p	18p
7437	27p	22p	18p
7441	75p	62p	50p
7442	65p	55p	43p
7445	85p	71p	57p
7447	81p	75p	65p
7448	75p	62p	50p
7447A	95p	83p	67p
7470	30p	25p	20p
7472	25p	21p	17p
7473	30p	25p	20p
7474	32p	26p	21p
7475	47p	39p	31p
7476	32p	26p	21p
7483	75p	62p	50p
7485	£1.30	£1.09	87p
7486	32p	26p	21p
7489	£2.92	£2.80	£2.10
7490	49p	40p	32p
7491	65p	55p	45p
7492	57p	46p	36p
7493	45p	40p	32p
7495	67p	55p	45p
74100	£1.08	89p	72p
74107	35p	28p	22p
74121	34p	28p	23p
74122	47p	39p	31p
74141	78p	63p	53p
74145	68p	58p	48p
74154	£1.62	£1.48	86p
74174	£1.00	83p	67p
74180	£1.06	88p	71p
74181	£3.20	£2.50	£1.90
74192	£1.35	£1.14	90p
74193	£1.35	£1.14	90p
74196	£1.64	£1.34	99p

LINEAR I.C.'s

555 (8 pin dip)	55p
555 (TO-99)	81p
556 (14 pin dip)	£1.29
703 (RF/IF Amp)	68p
709 (8 pin dip)	38p
709 (TO-99)	45p
709 (14 pin dip)	39p
710 (8 pin dip)	39p
710 (TO-99)	45p
710 (14 pin dip)	44p
711 (TO-99)	51p
711 (14 pin dip)	44p
720 (A.M. Radio)	£1.76
723 (TO-99)	£1.09
723 (14 pin dip)	55p
741 (8 pin dip)	30p
741 (TO-99)	43p
741 (14 pin dip)	36p
747 (14 pin dip)	£1.04
748 (8 pin dip)	42p
748 (TO-99)	46p
748 (14 pin dip)	49p
753 (F.M. Ist. I.F.)	£1.08
75491	88p
75492	£1.10

Regulators 100 mA

78L05WC (TO-92)	60p
78L12WC (TO-92)	60p
78L15WC (TO-92)	60p

Regulators 100mA

78L05AWC (TBA625A)	90p
78L12AWC (TBA625B)	90p
78L15AWC (TBA625C)	90p

Regulators 500mA

78M05HC	£1.35
78M12HC	£1.35
78M15HC	£1.35
78M18HC	£1.35
78M24HC	£1.35

Regulators 1A

7805KC (TO-3)	£2.09
7812KC (TO-3)	£2.09
7815KC (TO-3)	£2.09
7818KC (TO-3)	£2.09
7824KC (TO-3)	£2.09

Regulators 1A

7805UC (TO-220)	£1.72
7812UC (TO-220)	£1.72
7815UC (TO-220)	£1.72
7818UC (TO-220)	£1.72
7824UC (TO-220)	£1.72
ICL8030	£3.52

AY-1-0212	£6.93
AY-1-5051	£1.44
AY-5-1224	£3.95
AY-5-3500	£6.59
AY-5-3507	£6.59
AY-5-4007	£7.94
BHA0002	£3.01
CA2111	£1.19
CA3045	£1.69
CA3046	88p
CA3053	59p
CA3065	£1.60
CA3075	£1.64
CA3078	£1.26
CA3080	59p
CA3081	£1.86
CA3082	£1.86
CA3089E (TDA1200)	£2.43
CA3097E	£1.67
CA3123E	£1.76
CA3130	84p
CA3401E (LM3900)	68p
CA3600E	£1.44
CT7001	£5.34
L005T1 (TO-3)	£1.46
L036T1 (TO-3)	£1.46
L037T1 (TO-3)	£1.46
L129 (SOT-32)	85p
L130 (SOT-32)	85p
L131 (SOT-32)	85p
LM301T (TO-99)	65p
LM301S (8 pin dip)	59p
LM301A T (TO-99)	67p
LM301A S (8 pin dip)	59p
LM307 T (TO-99)	59p
LM307 S (8 pin dip)	57p
LM308 T (TO-99)	£1.96
LM308 S (8 pin dip)	98p
LM308A T (TO-99)	£7.92
LM308A S (8 pin dip)	£6.90
LM309K	£2.34
LM339	£2.25
LM370N	£2.85
LM371	£2.08
LM372N	£1.99
LM373N	£2.99
LM377N	£2.71
LM380	£1.25
LM381	£1.85
LM382	£1.66
LM703	68p
LM1820	£1.03

LM2111	£1.12
LM3900	69p
LM3909	66p
MC1303L	£1.94
MC1306P	85p
MC1310P	£2.10
MC1312P	£2.52
MC1314P	£4.34
MC1315P	£4.85
MC1327P	£1.48
MC1330	89p
MC1339P	£1.60
MC1350	68p
MC1351	92p
MC1352	92p
MC1357	£1.60
MC1358 (CA3065)	£1.23
MC1375	£1.56
MC1455(555T)	65p
MC1456CG	£1.77
MC1458CPI	89p
MC1468G	£2.30
MC1495L	£4.48
MC1496G	£1.01
MC3302P	£1.65
MC3401P	81p
MFC4000B	87p
MFC4060A	85p
MFC6030A	85p
MFC6040	£1.01
MM5314	£4.80
MM5316	£9.99
MVRSV (TO-3)	£1.45
MVR12V (TO-3)	£1.45
MVR15V (TO-3)	£1.45
NE5401	£1.25
NE546A	£1.16
NE555V	69p
NE556	£1.29
NE560B	£5.06
NE561B	£5.06
NE562B	£5.06
NE563	£2.96
NE565N	£2.63
NE566V	£1.87
NE567V	£2.63
SD6000	£1.22
SL414A	£2.09
SL415A	£2.75
SL437D	£1.50
SL440	£2.84
SN75491N	88p
SN75492N	£1.10

SN76001N (TAA611)	£1.82
SN76003N	£3.30
SN76013N	£1.98
SN76023N	£1.98
SN76227N (MC1327)	£1.89
SN76532N	£1.86
SN76544N	£1.81
SN76550-2 (TAA550)	89p
SN76552-2	81p
SN76660N (TBA120)	75p
SN76666N (CA3065)	£1.12
TAA263	£1.50
TAA300	£2.16
TAA310A	£1.87
TAA320	£1.44
TAA350	£2.43
TAA370	£3.45
TAA550	75
TAA570	£2.75
TAA700	£5.03
TBA120S	£1.25
TBA231	£1.02
TBA281 (723)	£2.59
TBA500Q	£3.16
TBA520Q	£3.85
TBA530Q	£3.27
TBA540Q	£3.72
TBA550Q	£5.29
TBA560CQ	£5.29
TBA625A	£1.03
TBA625B	£1.03
TBA625C	£1.03
TBA651	£1.87
TBA720Q	£2.79
TBA750Q	£2.79
TBA800	£1.11
TBA810S	£1.24
TBA810AS	£1.24
TBA820	86p
TBA920Q	£4.71
TBA990Q	£4.71
TCA270Q	£5.24
TCA760	£2.16
TCA800Q	£7.24
TCA830S	£1.04
TCA940	£2.25
TDA1054	£1.50
TDA1200	£2.43
TDA1405	80p
TDA1412	80p
TDA1415	80p
TDA2010	T.B.A.
TDA2020	T.B.A.
ULN2111A	£1.52
ZN414	£1.26

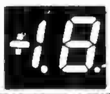
ZN414 Leaflet free with devices (10p alone)

MC1310, 2, 4 & 5 leaflet free with devices (10p alone)

LED DISPLAYS

Litronix Double Digit Displays 0.5" Common Anode, ? R.H. Decimal Points
DL721 ± 1.9
DL727 0.0 to 9.9
Suitable for Clocks, Meters, Instruments, Channel Indicators
Our price £4.75.* each

NEW



C.Anode R/H Dec. pt. · C.Anode L/H Dec. pt. · C.Anode ±1 · C.Cathode R/H Dec. Pt.

Low cost Red GaAsP Motorola MLED 500 in a TO92 package	0.33"	Litronix DL 707 Series	✓	✓	✓	✓	all £1.82* each (Red only)
	0.33"	Monsanto MAN 50/70/80/3600	✓	✓	✓	✓	all £1.82* Each (Red, green, yellow, Orange)
	0.33	Xciton XAN 70 Series	✓	✓	✓	✓	all £1.49* Each (Red Green, yellow)
	0.43	Monsanto MAN 4000 Series	✓	✓	✓	✓	all £2.32* Each (Red, Green, Yellow, Orange)
15p.*	0.63	Litronix DL747 'Jumbo' Series	✓	✓			all £2.42* Each (Red only)

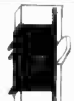
Common Cathode as Common Anode (Red only)

NOTE: MAN 4000 Series pin outs are 14 pin dil the same as MAN 50, 70 and 80 series

DIGITAL SWITCH

BCD encoded digital switch Reading 0 to 9. Suitable for digital clock alarm setting DVM input Scaling etc.

1 to 9. £1.49 each *



LIGHT EMITTING DIODES

Free snap-on plastic retainer

	0.125" dia lens (TIL209) 1+	10+	100+	0.16" dia lens 1+	10+	100+	0.2" dia. lens (MLED 650) 1+	10+	100+
Red	16p	15p	13p	27p	24p	22p	18p	16p	14p
Green	27p	24p	22p	33p	30p	27p	30p	27p	25p
Orange	27p	24p	22p	33p	30p	27p	30p	27p	25p
Yellow	34p	31p	29p	35p	32p	29p	35p	33p	30p

.......Cont'd

Our Bulk Buying Power enables a repeat of our Special Offer.
0.33" (LIT 707) 90p. *(inc. VAT)
0.63" (LIT 747) £1.99. *(inc. VAT)

OPTO-ISOLATORS

IL1 4N25 or TIL116
6 pin industry standard package
2.5KV isolation £1.00.*

MAINS TRANSFORMERS

Secondaries

					.5A	1A	2A	4A
6-0-6V	100 mA	97p		0-9-12 V	-	£1.95	£2.27	£2.64
9-0-9V	100 mA	97p		0-12-15-20-24-30 V	-	£2.48	£4.15	-
12-0-12V	100 mA	97p		0-24-30-40-48-60 V	-	£5.18	£7.02	-
20-0-20V	1 A	£4.55		0-19-25-33-40-50 V	£2.70	£3.40	£4.53	-
24-0-24V	500 mA	£2.48						
28-0-28V	1 A	£6.18						

p.p. on transformers 10% of price min. 20p

VAT INC

Items followed by a* inc. VAT at 8%. all others include 25%

Overseas Customers deduct 2/27 from items, 1/5 from others

Orders for over £6 post free. Except transformers

Data Sheet and photocopy service available 10p. per page

Advert No. 1A of Series B

CALLERS WELCOMED

More than just a catalogue!

PROJECTS FOR YOU TO BUILD

4-digit clock, 6-digit clock, 10W high quality power amp., High quality stereo pre-amp., Stereo Tuner, F.M. Stereo decoder, etc., etc.

CIRCUITS . . . Frequency Doublers, Oscillators, Timers, Voltmeters, Power Supplies, Amplifiers, Capacitance Multiplier, etc., etc. . . .

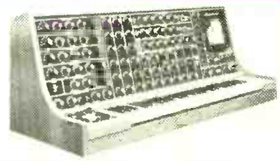
Full details and pictures of our wide range of components, e.g. capacitors, cases, knobs, veroboards, edge connectors, plugs and sockets, lamps and lampholders, audio leads, adaptor plugs, rotary and slide potentiometers, presets, relays, resistors (even 1% types!), switches, interlocking pushbutton switches, pot cores, transformers, cable and wire, panel meters, nuts and bolts, tools, organ components, keyboards, L.E.D.'s, 7-segment displays, heatsinks, transistors, diodes, integrated circuits, etc., etc., etc. . . .

Really good value for money at just 40p.

132 Pages

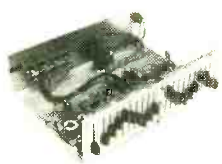
YOU MUST
SEE OUR PRICES BEFORE YOU BUY (S.a.e. please for details)

The 4600 SYNTHESISER



We stock all the parts for this brilliantly designed synthesiser, including all the PCB's, metalwork and a drilled and printed front panel, giving a superb professional finish. Opinions of authority agree the ETI International Synthesiser is technically superior to most of today's models. Complete construction details in our booklet now available price £1.50, or S.A.E. please for specification

GRAPHIC EQUALIZER



A really superior high quality stereo graphic equaliser as described in Jan. 1975 issue of ETI. We stock all parts (except woodwork) including all the metal work drilled and printed as required to suit our components and PCB's. Complete reprint of article—price 15p.

ELECTRONIC ORGAN

Build yourself an exciting Electronic Organ. Our leaflet MES51, price 15p, deals with the basic theory of electronic organs and describes the construction of a simple 49-note instrument with a single keyboard and a limited number of stops. Leaflet MES52, price 15p, describes the extension of the organ to two keyboards each with five voices and the extension by an octave of the organ's range. Solid-state switching and new footages along with a pedal board and a further extension of the organ's range are shown in leaflet MES53, priced at 35p (Pre-publication price 15p)

NO MORE DOUBTS ABOUT PRICES

Now our prices are GUARANTEED (changes in VAT excluded) for two month periods. We'll tell you about price changes in advance for just 30p a year (refunded on purchases). If you already have our catalogue send us an s.a.e. and we'll send you our latest list of GUARANTEED prices. Send us 30p and we'll put you on our mailing list — you'll receive immediately our latest price list then every two months from the starting date shown on that list you'll receive details of our prices for the next GUARANTEED period **before** the prices are implemented! — plus details of any new lines, special offers, interesting projects — and coupons to spend on components to repay your 30p

NOTE: The price list is based on the Order Codes shown in our catalogue so an investment in our super catalogue is an essential first step.

Call in at our shop, 284 London Road, Westcliff on Sea, Essex. Please address all mail to

MAPLIN ELECTRONIC SUPPLIES
P.O. Box 3 Rayleigh Essex SS6 8LR.

PW

I enclose Cheque/P.O. value ____________

For ____ copy/copies of your Catalogue

Name ____________

Address ____________

____

MAPLIN ELECTRONIC SUPPLIES P.O. Box 3 Rayleigh Essex SS6 8LR.