PRACTICAL WIRELESS

NOVEMBER 1973

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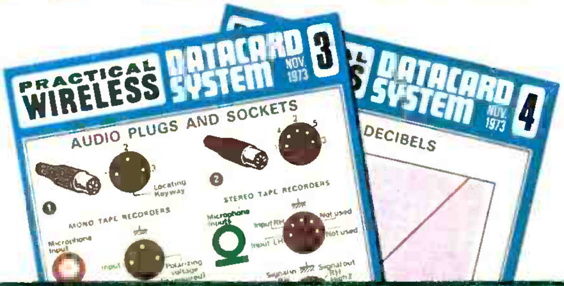

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DICTIONARY of AUDIO TERMS

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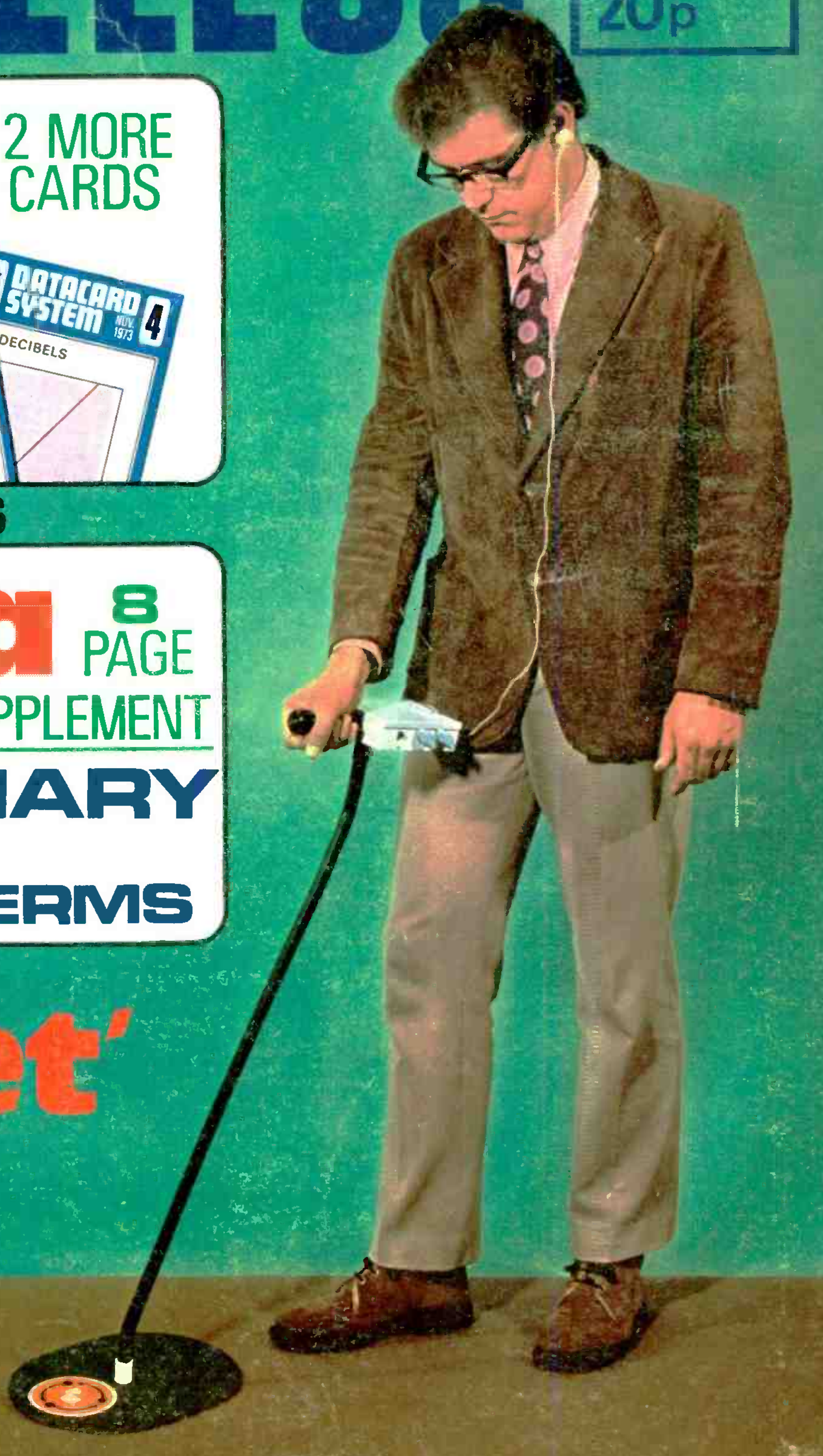

PRACTICAL WIRELESS

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ISSUE 801
NOVEMBER 1973

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NEWS & COMMENT

CONSTRUCTIONAL

OTHER FEATURES

EXTRA WITH THIS ISSUE

INSET P.W. DATACARDS in COLOUR
No. 3 Audio Plugs and Sockets
No. 4 Using Decibels

SUPPLEMENT DICTIONARY OF AUDIO TERMS (Illustrated)

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SN7407N	0·40	0·38	0·35
SN7408N	0·25	0·22	0·19
SN7409N	0·33	0·33	0·28
SN7409AN	0·44	0·44	0·38
SN7410N	0·20	0·18	0·16
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SN7412N	0·28	0·28	0·25
SN7412AN	0·38	0·38	0·33
SN7413N	0·30	0·27	0·25
SN7414N	0·72	0·72	0·63
SN7416N	0·30	0·27	0·25
SN7417N	0·30	0·27	0·25
SN7420N	0·20	0·18	0·16
SN7422N	0·28	0·28	0·25
SN7422AN	0·38	0·38	0·33
SN7423N	0·37	0·34	0·32
SN7425N	0·37	0·37	0·32
SN7427N	0·37	0·37	0·32
SN7428N	0·43	0·43	0·37
SN7430N	0·20	0·18	0·16
SN7432N	0·37	0·37	0·32
SN7433N	0·43	0·43	0 38
SN7433AN	0·57	0·57	0·50
SN7437N	0·43	0·43	0·37
SN7438N	0 43	0 43	0·37
SN7438AN	0·57	0·57	0·50
SN7440N	0·20	0·18	0·16
SN7441AN	0·85	0·79	0·73
SN7442N	0·85	0·79	0·73
SN7443N	1·50	1·27	1·13
SN7444N	1·50	1·27	1·13
SN7445N	2·16	2·16	1·89
SN7446N	2·16	2·16	1·89
SN7447AN	1·80	1·80	1·57
SN7448N	1·50	1·27	1·13
SN7450N	0·20	0·18	0·16
SN7451N	0·20	0·18	0·16
SN7453N	0·20	0·18	0·16
SN7454N	0·20	0·18	0·16
SN7460N	0·20	0·18	0·16
SN7470N	0·33	0·30	0·27
SN7472N	0·38	0·38	0·34
SN7473N	0·44	0·41	0·37
SN7474N	0·48	0·48	0·42
SN7475N	0·59	0·55	0·51
SN7476N	0·45	0·36	0·32
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SN7481N	1·25	1·10	0·95
SN7482N	0·87	0·80	0·72
SN7483N	1·20	1·10	1·00
SN7485N	1·87	1·87	1·63
SN7486N	0·50	0·50	0·44
SN7489N	4·32	4·32	3·78
SN7490N	0·75	0·70	0·63
SN7491AN	1·10	1·00	0·90
SN7492N	0·75	0·70	0·63
SN7493N	0·75	0·70	0·68
SN7494N	0·85	0·80	0·75
SN7495N	0·85	0·80	0·75
SN7496N	1·00	0·90	0·83
SN74100N	2·16	1·89	1·89
SN74104N	0·60	0·53	0·45
SN74105N	0·60	0·53	0·45
SN74107N	0·51	0·51	0·45
SN74110N	0·57	0·57	0·50
SN74111N	0·86	0·86	0·75
SN74116N	2·16	2·16	1·89
SN74118N	1·00	0·90	0·83
SN74119N	1·92	1·92	1·68
SN74120N	1·05	1·05	0·92
SN74121N	0 57	0·57	0·50
SN74122N	0·80	0·80	0·70
SN74123N	1·44	1·44	1·26
SN74125N	0·69	0·69	0·60
SN74126N	0·69	0·69	0·60
SN74132N	0·72	0·72	0·63
SN74136N	0·63	0·63	0·55
SN74141N	1·00	0·90	0·80
SN74142N	2·88	2 88	2 52
SN74145N	1·44	1·44	1·26
SN74147N	2·30	2·30	1·83
SN74148N	2·01	2·01	1·63
SN74150N	2·30	2·30	2·01
SN74151N	1·15	1·15	1·00
SN74153N	1·09	1·09	0·95
SN74154N	2·30	2·30	2·01
SN74155N	1·15	1·15	1·00
SN74156N	1·09	1·09	1·00
SN74157N	1·09	1·09	0·95
SN74159N	2·44	2·44	2·14
SN74160N	1·58	1·58	1·38
SN74161N	1·58	1·58	1·38
SN74162N	1·58	1·58	1·38
SN74163N	1·58	1·58	1·38
SN74164N	2·01	2·01	1·76
SN74165N	2·01	2·01	1·76
SN74166N	2·16	2·16	1·89
SN74167N	4·10	4·10	3·59
SN74170N	2·88	2·88	2·52
SN74172N	5·76	5·76	5·04
SN74173N	1·66	1·66	1·45
SN74174N	1·80	1·80	1·57
SN74175N	1·29	1·29	1·13
SN74176N	1·44	1·44	1·26
SN74177N	1·44	1·44	1·26
SN74180N	1·44	1·44	1·26
SN74181N	5·18	5·18	4·53
SN74182N	1·44	1·44	1·26
SN74184N	2·16	2·16	1·89
SN74185AN	2·16	2·16	1·89
SN74188N	6·48	6·48	5·67
SN74190N	2·30	2·30	2·01
SN74191N	2·30	2·30	2·01
SN74192N	2·30	2·30	2·01
SN74193N	2·30	2·30	2·01
SN74194N	1·72	1·72	1·51
SN74195N	1·44	1·44	1·26
SN74196N	1·58	1·58	1·38
SN74197N	1·58	1·58	1·38
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BA115	10p	BFY50	20p	OA200	8p	P346A	20p	2N2926	10p	40361	45p
BAX13	5p	BFY51	20p	OA202	10p	TIL209	25p	2N3053	20p	40362	40p
BC107	12p	BFY64	45p	OC16	85p	TIP29A	49p	2N3054	45p	40408	50p
BC108	12p	BFY90	75p	OC20	1·25	TIP30A	58p	2N3055	45p	40486	75p
BC109	12p	BLY36	6·25	OC28	65p	TIP31A	61p	2N3440	50p	40636	1·00
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BC113	16p	BU105	2·20			TIP42A	90p	2N3525	80p		
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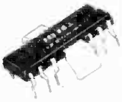
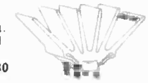


Sinclair IC12 with circuits and data. 6 watt IC with printed circuit board 28 volt operated **£1·80**



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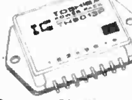

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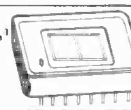

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SC45B	200v	£1·15
SC45D	400v	£1·45
SC45E	500v	£1·85
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3 Amp
T048

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B05/10	100v	22p
B05/20	200v	23p
B05/40	400v	25p
B05/60	600v	27p

½H x ½L x $\frac{3}{16}$" dia.

1 AMP P.I.V.

B1/05	50v	25p
B1/10	100v	25p
B1/20	200v	28p
B1/60	600v	30p

½H x ½L x $\frac{3}{16}$" dia.

1 AMP P.I.V.

W005	50v	29p
W01	100v	30p
W02	200v	32p
W06	600v	35p

⅜ x ⅜" Tubular

2 AMPS P.I.V.

B2/05	50v	35p
B2/10	100v	40p
B2/20	200v	45p
B2/60	600v	50p
B2/100	1000v	55p

½H x ½L x $\frac{3}{16}$" dia.

4 AMPS P.I.V.

B4/100	100v	55p
B4/200	200v	59p
B4/400	400v	65p
B4/600	600v	75p
B4/800	800v	£1·00

½H x ½L x $\frac{3}{16}$" dia.

6 AMPS P.I.V.

B6/05	50v	65p
B6/10	100v	70p
B6/20	200v	80p
B6/40	400v	90p
B6/6x0	600v	£1·00

½H x ½L x $\frac{3}{16}$" dia.

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Type	P.I.V	1-11
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CRS 1/05AF	50v	30p
CRS 1/10AF	100v	30p
CRS 1/20AF	200v	35p
CRS 1/40AF	400v	45p
CRS 1/60AF	600v	55p
THREE AMP (T048)		
CRS 3/05AF	50v	40p
CRS 3/10AF	100v	40p
CRS 3/20AF	200v	45p
CRS 3/40AF	400v	55p
CRS 3/60AF	600v	65p
FIVE AMP		
CRS 5/400	400v	60p
SEVEN AMP (T048)		
CRS 7/100	100v	60p
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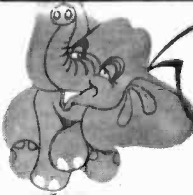

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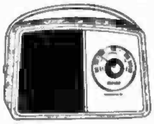
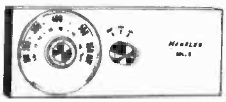
BUILD THIS RADIO



Portable MW / LW radio kit using Mullard RF/IF module. Features MW — bandspread for extra selectivity. Slow motion tuning. Fibre glass PVC cabinet. 600MW output.
All parts £7·98 (battery 22p), carr. etc. 32p



BUILD THIS TUNER

MW/LW Radio Turner to use with any amplifier. Features Mullard RF/IF module Ferrite aerial, built in battery. Excellent results. Size 7" x 2¾" x 3¾". All parts £4·85, carr. 15p.

FIBRE OPTICS

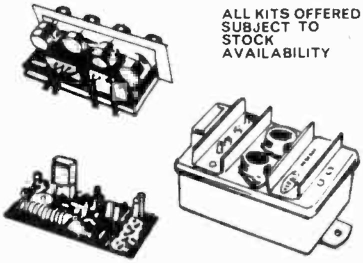
0·01 Diam. Mono Filament £1·50 per 25 metre reel
0·13 Diam. 64 Fibres Sheathed. £1·00 per metre
SPRAYS 15mm Diam. Mares Tails £9·50

KITS BY AMTRON UK LTD

EASY TO BUILD— EVERYTHING SUPPLIED

Model No.		
310	Radio control receiver	3·00
300	4-channel R/C transmitter	5·75
345	Superhet R/C receiver	5·08
450	TV sweep generator	10·24
455	AM signal generator	9·25
460	FM signal generator	9·91
65	Simple transistor tester	1·18
115	8 watt Amplifier	2·87
120	12 watt amplifier	3·88
125	Stereo control unit	4·20
130	Mono control unit	3·52
605	Power supply for 115	3·88
610	Power supply for 120	4·08
615	Power supply for 2 x 120	4·85
230	AM/FM aerial amplifier	2·79
240	Auto packing light	5·18
275	Mic. preamplifier	5·83
480	Electronic voltmeter	17·51
485	0-12v 300mA STAB. supply	9·68
570	LF generator 10Hz–1mHz	12·60
575	Sq. wave generator 20Hz–20Khz	12·87
590	SWR meter	10·24
620	NI-CAD Charger 1·2–12v	7·47
630	STAB Power supply 6-12v 0·25-0·1A	7·65
690	DC motor speed Gov.	2·63
700	Electronic Chaffinch	5·96
705	Windscreen wiper timer	5·56
760	Acoustic switch	8·87
780	Metal Detector (electronics only)	7·27
790	Capacitive Burglar alarm	6·16
810	Dynamic Compressor	6·79
835	Guitar preamp.	3·75
840	Delay car alarm	5·20
875	CAP. Discharge ignition for car engine (-Ve Earth)	10·68
80	Scope Calibrator	1·98
255	Level Indicator	5·50
430	3mHz Millivoltmeter	18·23
525	120–160mHz VHF timer	9·33
715	Photo cell switch	6·93
795	Electronic continuity tester	3·88
860	Photo timer	12·04
871	Slide projector auto feed control	8·72
235	Acoustic Alarm for driver	6·96
465	Quartz XTAL checker	7·89

ALL KITS OFFERED SUBJECT TO STOCK AVAILABILITY



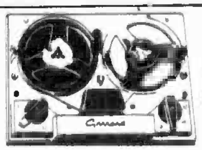
MULTI-USE & RADIONIC KITS

10–1	10 Projects	3·60
50–1	10 Projects	8·00
150–1	150 Projects	13·20
Telephone Communicator		7·20
X20	20 (Elec.) } Projects	4·95
X40	40 (radio) } Projects	9·45

(carr./packing 40p)

All transistor circuits with hand books

All types offered subject to availability. Prices correct at time of press E & OE. 10% VAT TO BE ADDED TO ALL ORDERS. UK post etc. 15p per order.



GARRARD BATTERY TAPE DECK

GARRARD 2 speed 9 volt tape decks. Fitted record/play and oscillator/Erase heads. Wind and rewind controls. Takes up to 4" spools. Brand new complete with head circuits.
£9·50 carr. 30p

TOP QUALITY SLIDER CONTROLS

60mm stroke high quality controls complete with knobs (post, etc. 15p any quantity).

Singles Log and Lin 5K, 10K, 22K, 50K, 100K, 250K, 500K, 1 Meg. 45p each.

Ganged Log and Lin 10K, 22K, 50K, 100K, 250K, 65p each. (Quantity discounts available)

Complete with knobs.

MARRIOT TAPE HEADS

4 TRACK MONO or 2 TRACK STEREO
'17' High Impedance **£2·00**
'18' Med. Impedance **£2·00**
R730/E73 2 track mono Record/Erase low Imp. 75p pair.
Erase Heads for '17' and '18' **75p**
'63' 2 track mono, Hi imp. **£1·75**
'43' Erase Head for '63' **75p**
(Post, etc. 15p any quantity).

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AMPLIFIERS (carr., etc. 20p)

4-300, 0·3 watt 9 volt	1·75
104, 1 watt 9 volt	2·20
304, 3watt 9 volt	2·50
555, 3 watt 12 volt	2·85
E1208, 5 watt 12 volt	4·50
608, 10 watt 24 volt	4·10
410, 10 watt 28 volt	4·95
Z30, 15 watt 30 volt	3·57
E1206, 30 watt 45 volt	9·75
Z50, 30 watt 50 volt	4·37
E1210, 2½ + 2½ watts 12 volt	5·25
RE500, 5 watt IC mains operated Amplifier with controls	£6·30
SAC14, 7 + 7 watt Stereo with controls	£8·00
SAC13, 15 + 15 watt Stereo with controls	£11·00

SINCLAIR UNITS
(carr. 20p)
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Stereo 60 Preamplifier 7·97
PZ5 £3·97, PZ6 £6·37
PZ8 (for Z50) £4·77 (TRANS £2·95)
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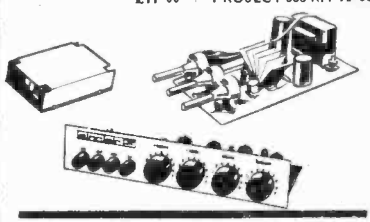
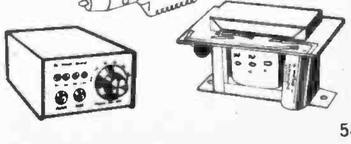
2 x Z30, Stereo 60, PZ6 18·00
2 x Z50, Stereo 60, PZ8 20·25
Transformer for PZ8 2·95
PROJECT 605 KIT 19·95



POWER SUPPLIES FOR EVERY PURPOSE

(All cased unless stated chassis)

470C 6/7½/9 volt 300 MA (includes Multi-Adaptor for Tape Recorders, etc.)	1·95 post 20p
Car Lighter Voltage Adaptors 300mA (State voltage 6v, 7½v, 9v)	1·95 ea. post 25p
SC202 3/6/7½/9 volt 400mA	3·25 carr. 30p
HC244R Stabilised version	4·25 carr. 30p
P500 9 volt 500mA	2·80 post 20p
P11 24 volt 500mA (chassis)	2·80 post 20p
P15 26/28 volt 1 amp (chassis)	2·70 post 20p
P1080 12v 1 amp (chassis)	3·25 post 20p
P1081 45v 0·9 amp (chassis)	4·40 post 20p
P12 4½–12 volt 0·4–1 amp	6·75 post 30p
SE101A 3/6/9/12 volt 1 amp (Stab.)	9·15 post 25p
RP164 6/7½/9/12 1 amp (Stab.)	9·95 post 30p



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EDGWARE ROAD, W2

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(carr./packing 50p)

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	AA5500	78·50
	AA5800	117·50
AMSTRAD	1C2000 Mk. II	29·50
	4000	23·10
EAGLE	TSA149	25·10
	TSA151	34·85
	AA2	30·80
	AA4	42·45
	AA6	55·95
HOWLAND WEST	DA1000	22·45
HENELEC WEST	Kit	28·50
HENELEC TEXAN	Built	35·00
NIKKO	TRM300	25·95
	TRM400	32·50
PIONEER	SA500A	34·25
ROTEL	RA310	36·95
	RA610	54·95
	RA810	75·75
	RA1210	92·50
SINCLAIR	2000	22·95
	3000	28·95
TANDBERG	TA300	66·10
TELETON	SAQ206B	22·50
	SAQ307	22·50
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STEREO RADIO TUNERS
(carr./packing 50p)

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	AT580	94·50
AMSTRAD	3000	23·55
EAGLE	AA8	40·50
	TST152	29·45
HENELEC Stereo Kit		21·00
HENELEC Stereo Built		24·95
HOWLAND WEST	DA1000T	25·35
PIONEER	TX500A	48·75
ROTEL	RT320	36·95
	RT620	57·95
SINCLAIR	2000	26·95
	3000	26·95
TELETON	GT202	30·50

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(carr. etc. 30p)

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DYNACO QUADRATOR		16·90
EAGLE	AA10	12·00
	AA26	16·35
TATE 1	Chassis	7·95
TATE 3	Chassis	15·75
TATE 4	Chassis	19·95
TATE 7	Boxed	25·95

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Recommended pairs 8 ohms
(Carr. / Packing £1·50 pair)

MARSDEN HALL		
110	10 watt	19·95 pr.
150	15 watt	23·50 pr.
200	20 watt	33·50 pr.
AMSTRAD		
Acousta	1500 15 watt	24·90 pr.
Acousta	2500 20 watt	28·50 pr.
DYNACO		
A10	20-60 watts	41·00 pr.
A25	20-60 watts	65·00 pr.
A35	20-60 watts	78·00 pr.
WHARFEDALE		
Denton 2	18 watt	24·40 pr.
Linton 2	20 watt	31·00 pr.
Triton	25 watt	37·75 pr.
LEAK		
160	18 watt	33·50 pr.
250	18 watt	42·50 pr.
CELESTION		
120	20 watt	35·95 pr.
COUNTY	25 watt	31·50 pr.
15	30 watt	47·95 pr.
44	44 watt	79·95 pr.

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	Pioneer PL12D	31·75
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G800	3·75	G820	6·70
G800H	3·50	G820E	10·00
G800E	5·75	G820SE	13·35
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Q36	10·70	Q30	5·90
Q32	8·70		
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Sanyo	GXT4520KL	103·50
Sanyo	GXT4730KL	97·50
Philips	GF908	99·65
Philips	RH802	159·95
Philips	RF836	57·20
Philips	GF826	41·75
Philips	RH813/RH142	129·50
Philips	RH811/RH421	84·95
Philips	RF839	55·95
Philips	GF829	39·95
Philips	GF815	47·75
Philips	GF808	65·75
Philips	RH814/RH411	93·50
Philips	GF603	19·95

8 TRACK STEREO HOME UNITS
(carr/packing 70p)

Amerlex ACR301 — 48·00
(with MW/FM stereo radio)

PORTABLE TV BATTERY / MAINS
(carr./packing £1·00)

Elizabeth T9	9"	43·50
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Teleton TW12	12"	46·95
Sanyo 10T150	12"	49·95

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CAR CIGAR LIGHTER PLUG-IN ADAPTOR £1.95

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(carr./packing 30p)

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Philips	N6720	15·00

Teak AN60/AN80/AN180 stocked

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(carr. etc. 30p)

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Wien	ET1008	11·00
Philips	EL3302	14·40
	N2203	16·60
	N2211	19·95
Sanyo	M1101	13·90
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BATTERY / MAINS CASSETTE
(carr. etc. 35p)

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Amerex	AC101	12·00
Elizabethan	LZ315	12·25
Amerex	AC104	16·00
Philips	N2204	20·75
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PYE	9115	27·75
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Sanyo	M2000G	23·25
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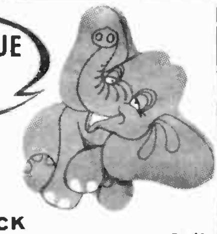

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Philips	RR322	28·75
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Sanyo	M4141	39·50
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Tandberg	TCD300	112·00
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	GXC45D	74·00
	GXC46D	84·30
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Akai	4000DS	59·95
Tandberg	3321X/3341X	102·80

Large range Akai/Tandberg/Revox/Teac stocked.

8 TRACK

Akai	CR81D	54·10
	CR80DSS	94·95

STEREO RECORDERS
(carr./packing 70p)

Akai	1721L	60·35
Cassette		
Akai	GXC40	67·95
	GXC46	90·75
Philips	N2400/RH411	63·75
	N2401/RH411	74·50
	N2401S/RH411	79·95
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STEREO TUNER AMPLIFIERS
(carr./packing 75p)

Akai	AA8030	92·50
Goodmans Module 80		58·90
Goodmans Module 90		75·90
Goodmans One/Ten		88·50
Pioneer	SX525	90·75
	SX626	124·75
Rotel	RX150A	42·95
	RX200A	53·95
	RX400A	65·95
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	RX800	116·50
	RX154A	78·95
Tandberg	TR200MPX	85·00
	TR1000MPX	125·35
	TR1010MPX	135·75
Teleton	TSF55	57·20

8 TRACK

Akai	CR81	66·20

8 TRACK PLAYER DECKS
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Elizabethan	8/LZ1	13·40
McDonald/BSR	TD8S	12·75
	TD83V	15·25

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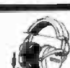

AKAI	
ASE9S	5·80
ASE20	7·30
ASE22	8·25
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SH650D	2·25
SH850GX	3·95
SH1300VS	5·25
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K60	9·25
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T5A	4·95
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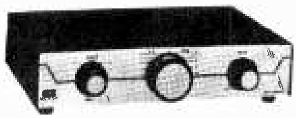


P.R.40

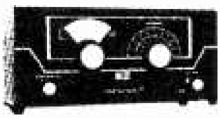
SOLID STATE R.F. PRESELECTOR

The PR40 R.F. Preselector is the solid state version of the world famous PR30 which is now supercedes.

It employs Silicon "N" Channel FET (Field Effect Transistor) front end, followed by silicon NPN Broad Band R.F. Amp., and will substantially improve receiver performance over the range 1·5 to 35 MHz, providing a considerable increase in gain up to an overall average of 30 dB, with improved image rejection and noise ratio.

Supplied complete with co-ax plug (less standard 9 volt PP6 Battery), 12 months Guarantee.

£10·12 V.A.T./Carr. Paid.



MULTIBAND—6

SOLID STATE

SHORT WAVE RECEIVER KIT

All transistor T.R.F. Receiver tunes 550 KHz to 30 MHz (540 to 10 metres) complete coverage—no gaps. Medium waves—Trawlers—Ship/Shore Telephone—All Six Amateur Bands 160-10 metres—International Broadcast from Australia, Far East, Russia, USA etc. using 4 miniature plug in Coils.

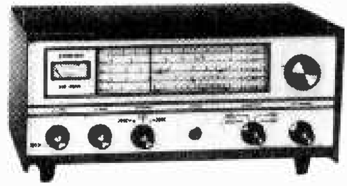
Hi-Gain FET Regen, Det./AF/AF Module giving full loudspeaker output to any external 2/3 ohm speaker. Receives AM/CW/SSB.

Separate Electrical Bandspread, Calibrated Main Tuning.

A Quality CODAR-KIT with 12 months Guarantee. No technical knowledge required, simple to built, printed circuit and Pictorial Instruction Manual, fully detailed step by step.

Complete Kit with 4 Coils (less standard PP6 battery).

£14·90 V.A.T./Carr. Paid.



CR70A

COMMUNICATION RECEIVER

The CODAR CR70A is an outstanding general coverage communication receiver, ideal for the keen S.W.L.
It tunes from 540 metres medium through to 10 metres with no gaps. Covers shipping, coastguard and distress frequencies, all six amateur bands 160-10 metres, International broadcast, Met. stations etc. etc. giving world-wide reception, Exclusive features include Air-spaced CODAR-COIL Hi-"Q" Aerial input, illuminated Meter and Slide Rule Scale, Two Speed vernier tuning, Switched B.F.O. for CW/SSB signals. Separate output for Tape recorder.
Ready to plug in to 200/240 volts A.C. it only needs your aerial and a 2/3 ohm loudspeaker to bring the world to your finger tips. 12 months full guarantee. Complete ready built. £31·00 V.A.T. /Carr. Paid.

SEND FOR YOURS TODAY!

FREE LEAFLETS ON REQUEST.

NOTE: These CODAR Receivers meet the B.R.E.M.A. specification for Communication Receivers. Some portable receivers being advertised as Communication Receivers do not meet these requirements.

TRADE DESCRIPTIONS ACT 1968

It is illegal to make false claims or misleading statements in advertising. The following are just a few extracts from the many letters received from satisfied customers. All are unsolicited and can be inspected at any time.

Mr. S. Keightly, Southsea, Hants.
I am delighted with the CODAR equipment I am using . . . everything has come up to your specifications.

Dr. R. E. Wood, Louisiana State University, U.S.A.
Congratutlaions on an excellent product. The PR40 Preselector is the first preselector I have found to operate efficiently with ample gain, and without feedback or image problems.

Mr. W. R. Jones, Woy, N.S.W., Australia.
The PR40 peaked signals remarkably and performed as you claim. I am very satisfied.

M. G. Bennett, Bath, Somerset.
I am very pleased with my CR70A—results are excellent with many overseas stations I have not heard before and excellent results on the Amateur Bands.

Mr. J. Macdonald, Coningsby, Lincoln.
Received Multiband Kit OK. Assembled it in two hours, worked a treat first time.

Mr. E. Joy, Chesham, Bucks.
The performance of the CR70A is out of this world for its price, and its construction and design, great. I am really delighted . . . I cannot fault it.

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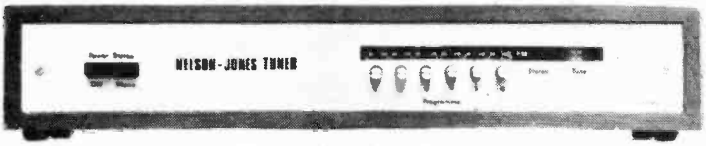

VARICAP TUNING

as in 'W.W.' June '73

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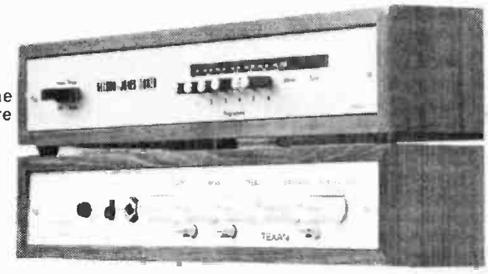

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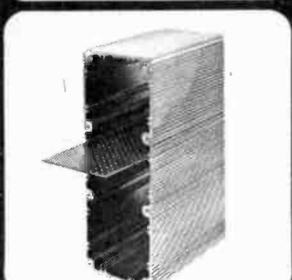

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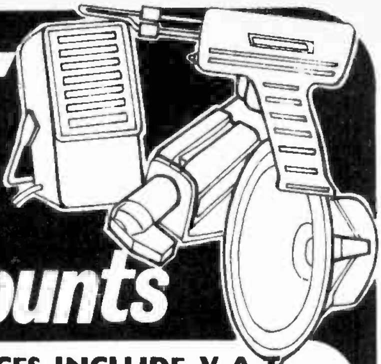

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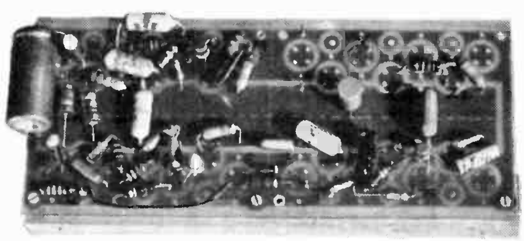

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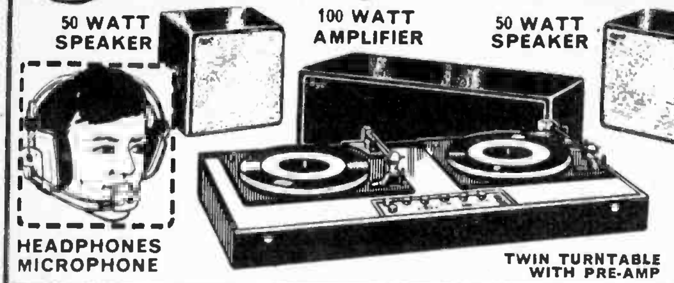

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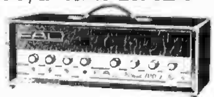

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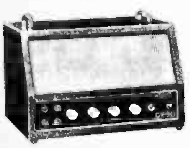
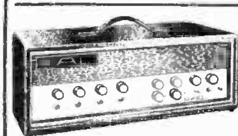
RSC GP30 HI-FI AMPLIFIER
For Guitar, Vocal or Instrumental Group



A 4 input, 2 vol. control Hi-Fi 30 watt unit with Separate Bass and Treble controls. Current valves. Peak output rating. Strong Rexine covered cabinet with handles. Attractive black/silver P.V.C. fascia. Neon indicator. For 200-250v. A.C. mains. For 3 or 15 ohm speakers. Send S.A.E. for leaflet. Terms: Deposit £4·40 and 9 monthly payments of £2·75 (Total £29·15). **£25·85** Carr. 72p

FAL TWIN CHANNEL AMPLIFIERS



Solid State. 4 sep. controlled inputs plus master volume control. Individual Bass and Treble controls. Output for speakers 3–30 ohms. Protective circuitry against damage from short circuits.

FAL 'SUPER 50' 50 WATTS MUSIC RATING **£59·50** Carr. 80p
Terms: Dep. £8·50 & 9 mthly. pymts. £6·50 (Total £67)

FAL 'SUPER 100' 100 WATTS MUSIC RATING **£79·95** Carr. 90p
Terms: Dep. £12·50 & 12 mthly. pymts. £6·45 (Total £89·90)

HUGE DISCOUNTS
ON LEADING BRAND TAPE AND TURNTABLE UNITS

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AKAI GXC 40D Tape Unit £62·95 (Rec. Price £89·74) Carr. £1
AKAI 4000DS Tape Unit £68·95 (Rec. Price £93·50) Carr. £1
AKAI 1721L Tape Unit £66·95 (Rec. Price £93·87) Carr. £1
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Also FREE with above GL72 Goldring G800 cartridge worth over £10
B.S.R. MACDONALD MP60 TYPE T/Table & P.U. £10·95 (Rec. Price £14·95) Carr. 40p
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These are only a few of our many discount lines—visit your nearest RSC Hi Fi Centre

FANE 'MODE ONE' HIGH FIDELITY SPEAKER KIT

Incorporating a model 803 8" 13,000 Gauss Bass Speaker with ultra low resonance. P.V.C. surround cone. Printed circuit cross-over assembly with ferrite cored coils. Model 303 Pressure Tweeter, Acoustic damping material, Screws, Panels etc., and instructive diagrams, Frequency Response 25 Hz–20 kHz. Impedance 8–15 ohms.

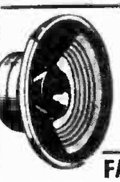
£10·98 post free
Or Dep. £2·47 & 9 mthly pymnts. £1·28 (Tot. £13·99)

RSC G66 MkII 6+6 WATT high quality STEREO AMPLIFIER

Individual Ganged Controls: Bass, Treble, Volume and Balance. Printed circuit construction employing 10 Transistors plus Diodes. Output rating I.H.F.M. Frequency range 20-20,000 c.p.s. Bass Control ± 12db. Treble Control ± 13db. Selector switch for P.U. or Tape/Radio. For loudspeaker output impedances of 3 to 15 ohms. For standard 200-250v. A.C. mains operation. Attractive Black and Silver finished metal fascia plate and matching control knobs.

COMPLETE KIT OF PARTS INCLUDING FULLY WIRED PRINTED CIRCUIT and COMPREHENSIVE WIRING DIAGRAMS & INSTRUCTIONS **£12·65** Carr. 40p
Or FACTORY BUILT IN TEAK VENEERED CABINET as illustrated £16·50 or dep. £2·50 and 9 monthly payments £1·83 (Total £18·97).

AUDIOTRINE HIGH FIDELITY SPEAKERS



Heavy construction. Latest high efficiency ceramic magnets. Plasticised Cone surround. "D" indicates Tweeter Cone providing extended frequency range up to 15,000 c.p.s. Impedance 3 or 8-15 ohms. PLEASE STATE CHOICE.

Exceptional performance at low cost.

HF808T	8"	10W	£2·98	HF120D	12"	15W	£5·50
HF102D	10"	10W	£3·30	HF126	12"	15W	£6·35
HF120	12"	15W	£4·95	HF126D	12"	15W	£6·85

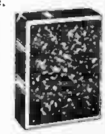
FANE 807T HIGH FIDELITY SPEAKER

A full range 8in. 10 watt unit for excellent sound quality, in suitable enclosure. Cast chassis Roll P.V.C. cone surround and long throw voice coil to achieve very low fundamental resonance of 30 c.p.s. Tweeter cone is fitted to extend high note response. Frequency range 25 Hz to 15 KHz. Gauss 10,000. Impedance 3 or 8-15 Ω. Post Free **£4·99**
PLEASE STATE IMPEDANCE WHEN ORDERING
MODEL 803T 8" 15w. with parasitic Tweeter. Response 25 Hz to 15 KHz. Gauss 13,000 Imp 3 or 8–15Ω. **£6·99** Post Free

ALL R.S.C. PRICES INCLUDE VAT FULL LABOUR AND MATERIAL GUARANTEES FOR 12 MONTHS

HI-FI SPEAKER ENCLOSURES MODERN DESIGN

Teak veneer finish. Acoustically lined. Sizes approx. Carr. 35p. per enc.



JE8 Size 16" × 11" × 9". Pressurised. Gives pleasing results with any 8in. Hi-Fi speaker. **£5·50**

SE8 For optimum performance with any 8in. Hi-Fi speaker. Size 19 × 10½ × 9in. **£6·50**

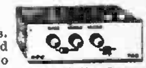
SE10 For outstanding results with 10in. Hi-Fi spkr. Size 25½ × 16 × 9in. Ported **£6·75**

SE12 For excellent performance with 12in. Hi-Fi speaker and tweeter Size 25½ × 16 × 9in. **£7·95**

AUDIOTRINE HI-FI SPEAKER SYSTEMS

Consisting of matched 12in. 11,000 line 15 Watt 15 ohm high quality speaker, cross-over unit and tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. **£6·50** Carr. 33p
OR SENIOR 15 WATT INCLUDING HF126 15,000 LINE SPEAKER **£7·65** Carr. 39p

R.S.C. TA6 6 Watt HI-FI AMPLIFIER



200-250v. AC mains operated. Frequency Response 30-20,000 c.p.s. −2dB. Harmonic Distortion 0·3% at 1,000 c.p.s. Separate Bass and Treble 'lift and cut' controls. 3 input sockets for Mike, Gram, Radio or Tape. Input selector switch. Output for 3-15 ohm spkrs. Max. sensitivity 5mV Output rating I.H.F.M. Fully enclosed enamelled case, 9½ × 2½ × 5½in. Attractive brushed silver finish facia plate 10½ × 3½in. and matching knobs. Complete kit of parts with full wiring diagrams and instructions. **£8·50** Carr. 40p.
OR FACTORY BUILT WITH 12 MONTHS' GUARANTEE £12·05

R.S.C. BATTERY/MAINS CONVERSION UNITS

TYPE BM1. An all-dry battery eliminator. Size 5½ × 4½ × 2in. approx. Completely replaces batteries supplying 1·5v and 90v, to battery radio where A.C. mains 200/250v. 50c/s is available. Post 30p
ASSEMBLED READY FOR USE **£4·15**

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

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

MIDGET CLAMPED TYPE 2½ × 2½ × 2½in.
250v., 60mA, 6·3v. 2a .... £1·10
250-0-250v., 60mA 6·3v 2a .... £1·16

FULLY SHROUDED UPRIGHT MOUNTING
250-0-250v. 60mA, 6·3v. 2a., 0-5-6·3v. 2a. £1·55
250-0-250v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a. £2·45
300-0-300v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a. £2·45
300-0-300v. 130mA, 6·3v. 4a. c.t., 6·3v. 1a. For Mullard 510 Amplifier .... £2·95
350-0-350v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a. £2·45
350-0-350v. 150mA, 6·3v. 4a., 0-5-6·3v. 3a. £2·95
425-0-425v. 200mA, 6·3v. 4a., c.t., 5v. 3a. £5·45
425-0-425v. 200mA, 6·3v. 4a., 6·3v. 3a., 5v. 3a .... £5·60
450-0-450v. 250mA, 6·3v. 4a., c.t., 5v. 3a. £6·00

TOP SHROUDED DROP-THRO' TYPE
250-0-250v. 70mA, 6·3v. 2a., 0-5-6·3v. 2a. £1·49
250-0-250v. 100mA, 6·3v. 3·5a. .... £1·71
250-0-250v. 100mA, 6·3v. 2a., 6·3v. 1a. .. £1·75
350-0-350v. 80mA, 6·3v. 2a., 0-5-6·3v. 2a. £1·81
250-0-250v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a. £2·45
300-0-300v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a. £2·45
300-0-300v. 130mA, 6·3v. 4a., c.t. 6·3v. 1a. Suitable for Mullard 510 Amplifier ...... £2·85
350-0-350v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a. £2·45
350-0-350v. 150mA, 6·3v. 4a., 0-5-6·3v. 3a. £2·85

FILAMENT or TRANSISTOR POWER PACK Types 6·3v. 1·5a. 55p; 6·3v. 2a. 60p; 6·3v. 3a. 85p; 6·3v. 6a. £1·45; 12v. 1a. 61p; 12v. 3a. or 24v. 1·5a £1·50; 0·9-18v 1½a £1·25; 0-12-25-42v 2a £1·95.

CHARGER TRANSFORMERS 0-9-15v. 1½a. £1·10, 2½a. £1·25; 3a. £1·40; 5a. £1·60; 6a. £1·85; 8a. £2·20
AUTO (Step UP/step DOWN) TRANSFORMERS 0-110/120v. 200-230-250v. 50-80 watts £1·25. 150 watts, £2·10 250 watts £3·00; 500 watts £6·40
OUTPUT TRANSFORMERS
Standard Pentode 5,000 Ω or 7,000 Ω to 3 Ω 55p
Push-Pull 8 watts EL84 to 3 Ω or 15 Ω .. 95p
Push-Pull 10 watts 6V6, ECL86 to 3, 5, 8 or 15 Ω .... £1·55
Push-Pull EL84 to 3 or 15 Ω 10-12 watts .. £1·50
Push-Pull Ultra Linear for Mullard 510, etc. £2·45
Push-Pull 15-18 watts, sectionally wound 6L6, KT66, etc., for 3 or 15 Ω .... £2·20
Push-Pull 20 watt high quality sectionally wound EL34, 6L6, KT66 etc. to 3 or 15 Ω £3·65

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All 6/12v. D.C. output. Max. A.C. input 18v.
1a, 28p. 2a, 39p. 3a, 55p. 4a, 72p. 6a, 88p.

SMOOTHING CHOKES
150mA, 7-10H, 250 Ω 77p; 100mA, 10H, 200 Ω 66p; 80mA, 10H, 350 Ω 55p; 60mA, 10H, 400 Ω 28p.

R.S.C. MkIII SUPER 30 HIGH FIDELITY STEREO AMPLIFIER

BUILD AN AMPLIFIER WORTH APPROXIMATELY DOUBLE THE KIT PRICE INCLUDING CABINET
Only high grade components by leading manufacturers

- Push Button Selector Switching
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- Neon Indicator
- Satin Silver Finish Metal Fascia
- Solid State Circuitry
- Twenty Silicon Transistors
- Four Diodes, Four Rectifiers

Send S.A.E. for full descriptive leaflet.

For Magnetic or Ceramic Pick-Ups regardless of Price. Output (per channel) 15 watts RMS into 8Ω. Frequency Response 7 Hz to 70 KHz ± 1½ dB.

COMPLETE KIT (less cabinet). Carr. 70p. Cabinet if req. £5 extra. **£27·50**

FACTORY BUILT UNIT INC. CABINET with 12 months' guarantee. Or Dep. £7 and 9 monthly payments £4·54 (Total £47·86). **£42·50**

R.S.C. STEREO FM III TUNER. in cabinet Visually matches Super 30 Mk. III **£37·50**

'YORK' HIGH-FIDELITY 3 SPEAKER SYSTEM

★ Moderate size only 25 × 14 × 10in. approx.
★ Response 30-20,000 c.p.s. Impedance 15 ohms
★ Performance comparable with units costing considerably more

COMPLETE KIT **£25·25** Carr. 65p

Consists of (1) 12in. 15 watt Bass unit with cast chassis, Roll rubber cone surround for ultra low resonance, and ceramic magnet. (2) 3-way quarter section series cross-over system. (3) 8 × 5in. high flux middle range speaker. (4) High efficiency tweeter. (5) Appropriate quantity acoustic damping material. (6) Handsome Teak veneered cabinet. (7) Circuit and full instructions. Terms: Deposit £5 and 9 monthly payments £2·64 (Total £28·76).

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DARLINGTON 19 Northgate (Closed Wed.). Tel. 68043
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EDINBURGH 101 Lothian Rd. (Closed Wed.). Tel. 229 9501
GLASGOW 326 Argyle St. (Closed Tues.). Tel. 248 4158
HULL 7 Whitefriargate (Closed Thurs.). Tel. 20505
LEICESTER 32 High Street (Closed Thurs.). Tel. 56420
LEEDS 5-7 County (Mecca) Arcade, Briggate (Closed Wed.). Tel. 28252
LIVERPOOL 73 Dale St. (Closed Wed.). Tel. 236 3573
LONDON 238 Edgware Road, W.2. (Closed Thurs.). Tel. 723 1629
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MIDDLESBROUGH 106 Newport Rd. (Closed Wed.). Tel. 47096
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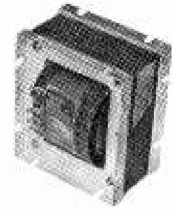
NOTTINGHAM 19/19A Market Street (Closed Thurs.). Tel. 48068
SHEFFIELD 13 Exchange Street (Castle Mkt. Blds. (Closed Thurs.). Tel. 20716
STOCKPORT 8 Little Underbank (Closed Thurs.). Tel. 480-0777
SUNDERLAND 5 Market Sq. (Closed Wed). Tel. 70573

MAINS TRANSFORMERS



SAFETY ISOLATING TRANSFORMERS

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

VA (watts)	Ref No.	Price £	P & P £
60	149	2·86	0·38
100	150	3·15	0·52
200	151	5·30	0·52
250	152	7·05	0·65
350	153	9·40	0·80
500	154	13·55	1·00
1000	156	24·97	1·20
2000	158	41·25	*
3000	159	64·54	*
6000	160	105·90	*

* On application.

AUTO TRANSFORMERS

Taps:- 115, 210, 240V

VA (watts)	Type No.	Price £	P & P £
20	113	1·00	0·22
75	64	2·00	0·30
Taps:- 115, 200, 220, 240V			
150	4	2·40	0·38
300	66	4·70	0·52
500	67	6·90	0·69
1000	84	12·60	0·82
2000	95	24·00	1·10
3000	73	32·60	1·20

CASED AUTO TRANSFORMERS

220/240V to 115V, Lead & Socket

20	113G	1·95	0·22
500	671G	9·46	0·67
1000	841G	16·50	1·00

LOW VOLTAGE TRANSFORMERS

Prim:- 200-240V. Sec:- 12 & 24V.

Amps 12V	Amps 24V	Type No.	Price £	P & P £
0·5	0·25	111	1·00	0·22
1	0·5	213	1·23	0·22
2	1	71	1·60	0·22
4	2	18	2·25	0·38
6	3	70	2·70	0·42
8	4	108	3·00	0·52
10	5	72	3·55	0·52
12	6	116	4·50	0·52
16	8	17	5·50	0·52
20	10	115	6·95	0·69
30	15	187	12·90	0·97
40	20	232	18·30	1·00
60	30	226	23·70	1·10

30V TRANSFORMERS

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

Amps	Type	Price	P & P
0·5	112	1·20	0·22
1	79	1·64	0·38
2	3	2·45	0·38
3	20	3·00	0·42
4	21	3·55	0·52
5	51	4·40	0·52
6	117	5·25	0·52
8	88	6·80	0·67
10	89	8·36	0·67

50V TRANSFORMERS

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

Amps	Type	Price	P & P
0·5	102	1·60	0·30
1	103	2·35	0·38
2	104	3·25	0·42
3	105	4·40	0·52
4	106	5·48	0·52
6	107	8·65	0·67
8	118	11·27	0·97
10	119	14·15	0·97

60V TRANSFORMERS

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

Amps	Type	Price	P & P
0·5	124	1·60	0·38
1	126	2·25	0·38
2	127	3·55	0·42
3	125	5·40	0·52
4	123	6·98	0·67
5	40	8·46	0·67
6	120	9·20	0·82
8	121	11·60	1·00
10	122	15·25	1·00
12	189	16·43	1·10

MINIATURE AND EQUIPMENT TRANSFORMERS

Prim 240V with screen

Volts Sec. 1	Volts Sec. 2	Milliamps Sec. 1	Milliamps Sec. 2	Type No.	Price £	P & P £
3-0-3	—	200	...	238	1·12	0·10
0-6	0-6	500	500	234	1·18	0·10
0-6	0-6	1000	1000	212	1·28	0·22
9-0-9	—	100		13	0·95	0·10
0-9	0-9	330	330	235	1·28	0·10
0-8-9	0-8-9	500	500	207	1·70	0·22
0-8-9	0-8-9	1000	1000	208	2·30	0·30
15-0-15	—	40		240	1·28	0·10
0-15	0-15	200	200	236	1·28	0·10
20-0-20	—	30		241	1·09	0·10
0-20	0-20	150	150	237	1·28	0·10
0-15-20	0-15-20	500	500	205	2·16	0·38
0-20	0-20	300	300	214	1·36	0·22
20-12-0-12-20		700(D/C)		221	1·21	0·30
0-15-20	0-15-20	1000	1000	206	3·10	0·38
0-15-27	0-15-27	500	500	203	2·38	0·38
0-15-27	0-15-27	1000	1000	204	2·40	0·38

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One Amp	Two Amp	Four Amp	Six Amp
50 Volt 25p	50 Volt 35p	100 Volt 55p	50 Volt 65p
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200 Volt 28p	200 Volt 45p	400 Volt 65p	200 Volt 80p
600 Volt 30p	600 Volt 50p	600 Volt 75p	400 Volt 90p
	1000 Volt 55p	800 Volt £1·00	600 Volt £1·00

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1T4	·18	DAF96	·35	ECH35	·46	EM80	·35	PCF805	·65	U25	·63
3S4	·22	DF91	·18	ECH42	·55	EM81	·35	PCL82	·28	U26	·59
3V4	·46	DF96	·35	ECH81	·21	EM84	·30	PCL83	·53	U191	·60
6/30L2	·48	DK91	·25	ECL80	·27	EY86	·27	PCL84	·31	U251	·60
6BW7	·48	DK92	·47	ECL82	·27	EZ80	·19	PCL85	·36	UABC80	·28
6F23	·64	DK96	·43	ECL83	·48	EZ81	·21	PCL86	·35	UBC41	·40
6F25	·49	DL92	·22	ECL86	·32	KT61	·73	PFL200	·48	UBF89	·31
787	£1·75	DL94	·46	EF39	·43	KT66	·75	PL36	·45	UCC85	·31
12AU7	·17	DL96	·36	EF41	·54	N78	£1·00	PL81	·41	UCH42	·54
25L6GT	·18	DY86	·21	EF80	·22	PC86	·42	PL82	·27	UCH81	·28
30C15	·53	DY87	·21	EF85	·26	PC88	·42	PL83	·30	UCL82	·30
30C17	·73	DY802	·28	EF86	·26	PC97	·34	PL84	·26	UCL83	·48
30C18	·65	EABC80	·29	EF89	·21	PC900	·28	PL500	·56	UF41	·47
30F5	·58	EBC33	·41	EF91	·15	PCC84	·26	PL504	·56	UF89	·24
30FL1	·58	EBC41	.42	EF92	·25	PCC89	·40	PY32	·47	UL41	·52
30FL14	·63	EBF89	·24	EF183	·26	PCC189	·46	PY33	·47	UL84	·27
30P19	·63	ECC81	·15	EF184	·27	PCF80	·25	PY81	·24	UY41	·35
30PL1	·54	ECC82	·17	EL33	·73	PCF86	·44	PY82	·23	UY85	·22

Post/Packing on 1 valve 7p, plus 3p per valve on each extra valve. Any parcel insured against damage in transit 3p extra. Office address, no callers.

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Another winner!

fane MODE ONE HIGH FIDELITY LOUDSPEAKER KIT

Recommended retail price

£10·98

including V.A.T.

Consisting of a Fane Model 803 ultra-low resonance 8″ speaker unit with PVC cone surround, and a Fane Model 303 high frequency pressure tweeter together with a printed circuit cross-over assembly with ferrite cored coils.

SPECIFICATION OF UNITS

	Model 803	Model 303
Overall Diameter	8″	3″
Natural resonance	30Hz	—
Main resonance	*35Hz	1200Hz
Magnet Pole Diameter	1″	¾″
Magnet Flux Density	13,000 gauss	10,000 gauss
Frequency response	30Hz–8kHz	2kHz–17kHz
Impedance	8–15 ohms	8–15 ohms
Power Handling	*15 watts	*15 watts

Very easy to assemble, this boxed kit comes with acoustic foam damping material, panels, screws, wire, wiring diagrams and instructions to provide a remarkable loudspeaker assembly—a pair is ideal for stereo.

CABINETS for the 'Mode One' are available in Teak veneer finish. SIZE 15¾″ x 10¾″ x 9″.

**When used with above cabinet.*

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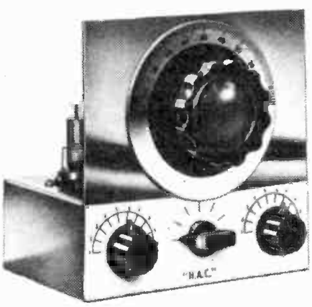
H.A.C. SHORT-WAVE KITS

WORLD-WIDE RECEPTION



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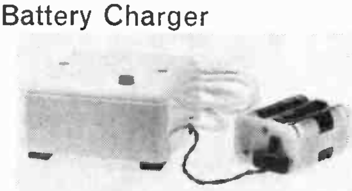

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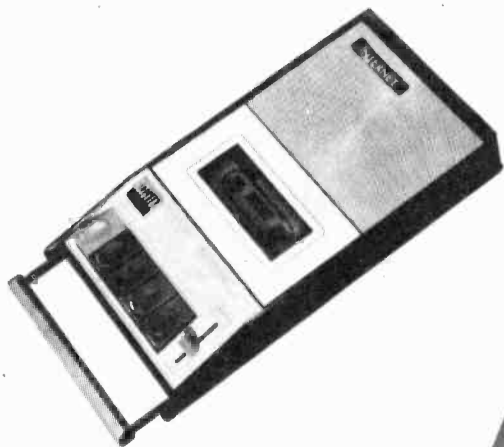

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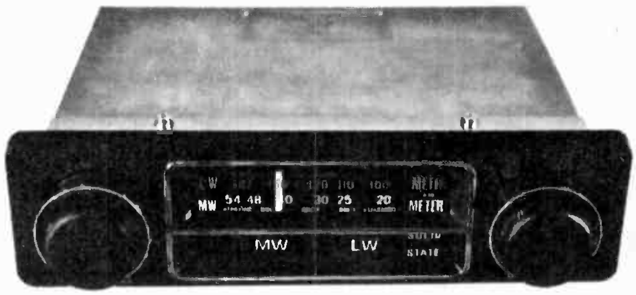

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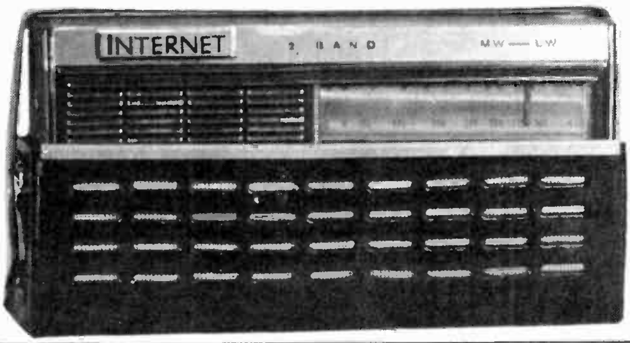

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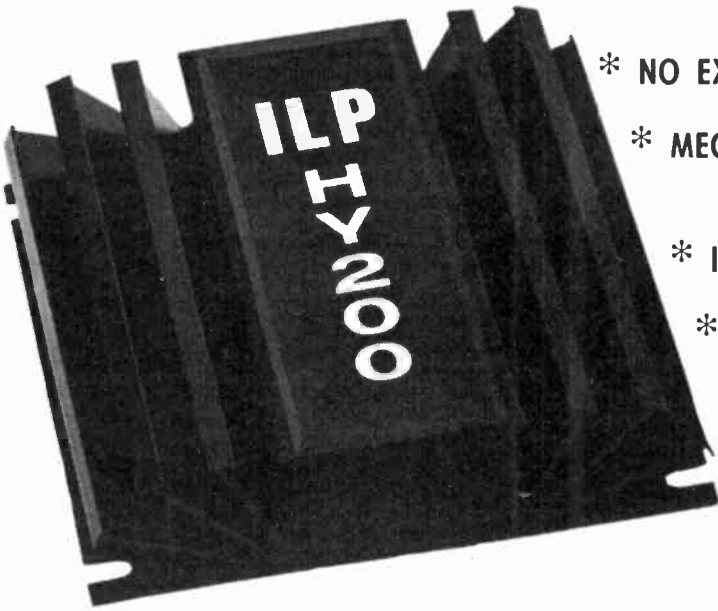

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Type	Price p
AC107	22
AC113	22
AC115	26
AC117K	22
AC122	13
AC125	19
AC126	19
AC127	19
AC128	19
AC132	16
AC134	16
AC137	16
AC141	16
AC141K	19
AC142	13
AC142K	19
AC151	17
AC154	22
AC155	22
AC156	22
AC157	27
AC165	22
AC166	22
AC167	22
AC168	27
AC169	16
AC176	22
AC177	27
AC178	31
AC179	31
AC180	19
AC180K	22
AC181	19
AC181K	22
AC187	24
AC187K	22
AC188	24
AC188K	22
ACY17	28
ACY18	22
ACY19	22
ACY20	22
ACY21	22
ACY22	18
ACY27	20
ACY28	21
ACY29	39
ACY30	31
ACY31	31
ACY34	23
ACY35	23
ACY36	31
ACY40	19
ACY41	20
ACY44	39
AD130	42
AD140	53
AD142	53
AD143	42
AD149	55

Type	Price p
AD161	37
AD162	37
AD161 & AD162 (MP)	61
ADT140	55
AF114	27
AF115	27
AF116	27
AF117	27
AF118	39
AF124	33
AF125	28
AF126	31
AF127	31
AF139	33
AF178	33
AF179	55
AF180	55
AF181	50
AF186	50
AF239	41
AL102	72
AL103	72
ASY26	28
ASY27	33
ASY28	28
ASY29	28
ASY50	28
ASY51	28
ASY52	28
ASY54	28
ASY55	28
ASY56	28
ASY57	28
ASY58	28
ASZ21	44
BC107	10
BC108	10
BC109	11
BC113	11
BC114	17
BC115	17
BC116	17
BC117	17
BC118	11
BC119	33
BC120	88
BC125	13
BC126	20
BC132	13
BC134	20
BC135	13
BC136	17
BC137	17
BC139	44
BC140	33
BC141	33
BC142	33
BC143	38

Type	Price p
BC145	50
BC147	11
BC148	11
BC149	13
BC150	20
BC151	22
BC152	19
BC153	31
BC154	33
BC157	20
BC158	13
BC159	13
BC160	50
BC161	55
BC167	13
BC168	13
BC169	13
BC170	13
BC171	16
BC172	16
BC173	16
BC174	16
BC175	24
BC177	21
BC178	21
BC179	21
BC180	27
BC181	27
BC182	11
BC182L	11
BC183	11
BC183L	11
BC184	13
BC184L	13
BC186	31
BC187	31
BC207	12
BC208	12
BC209	13
BC212L	12
BC213L	12
BC214L	16
BC225	28
BC226	39
BCY30	27
BCY31	29
BCY32	33
BCY33	24
BCY34	28
BCY70	16
BCY71	20
BCY72	16
BCZ10	22
BCZ11	28
BCX12	28
BD121	66
BD123	72
BD124	66
BD131	55
BD132	66

Type	Price p
BD133	72
BD135	44
BD136	44
BD137	50
BD138	55
BD139	61
BD140	66
BD155	88
BD175	66
BD176	66
BD177	72
BD178	72
BD179	77
BD180	77
BD185	72
BD186	72
BD187	77
BD188	77
BD189	83
BD190	83
BD195	94
BD196	94
BD197	99
BD198	99
BD199	1·05
BD200	1·05
BD205	88
BD206	88
BD207	1·05
BD208	1·05
BDY20	1·10
BF115	27
BF117	50
BF118	77
BF119	77
BF121	50
BF123	55
BF125	50
BF127	55
BF152	61
BF153	50
BF154	50
BF155	77
BF156	53
BF157	61
BF158	61
BF159	66
BF160	44
BF162	44
BF163	44
BF164	44
BF165	44
BF167	24
BF173	24
BF176	39
BF177	39
BF178	33
BF179	33
BF180	33
BF181	33

Type	Price p
BF182	44
BF183	44
BF184	28
BF185	33
BF188	44
BF194	13
BF195	13
BF196	16
BF197	16
BF200	50
BF222	1·05
BF257	50
BF258	66
BF259	94
BF262	61
BF263	61
BF270	39
BF271	33
BF272	88
BF273	39
BF274	39
BFW10	66
BFX29	30
BFX84	24
BFX85	33
BFX86	24
BFX87	27
BFX88	24
BFY50	22
BFY51	22
BFY52	22
BFY53	19
BPX25	94
BSX19	17
BSX20	17
BSY25	17
BSY26	17
BSY27	17
BSY28	17
BSY29	17
BSY38	20
BSY39	20
BSY40	31
BSY41	31
BSY95	14
BSY95A	14
Bu105	2·20
C111E	55
C400	33
C407	28
C424	22
C425	55
C426	39
C428	22
C441	33
C442	33
C444	39
C450	24
MAT100	21
MAT101	22

Type	Price p
MAT120	21
MAT121	22
MPF102	46
MPF104	41
MPF105	41
OC19	39
OC20	70
OC22	42
OC23	46
OC24	62
OC25	42
OC26	28
OC28	55
OC29	55
OC35	46
OC36	55
OC41	22
OC42	27
OC44	16
OC45	14
OC70	11
OC71	11
OC72	16
OC74	16
OC75	17
OC76	17
OC77	28
OC81	17
OC81D	17
OC82	17
OC82D	17
OC83	22
OC84	22
OC139	22
OC140	22
OC169	28
OC170	28
OC171	28
OC200	28
OC201	31
OC202	31
OC203	28
OC204	28
OC205	39
OC309	44
OCP71	48
ORP12	48
ORP60	44
ORP61	44
P346A	22
P397	46
ST140	14
ST141	19
TI843	33
UT46	30
2G301	21
2G302	21
2G303	21
2G304	27
2G306	44

Type	Price p
2G308	39
2G309	39
2G339	22
2G339A	18
2G344	20
2G345	18
2G371	18
2G371B	13
2G373	19
2G374	19
2G377	33
2G378	18
2G381	18
2G382	18
2G401	33
2G414	33
2G417	28
2N388	39
2N388A	61
2N404	22
2N404A	31
2N524	46
2N527	54
2N598	46
2N599	50
2N696	14
2N697	15
2N698	27
2N699	39
2N706	9
2N706A	10
2N708	13
2N711	33
2N717	39
2N718	27
2N718A	55
2N726	31
2N727	31
2N743	22
2N744	22
2N914	16
2N918	33
2N929	23
2N930	23
2N1131	22
2N1132	24
2N1302	16
2N1303	16
2N1304	19
2N1305	19
2N1306	23
2N1307	23
2N1308	26
2N1309	26
2N1613	22
2N1711	22
2N1889	35
2N1890	50
2N1893	41
2N2147	79

Type	Price p
2N2148	63
2N2160	66
2N2192	39
2N2193	39
2N2194	39
2N2217	24
2N2218	22
2N2219	22
2N2220	24
2N2221	22
2N2222	22
2N2368	19
2N2369	16
2N2369A	16
2N2411	27
2N2412	27
2N2646	52
2N2711	23
2N2712	23
2N2714	23
2M2904	19
2N2904A	23
2N2905	23
2N2905A	23
2N2906	17
2N2906A	20
2N2907	22
2N2907A	24
2N2923	16
2N2924	16
2N2925	16
2N2926(G)	14
2N2926(Y)	12
2N2926(O)	11
2N2926(R)	11
2N2926(B)	11
2N3010	77
2N3011	16

Type	Price p
2N3053	19
2N3054	51
2N3055	55
2N3391	16
2N3391A	18
2N3392	16
2N3393	16
2N3394	16
2N3395	19
2N3402	23
2N3403	23
2N3404	31
2N3405	46
2N3414	17
2N3415	17
2N3416	31
2N3417	31
2N3525	83
2N3646	10
2N3702	11
2N3703	11
2N3704	12
2N3705	11
2N3706	10
2N3707	12
2N3708	8
2N3709	10
2N3710	10
2N3711	10
2N3819	31
2N3820	55
2N3821	39
2N3823	31
2N3903	31
2N3904	33
2N3905	31
2N3906	30
2N4058	13

Type	Price p
2N4059	11
2N4060	13
2N4061	13
2N4062	13
2N4284	19
2N4285	19
2N4286	19
2N4287	19
2N4288	19
2N4289	19
2N4290	19
2N4291	19
2N4292	19
2N4293	19
2N5172	13
2N5457	35
2N5458	35
2N5459	44
28301	55
28302A	46
28302	46
28303	61
28304	77
28305	93
28306	93
28307	93
28321	62
28322	46
28322A	46
28323	62
28324	77
28325	77
28326	77
28327	77
28701	46
40361	44
40362	50

DIODES AND RECTIFIERS

AA119	9
AA120	9
AA129	9
AAY30	10
AAZ13	11
BA100	11
BA116	23
BA126	24
BA148	16
BA154	13
BA155	16
BA156	15
BY100	17
BY101	13
BY105	19
BY114	13
BY126	16
BY127	17
BY128	17
BY130	18

BY133	23
BY164	55
BYX38/30	46
BYZ10	39
BYZ11	33
BYZ12	33
BYZ13	28
BYZ16	44
BYZ17	39
BYZ18	39
BYZ19	31
CG62 (OA91 Eq.)	6
CG651 (OA70-OA79 Eq.)	7
OA5	39
OA58L	23
OA10	39
OA47	8

OA70	8
OA79	8
OA81	8
OA85	10
OA90	7
OA91	7
OA95	8
OA200	7
OA202	8
SD10	6
SD19	6
1N34	8
1N34A	8
1N914	7
1N916	7
1N414B	7
18021	11
18951	7

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BP 710—72710	50p	46p	44p
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μA703C	81p	29p	27p
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TAA 293	99p	83p	77p
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ZN414 .. .. £1·20 each
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BP932	14p	13p	12p
BP933	14p	13p	12p
BP935	14p	13p	12p
BP936	14p	13p	12p
BP944	14p	13p	12p
BP945	28p	27p	24p
BP946	13p	12p	11p
BP948	28p	27p	24p
BP951	72p	66p	61p
BP962	13p	12p	11p
BP9093	44p	42p	39p
BP9094	44p	42p	39p
BP9097	44p	42p	39p
BP9099	44p	42p	39p

Devices may be mixed to qualify for quantity price. Larger quantity prices on application. (DTL 930 Series only).

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TO.3 Plastic 1·5 Amps
UA.7805. 5v. (Equiv. to MVR 5V) £1·76
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	1	25	100+		1	25	100+		1	25	100+
SN7400	0·17	0·16	0·15	SN7450	0·17	0·16	0·15	SN74141	0·74	0·71	0·64
SN7401	0·17	0·16	0·15	SN7451	0·17	0·16	0·15	SN74145	£1·65	£1·54	£1·43
SN7402	0·17	0·16	0·15	SN7453	0·17	0·16	0·15	SN74150	£3·30	£2·97	£2·75
SN7403	0·17	0·16	0·15	SN7454	0·17	0·16	0·15	SN74151	£1·10	£1·05	0·99
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SN7405	0·17	0·16	0·15	SN7470	0·32	0·29	0·27	SN74154	£1·98	£1·87	£1·76
SN7406	0·39	0·34	0·31	SN7472	0·32	0·29	0·27	SN74155	£1·54	£1·43	£1·32
SN7407	0·39	0·34	0·31	SN7473	0·41	0·39	0·35	SN74156	£1·54	£1·43	£1·32
SN7408	0·20	0·19	0·18	SN7474	0·41	0·39	0·35	SN74157	£2·09	£1·98	£1·87
SN7409	0·20	0·19	0·18	SN7475	0·50	0·48	0·46	SN74160	£1·98	£1·87	£1·76
SN7410	0·17	0·16	0·18	SN7476	0·44	0·43	0·42	SN74161	£1·98	£1·87	£1·76
SN7411	0·28	0·27	0·26	SN7480	0·74	0·71	0·64	SN74162	£4·40	£4·13	£3·85
SN7412	0·39	0·34	0·31	SN7481	£1·32	£1·27	£1·21	SN74163	£4·40	£4·13	£3·85
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PIV	1A TO5	3A TO66	5A TO66	5A TO64	7A TO48	10A TO48	16A TO48	30A TO48
50	0·26	0·28	0·39	0·39	0·52	0·55	0·59	1·27
100	0·28	0·37	0·52	0·52	0·55	0·64	0·70	1·54
200	0·39	0·41	0·54	0·54	0 63	0·67	0·83	1·76
400	0·48	0·52	0·62	0·62	0·74	0·83	1·03	1·93
600	0·59	0·63	0·75	0·75	0·85	1·07	1·38	—
800	0·70	0·77	0·88	0·88	0·99	1·32	1·65	4·40

SIL. RECTS. TESTED

PIV	300mA	750mA	1A	1·5A	3A	10A	30A
50	0 04	0·06	0·06	0·08	0·16	0·23	0·66
100	0·04	0·07	0·06	0·15	0·18	0·26	0·83
200	0·06	0·10	0·07	0·16	0·22	0·27	1·10
400	0·07	0·15	0·08	0·22	0·30	0·41	1·38
600	0·08	0·18	0·11	0·26	0·38	0·50	2·05
800	0·11	0·19	0·12	0·28	0·41	0·61	2·20
1000	0·12	0·28	0·16	0·33	0·51	0·70	2·75
1200	—	0·37	—	0·42	0·63	0·83	—

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UIC05 = 12 × 7405	0·55	UIC54 = 12 × 7454	0·55	UIC95 = 5 × 7495	0·55
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UIC10 = 12 × 7410	0·55	UIC72 = 8 × 7472	0·55	UIC121 = 5 × 74121	0·55
UIC20 = 12 × 7420	0·55	UIC73 = 8 × 7473	0·55	UIC141 = 5 × 74141	0·55
UIC30 = 12 × 7430	0·55	UIC74 = 8 × 7474	0·55	UIC151 = 5 × 74151	0·55
UIC40 = 12 × 7440	0·55	UIC76 = 8 × 7476	0·55	UIC154 = 5 × 74154	0·55
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H8/3A	4μf	50v	4p	H7/6A	100μf	15v	4p
H8/4	4·7μf	25v	4p	H7/7	100μf	25v	4p
H8/4A	5μf	64v	4p	H7/8	125μf	16v	5p
H8/5	5μf	10v	4p	H7/8A	100μf	35v	6p
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H8/7	10μf	70v	4p	H7/10	125μf	25v	6p
H8/8	16μf	35v	4p	H7/10A	160μf	2·5v	3p
H8/8A	16μf	16v	4p	H7/11	160μf	25v	6p
H8/9	20μf	6v	2p	H7/11A	150μf	16v	5p
H8/9A	20μf	70v	4p	H7/13A	200μf	25v	8p
H8/10	22μf	50v	4p	H7/14	220μf	50v	10p
H8/10A	22μf	100v	4p	H7/14A	220μf	16v	6p
H8/11	25μf	12v	4p	H7/15	220μf	25v	5p
H8/11A	24μf	275v	4p	H7/15A	220μf	35v	10p
H8/12	32μf	15v	4p	H6/1A	250μf	4v	3p
H8/12A	30μf	10v	4p	H6/3A	320μf	2·5v	3p
H8/13A	32μf	50v	4p	H6/4	320μf	10v	4p
H8/14	40μf	25v	5p	H6/4A	330μf	16v	5p
H8/14A	40μf	16v	4p	H6/5	330μf	25v	10p
H8/15	47μf	50v	4p	H6/5A	330μf	35v	15p
H8/15A	40μf	35v	4p	H6/7	400μf	15v	5p
H7/1	50μf	6v	3p	H6/8	470μf	25v	10p
H7/1A	50μf	10v	4p	H6/8A	470μf	35v	20p
H7/2	50μf	50v	4p	H6/9A	400μf	40v	20p
H7/2A	64μf	2·5v	2p	H6/10	750μf	12v	5p
H7/3A	64μf	25v	4p	H6/13A	1000μf	25v	16p
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071 18681	63	680	2·1 amps	1oz	15p
072 18172	63	1650 + 1650	7·8 amps	3oz	37p
106 and 107 Series					
106 15103	16	10000	7 amps	2½oz	65p
106 16223	25	22000	17 amps	10oz	£1·12
106 17103	40	10000	12 amps	7½oz	94p
106 18153	63	15000	28 amps	18oz	£1·79
107 10222	100	2200	10 amps	5½oz	74p

Type No.	Voltage	Capacitance	Weight	Price
102 15163	16	16000	8oz	20p
104 90003	20	39000	16oz	30p
102 16802	25	8000	7oz	25p
104 17562	40	5600	5oz	25p
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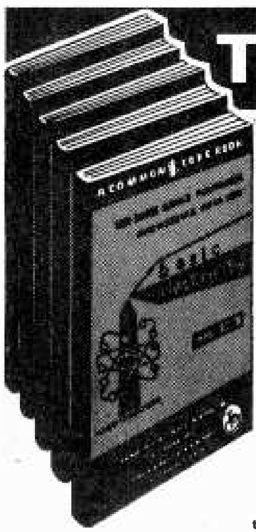

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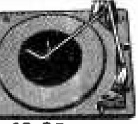

Plays 12", 10" or 7" records. Auto or Manual. A high quality unit backed by BSR reliability with 12 months' guarantee. AC 200/250v. Size 13¾ × 11¼in. Above motor board 3¼in. Below motor board 2½in. With STEREO and MONO XTAL **£8·25** Post 25p

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Two full size loudspeakers 13¾ × 10 × 8¾in. Player unit clips to loudspeakers making it extremely compact.

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

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Dual cone plasticised roll surround. Large ceramic magnet. 50–16,000 c/s. Bass resonance 55 c/s. 8 ohm impedance. 8in. 10 watt, 10in. 12 watt music power. **£3·75** Post 25p

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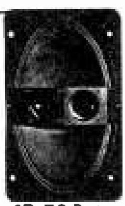

With twin tweeters and crossover, 10 watt. State 3 or 8 or 15 ohm. (As illustrated) **£4·50** Post 25p

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

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Powerful 3 watt output. 15 ohm. AC mains operated with transformer. 3-Controls, volume, treble, bass and On/Off switch with knobs. Ready made on printed circuit board. Fused inputs and outputs. Famous make. Size 8in. wide × 4in. deep × 3in. high. Less speaker
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All parts and instructions with Zener Diode, Printed Circuit, Bridge Rectifiers and Double Wound Mains Transformer. Input 200/240V a.c. Output voltages available 6 or 9 or 12 or 15 or 18 or 20V d.c. at 100mA or less.
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Woofer 10½ × 6½in. Ceramic Magnet, 44oz. 13,000 lines, Tweeter 3½in. square, 10,000 lines. Crossover condenser full instructions supplied. Impedance 8 ohms, power 12 watts. **£5·75** Post 25p.

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88 to 108 M/CS British made. 2 Transistors ready aligned requires 10·7 M/CS I.F. Complete with tuning gang. Connections supplied but some technical experience essential. **Our price £3·95** Post 20p

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2/350V .. 14p	100/25V .. 10p	32+32/350V .. 40p
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8/450V .. 18p	500/25V .. 20p	60+100/350V .. 85p
16/450V 22p	1000/25V .. 35p	32+32/250V .. 20p
32/450V 35p	1000/50V .. 47p	32+32/450V .. 45p
32/500V 50p	8+8/450V.. 22p	350+50/325V .. 55p
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50/50V .. 10p	16+16/450V 40p	100+50+50/350V 55p

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LOUDSPEAKER CABINET WADDING 18in. wide, 15p ft

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The moving coil diaphragm gives a good radiation pattern to the higher frequencies and a smooth extension of total response from 1,000 c/s to 18,000 c/s. Size 3½ × 3½ × 2in. deep. Rating 10 watt, 3 ohm or 15 ohm models. Crossover 95p. **£1·90** Post 20p

SPEAKER COVERING MATERIALS. Samples Large S.A.E.
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All purpose transistorised. Ideal for Groups, Disco and P.A. 4 inputs speech and music. 4 way mixing. Output 8/15 ohm. a.c. Mains. Separate treble and bass controls. **£49** Carr. £1·00
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SHOPERTUNITIES LTD. Dept. WP/NC/34, 164 UXBRIDGE ROAD (facing Shepherds Bush Green), LONDON, W12 8AQ (Thurs. 1, Fri. 7). Also at 37/39 HIGH HOLBORN (opp. Chancery Lane), LONDON, W.C.1 (Thurs. 7) BOTH STORES OPEN MON. TO SAT. 9 A.M. UNTIL 6 P.M.

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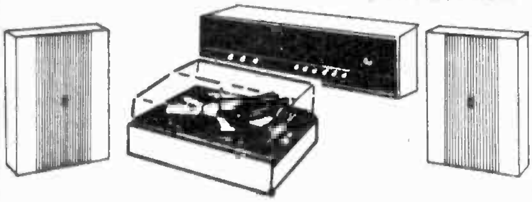
A COMPLETE AUDIO SYSTEM

An all "White" Hi-Fi Stereo System to blend with modern furnishings. Solid state, fully transistorised tuner/amplifier with Stereo Multiplex Decoder. 4 wavebands Long/Medium/Short/VHF, 8 watts per channel (music power) output. The latest BSR C129 4 speed Mono/Stereo record changer. Two white matching bookshelf speaker units.

OUR PRICE £55·00



Credit terms £5·00 deposit plus £2·00 p. & p. followed by 12 payments of £4·80. Total Credit Terms £62·60 **SEND £7·00 TODAY.**

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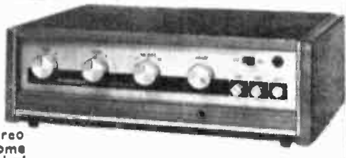

High performance Stereo Amplifier designed for home entertainment at economical cost. Represents a considerable advance in solid state, high fidelity stereo amplifiers. Outstanding performance is allied to meticulous construction, comprehensive facilities, installation simplicity and attractive styling.

10 watt per channel power; push button selectors; tone controls; balance control; tape record and replay facilities. Stereo headphone socket on front panel with automatic speaker muting; Teak finish.

Our price £75·00 + £2·00 p. & p.

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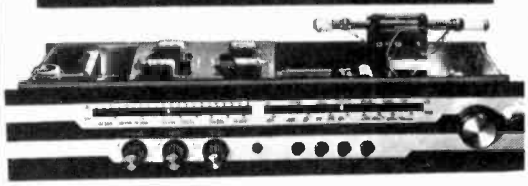
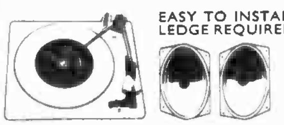


The uncabineted system is ideal as an economical replacement for an outdated chassis. The Stereo Tuner Amplifier with medium, long and short wavebands provides Worldwide coverage, even the weakest continental stations can be received with superb clarity. Push button band selection, 10 watts total output. Frequency response 25-18000 Hz.

BSR 4 SPEED STEREO/MONO RECORD CHANGER plays all types of 7in., 10in., and 12in. Mono or Stereo records. Manual or automatic play.

TWIN ELLIPTICAL SPEAKER. These low impedance, permanent magnet units have been specially selected to provide the fullest range of audio reproduction.



EASY TO INSTALL—NO TECHNICAL KNOWLEDGE REQUIRED. List Price £45·74. OUR PRICE £35·00. Credit Terms £3·50 deposit plus £2 Post & Packing followed by 12 payments of £3·10 (Total Credit Terms £40·70) Dont miss this bargain.

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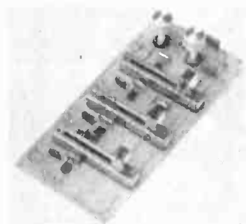
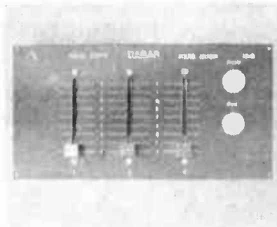
DABAR MN3 MIXER KIT





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- ★ Uses advanced design with five integrated circuits.
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- ★ Guaranteed top grade components with fibreglass printed circuit board, ready-drilled and tinned.
- ★ Battery operated (2 x PP3) not supplied with kit.
- ★ Easy to follow assembly instructions (available separately 25p).
- ★ Attractive ready punched facia plate, available at extra cost, gives that professional finish to the unit.
- ★ Size: 9·5" x 4·8" x 2".

PRICE: KIT ONLY £11·00
FACIA PLATE £1·50
MANUAL AND ASSEMBLY INSTRUCTIONS 25p
AVAILABLE READY BUILT WITH FACIA £15·00

ALL PRICES INCLUDE V.A.T. & POSTAGE IN U.K.

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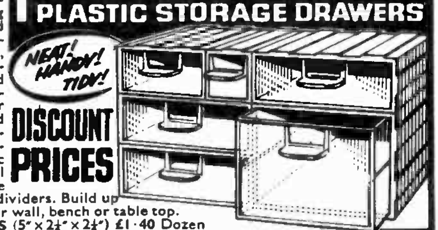

Newest, neatest system ever devised for storing small parts and components: resistors, capacitors, diodes, transistors, etc. Rigid plastic units, interlock together in vertical and horizontal combinations. Transparent plastic drawers have label slots. 1D, 2D have removable space dividers. Build up any size cabinet for wall, bench or table top.

SINGLE UNITS (5" × 2¼" × 2¼") £1·40 Dozen
DOUBLE UNITS £2·30 Dozen
TREBLE (3D) £2·50 for 8
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DY86/7	0·42
DY802	0·45
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EB91	0·38
EBC81	0·75
EBF80	0·60
EBF83	0·62
EBF89	0·58
EC86	0·75
EC88	0·77
ECC81	0·45
ECC82	0·43
ECC83	0·45
ECC84	0·55
ECC85	0·53
ECC88	0·75
ECC189	0·71
ECF80	0·56
ECF82	0·73
ECF86	0·71
ECH81	1·00
ECH83	1·00
ECH84	0·78
ECL80	0·53
ECL82	0·61
ECL83	0·68
ECL86	0·63

EF80	0·46
EF83	1·03
EF85	0·43
EF86	0·90
EF89	0·81
EF91	1·30
EF92	1·40
EF95	1·35
EF183	0·60
EF184	0·60
EH90	0·56
EL34	0·95
EL36	1·05
EL81	0·90
EL84	0·47
EL85	0·55
EL86	0·95
EL95	0·70
EL91	1·31
ELL80	1·30
EM84	1·18
EM87	1·18
EY51	0·88
EY86/87	0·42
EY88	0·64
EZ80	0·51
EZ81	0·40
GY501	0·90
GZ34	0·78

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

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

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

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AZ31	0·55
CBL31	1·00
CL33	1·50
CY31	0·50
DAF91	0·30
DAF96	0·50
DCC90	1·35
DF91	0·80
DF96	0·50
DK91	0·45
DK92	0·70
DK96	0·60
DL92	0·40
DL94	0·48
DL96	0·55
DY86/87	0·37
DY802	0·37
EABC80	0·38
EAF42	0·75
EB91	0·22
EBC33	1·00
EBC41	0·75
EBC81	0·33
EBF80	0·40
EBF83	0·40
EBF89	0·32
EBL31	1·50
ECC81	0·40
ECC82	0·33
ECC83	0·33
ECC84	0·30
ECC85	0·40
ECC88	0·40
ECH35	1·25
ECH42	1·00
ECH81	0'30
ECH83	0·45
ECL80	0·45
ECL82	0·35
ECL83	0·68
ECL86	0·40
ECLL800	2·25
EF37A	1·20
EF39	1·20

EF80	0·25
EF85	0·35
EF86	0·30
EF89	0·28
EF91	0·37
EF92	0·35
EF95	0·40
EF98	0·75
EF183	0·30
EF184	0·35
EL32	0·60
EL33	1·75
EL34	0·50
EL36	0·50
EL37	2·35
EL41	0·90
EL42	0·90
EL84	0·25
EL95	0·35
ELL80	1·00
EM80	0·45
EM81	0·60
EM84	0·35
EM85	1·00
EY51	0·40
EY86	0·40
EZ40	0·75
EZ41	0·75
EZ80	0·28
EZ81	0·29
GY501	0·80
GZ30	0·45
GZ32	0·50
GZ34	0·60
GZ37	1·25
HN309	1·50
KT61	1·75
KT66	2·35
KT81 (7C5)	1·13
KT81	1·75
KT88	2·25
KTW61	1·00
MU14	1·00
N78	1·60

PC86	0·60
PC88	0·60
PC97	0·45
PC900	0·48
PCC84	0·40
PCC88	0·55
PCC89	0·50
PCC189	0·60
PCF80	0·30
PCF82	0·35
PCF86	0·60
PCF801	0·50
PCF802	0·50
PCF805	0·80
PCF806	0·75
PCF808	0·85
PCL82	0·35
PCL83	0·66
PCL84	0·45
PCL85	0·50
PCL86	0·45
PCL805/85	0·50
PD500	1·30
PEN45	0·75
PL36	0·55
PL81	0·50
PL82	0·45
PL83	0·45
PL84	0·40
PL500	0·75
PL504	0·75
PL508	0·90
PL509	1·55
PL802	0·95
PX4	3·00
PX25	3·00
PY33	0·63
PY81	0·30
PY82	0·35
PY83	0·38
PY88	0·40
PY500	0·47
PY81/800	0·50
PY801	0·50

SP41	3·00
SP61	0·75
T41	1·00
U14	1·00
U25	0·85
U26	0·85
U191	0·75
UABC80	0·40
UAF42	0·75
UBC41	0·75
UBC81	0·45
UBF80	0·40
UBF89	0·40
UCC85	0·45
UCH42	0·75
UCH81	0·40
UCL82	0·35
UCL83	0·70
UF41	0·75
UF89	0·40
UL41	0·85
UL84	0·43
UY41	0·48
UY85	0·40
VR105-30	0·40
VR150-30	0·40
OA2	0·40
OB2	0·40
1R5	0·45
1S5	0·30
1T4	0·30
3S4	0·40
3V4	0·48
5R4GY	0·75
5U4G	0·40
5V4G	0·50
5Y3GT	0·45
5Z4G	0·45
6/30L2	0·80
6AK5	0·40
6AM5	0·90
6AQ5	0·42
6AS7G	0·85
6AT6	0·38
6AU6	0·30
6BA6	0·28
6BE6	0·32
6BH6	0·75
6BJ6	0·55
6BQ7A	0·55
6BR7	0·90
6BS7	1·85
6BW6	0·90
6BW7	0·90
6C4	0·35
6CD6G	1·30
6CH6	0·60
6CW4	0·70
6F23	1·05
6F25	1·00
6F28	0·70
6J5M	0·60
6J5G	0·45

6J6	0·30
6J7M	0·45
6J7G	0·40
6K6GT	0·75
6K7M	0·48
6K7G	0·30
6K8M	0·60
6K8G	0·45
6K25	0·75
6L6G	0·55
6Q7M	0·50
6Q7G	0·50
6SL7GT	0·45
6SN7GT	0·45
6SQ7GT	0·50
6U5G	0·75
6V6G	0·40
6V6GT	0·45
6X4	0·40
6X5G	0·40
6X5GT	0·45
7B6	0·75
7B7	0·70
7C5	1·00
7C6	0·75
7H7	0·70
7R7	0·75
7S7	2·25
7Y4	0·75
12AT6	0·40
12AT7	0·40
12AU6	0·45
12AU7	0·38
12AX7	0·38
12BA6	0·45
12BE6	0·50
30C1	0·30
30C15	1·05
30C17	1·10
30C18	0·80
30F5	1·10
30FL1	0·75
30FL2	0·75
30FL14	0·85
30L15	1·05
30L17	0·90
30P4MR	1·30
30P12	1·05
30P19	1·00
30PL1	0·95
30PL13	1·20
30PL14	1·25
35W4	0·40
35Z4GT	0·70
50CD6G	1·20
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813 ITT	£13
813 USSR	£5·75
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AC107	0·35
AC126	0·25
AC127	0·25
AC128	0·25
AC176	0·25
AC187	0·25
AC188	0·25
ACY21	0·20
ACY39	0·55
AD140	0·50
AD149	0·50
AD161	0·35
AD162	0·35
AF115	0·24
AF116	0·25
AF117	0·20
AF186	0·40
AF239	0·40
ASY27	0·30
ASY28	0·25
BA102	0·30
BA115	0·7
BC107	0·10
BC108	0·10
BC109	0·10
BC113	0·15
BC117	0·20
BC143	0·35
BC147	0·12
BC148	0·10
BC169C	0·12
BC182	0·10
BC182L	0·12
BC184L	0·11
BCY32	0·60
BCY33	0·34
BCY34	0·35
BCY70	0·15
BCY71	9·20
BCY72	0·15
BCZ11	0·50
BD121	0·75
BD124	0·80
BD131	0·75

BD132	0·80
BF115	0·25
BF167	0·25
BF173	0·25
BF179	0·30
BF180	0·30
BF181	0·32
BF194	0·15
BF195	0·15
BF197	0·15
BF200	0·35
BF861	0·25
BF898	0·25
BFX29	0·25
BFX88	0·20
BFY50	0·20
BFY51	0·20
BFY52	0·20
BFW10	0·61
BY100	0·15
BY126	0·15
BY127	0·15
BZX61 series	0·12
BZY88 series	0·10
CR81-05	0·25
CR81-40	0·35
CR83-05	0·30
CR83-40	0·45
MJE340	0·50
MJE370	0·70
MJE520	0·75
MJE2955	1·10
MJE3055	0·75
MPF102	0·42
MPF103	0·35
MPF104	0·37
MPF105	0·40
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OA5	0·50
OA10	0·35
OA79	0·7
OA81	0·10
OA91	0·7
OA200	0·7
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OC16	0·75
OC20	0·95
OC23	0·85
OC25	0·40
OC28	0·65
OC35	0·50
OC36	0·65
OC42	0·40
OC44	0·15
OC45	0·15
OC71	0·15
OC72	0·25
OC76	0·40
OC77	0·45
OC81	0·25
OC81D	0·25
OC81Z	0·55
OC83	0·25
OC140	0·55
OC170	0·25
OC171	0·30
OC200	0·45
OC201	0·75
OC202	0·80
OC203	0·50
OCP71	1·25
ORP12	0·50
ORP60	0·40
T1005	0·30
TIC44	0·35
TIC226D	1·50
TIL209	0·30
TIS43	0·35
ZTX107	0·15
ZTX108	0·12
ZTX300	0·12
ZTX301	0·15
ZTX302	0·18
ZTX304	0·25

ZTX500	0·15
ZTX501	0·16
ZTX503	0·17
ZTX531	0·20
ZTX550	0·20
IN914	0·7
IN4001	0·6
IN4002	0·7
IN4003	0·8
IN4004	0·8
IN4005	0·10
IN4006	0·12
IN4007	0·15
IN4009	0·5
IN4148	0·8
IS921	0·10
IS2033	0·20
IS2051A	0·20
IS2100A	0·20
IS3010	0·25
2N696	0·15
2N697	0·15
2N706	0·10
2N706A	0·12
2N1131	0·25
2N1132	0·25
2N1302	0·18
2N1303	0·16
2N1304	0·22
2N1305	0·22
2N1306	0·29
2N1307	0·25
2N1308	0·25
2N1309	0·87
2N1613	0·20
2N1614	0·20
2N2147	0·75
2N2160	0·59
2N2369A	0·15

2N2646	0·50
2N2904	0·18
2N2904A	0·25
2N2905	0·26
2N2905A	0·23
2N2906	0·20
2N2926	0·10
2N3053	0·20
2N3055	0·55
2N3525	0·75
2N3614	0·59
2N3615	0·75
2N3702	0·10
2N3703	0·10
2N3704	0·10
2N3705	0·10
2N3706	0·10
2N3707	0·10
2N3708	0·10
2N3709	0·10
2N3710	0·10
2N3711	0·10
2N3819	0·35
2N3820	0·50
2N3823	0·62
2N3903	0·15
2N3904	0·17
2N3905	0·21
2N3906	0·19
2N4058	0·16
2N4059	0·9
2N4060	0·12
2N4061	0·12
2N4062	0·12
3N141	0·81
40360	0·40
40361	0·40
40362	0·50
40430	1·00

SN7400	0·20
SN7401	0·20
SN7402	0·20
SN7403	0·20
SN7404	0·20
SN7405	0·20
SN7406	0·30
SN7407	0·30
SN7408	0·20
SN7409	0·45
SN7410	0·20
SN7411	0·23
SN7412	0·42
SN7413	0·30
SN7416	0·30
SN7417	0·30
SN7420	0·20
SN7422	0·48
SN7423	0·48

SN7425	0·48
SN7427	0·42
SN7428	0·50
SN7430	0·20
SN7432	0·42
SN7433	0·70
SN7437	0·65
SN7438	0·65
SN7440	0·20
SN7441AN	0·75
SN7442	0·75
SN7450	0·20
SN7451	0·20
SN7453	0·20
SN7454	0·20
SN7460	0·20
SN7470	0·30
SN7472	0·30

SN7473	0·40
SN7474	0·40
SN7475	0·55
SN7476	0·45
SN7480	0·80
SN7482	0·87
SN7483	1·00
SN7484	0·90
SN7486	0·45
SN7490	0·75
SN7491AN	1·00
SN7492	0·75
SN7493	0·75
SN7494	0·80
SN7495	0·80
SN7496	1·00
SN7497	6·25
SN74100	2·50

SN74107	0·50
SN74110	0·80
SN74111	1·45
SN74118	1·00
SN74119	1·90
SN74121	0·60
SN74122	1·85
SN74123	2·70
SN74141	1·00
SN74145	1·50
SN74150	3·85
SN74151	1·10
SN74154	2·00
SN74155	1·55
SN74156	1·55

SN74157	1·80
SN74170	4·10
SN74174	2·00
SN74175	1·85
SN74176	1·60
SN74190	1·95
SN74191	1·95
SN74192	2·00
SN74193	2·00
SN74194	2·50
SN74195	1·85
SN74196	1·50
SN74197	1·50
SN74198	4·60
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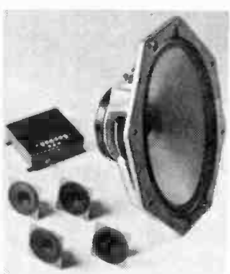
950 Kit. Five matched speakers and crossover unit for handling up to 45 watts, from 20 to 20,000 Hz. Huge – 19″ x 14″ (approx.) high efficiency 16, 500-gauss bass unit built on a heavy diecast frame. The four 10,000 gauss tweeters, each 3¼″ dia. approx., are fed by the crossover with a critically adjusted signal for maximum fidelity. Impedance at 1 kHz is 8 ohms. Bass coil 2″, others 0·5″. Recommended list price £44·00.

OUR PRICE £25·00 + £1·50 p & p



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SPEAKERS: **Duo Type II** Size approx. 17in × 10½in × 6½in. Drive unit 13in × 8in with parasitic tweeter. Max. power 10 watts 8 ohms. Simulated Teak cabinet. £14·00 a pair + £2·20 p. & p. **Duo Type III** Size approx. 23½in × 11½in × 9½in. Drive unit approx 13½in × 8½in with HF speaker. Max. power 20 watts, 8 ohms. Freq. range 20Hz to 20kHz. Teak veneer cabinet. £32·00 a pair + £3·30 p. & p.

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PRICES : SYSTEM 1

Viscount III R102 amplifier	£24·20 + £1 p & p
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Garrard SP25 Mk III with MAG. cartridge /plinth & cover	£18·00 + £1·75 p & p
total	£56·20

Available complete for only £49·00 + £3·50 p & p

PRICES : SYSTEM 2

Viscount R102 amplifier	£24·20 + £1 p & p
2 Duo Type III speakers	£32·00 + £3·30 p & p
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THE TOURIST PUSH-BUTTON CAR RADIO KIT £6·60

The Tourist PB is suitable for 12 volt working on both negative and positive earth vehicles. It covers the full medium and long wave bands. It is permeability tuned and sturdily constructed. Output is a full 2·5 watts into an 8 ohms speaker. But the Tourist PB will operate into any loud-speaker from 8 to 15 ohms.
Apart from the output stage, which is an integrated circuit, the only other electronic components that need soldering are some capacitors, resistors, etc. The kit includes a pre-built RF tuner unit, and fully modulised IF stages which are pre-aligned before despatch. As well as electronic components this kit also contains 2 diamond-spun aluminium knobs, elegant matching front panel, dial, washers, screws and wire.
The Tourist PB can be mounted in any standard size dash panel and it has an illuminated tuning scale. Chassis size is: 7in wide, 2in high and 4$\frac{3}{16}$in deep.
Circuit diagram and comprehensive instructions 55p free with parts.
Fully retractable and lockable car aerial £1·37 post paid.

CAR RADIO KIT £6·60 p. and p. 55p. Speaker with baffle and fixing strips £1·65, + 23p p. & p. post free if bought with the kit. Send stamped addressed envelope for leaflet.
If you can solder on printed circuit board, you can build this push-button car radio kit. It's simple—just follow the step-by-step instructions.

PE TAPE LINK CONSTRUCTORS

Suitable 3 speed tape deck, **less heads.** Caters up to 5¾ins. spools. 240V AC mains. Unused but store soiled hence no warranty.
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RELIANT Mk IV
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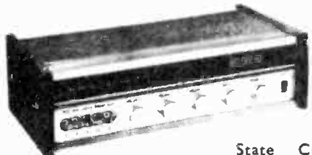

*5 Electrically Mixed inputs. *3 Individual Mixing controls. *Separate bass and treble controls common to all 5 inputs. *Mixer employing F.E.T. (Field Effect Transistors). *Solid State Circuitry. *Attractive Styling.
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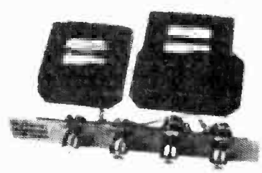
ONLY £7·64 + 55p. p & p



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

IN-CAR ENTERTAINMENT AT HOME

With this elegant stereo 8 track add on unit, audio enthusiasts now have the opportunity to extend their systems to include the playing of 8 track cartridges. Simply select your channel, by push button, four digital lamps indicate channel selected. The Viscount III, the fabulous Stereo 21 and the Unisound Modules will accept this unit, simply connect up. **£9·90** + 80p. p. & p.

SEE OPPOSITE PAGE FOR ADDRESS DETAILS

AUTUMN ACTION

IF you were fortunate enough to obtain last month's special issue of *Practical Wireless*, and your particular interests are in audio, short wave, broadcast reception, test equipment, or experimental electronics, you will have found at least one item of interest to you. In very general terms, this is what *Practical Wireless* is about, helping and encouraging its readers to have-a-go. This issue is also special in that it is the largest *P.W.* ever produced, carrying 120 pages and two free colour Datacards.

Activities covered by this magazine are, believe it or not, of a seasonal nature and we are always delighted in one sense when the holiday season ends, because we all settle down again after sun-tan(?) and surf-riding to renew our absorbing interest in d.i.y. radio and electronics.

It was often the case in the past when we would expect readers who go away in the summer to leave their tools and *P.W.* at home. Imagine some reader on the Costa Brava wielding a soldering iron on a pair of gritty output transistors—it's just not done is it? We were particularly pleased therefore that the temporary summer recess this year was hardly noticeable; surely the summer was not that bad! And it is known that *P.W.* is read on beaches.

The autumn, therefore, is just the time when, if not already bitten by the bug, our readers look around as if to court the means to satisfy their instinctive curiosity in the techniques of working circuits. You might say that we also provide the necessary bait to give newcomers encouragement to have a go. You might be right, but then if we did not learn something about our readers we would not be the highest selling British magazine of its kind. Some subjects do come up for renewed treatment but unlike some magazines, they are seldom in the same guise as before.

Take our Metal Detector on page 634; not a scrap like the earlier models and certainly easier to make.

October is also the time for the London Audio Fair; it is natural therefore that those readers who will be going to Olympia will want to sort out some of the technical jargon used in the audio world. Very sad that we cannot be there this year so we expect every *P.W.* reader visitor to carry this issue in his pocket, so that he can refer to the extra supplement which we have bound in the centre.

Incidentally, we have heard rumour on the "grape vine" that a certain company is biting its tongue for not having published a multi-systems quad matrix decoder as simple as ours.

M. A. COWELL—*Editor.*

The December issue, on sale 2nd November, will include a 12 volt 15 watt fluorescent light unit for your car, caravan, garage, shed or anywhere that emergency lighting is needed during power failure. Also included will be a 3-band short wave superhet, some simple practical applications of the LM380N integrated circuit audio amplifier and another series of circuits for the Experimental Workshop. Also next month don't miss the third pair of P.W. Datacards and first details of our new project that you can add on to the P.W. Q4 quad decoder.

Further details on page 640.

NEWS...

Paris Component Show

MEASURING instruments will be featured in addition to the usual sections on electronic components, materials, equipment and products at the Paris Component Show.

Venue is Exhibition Park, Porte de Versailles and date 1st-6th April 1974.

Mullard back out

MULLARD Ltd. have decided to kill off their Educational Service. The service has acted as a valuable aid for the teaching profession for the last 25 years.

Oxidising agent

ENTHONE Inc. Ebonol C Special is an oxidising agent which increases the strength of the bond in the production of single, double-sided and multi-layer printed circuit boards. The process involves producing many thousands of little cupric oxide needles. The oxide coating is obtained by the immersion of suitably treated copper in a solution of 180gm/l Ebonol C at 104°C.

Liquid adhesive may then be brushed or rolled onto the oxidised surface. After the adhesive has "cured" the imbedded needles of cupric oxide maintain a "key", firmly fixing the adhesive to the copper. The prepared copper foil is then affixed to the plastics base.

We settle down when the holiday season ends . . .

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

Packaging for professionals

THE Inter-Nepcon conference at Brighton specialises in broad terms in electronic component packaging and assembly. There is a very strong emphasis on printed circuit techniques and integrated circuit encapsulation.

Although not strictly dealing with electronics techniques, this exhibition has a distinctly practical emphasis because it concerns the making of component assemblies and modules. It is being held at the Metropole Hotel on the sea-front at Brighton, from 16th to 18th October and is organised on an international basis by Kiver Communications Ltd of 149-155 Ewell Road, Surbiton, Surrey. Admission is restricted to those who register as being engaged full-time in electronic circuit packaging and production.

No more please!

WITH the Audio Fair about to open its doors on 22nd October (trade only), and 23rd October to the public, it is interesting to learn that one famous British manufacturer, Armstrong Audio, has had to withdraw because it could not contemplate at present the thought of taking on more orders. It seems that the new 600 series has created so much interest that current orders exceed their present manufacturing capacity.

Rather than spend time and money in exhibiting with the prospect of more orders, Armstrong have decided that they should expand their facilities to cope with the rush.

Multimeter competition

WE wish to apologise to readers for the omission of information in last month's issue on the Digital multimeter competition. Due to the fact that so many readers sent in answers that were the best according to the considered opinion of the judges, our Competitions Department is at present organising a further contest for these readers. We will be publishing the result just as soon as we have it.

Derby modellers get together

DERBY and District Amateur Radio Society (G3ERD, G2DJ), are branching into radio control models. The new club is already under way and held its first meeting in September. Anyone interested should contact Ray Webster, c/o 5 Uplands Avenue, Littleover, Derby.

Ham Exhibition

THE Midland National Amateur Radio and Electronics Exhibition will be held at the Granby Halls, Leicester from 25th to 27th October.

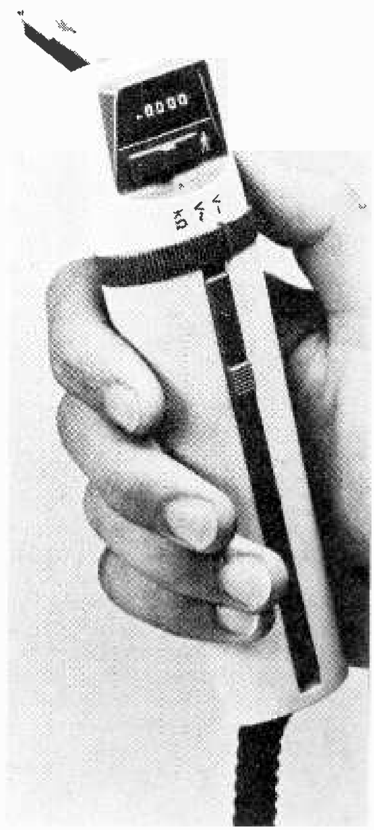
Commercials date

AT the time of going to press, we have heard that the London Broadcasting Company will go on the air on Monday 8th October. There will be a special message from the Minister of Posts and Telecommunications. Frequencies 719kHz, 417m and 97·3MHz.

Slimline digital multimeter

OF professional quality, this unusual device is a hand-held digital multimeter from Hewlett-Packard. At £138 (+VAT) this instrument represents a valuable on-line tool for engineers and technicians. A $3\frac{1}{2}$ digit l.e.d. display uses automatic decimal placement and polarity indication.

The heart of the instrument is a "postage-stamp" size thin film hybrid circuit with analogue and digital processing. It is claimed to measure d.c. voltage from 0·1mV to 500V and a.c. voltages from 3mV to 500V. The resistance range measures from 1 ohm to 10MΩ. The input resistance is stated as 10MΩ.



Cassette library system

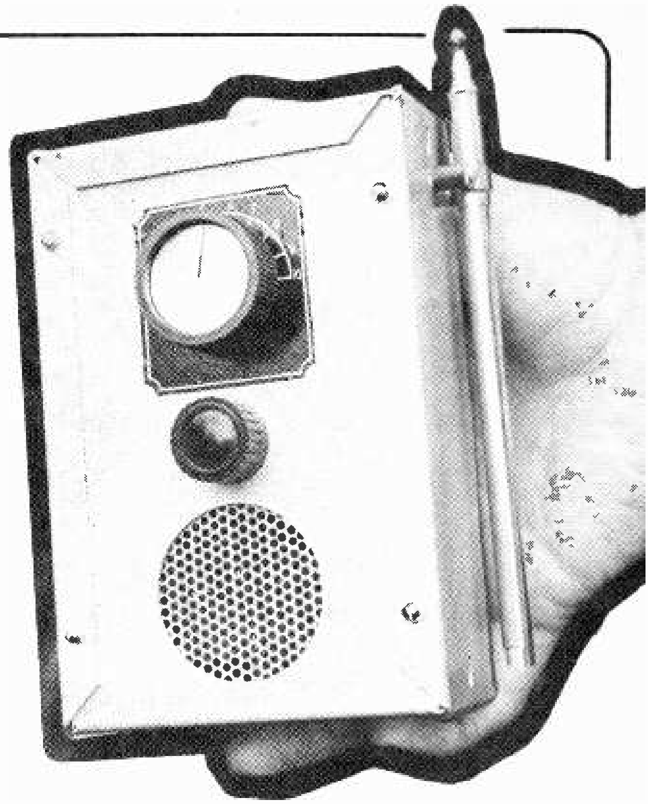
WITH the current boom in tape cassette recorders, BASF are to show at the Audio Fair two new machines for chromium dioxide tape and a (quote) "unique library system for cassettes", that can be free standing or fitted to the wall.

BIB's own set-up

MULTICORE Solders Ltd. have set up a subsidiary company, BIB Hi-Fi Accessories Ltd., to look after the interests of growing range of products with the "BIB" trade name, including record and tape cleaning accessories and splicing kits. The board of the new company is selected from the parent company and will continue to operate from P.O. Box 78, Hemel Hempstead, Herts, HP2 7EP.

portable VHF receiver

F. G. RAYER G3OGR



SUPER-REGENERATIVE receivers may use a simple and easily built circuit, and are highly sensitive. There are no gauging or other alignment problems, and frequency coverage is easily modified. A straightforward circuit of this type is thus completely practical, as an alternative to a complicated v.h.f. superhet, or v.h.f. converter used with a short wave receiver.

On the other hand, the disadvantages of the super-regenerative type of circuit should be remembered. One is the lack of selectivity, and another the background hiss which is present when no transmission is tuned in. The lack of selectivity means that a strong, local transmission can prevent reception of a weaker signal on a nearby frequency. The stronger signals are, however, very well received, and any signal which is received at sufficient strength will automatically quiet the background hiss.

A further important point is the extent to which a super-regenerative receiver can cause interference to other receivers. Some radiation of this kind seems unavoidable, but it can be kept within limits by screening the receiver, and using an r.f. stage to help isolate the aerial from the oscillating detector stage. In these circumstances, interference is not caused over a wide area.

Interference is primarily caused on the frequency to which the super-regenerative receiver is tuned, and nearby frequencies. As example, if an unscreened super-regenerative receiver is tuned to 144MHz this is found to cause no interference at all to a normal receiver in the 88-108MHz range, with the equipment side by side. On the other hand, interference would arise with nearby receivers tuned to 144MHz or adjacent frequencies.

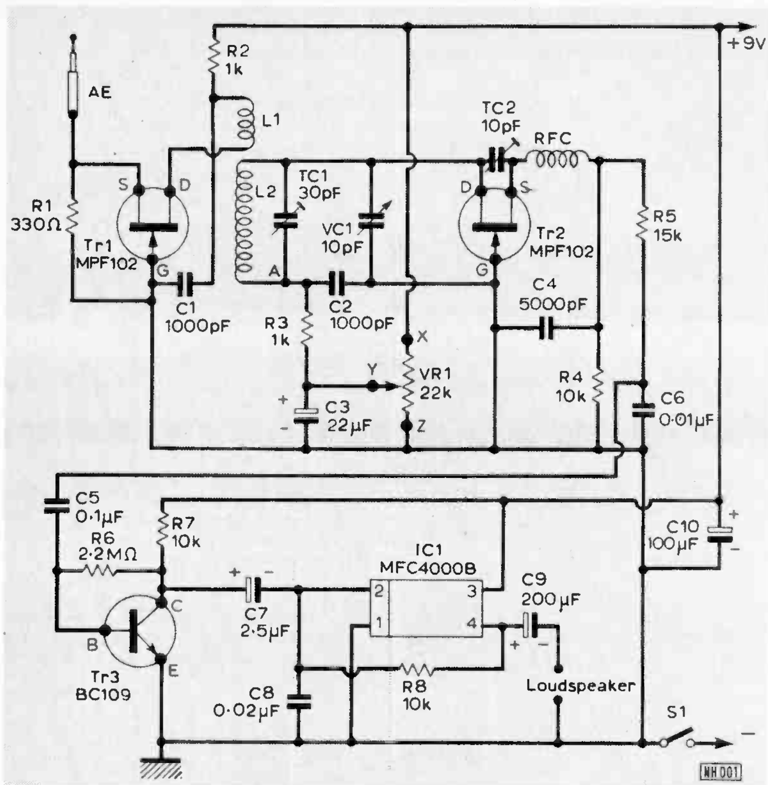
This really means that the super-regenerative receiver should be confined to use in those circumstances where other people are not listening on the same or a near-by frequency. In fact, the receiver described has often been used as the only means of reception for 2 metre amateur band contacts, without any complaint. This does not mean, however, that it would be wise to use it for 2 metre reception when there are other 2 metre receivers or converters in use nearby.

Receiver circuit

This is shown in Fig. 1. Though actually constructed for 2 metre reception as a portable, it can be used over the 90MHz to 150MHz range without any change other than re-adjusting the preset trimmer TC1. Tr1 is the untuned r.f. stage, with input to the source across the source bias resistor R1. A tuned r.f. stage increases gain, but has to be screened from the detector, and also requires its own means of tuning, unless a small frequency band is adopted. The main purpose of this stage is to reduce radiation caused by coupling an aerial directly to the detector coil L2. The r.f. stage does not provide complete isolation, due to the internal capacitance of Tr1 and other unwanted coupling through leads.

Tr2 is the detector. The operating frequency depends on the coil L2, trimmer TC1, and VC1. There are of course no alignment adjustments at all. With TC1 fully open, VC1 tuned approximately 130-150MHz. Super-regeneration is maintained until TC1 is about two-thirds closed, giving a low frequency limit of about 90MHz. For lower frequencies it would be necessary to increase the number of turns on L2. The upper limit at which the receiver can be made to operate is largely determined by Tr2.

Regeneration is controlled by VR1, and it is recommended that the values shown for C4, C6, R4 and R5 are as shown, though VR1 can equally well be 20kΩ or 25kΩ. TC2 from source to drain allows



◀ *Fig. 1 : Complete circuit of the portable v.h.f. receiver.*

adjustment of regeneration, and was found of advantage with various transistors employed for Tr2.

A detector of this type is usually considered to have a sensitivity of about 0·5μV, which offers a useful range with a simple aerial.

Tr3 is an audio amplifier, followed by the i.c, which contains six transistors in a driver-push-pull arrangement. This gives reasonable loudspeaker volume from the internal miniature speaker. The receiver is free from troublesome hand capacity effects, if constructed as shown.

Circuit board

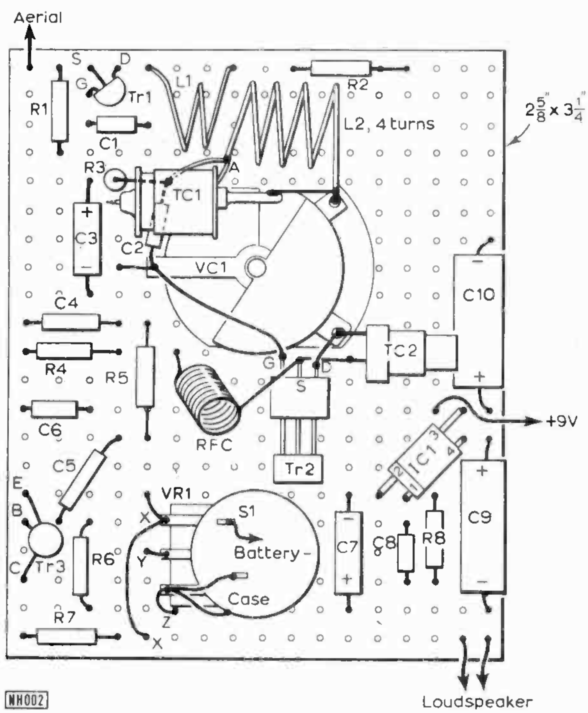
This is plain Veroboard, 0·15in. matrix, and is approximately $2\frac{5}{8} \times 3\frac{1}{4}$in., see Fig. 2. The detector stage is assembled in close proximity to VC1.

L2 is self-supporting, and is wound with 18 or 16 s.w.g. wire, with an outside diameter of $\frac{1}{2}$in. The coil is approximately $\frac{3}{4}$in. long, and its ends are shaped so that they may be soldered to the fixed plates tag of VC1, and to C2. C2 has the shortest possible leads each end. A stout wire supports TC1 just clear of the plates of VC1, and the outer tag A of TC1 is bent down and soldered to L2 as shown. L1 is 2 turns of insulated wire near L2, and is soldered to two Veropins.

Coverage can be modified to some extent by stretching L2, or by compressing it so that the turns are closer together. For the coverage mentioned, four turns are used. The coil should be at least $\frac{1}{2}$in. from the metal case.

A small 3-lead holder is fitted for Tr2, and is of

▼ *Fig. 2: Component layout on the circuit board.*



advantage in allowing this transistor to be changed readily. TC2 and the holder can be soldered almost directly together and to VC1. A stout lead, just clear of VC1 moving plates, runs to the rotor tag with C2.

The r.f. choke is self-supporting, and is wound with 22 s.w.g. enamelled wire. It has 35 turns and is 0·3in. outside diameter. Wind the turns side by side on a suitable object, which is then removed. The ends are scraped and tinned, and soldered to Tr2 source at the holder, and to a Veropin adjacent to R5.

When inserting Tr2, always take care that it is placed the correct way, so that leads come as in Fig. 2.

Underside wiring

A lead passes through the board from VC1 rotor, forming the negative line, as in Fig. 3. The metal case or bush of VR1 is grounded by a lead under the control or its fixing nut, Fig. 2.

The resistors and capacitors can then be inserted as in Fig. 2, and connected as in Fig. 3. Place insulated sleeving on leads where required, and keep all the leads and joints close against the board. Here, there will be a clearance of about $\frac{3}{16}$in. from the metal panel, so there is no real danger of shorts to the metal if joints are made neatly and excess wire snipped off close to the board.

The i.c. has two long tags, and two short tags, and will fit the matrix of the Veroboard when placed as in Fig. 2. Leads are soldered to the projecting pins underneath, as in Fig. 3.

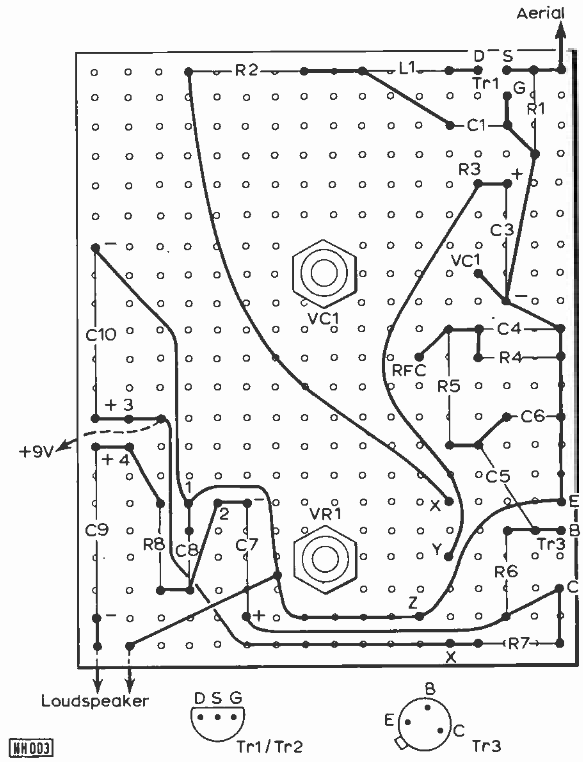
Solder a black flexible lead to S1, Fig. 2, and fit this with a negative battery clip. A red lead with a positive clip passes through the board to the positive circuit for C10.

A short wire runs from R1, as in Fig. 2, and is later soldered to a tag for the aerial connection. Also bring out leads from C9 and the negative line, for the loudspeaker.

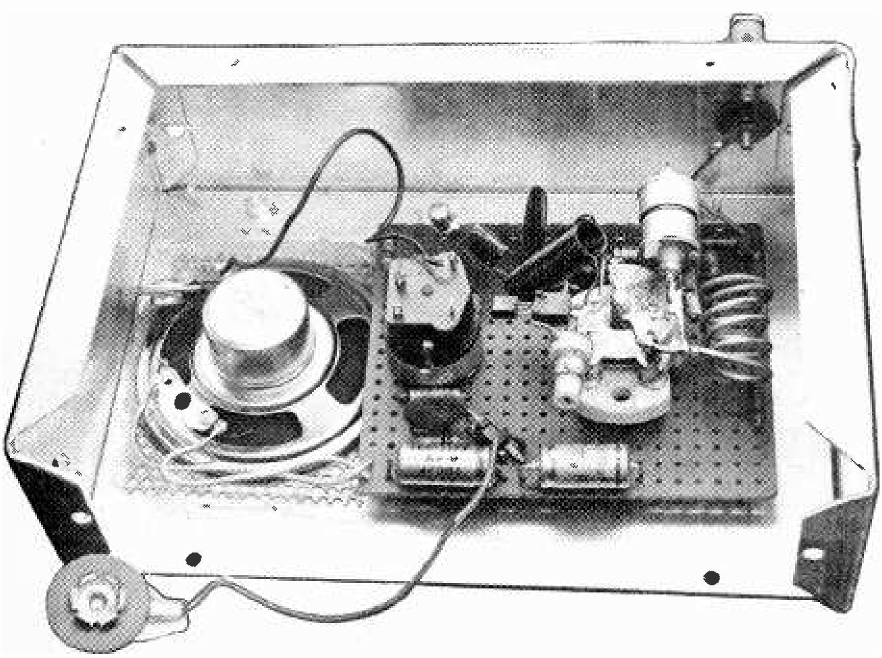
Metal panel

For the 6×4×2in. universal chassis box, this is 6×4in. The dimensions could be modified to suit a different case.

A $1\frac{3}{4}$in. hole is punched for a 2in. or $2\frac{1}{4}$in. speaker. A piece of perforated metal is fixed across the opening inside with adhesive, and the miniature



▲ *Fig. 3: The underside wiring.*



◀ *Photograph showing internal layout of the receiver.*

speaker is fixed with more adhesive. Though the speaker is 40Ω, a 75 or 80Ω unit can be fitted with almost similar results, though the best impedance for the i.c. is in the 15 to 40Ω range.

Washers are put on the bush of VC1 to space the insulated board from the metal panel, and these are then secured together with the capacitor nut. Check that all joints etc. are clear of the metal.

Final assembly

The receiver should be tested and adjusted before fitting it in its case. The box is assembled with 4BA bolts through the holes punched in its flanges, and the panel is fixed with 6BA bolts or self-tapping screws.

A 34in. telescopic aerial is used, bolted to the side of the box near R1, but insulated from the metal. This is done by using insulated washers and bushes, or insulated washers and pieces of sleeving on the bolts. One bolt carries a tag, for the aerial lead mentioned.

The battery rests in the bottom of the box, and folded card can be put round it and between battery and speaker. There must be no contact between the battery clips and metal case.

For 2 metre reception, a ¼-wave aerial is around 19 to 20 inches. But it was found that the exact length of the aerial was not important, there being no noticeable change in volume when changing this from about 20in. to 30in. or so. Some strong transmissions were received with the aerial completely closed.

In many cases it is better to have the aerial sloping or near horizontal, but with a hand-held receiver of this sort it is easy to move around to find the best position for the aerial, if needed.

Indoors, reception is modified by the proximity of objects such as metal windows. On a few occasions an outdoor dipole, with a co-axial feeder, has been connected, and this naturally increased range.

★ components list

Resistors

R1	330Ω	R5	15kΩ
R2	1kΩ	R6	2·2MΩ
R3	1kΩ	R7	10kΩ
R4	10kΩ	R8	10kΩ

All 5% ¼W.
VR1 22kΩ linear pot with switch

Capacitors

C1	1000pF disc or tubular ceramic
C2	1000pF disc or tubular ceramic
C3	22μF 10V
C4	5000pF
C5	0·1μF
C6	0·01μF
C7	2·5μF 6V electrolytic
C8	0·02μF
C9	200μF 6·4V electrolytic
C10	100μF 10V electrolytic
VC1	Jackson C804, 10pF
TC1	Beehive trimmer, 30pF
TC2	Jackson 'Tetfer' 10pF trimmer

Semiconductors

Tr1	MPF102
Tr2	MPF102
Tr3	BC109
IC	MFC4000B

Miscellaneous

Speaker 2¼in. or similar, 15 to 40Ω; plain Veroboard 2⅝ x 3¾in., 0·15in. matrix, aluminium panel 6 x 4in. and 6 x 4 x 2in., universal chassis box (Home Radio), telescopic aerial, small knob, large knob, battery clips, transistor holder, insulated washers and bolts, etc.

Adjustment

Both TC1 and TC2 may be fully unscrewed, for about 130-150MHz. (Exact coverage naturally depends on L1 and other factors, but is likely to be near this.)

When VR1 is rotated to switch on, a point should be reached where a loud hiss commences. This is the point where super-regeneration, upon which sensitivity depends, has commenced. No reception is possible if this is not obtained. Should super-regeneration be absent, TC2 may need screwing down *slightly*. A setting should be found where super-regeneration continues over the whole band tuned by VC1, with only a little re-adjustment of VR1.

When a signal is tuned in, this hiss should cease. Strong signals will produce this effect with most settings of VR1 which permit super-regeneration; but with weak signals VR1 may have to be backed off slightly.

L1 should be quite near L2, but if coupling is very tight this may prevent regeneration in some circumstances. It is possible to boost volume by using more turns on L1 so that it is broadly self-resonant at the wanted frequency. However, this adjustment is fairly touchy. L1 may be unsoldered from the pins, and a new winding may be fitted, with a minimum of disturbance.

If all connections are short and direct, and no fault is present, the absence of super-regeneration can only arise from Tr2 being inefficient at the frequency wanted. Of several quite inexpensive transistors tried here, one failed to operate at any frequency higher than about 100MHz, while another continued to provide regeneration at over 200MHz. As Tr1 and Tr2 are of the same type, the transistor found to give best regeneration may be used for Tr2. Its leads need not be cut down. This test can be made with the aerial temporarily taken to the drain pin of L1.

It is in order to use a 4·5pF or 5pF capacitor at VC1, if a narrower band is required, or to fit a 15pF capacitor for a larger band. The overall drain of the receiver is about 10-20mA, depending on volume.

The amount of activity on these frequencies varies very considerably in different areas, being least in some isolated parts of the country. Amateur activity on the 2 metre band is most likely at certain times at weekends. It may be considerable during v.h.f. contests, while at other times no stations may be operating. Any amateur in the 2 metre band (144-146MHz) will provide a tuning calibration point which can be noted as a guide for future reference when listening. ■

I.C. OF THE MONTH

L.A.J. IRELAND

Number 42 — National LM101 for Audio Signal Generators

A simple requirement whose realisation in practice can be rather difficult is the tunable audio oscillator with an accurate sine waveform. At frequencies below 20kHz the use of inductive tuned circuits is not practical and the most commonly used circuit is the Wien bridge using RC circuits to determine the time constant of the oscillator feedback loop. The impedance of such a circuit is, of course, frequency dependent; the loop gain therefore also tends to be frequency dependent, with the result that the circuit can produce some variation in waveform and amplitude as the operating frequency is varied.

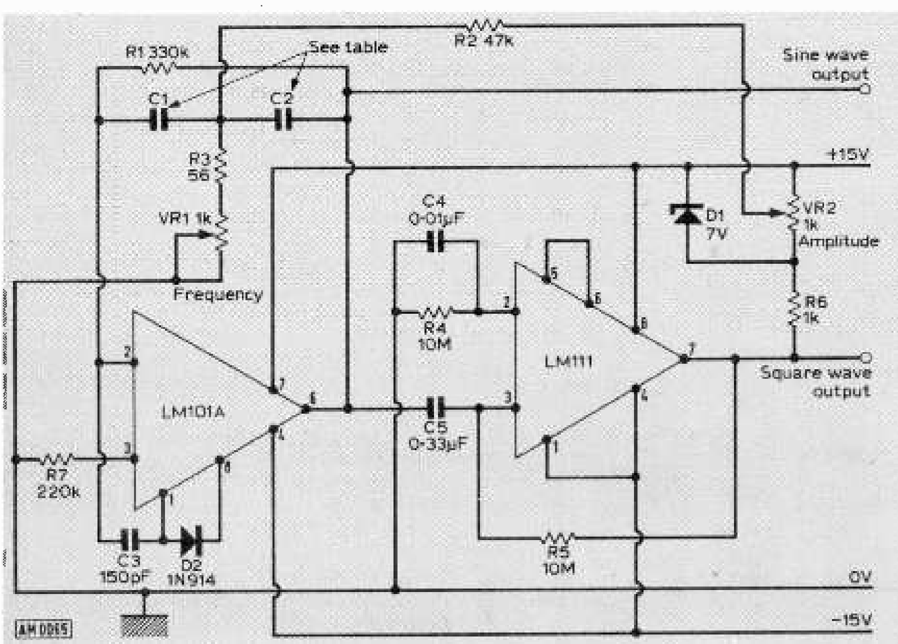
Any departure from a true sine waveform, such as the square wave produced by an oscillator with excessive loop gain, contains harmonics or overtones of the fundamental frequency and is therefore unsuitable for many applications such as the determination of the frequency response of an audio system. Various improvements on the basic Wien bridge circuit have been introduced to overcome these defects, such as the incorporation of an AGC loop with a thermistor to regulate gain.

Op Amp + Comparitor

This month, however, a completely different approach is outlined, one first introduced by engineers of the National Semiconductor Corp. and employing two integrated circuits. One of these is an operational amplifier, the other a voltage comparator. The standard application of a voltage comparator unit is as a sensing element, operating a relay or switching the state of a logic circuit on the application of a low level input signal.

Operation

In the oscillator circuit to be described, it is accepted that the output of a comparator will alternate between extreme values irrespective of the waveform of the input signal. If, then, the input signal has a fixed period, the output of the comparator will be a square wave with that period and a fixed amplitude. With effective filtering to remove



C1 and C2	Frequency range
0·47µF	18Hz – 80Hz
0·1µF	80Hz – 380Hz
0·022µF	380Hz – 1·7kHz
0·0047µF	1·7kHz – 8kHz
0·002µF	4·4kHz – 20kHz

Practical circuit for an audio signal generator based on the LM101A/LM111 combination. Capacitors C1/C2 may be mounted on a range switch and should be of close tolerance and best quality. The frequency control VR1 should be large, physically, and again, of highest quality, if accurate calibration is to be achieved.

harmonics, a sine wave of fixed amplitude will remain. The filter in question is in this case an active filter incorporating an operational amplifier integrated circuit, with its centre frequency determined by an RC network. In turn, the output of the filter provides the input signal for the voltage comparator, thereby closing the oscillator feedback loop. It is clear that two separate waveforms are available from the oscillator, both stabilised in amplitude and locked together in frequency and phase; a square wave at the output of the voltage comparator, and a sine wave at the output of the operational amplifier.

Simplified Tuning

There is the further advantage that the frequency is set by a single variable resistor, whereas the Wien oscillator requires matched ganged tuning elements. The audio range from 18Hz to 20kHz is covered in five bands with band switching achieved by changing the capacitive elements in the tuned filter. The limitation on the frequency range covered with any given pair of capacitors is applied by the rise in harmonic distortion to some 2% at the maximum value of R3. Further, the principle is not applicable to the construction of RF signal generators since a sufficiently high Q is not available without the use of inductors.

Construction

In construction of these oscillators, however, some care is necessary to follow good high frequency design practice, since the individual IC's are wide bandwidth devices. Careless construction could therefore lead to an oscillator with RF instability, and plagued by parasitic oscillations. Both power supply lines, therefore, should be decoupled by 0·1μF disc ceramic capacitors. Further, the output of the comparator should be shielded from the op amp input, to ensure that the only feedback occurs via the intended filtered loop.

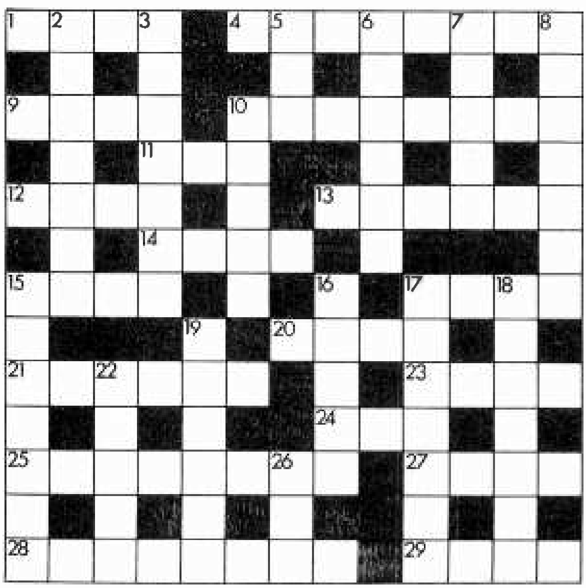
Radio Control

For those interested in radio control techniques, it can be seen that a simple modification to the circuit can produce a frequency-operated switch. If the operational amplifier and associated tuned circuit are examined alone, it is clear that an output signal is produced only if the input applied via R2 contains a component at the resonant frequency. That output signal can then be detected by a conventional diode, and the resultant DC level applied to the voltage comparator, thereby operating a relay. Such a system therefore would function on the presence or otherwise of an appropriate AF modulation on a radio control signal.

The National Semiconductors devices are available from: ITT Electronic Services, Edinburgh Way, Harlow, Essex.

The LM101A and LM111 are manufactured to military specifications and therefore somewhat expensive. The 'civilian' equivalents LM301A and LM311 are very much cheaper and should perform quite adequately in this application (Technical Editor).

PW TECHNICROSS PUZZLE No. 1



ACROSS

1 Sort of band which has been infiltrated? (4)
4 Sound representation in broadcasting? (8)
9 New Zealander involved in ski wireless? (4)
10 Such rule of thumb for a conductor? (4-4)
11 The radio's epoch-making centre (3)
12 Push with it for amplification (4)
13 A feeler for a better receiver? (6)
14 Steady Eddie changed colour inside! (4)
15 Resistance units of German origin (4)
17 Condensed diagrams for fruit production (4)
20 No charge for such oscillation (4)
21 Overtakes—with or without a car! (6)
23 Phone for this type of modulator? (4)
24 Torn away from electricity by a dog? (3)
25 It returns part of your output! (8)
27 Girl in a Fair Isle pullover (4)
28 Record needs waxing with this valve? (4-4)
29 Natural products of 10 Down (4)

DOWN

2 It has an angle in radio communication (7)
3 All-rounders in coil protection (7)
5 Yes, relay equipment is connected (3)
6 Invitation to part of a French meal? (6)
7 Took a pitch from the animal within? (5)
8 Expression of effective forcefulness (7)
10 A piece of cake in ionization? (5)
15 Too much connection with 25 Across? (7)
16 A circuit may do so, of course (5)
17 Good reception for a type like Rod? (7)
18 Crew formation for co-ordinating adjustment? (7)
19 Revolvers instead of maps for world travellers (6)
22 Aches so about a mere game? (5)
26 Network of transatlantic origin (1, 1, 1)

FOR AMUSEMENT ONLY
ANSWERS NEXT MONTH

BETTER AERIALS for BETTER STEREO

GORDON KING

PART 3

AERIAL DESIGN

Accurate design of good FM aerials of multi-element composition is complex, and since very good FM aerials of all types are readily available at quite reasonable prices it hardly pays the enthusiast these days to tailor his own design. Discarded television aerials as they stand are useless for FM since their tuned frequency is all wrong. However, it is sometimes possible to make use of some of the components of such aerials in the construction of an FM aerial. The elements and cross-boom of a Band I aerial can be cut down to tune Band II, and the insulator at the dipole and other fitments can often be used to advantage. There is no 'standard' design; the absolute dimensions of the elements and their spacings determine the overall bandwidth, the nature of the polar diagram and the correct impedance matching to the feeder over the bandwidth.

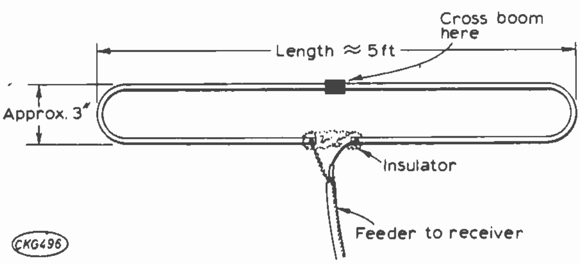


Fig. 7: General construction of a folded dipole which can be used by itself or form the basis of a multi-element aerial.

A simple dipole has a centre impedance of about 72 ohms and thus closely matches 72 ohm coaxial feeder, this being necessary for maximum energy transfer from the aerial to the receiver or tuner. However, when the simple dipole is advanced into a multi-element array by the addition of parasitic elements the impedance at the centre of the dipole falls and some artifice has to be employed to increase the coupling impedance to a value matching the feeder.

One such artifice is 'folding' the dipole, as shown in Fig. 7. This quadruples the impedance at the feeder connecting point, increasing it to about 300 ohms in the simple case. However, when a reflector and directors are added the centre impedance of a simple dipole falls to about 24 ohms, so by folding the dipole as shown in Fig. 7 the coupling impedance is restored to about 72 ohms.

HOME-MADE AERIAL

Fig. 8 gives the dimensions for a home-made four-element array which will respond pretty well over the whole of Band II. The dipole can be folded as shown in Fig. 7 and 72 ohm coaxial feeder should be used. Notice that the reflector is slightly longer than the dipole and that the directors are shorter. Additional directors can be used, the third then being 4ft. 3in. and the fourth 4ft. with 1ft. 7in. spacing.

It should be noted that the element dimensions correspond to length plus diameter, so if they are

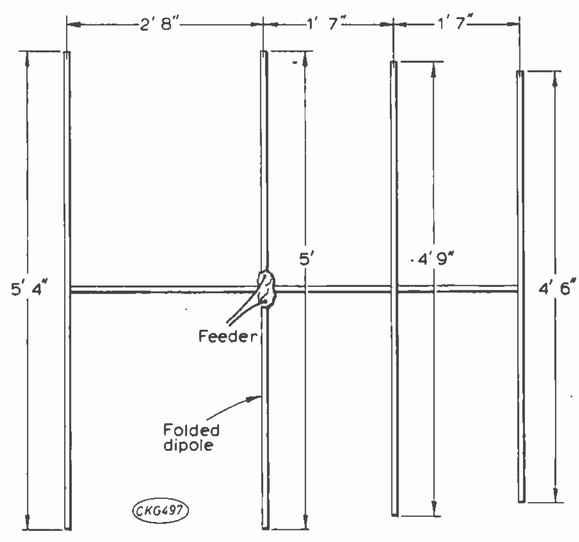


Fig. 8: Dimensions for a four element beam using a folded dipole as shown in Fig. 7.

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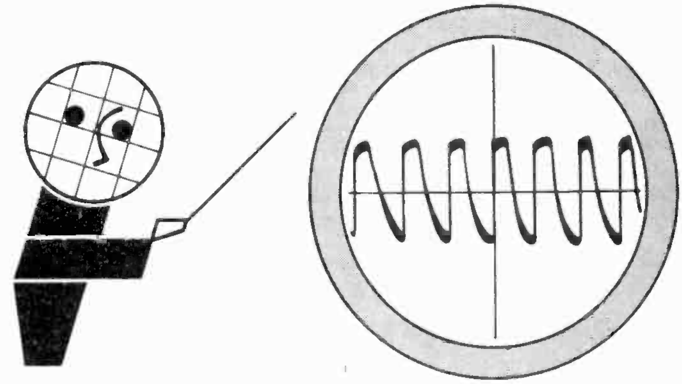

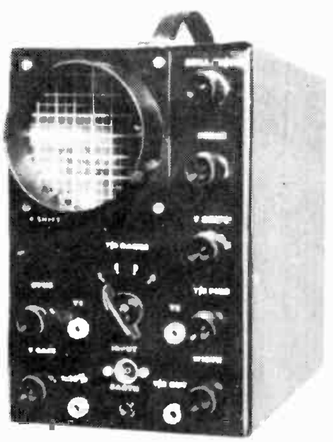

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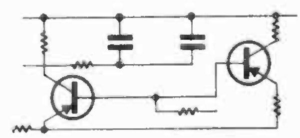

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⅓	2%	10 Ω–1M Ω	E24	3·5p	3p
⅛	10%	1 Ω–3·9 Ω	E12	1p	0·8p
½	5%	4·7 Ω–1M Ω	E12	1p	0·8p
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AC107	15p	AF126	20p	BF115	25p	OC42	12p	SN3707	12p
AC126	12p	AF139	32p	BF173	20p	OC44	12p	2N3708	10p
AC127	15p	AF178	32p	BF177	28p	OC45	12p	2N3709	11p
AC128	15p	AF180	40p	BF178	32p	OC70	12p	2N3710	11p
AC131	12p	AF181	40p	BF179	32p	OC71	12p	2N3711	11p
AC132	12p	BC107	12p	BF180	32p	OC72	12p	2N3819	32p
AC176	15p	BC108	12p	BF181	32p	OC81	12p	2N4062	12p
AC187	22p	BC109	12p	BF194	14p	OC82D	12p	2N4286	20p
AC188	22p	BC147	12p	BF195	14p	2N2646	60p	2N4289	20p
AD140	50p	BC148	12p	BF197	15p	2N2904	20p	40360	35p
AD149	45p	BC149	12p	BF200	32p	2N2926	10p	40361	35p
AD161	33p	BC157	14p	BFY50	20p	2N3054	58p	40362	40p
AD162	36p	BC158	14p	BFY51	20p	2N3055	60p	40408	40p
AF114	20p	BC159	14p	BFY52	20p	2N3702	13p	ZTX108	15p
AF115	20p	BC187	22p	BUY105	225p	2N3703	13p	ZTX300	15p
AF116	20p	BD131	75p	OC26	45p	2N3704	13p	ZTX302	20p
AF117	20p	BD132	75p	OC28	50p	2N3705	12p	ZTX500	15p
AF118	38p	BD133	75p	OC35	50p	2N3706	11p	ZXT503	20p

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BY127	1250V	1A	12p	OA85	7p
BZY10	800V	6A	25p	OA90	5p
BZY13	200V	6A	20p	OA91	5p
1N4001	50V	1A	7p	OA202	7p
1N4004	400V	1A	8p	1N4148	5p
1N4007	1000V	1A	10p	BA114	8p

BRUSHED ALUMINIUM PANELS

12in x 6in, **25p**; 12in x 2½in, **10p**; 9in x 2in, **7p**

SLIDER POTENTIOMETERS

86mm x 9mm x 16mm, length of track 59mm.
SINGLE 10K, 25K, 100K log. or lin. **40p.**
DUAL GANG, 10K + 10K etc. log. or lin. **60p.**
KNOB FOR ABOVE, **12p.**
FRONT PANEL, **65p.**
18 Gauge panel 12in x 4in with slots cut for use with slider pots. Grey or matt black finish complete with fixings for 4 pots.

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2N5064	200V	0·8A	47p
106F	50V	4A	40p
106D	400V	4A	55p

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160V: 0·01μF, 0·015μF, 0·022μF, 0·033μF, 0·047μF, 0·068μF, **3p.** 0·1μF, **3½p.** 0·15μF, **4½p.** 0·22μF, **5p.** 0·33μF, **6p.** 0·47μF, **7½p.** 0·68μF, **11p.** 1·0μF, **13p.**

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0·22μF	35V	4·7μF	35V	33μF	10V
0·47μF	35V	6·8μF	25V	47μF	6·3V
1·0μF	35V	10μF	25V	100μF	3V

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2½ x 3¾	22p	16p
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3¾ x 5	27p	27p
17 x 2½	75p	57½p
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17 x 5 (plain)	—	82p
17 x 3¾ (plain)	—	60p
17 x 2½ (plain)	—	42p
2½ x 5 (plain)	—	12p
2½ x 3¾ (plain)	—	11p
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7401	18	16	14	13
7402	18	16	14	13
7403	18	16	14	13
7404	20	18	16	14
7405	20	18	16	14
7406	50	45	40	35
7407	56	50	44	38
7408	36	30	27	23
7409	36	30	27	33
7410	18	16	14	13
7411	23	21	20	18
7412	36	30	27	23
7413	34	28	26	22
7416	45	43	39	34
7420	18	16	14	13
7421	36	30	27	23
7426	32	29	23	20
7430	20	18	16	14
7432	40	36	32	28
7440	20	18	16	14
7441	80	75	70	65
7442	80	75	70	65
7443	125	120	115	115
7447	175	165	150	120
7448	185	175	170	165
7450	18	16	14	13
7451	18	16	14	13
7453	18	16	14	13
7454	18	16	14	13
7460	18	16	14	13
7470	30	28	25	24
7472	30	28	27	23
7473	40	38	36	30
7474	40	36	32	28
7475	55	52	50	49
7476	40	36	32	30
7480	100	95	90	85
7481	125	115	110	105
7482	100	96	90	85
7483	100	97	95	92
7484	120	115	110	105
7485	250	245	240	230
7486	45	42	37	33
7490	75	67	60	52
7491A	100	92	85	79
7492	75	70	65	60
7493	75	68	60	52
7494	95	90	85	80
7495	105	100	95	90
7496	100	95	90	85
74100	250	240	235	230
74118	100	82	73	64
74121	43	40	38	36
74141	100	95	90	85
74145	150	140	135	130
74150	330	280	250	220
74151	110	100	95	89
74153	120	110	105	95
74154	200	180	170	160
74155	150	120	100	86
74156	130	120	100	96
74180	155	136	112	105
74190	195	190	185	180
74191	195	190	185	180
74192	200	190	180	164
74193	200	180	170	150
74196	200	190	180	170
74197	200	195	180	170

LINEAR IC's

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741	14 pin DIL	38p
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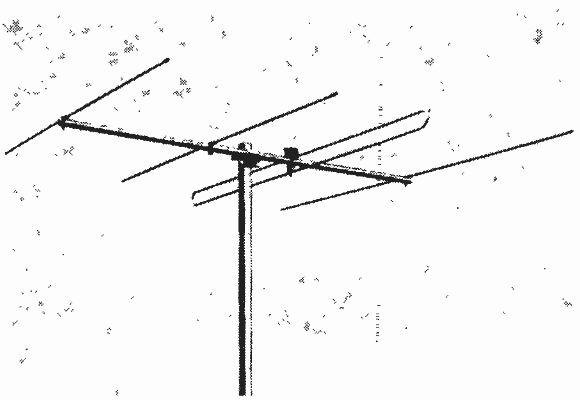
747	14 pin DIL	85p
748	8 pin DIL	45p
DIL sockets	14 pin and 16 pin	16p



A commercial version of a four element array for FM (J-Beam Aerials Ltd.).

composed of, say, ½in. rod the actual lengths are all ½in. less than given on the diagram. The spacings are taken from the centre axis of each rod or element.

INPUT MATCHING

Most British receivers and tuners destined for the British market have aerial inputs suitable for 72 ohm coaxial cable (the British 'standard'). Some imported receivers and tuners have inputs for both 72 ohms coaxial (which is unbalanced) and 240/300 ohms balanced twin feeder, used in European areas and American countries. There are times, however, when the receiver or tuner has only a 240/300 ohm balanced input. By connecting the British standard coaxial cable direct to such an input results in a mismatch and hence loss of signal energy transfer.

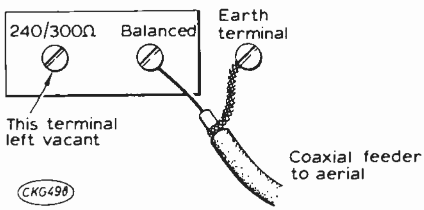


Fig. 9: A useful 'dodge' to permit feeding a balanced input with unbalanced coaxial cable.

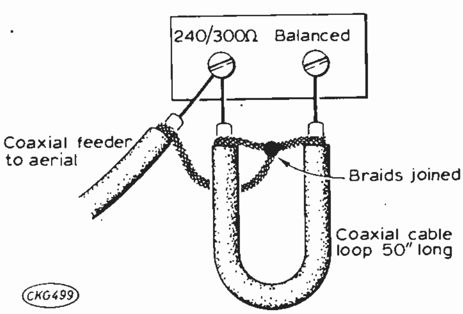


Fig. 10: An alternative method of feeding unbalanced coaxial cable to a balanced input circuit.

In quite a few cases like this it is possible to achieve matching to coaxial cable by connecting the inner conductor to one of the 240/300 ohm sockets or terminals and the braid to an adjacent earth terminal or to the metal part of the chassis **(Important: this must never be done if the receiver is of the 'a.c./d.c.' type which uses no mains transformer for isolation; if in doubt consult a qualified dealer or technician),** as shown in Fig. 9.

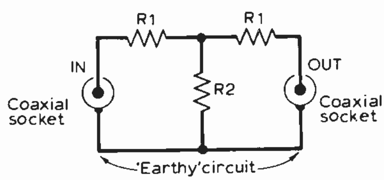
This matching results from the centre-tapped winding on the primary of the aerial input transformer, giving a 4:1 impedance transformation since the turns ratio is 2:1.

Should the 300 ohm balanced aerial input circuit of the receiver or tuner be unsuitable for matching this way, then an external impedance matching transformer must be used for the best results. A simple coaxial cable transformer arrangement is shown in Fig. 10. It is also possible to obtain commercially small low-loss balun transformers using ferrite cores.

A multi-element FM aerial can be an awkward brute! Erection of these arrays is best left to the experts (R. Smith Aerials, Luton).

INPUT OVERLOAD

When a tuner or receiver is used very close to a powerful station the input stages may be unable to accommodate the multiplicity of strong signals



$R1 = Z\frac{A-1}{A+1}$ $R2 = Z\frac{2A}{(A+1)(A-1)}$

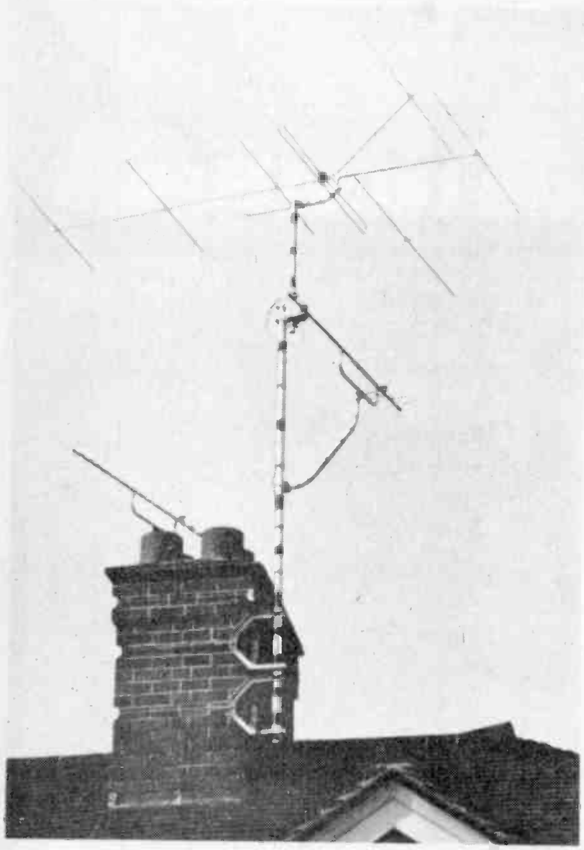
Z = Receiver/feeder input impedance

A = Voltage reduction ratio

Fig. 11: Overloading of input circuits can cause all kinds of strange noises on FM. Suitable signal attenuators can be constructed using the above formulae.

without overloading. This is manifested by spurious signals appearing at incorrect tuning points over the scale, and intermodulation may occur between the various programmes.

This trouble can also incite a 'warbling' type of interference on stereo. The solution to the problem is to reduce the level (attenuate) the signal from the aerial to the receiver or tuner. A less elaborate indoor aerial may reduce the signal input, but in some cases this could be undesirable, notably when



The lower mast carries a fixed TV array plus a Stolle rotator for the Arrow 7 FM beam above (R. Smith Aerials, Luton).

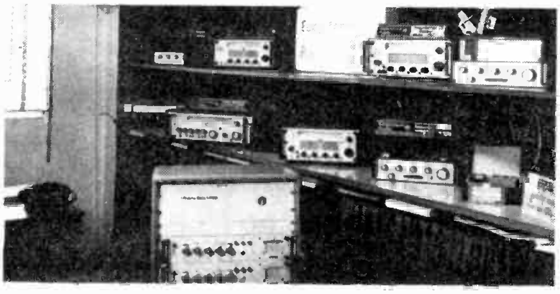
a directional aerial is used to reduce distortion due to reflected signals (Fig. 6).

Plug-in coaxial attenuators in a range of values are obtainable from dealers, and there is a similar type available with adjustable attenuation values. Alternatively, it is not a difficult matter to make one's own attenuators for unbalanced circuits, as shown in Fig. 11. The resistors, which should be of non-inductive type (i.e., cracked carbon), can be mounted in a discarded tobacco tin, using the tin itself as the 'earthy' circuit.

Overloading can also occur under certain conditions at distances of twenty or more miles from a station at elevated sites with open aspects towards the station. It is likely that more overloading problems will occur when the FM commercial stations go on the air, for these may not be co-sited with the regular BBC stations and thus could introduce heavy signal fields in areas where only moderate signals are present from the BBC stations.

In some cases like this it may be necessary to use frequency-selection attenuation adjusted only to the frequency of the powerful offending station, but this is another story which will be examined in greater detail when the time comes. ■

London's Lighthouse



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AD162	30p	BF195	15p	2N2926R	9p
AF114	12p	BFY50	22p	2N2926O	9p
AF115	12p	BFY51	22p	2N2926V	9p
AF116	12p	OC26	40p	2N2926G	10p
AF117	12p	OC28	40p	2N3014	10p
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IN4007	8p
IN4148	5p
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1	5%	2·2—10 Meg.	E12	2p	1·6p	1·4p
4	10%	1ohm—10ohm	E12	6p	5p	—

Do not mix ohmic values to obtain quantity prices. Ignore fraction.

POLYESTER CAPACITORS. Axial lead type.
400V: 0·001μF, 0·0015μF, 0·0022μF, 0·0033μF, 0·0047μF, 0·0068μF, 2½p; 0·01μF, 0·015μF, 0·022μF, 0·047μF, 3p; 0·068μF, 0·1μF, 0·15μF, 4p; 0·22μF, 7p; 0·33μF, 10p; 0·47μF, 13p
160V: 0·1μF, 0·15μF, 4p; 0·22μF, 5p; 0·33μF, 6p; 0·47μF, 7p; 0·68μF, 10p; 1μF, 13p.
Radial lead P.C. type:
250V: 0·01μF, 0·015μF, 0·022μF, 3p; 0·033μF, 0·047μF, 0·068μF, 3½p; 0·1μF, 4p; 0·15μF, 4p; 0·22μF, 0·33μF, 5p; 0·47μF, 7p; 0·68μF, 10p; 1·0μF, 11p.

ELECTROLYTIC CAPACITORS. Miniature axial lead type.
63V: 1μF, 1·5μF, 2·2μF, 3·3μF, 4·7μF, 6·8μF, 10μF, 15μF, 22μF, 47μF, 68μF, 6p each.
40V: 100μF, 6p; 150μF 25V, 6p; 25V: 220μF, 11p; 470μF, 13p; 1,000μF, 25p.

CERAMIC CAPACITORS: 50V d.c. Plaquette body 25mm leads.
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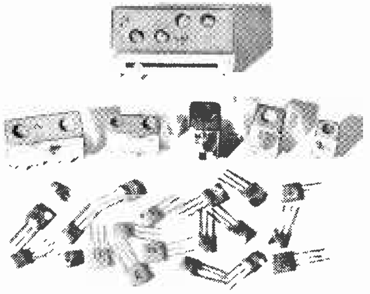


What appear to be small ceramic capacitors, albeit with three leads, are in fact ceramic IF filter blocks made by Toko of Japan. A coloured dot indicates the nominal centre frequency which may range from 10·62 to 10·78MHz. Prices 40p.

The equally minute IF units at the top of the photograph include the MFH51T mechanical filter and its matching transformer type YXE10857 which together cost around £1·50. The filter is available in 4, 5 and 7kHz bandwidths (5kHz) versions being readily available at the moment. The CFU455C and CFT455B are also shown in the group, these being ceramic filters centred on 455kHz. Details and current prices from *Ambit International, 37 High Street, Brentwood, Essex.*

DIGITAL CLOCK

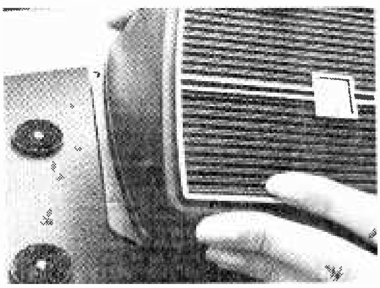
Fonadek have introduced their Copal 602 clock. It shows the day, date and time in white numerals and there is a small fluorescent tube built in which illuminates the digits. The cabinet is finished in simulated Brazilian rosewood and the unit is priced at £15·95 including VAT. *Fonadek International Ltd., Harbòrne, Birmingham B17 9JS.*

AMATEUR RADIO AWARDS

This new book from the R.S.G.B. compiled by the Society's HF Awards Manager contains details of the world's major awards, where and how to apply for them and illustrations of a number of the certificates.

USEFUL FASTENERS

Hedlock II fasteners are the latest from 3M. They consist of interlocking "*twin*" parts which just push together to give a strong bond. They can be screwed to two surfaces, ie: car parcel shelf and speaker (see picture), and make a good push fit. A sharp tug releases the fasteners. *3M. United Kingdom Limited, 3M House, Wigmore Street, London W1A. 1ET.*



20MHz COUNTER/TIMER

Meteronic announce this latest addition to their range of low-cost test instruments. The Type 410 may be used as a frequency meter, multiperiod meter or timer. Timebase stability is typically 1 part in 10^6 per °C. Time units are $10\mu S$ to 1 sec and frequency can be measured to over 20MHz with a resolution of 1Hz. The high impedance input accepts waveforms with slow transition rates. Range selection is manual, with automatic positioning of the decimal point, and allows up to 8 digits to be examined on the large 4 digit display. Overflow indication is provided. Timer start, stop and reset may be operated electronically or by push buttons. The U.K. price exclusive of VAT, is £85. *Meteronic, 114/116 Shipbourne Road, Tonbridge, Kent.*

HIGH-QUALITY STEREO DECODER

A recent addition to the Mullard range of modules for use in radio and audio amplifiers is a stereo decoder, type LP1400. It is intended for use by setmakers in high-quality equipment.

The LP1400 uses the sum and difference separation principle, which allows de-emphasis to be applied to the difference signal before demodulation. This attenuates interference from adjacent channel transmissions and noise components in the 114kHz and 190kHz regions which in a time multiplex system are frequently demodulated by harmonics of the 38kHz signal and transposed to produce unwanted components in the audio outputs.

The LP1400 offers good stereo separation and a better overall performance than is generally obtained with time multiplex systems. *Mullard Ltd., Mullard House, Torrington Place, London WC1E 7HD.*

QUADRAPHONIC PHONES

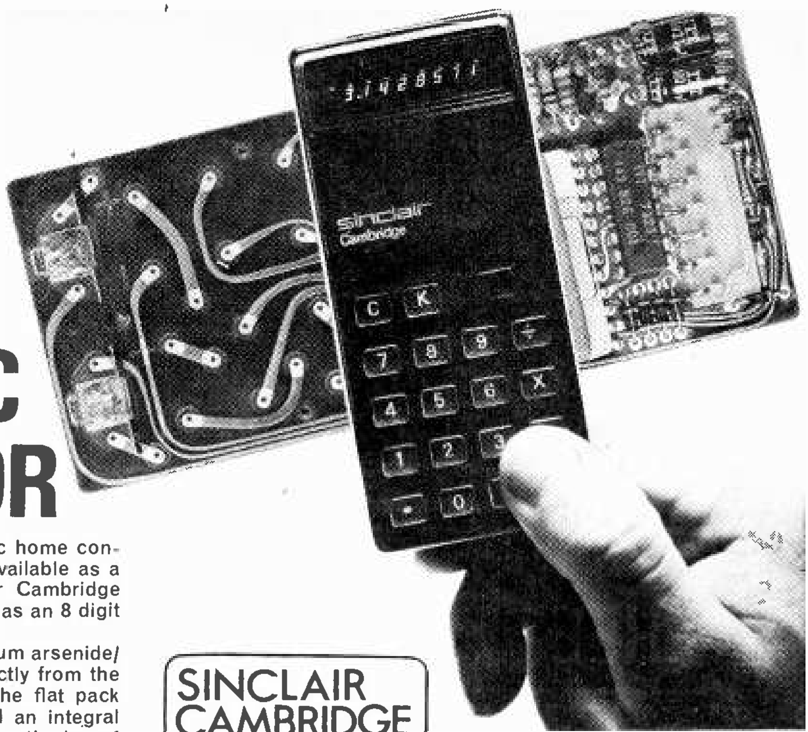
You don't have to have four ears to listen to quadraphonic sound on headphones, because in the new Eagle FF29, four 50mm transducers are so arranged that the effect is similar to four strategically-placed loudspeakers.

The FF29 phones use two coded jack plugs which are also ideally suited for use with the AA26 quadraphonic adaptor. This unit converts any stereo set-up into a 4-channel system with the addition of 2 extra speakers.

Frequency range of the phones is 20Hz-20kHz, impedance 8Ω per channel and matching impedance 8 to 16Ω. The retail price is £16·80 excluding VAT. *Eagle International, Precision Centre, Heather Park Drive, Wembley, HA0 1SU.*

SPECIAL PRODUCT REPORT

ELECTRONIC CALCULATOR



SINCLAIR CAMBRIDGE

ONE of the latest additions to the electronic home construction market is a pocket calculator available as a complete kit or fully assembled. The Sinclair Cambridge weighs $3\frac{1}{2}$ozs and measures $4\frac{1}{2} \times 2 \times \frac{11}{16}$in and has an 8 digit LED display.

The LED display is an 8 digit 7 segment gallium arsenide/phosphide device being driven via diodes directly from the calculator chip. The 8 diodes, D3-D10, and the flat pack resistor package RN1 form both isolation and an integral part of the keyboard's electronic routine. The cathodes of each digit are driven by a sixteen pin integrated circuit.

The keyboard is made from a single sheet of stainless steel with 18 'click fingers' chemically etched into it to enable the keys to have mechanical hysteresis and a positive click action.

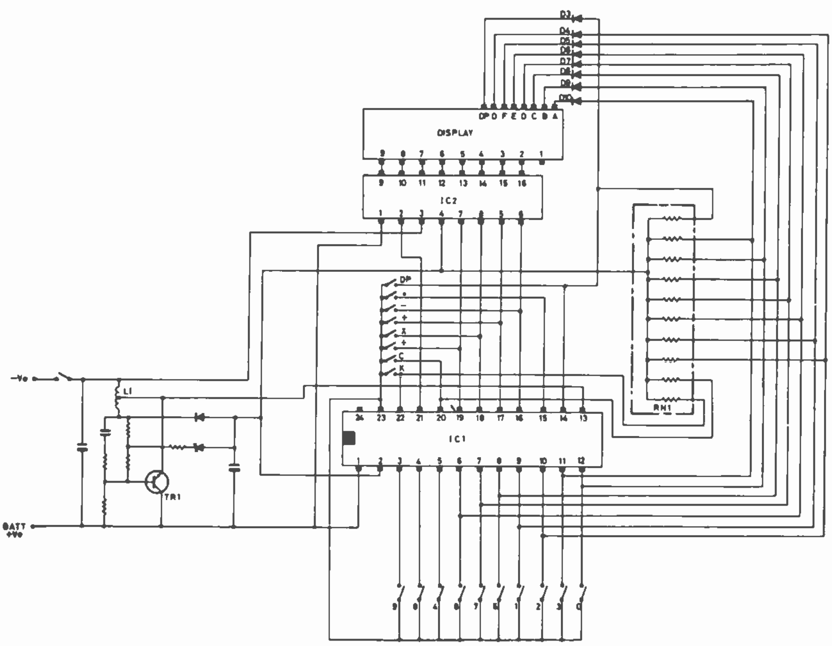
The power supply (incorporating Tr1 functioning as an oscillator) generates a stabilised 15 volt d.c. supply for the two IC's. The action of Tr1 is such that it switches fully on and off thereby producing a square wave at the emitter thus providing the clock pulse, which is required to drive the calculator chip.

The algebraic logic of this calculator—which enables calculation a to be entered as you would write it down, or in other words logically, acts together with an advanced constant function to give, in effect, a limited memory, thus extending the calculations which can be carried out as true chains. The constant facility may be used on all four functions—addition, subtraction, multiplication and division ($+ - \times \div$). These functions are often referred to in calculator terminology as operators.

In addition, the calculator operates across a wide exponent range from 10^{-20} to 10^{79} enabling it to handle large or small numbers without becoming overloaded. Calculations are to 8 significant digits, and incorporate a fully floating decimal.

A dual purpose clear button will remove only the last entry when used in conjunction with a function.

The calculator is battery powered by four cells. These may either be ordinary U16 cells (which give limited life) or the MN2400 mercury cells to give the calculator an extended



Basic circuit of the Sinclair Cambridge. A brief description of circuit function is given in the text.

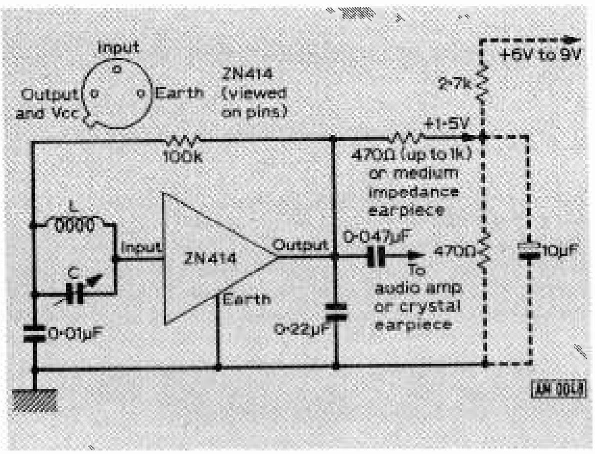
MORE ON THE ZN414

L.A.J. IRELAND

THE first surprise to the reader brought up on radio in the fifties and sixties is to find the TRF (tuned radio frequency or "straight") radio circuit making a comeback in the 1970s. This type of circuitry was discontinued in the thirties, with the development of the superhet, for several good reasons. First, the selectivity of the tuned circuits of the time became inadequate as the number of transmitters on the air increased, with the result that the ability to discriminate between stations closely separated in frequency was impaired. Improved selectivity required more sharply tuned coils, or alternatively the application of reaction or positive feedback. Further, with a series of tuned circuits operating at the same frequency, stray coupling could itself provide sufficient positive feedback to produce instability.

In any event, excessive positive feedback whether due to stray coupling or deliberate application of reaction could, quite simply, cause the circuit to radiate rather than receive and thereby render impossible reception of a broadcast on that frequency, for some distance around. The superhet, in which amplification of the signal occurs mainly at an intermediate frequency separated from that of the received signal, not only guarantees improved selectivity and stability but also permits the easy application of such refinements as automatic gain control (AGC).

The above observations apply generally to valve or transistor systems; it will be noted that, although TRF circuits have a deceptive simplicity, and avoid the purchase, installation and alignment of intermediate frequency transformers, they achieved only a very restricted popularity among the home constructors of the sixties. Also, despite the fact that quality in broadcast sound had been transferred to the FM channels, even the cheapest commercial AM receivers retained the superhet scheme. To be a credible contribution to the radio scene, therefore, the Ferranti ZN414 unit must have featured as distinctly novel in TRF circuits.



It should be clear, though, that the technology of the monolithic integrated circuit is better adapted to the TRF format. In every single operational amplifier or other high gain IC, methods have had to be developed and applied to enable the transfer of signals through several stages of amplification within a single chip without instability developing through stray capacitances. An integrated circuit IF amplifier for a superhet, however, must either lump all the frequency-selective tuned circuits before or after the amplification stage, or alternatively transfer the signal several times between the chip and external discrete circuitry, each time incurring the risk of instability problems which the superhet was intended to avoid. Further, with the high grade ferrites and litz wire, the tuned aerial circuit currently available has a higher "Q" and therefore an inherently improved selectivity, on the circuits of over thirty years ago. Further, a high input impedance can be developed, in the case of the Ferranti ZN414 typically over 1·5MΩ, so that this selectivity is not degraded by the loading presented by the following circuit. Finally, it has been found possible to incorporate an adequate AGC system.

Low current consumption

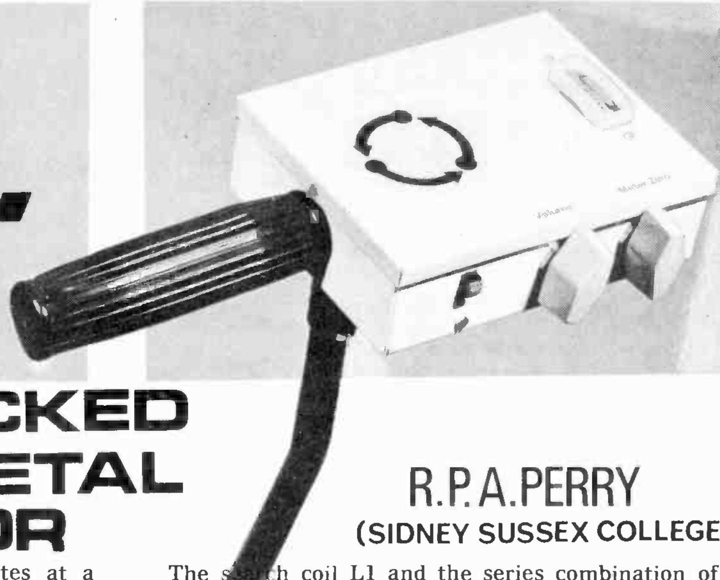
The unit incorporates the equivalent of ten transistors packaged in a three pin TO-18 can identical with that used for small NPN transistors. The required power source is a single 1·5V dry cell though the unit will function adequately over the range 1·1 to 1·8V; economy of operation is assured by the very low current drain, some 1mA being typical. Under such conditions, and with the AGC system operating on an incoming signal, the circuit produces an output of some 40mV quite adequate to operate a medium impedance magnetic earpiece (about 500Ω) or a crystal earpiece through a coupling capacitor. In general, though, the unit will be used to drive an audio amplifier, for which the output is adequate.

Constructional details

Now for one or two constructional points. The small capacitor from the output pin to earth bypasses to earth any radio frequency signal appearing at the output. It is therefore necessary that it be mounted as close as possible to the output and earth leads of the ZN414. It will be noted that the time constant of the output circuit, determined by this capacitor and the AGC resistor, is some 4kHz a feature tailored to the characteristics of the AM signal, for which a passband of some 10kHz (double sideband) is allowed.

The aerial used, which may be any of those advertised to cover the medium waveband with an appropriate capacitor, should have its ferrite rod at least an inch away from the IC, otherwise all leads should be as short as possible. Due to the high input impedance already mentioned it is not necessary to tap the tuned coil on the ferrite rod to find a matching point to feed the circuit input. However, on commercial rod aerials employed with this unit, such a tap, or a small secondary winding, may be available; this may be used experimentally for the connection of an external aerial, if so desired. ■

'ferret'



PHASE LOCKED LOOP I.C. METAL DETECTOR

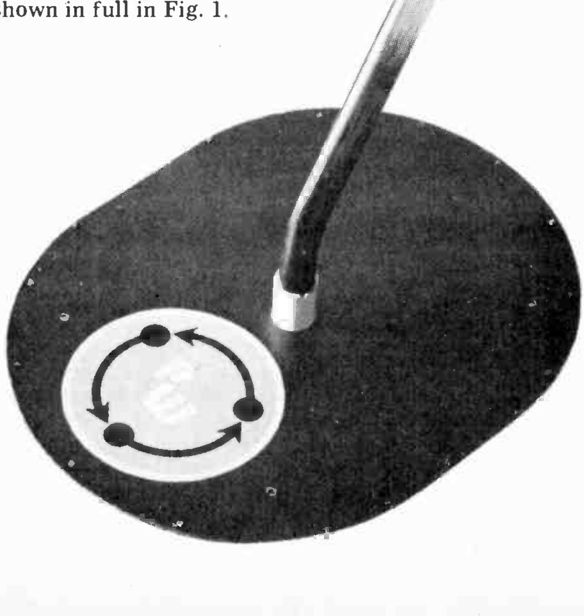
R.P.A.PERRY
(SIDNEY SUSSEX COLLEGE)

THIS lightweight metal detector operates at a frequency of 120kHz and uses a phase locked loop to provide both an audible and a visual indication of a find. Most detectors use either a variable inductance or a variable mutual inductance as the sensing element. The Ferret is no exception, the inductance of the search coil changing in the presence of metal. Ferrous and non-ferrous metals cause opposite changes in inductance and it is a unique feature of the Ferret that a visual indication of this is provided. The meter deflection is in opposite senses for the two types of metal.

Another feature not found on previous metal detectors is the use of harmonic mixing. Although the two oscillators in the Ferret are both operated at about 120kHz the beat note is derived from their fifth harmonics and the sensitivity is accordingly five times as great.

Main Oscillator

The electronics of the metal detector breaks down into four functions: the Main Oscillator, Beat Frequency Oscillator, Phase Locked Loop and DC Amplifier. Powered by two PP3 batteries the circuit is shown in full in Fig. 1.



The search coil L1 and the series combination of C4, C5 and C6 form a tuned circuit with Tr1 acting as an oscillator taking the voltage at the C4-C5 junction, amplifying it, and feeding it back to the C6-L1 junction in the correct phase for maintaining the oscillation. Diode D1 clamps the gate of Tr1 below earth potential and provides AGC action to stabilise the output and prevent it from being clipped. DC power is fed to the amplifier through the choke L2 the value of which is not critical, but 25mH should be considered a minimum and the value chosen (40mH) happened to be available to the author in a convenient size. An output of at least 5V peak to peak should be available, the frequency being adjusted by altering the number of turns on L1.

Beat Frequency Oscillator

An NE555 timer IC is used in astable mode to provide a variable frequency oscillator. Suppose C1 is charging up through R1, R2 and VR2; when the voltage across C1, sensed by pin 6, reaches $\frac{2}{3}$ Vcc pin 7 is earthed and C1 begins to discharge through R1. When the voltage across C1, sensed by pin 2, has fallen to $\frac{1}{3}$ Vcc pin 7 is allowed to float and C1 begins to recharge. The switching applied to pin 7 is amplified and presented at the output, pin 3, as a squarewave which swings between earth and Vcc.

C1 charge time $= 0{\cdot}685(R1+R2+VR2)C1$

C1 discharge time $= 0{\cdot}685 R1C1$

$\therefore$ Frequency $= 1/(\text{Charge time} + \text{Discharge time})$
$= 1/(2R1+R2+VR2)C1 \times 0{\cdot}685$

Substituting the circuit values gives a range of frequencies, as VR2 is varied, of 103-160kHz. The upper frequency is not reached due to stray capacitances and internal resistances (the chip is only specified to 100kHz) but an adequate band to either side of 120kHz can be swept.

Phase Locked Loop

The operation of the NE561B phase locked loop was described last month, but is outlined again below owing to the unconventional used made of it in the Ferret.

When the PLL has no input signal, the Voltage Controlled Oscillator (VCO) frequency resulting is called the free-running frequency and is determined by C12 and the current injected into pin 6 from VR3 and R6.

In Fig. 2, Vc assumes a quiescent value. On applying the main oscillator output to the FM input, pin 13, the phase sensitive detector and low pass filter cause Vc to change just enough to make the VCO frequency equal to the input frequency ($5\times Fo$).

The amount that Vc changes depends on the difference between the free-running frequency and $5\times Fo$. In this circuit the free-running frequency is fixed so Vc can be regarded as a function of Fo only.

$$\frac{\text{Change in Vc}}{\text{Change in Fo}} = 200\text{mV}/\%$$

Thus changes in the inductance of L1 have been transformed into changes in Fo which have in their turn been transformed into changes in Vc.

The VCO frequency, which by PLL action is exactly equal to $5\times Fo$, is mixed with the Beat Frequency Oscillator output $5\times Fb$ in the internal multiplier intended for AM demodulation, Fig. 2. An audible beat note, Fa, results where $Fa=(5\times Fo \pm 5\times Fb) = 5(Fo \pm Fb)$.

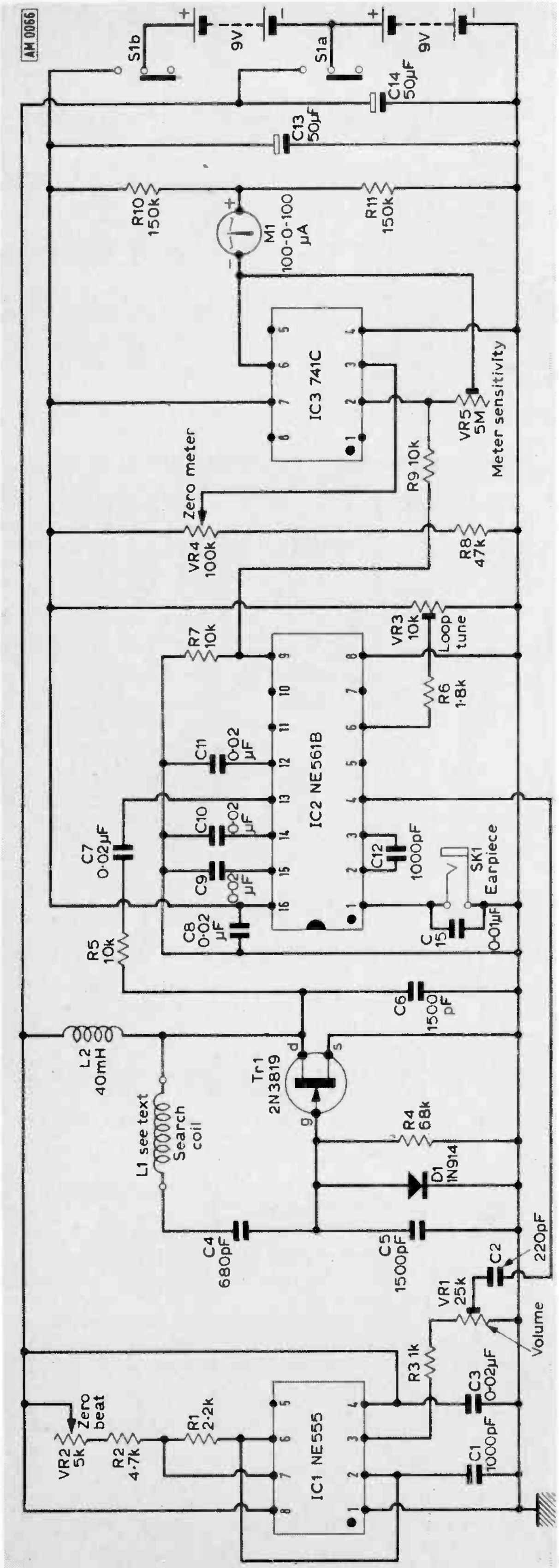
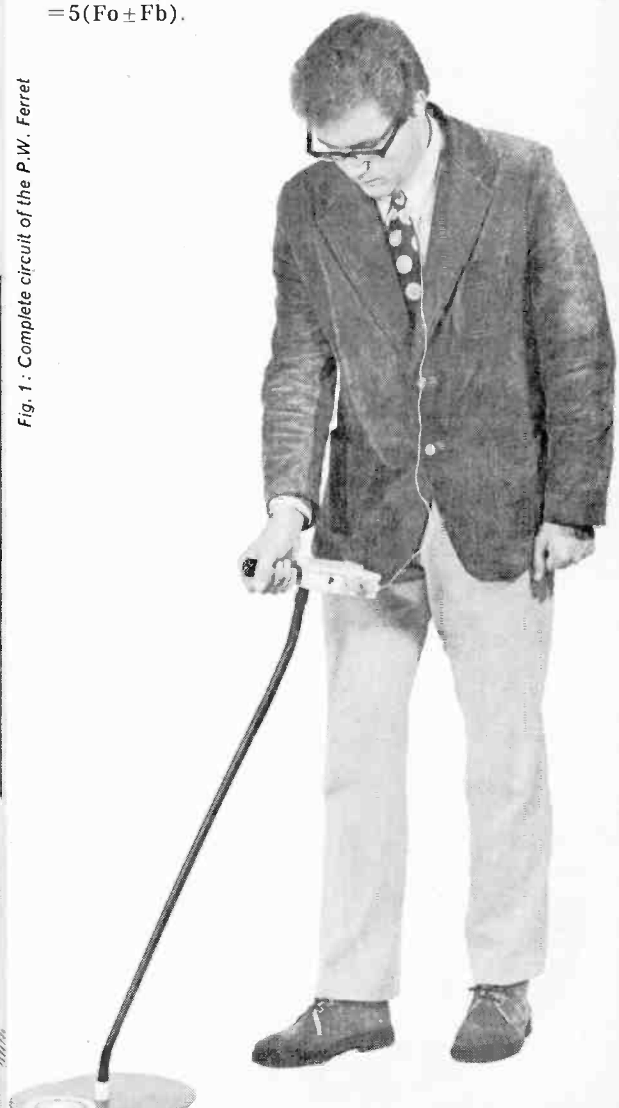
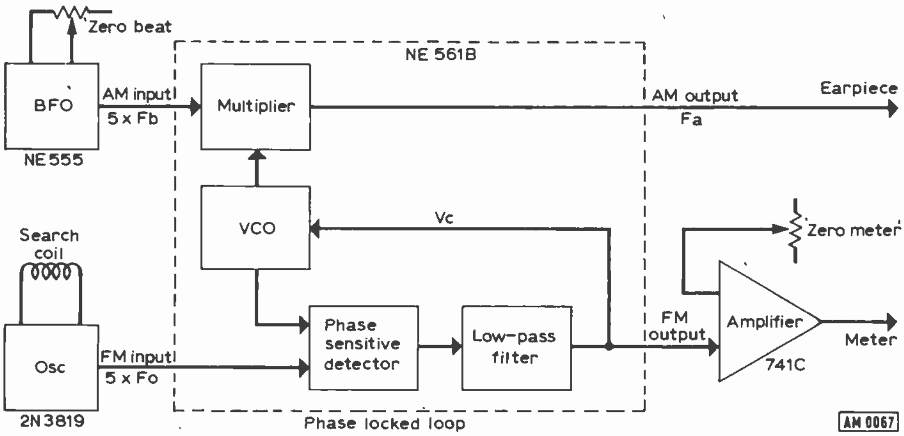


Fig. 1: Complete circuit of the P.W. Ferret





◀ *Fig. 3: Block diagram illustrating circuit function.*

Fig. 3: The printed circuit board—to scale. ▼

If Fo and Fb are very large compared with Fa, and are nearly equal to each other then very small changes in Fo will produce larges changes in Fa. Suppose Fo changes from 120kHz to 120·120kHz, with Fb=119·9kHz.

Vc will change by

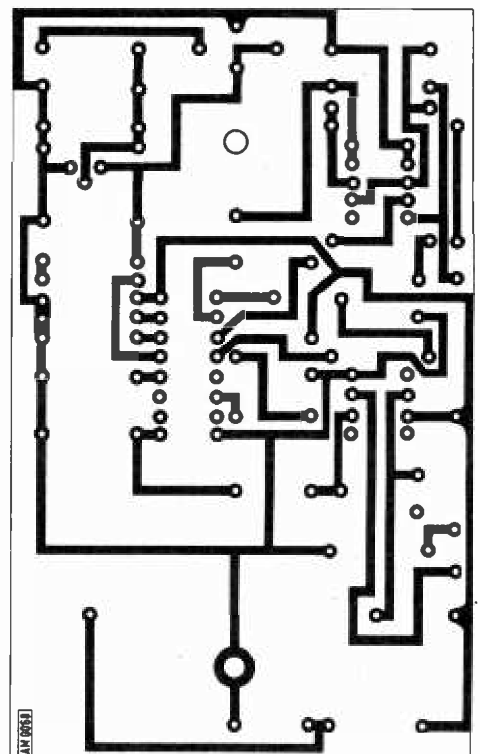
$$\left(\frac{120\cdot120-120}{120}\right)\times100\times200\text{mV}=20\text{mV}$$

and Fa will change from 5(120−119·9)=500Hz to 5(120·120−119·9)=1100Hz.

The output from the Beat Frequency Oscillator is dropped by the volume control VR1 to a level suitable for the phase locked loop and C2 tailors the frequency response of the coupling network to attenuate the fundamental of 120kHz but pass the required harmonic of 600kHz. An input of more than two volts will cause damage to the IC. The mixed output is fed directly into a crystal earpiece, and is quite sufficient for all but the most noisy surroundings. As mentioned above, VR1 acts as a preset volume control.

DO NOT attempt to drive a magnetic earpiece directly from the IC as this will seriously overload it. If it is required to run a magnetic earpiece or speaker then it is quite permissible to add a suitable amplifier stage, remembering that the AM output of an NE561B has a DC level of about +14V.

Capacitors C7-C11 perform coupling and bypass functions and any value between 0·01μF and 0·1μF should be adequate.



D.C. Amplifier

A 741 operational amplifier is used as a variable gain inverting amplifier. By altering the value of VR5, the preset sensitivity control, the gain of the amplifier can be adjusted from ×1 to ×500. At maximum gain an output swing of 1 volt is obtained for a 0·01% change in Fo.

Because the normal output level at pin 9 of IC2 is +12V a voltage divider VR4 and R8 is provided to give a zero-set control. The meter M1 will give a zero indication when the voltage at pin 3 of IC3 equals the voltage at pin 9 of IC2.

Resistors R10 and R11 are equivalent to a single resistance in series with the meter and connected to +9V. Their values should be adjusted so that full scale deflection of the meter occurs when the amplifier output is either at earth or +18V. 150kΩ was found to suit the miniature meter used in the prototype. Power supply decoupling is provided by C13 and C14.

Transistor enthusiasts may be interested to know that the three integrated circuits contain about seventy-five semiconductor devices although it is not often clear which of these are transistors and which are diodes!

Circuit Board

A printed circuit board 4×2⅜in. has been designed to take the Ferret, see Fig. 3. Only one interconnecting wire is used on the board and all terminations

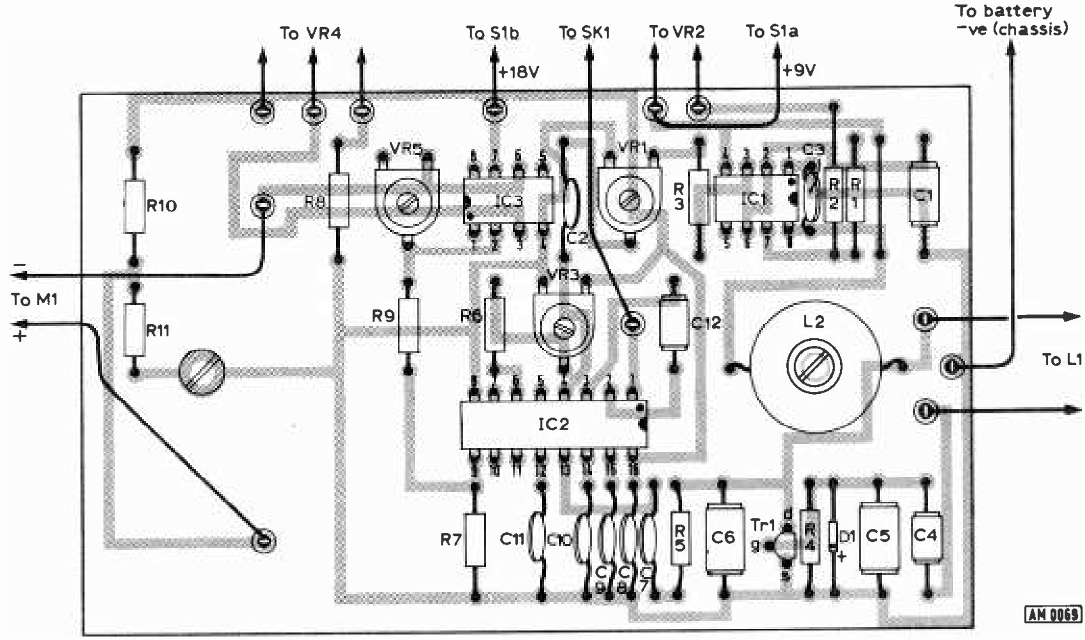


Fig. 4: Component layout and interconnections.

are taken to convenient points. The meter is intended to be positioned over the large clear area at one end of the board. Two holes are drilled to enable the board to be bolted into the box, one being positioned to take the integral screw of the specified pot core L2.

All the component holes except those for the preset potentiometers VR1, VR3 and VR5 are positioned on a 0·1in. matrix so the circuit could be made up as shown on perforated paxolin with pins and underboard connecting wires. Component positions are shown in Fig. 4.

If a new component layout is contemplated then the only precaution to take is to keep the leads to IC2 as short as possible and the circuit basically split up into its four sections, as depicted in Figs. 1 and 4.

Assembly

A small aluminium box $5\frac{1}{4} \times 4 \times 1\frac{1}{2}$in. has the remaining components mounted inside it with the meter in the lid. It is important to use a metal box in order to keep down stray radiation. Fig. 5 shows the positions of VR2, VR4, S1 and SK1. The cutting details for the meter will depend on the actual type used.

A 6BA bolt is used to augment the 6BA bolt in L2 for holding the circuit board. It is important to see that the case is earthed via the copper conductor pattern by at least one of these screws. The best way to ensure that the component wires do not short out on the case is to introduce a couple of extra nuts on the bolts between the board and the case.

If plastic electrical conduit, as described later, is used to construct the shaft of the Ferret then a hole large enough to accommodate the fixing bush must be punched or cut in the base of the case and a similar one for the handle.

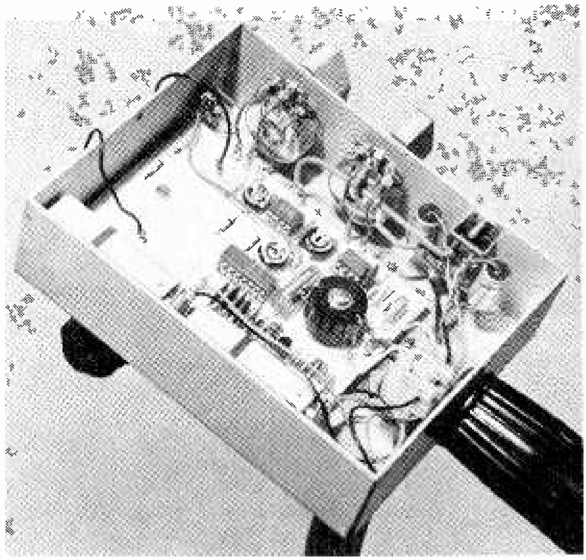


Fig. 5: The positions of the main controls can be clearly seen above.

The search coil, L1, must be wound for an inductance which gives a frequency of 120kHz in the main oscillator. It can be shown that the inductance is proportional to N^2D, where N is the number of turns and D the diameter of the search coil. Many different coils have been wound for the prototype using this formula based on an original made with the aid of a digital frequency meter. All have fallen well within the band that can be tuned in by the rest of the circuitry.

Fig. 6a shows a small coil for localised searches and Fig. 6b a larger coil, which is slightly less sensitive, for extended searches. The number of turns are respectively 90 and 65. To wind the coil, first nail a few small pins into the upper rim of the top plate and carefully wind the required number of turns from any thin insulated copper wire. When this is complete push the coil down on to the hardboard and secure with a dozen or so blobs of glue. When the glue is dry the pins can be removed and the two pieces of hardboard sandwiched together. Drill four holes in the complete assembly, as shown in Fig. 6, and bring the plates together with 4BA bolts.

The connection to the circuit board is made by a length of coax cable and a terminal block inside the case.

One of the easiest materials to use for the shaft is a length of plastic conduit intended for electrical wiring. Having been bent to the shape shown in Fig. 7, by gently heating the relevant section, it is fixed into the base of the box and the search coil top plate with termination pieces. The fixing to the search coil should be completed before it is finally screwed together.

A short length of conduit, fixed as described above into the end of the case, covered with a bicycle handlebar grip will suffice for a handle.

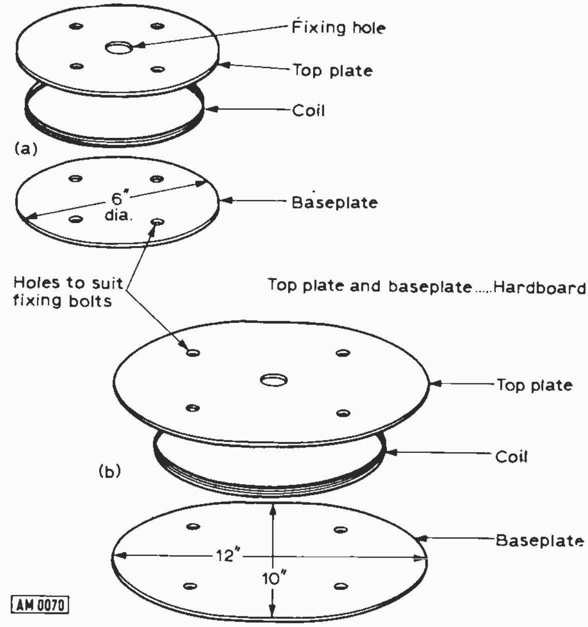


Fig. 6(a): A small coil used for localised searches and Fig. 6(b) a larger coil, although less sensitive, used for extended searches.

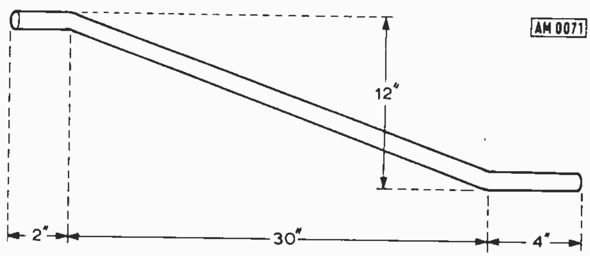
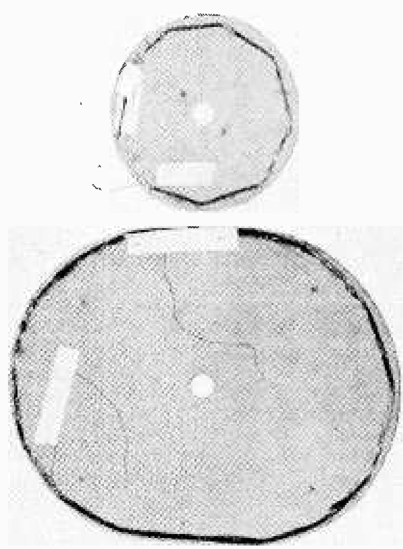


Fig. 7: The handle is formed as shown above.



Photograph shows two of the coils made by the author.

★ components list

Resistors

R1	2·2kΩ	R5	10kΩ	R9	10kΩ
R2	4·7kΩ	R6	1·8kΩ	R10	150kΩ
R3	1kΩ	R7	10kΩ	R11	150kΩ
R4	68kΩ	R8	47kΩ		

All ⅛ or ¼ watt, 20% or better, see text
VR1 25kΩ pre-set pot., horizontal, miniature
VR2 5kΩ pot., standard
VR3 10kΩ pre-set pot., horizontal, miniature
VR4 100kΩ pot., standard
VR5 5MΩ pre-set pot., horizontal, miniature

Capacitors

C1	1000pF polystyrene	C8	0·02μF ceramic
C2	220pF ceramic	C9	0·02μF ceramic
C3	0·02μF ceramic	C10	0·02μF ceramic
C4	680pF polystyrene	C11	0·02μF ceramic
C5	1500pF polystyrene	C12	1000pF polystyrene
C6	1500pF polystyrene	C13	50μF 25V electrolytic
C7	0·02μF ceramic	C14	50μF 25V electrolytic
		C15	0·01μF ceramic

Polystyrene capacitors 5% or better

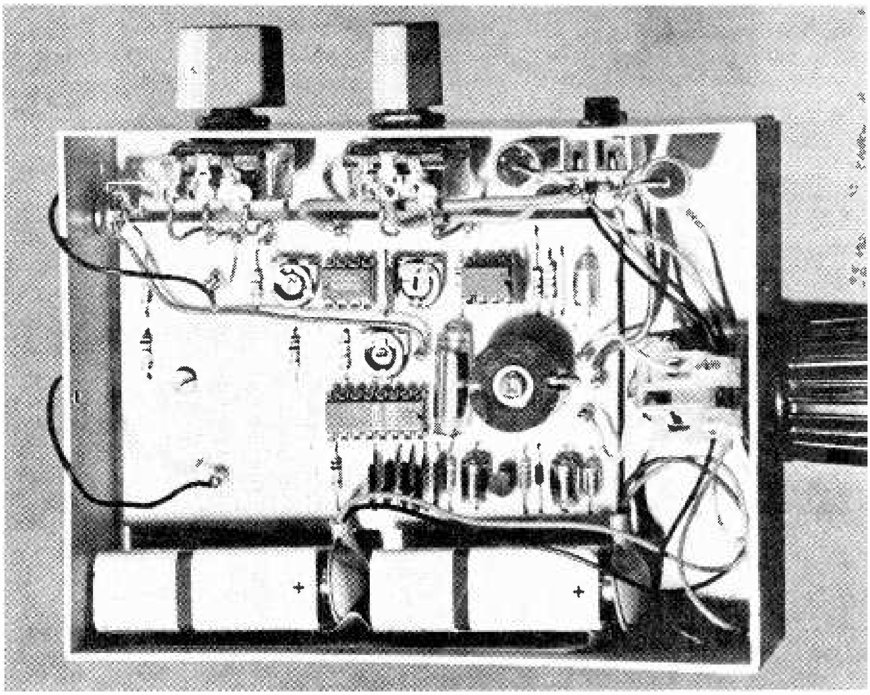
Semiconductors

IC1	NE555 8 pin DIL	D1	1N914 or similar
IC2	NE561B 16 pin DIL	Tr1	2N3819 or similar
IC3	741C 8 pin DIL		

Miscellaneous

L1, L2 see text. Jack socket, 3·5mm. Crystal earpiece and plug, 3·5mm. S1, 2 pole c/o slide switch. Aluminium box 5½ x 4 x 1½in. (AB10). Batteries PP3 (2) and 2 pairs battery clips. Knobs (2). Plastic conduit, 36in. approx. and conduit terminations (3). Plastic handlebar grip. Terminal block, 2 way. Hardboard and wire for heads. Co-axial cable. Printed circuit board. M1, centre-zero edge panel tuning meter (Henrys F11).

Ambit International, 37 High St., Brentwood, Essex, can supply the pcb for 78p inc., the three IC's and transistor for £4·90 inc. or a complete kit consisting of the pcb, three IC's and transistor, all remaining components, aluminium box and wire for search head for £9·50 inc.



Close-up view showing the inside of the PW Ferret. Compare this photograph with Fig. 4.

Setting Up

With the search coil connected, set all the preset pots to mid-rotation and switch on. Adjust VR2 for a strong and constant beat note. If only weak and varying notes can be obtained then the loop is not locked and VR3 must be rotated until the required note is heard. Set VR3 in the middle of the portion of its travel over which the beat note is clear. VR1 can then be set for the required volume in the earpiece.

Adjust VR4 to zero the meter, this will be a sensitive setting, and move the Ferret towards a large metal object. An indication should be both heard and seen. VR5 will then determine the strength of the meter reading when an object comes within range.

It may be possible to obtain beat notes from harmonics other than the fifth. It is sufficient, however, to select that beat note which gives the most sensitive audible response when the Ferret is brought near to some metal test object.

As has been already suggested in the text, a lot of the component values are non-critical and, in general, all except the polystyrene capacitors can have 20% tolerance. It is recommended that first grade integrated circuits are used, especially the NE555. If required, integrated circuit mounting pins can be used. ■

SPECIAL PRODUCT REPORT—*continued from page 630*

life. Sinclair Radionics claim that mercury cells will give 12 hours continuous operation. Certainly a small mains unit would be an advantage if continuous use of the calculator is contemplated.

The kit is intended for constructors with previous soldering experience. Estimated assembly time is approximately 3 hours. Tools required—and the most important item—is a properly earthed sub-miniature soldering iron with a $\frac{1}{16}$in. bit or smaller. Other items are wire cutters, tweezers and instrument type pliers.

The 15 page step-by-step assembly instruction booklet contains a section on special safety precautions which should be observed before and during assembly of the kit.

Attention is drawn to the point, that static electricity can be a hazard unless proper precautions are taken. The manufacturers instructions should be carefully read and fully understood before assembly is contemplated.

Care is necessary when assembling the kit, especially because of the numerous tiny solder connections to be made. Blobs of solder must be avoided and close inspection of the completed printed circuit board is essential after soldering has been completed. Examination of the finished p.c.b. with a magnifying glass is recommended to ensure a clean product.

Those constructors who after purchasing the kit and then having read the assembly instructions find that they are 'stumped' may return the kit (untouched) plus a cash balance in exchange for a built version. What could be more fair? Sinclair Radionics state that full service facilities are available for kits and ready built units.

Also included with the calculator is an informative 32 page booklet detailing the wide range of calculations that can be carried out. From simple arithmetic, compound interest, logarithms, trigonometric functions, roots, polynomials, hyperbolic functions and so on. In addition a credit card size aide-memoire with calculations summarised in formula form is included.

Calculations of all types were performed with the Cambridge and it is surprising how simple it is to use. It brings about a new and refreshing interest to calculations. In the calculation of square roots the iterative Newton-Raphson method is used. This sounds quite complex, but you simply take a (wild) guess at the square root and enter it on the keyboard, using the procedure outlined in the instruction booklet. We tried this method many times—feeding way-out guesses to the keyboard. The correct answer came up every time.

The kit is attractively packaged and includes all necessary components to complete the calculator. Even solder is supplied.

A full money refund guarantee applies to untouched kits if returned within 3 weeks.

At £27·45 (including VAT) for the complete kit, the Sinclair Cambridge provides excellent value for money.

Sinclair Radionics Ltd., London Road, St. Ives, Huntingdonshire PE14 17HJ.

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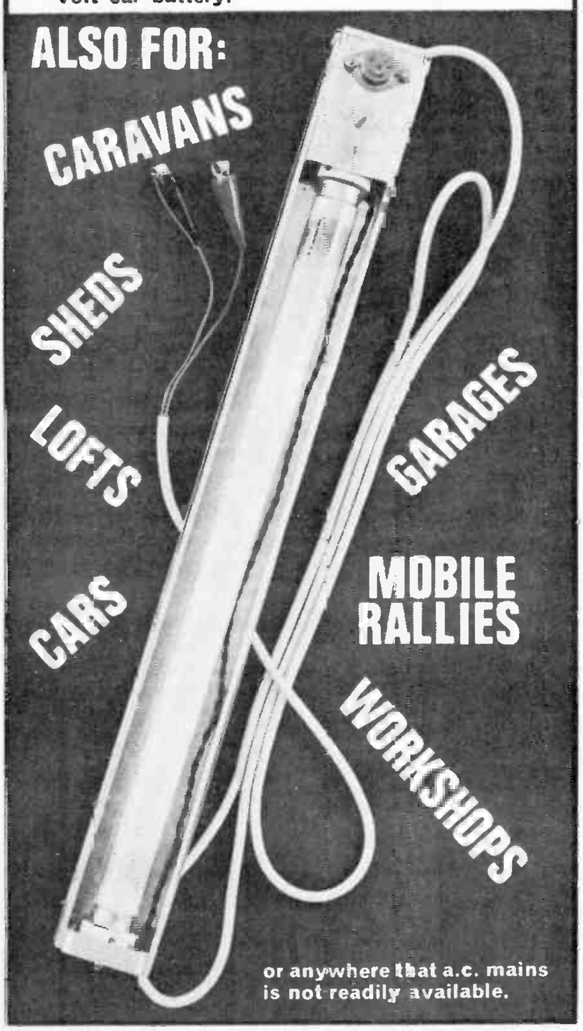

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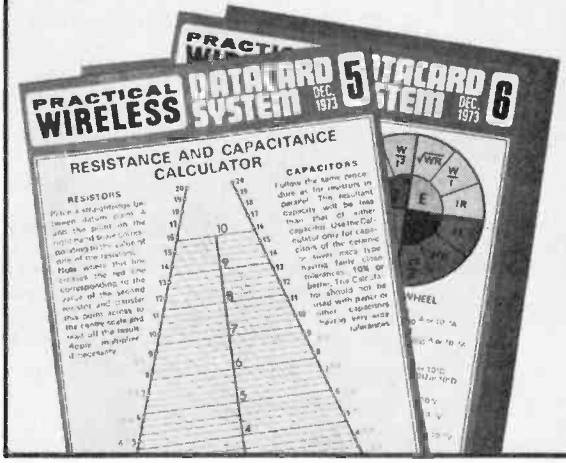

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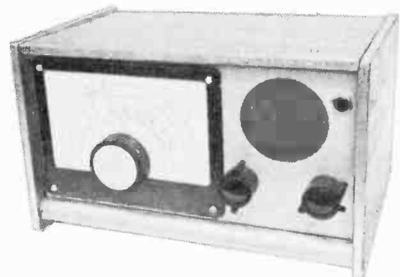
3-BAND SW RECEIVER



Pick up those unusual broadcasts and amateur transmissions that are found on the short wave band. This receiver is designed to tune 1·7MHz to 30MHz in three bands, using two transistors and two integrated circuits.

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This fascinating feature shows how you can use one i.c. in any of seven different simple amplifier circuits, including examples for a record player, radio, intercom, or tape player.

DECEMBER ISSUE ON SALE 2nd NOVEMBER

dictionary of audio terms & hi-fi specifications

PRACTICAL WIRELESS 8-PAGE SUPPLEMENT NOV. 1973

A

A-B. This is the kind of audio comparison test where any differences in sound quality can be assessed immediately upon switch-over, i.e. on "A-B" comparison between items of equipment A and B. Often the left and right-hand channels or the record and replay sound signals are designated A and B.

ACOUSTICS. The study of the behaviour of sound. The "acoustic characteristics" of a room are dependent on its size, shape and the reverberation time according to the reflective or absorbent items present.

ACOUSTIC FEEDBACK. Cycling of sound build-up to a continuous squeal as the microphone picks up a signal from a loudspeaker connected to the same microphone amplifier.

ACOUSTIC SUSPENSION. Some loudspeaker systems employ a sealed cabinet. This enables the acoustic pressure of the air enclosed therein to provide the principal restoring force for the diaphragm of the speaker.

A.F.C. Automatic frequency control. A control circuit in a receiver or tuner which compensates for small variations in the carrier signal frequency to provide a stable audio output. A circuit function in a tuner or receiver which keeps the unit accurately tuned to the desired station, eliminating any tendency to drift.

A.G.C. Automatic gain control. A circuit which stabilises a large variation in the strength of an incoming signal.

A circuit function in a tuner or receiver which maintains the mean amplitude of the modulated signal at almost a constant level. A.G.C. or A.V.C. (Automatic volume control) as it is sometimes called is also used to describe the audio compression system employed in automatic tape recorders, in which the recording signal level is adjusted to compensate for widely differing sound levels.

ALIGNMENT PROTRACTOR. Indicates errors in a pickup's lateral alignment. It fits on the centre spindle of the turntable, and the pick-up stylus fits into a small hole on the device. The correct indication is shown when the angle of lateral movement of the pick-up head is at 90° to the tangent of the groove at any point, although minimal tracking error is expected with most pick-up arms.

AMBIENCE. The "feeling" given to sounds by a room. The effect of the environment on the coloration of sounds produced.

AMBIENT NOISE. Unwanted background noise picked up by a microphone, i.e. any extraneous clatter in a room. Also any acoustic coloration that influences sounds, brought about by the acoustic properties of a room in which a recording is being made or replayed.

AMPLIFICATION. An increase in the magnitude of a signal brought about by passing it through an amplifier.

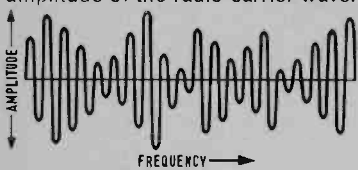
AMPLIFICATION FACTOR. The symbol used to signify this is "μ". It is the measurement of amplification in a circuit usually in voltage or current terms calculated by dividing the output by the input. This figure is often converted to decibels (which see).

AMPLIFIER. A device for increasing the magnitude of a signal by means of a varying control voltage, maintaining the signal's characteristic form as closely as possible to the original.

AMPLITUDE. The level of an audio or other signal in voltage or current terms.

AMPLITUDE DISTORTION. The distortion of a signal by the undesirable influence of a circuit or component and takes place when there is a change of amplitude in part of the input signal bringing about harmonic distortion and intermodulation distortion. This part is expressed as a percentage of the whole waveform at any given period of time.

AMPLITUDE MODULATION. Commonly known as a.m. and refers to the method of radio transmission where the audio modulating signal is made to vary the amplitude of the radio carrier wave.



The audio information is carried on a high frequency radio wave.

ANECHOIC CHAMBER. A special room used for testing audio transducers, where all wall surfaces have been covered with acoustically absorbent materials so that reflections of the sound waves are eliminated. Otherwise known as a "dead room".

ANTI-PHASE. Where two identical signals are disposed in 180° phase opposition. When superimposed, they tend to cancel each other because their waveform patterns are of equal magnitude but opposite polarity.

ANTI-SKATING DEVICE. A device found on many modern pick-ups which provides an "outward" force on a pick-up arm. This counteracts the arm's tendency to move towards the turntable centre due to offset geometry, and reduces stylus/groove friction.

ANTISTATIC CLEANER. Substance used on gramophone records which helps to prevent the build-up of a static charge which attracts dust.

ATTENUATOR. A device which reduces the amplitude of a signal by known proportions.

AUDIO FREQUENCY SPECTRUM. Mainly the full range of sounds we can hear. In a person with good hearing the range of sounds in the audio spectrum is usually between 30Hz and 16,000Hz. In older people this is usually 50Hz to 10,000Hz.

AUDIO OUTPUT. The output signal from any audio equipment. It is generally measured in volts or watts r.m.s.

AUTO-CHANGER. A device on a record-playing turntable which facilitates the automatic positioning of a disc and pickup ready for playing.

AUX. Abbreviation of auxiliary. Often applied to amplifier inputs and refers to an extra input facility as distinct from "mic", "tuner", "pickup", etc.

AZIMUTH. The angle which recording and playback head gaps make with the line along which the tape moves. The head is oriented until this angle is 90°.

B

BAFFLE. The mounting for a loudspeaker usually comprising a flat non-resonant panel. It is used to increase the length of the path of the sound waves between the front and rear of the speaker to minimise bass losses.

BALANCE. Equality of amplifier gain or signal level from right and left channels of a stereo amplifier. In theory the balance between each channel should be electrically perfect but there may be mismatch of nominal signal level from one or other channel which is compensated by adjustment of the "balance control".

BALANCE CONTROL. A variable resistor used to compensate for any slight loss of signal in the right or left channel of a stereo amplifier. To some extent, this control can compensate for unbalanced speakers and be used for adjustment when the listener is not in an equidistant position between the two loudspeakers.

BANDWIDTH. The range of audio frequencies over which an amplifier or receiver will respond and provide a useful output.

BASS. The lower end of the sound spectrum (usually 150Hz and below). An amplifier "bass control" usually provides a variance of decrease or increase in response at frequencies below 1kHz.

BEL. A ratio of two signal levels, such as at the output and input, in logarithmic terms. It is too large a unit to use for precise measurement and we use tenths or "decibels". These are defined in power terms as $10 \log_{10} \frac{\text{output}}{\text{input}}$ or in voltage or current terms as $20 \log_{10} \frac{\text{output.}}{\text{input.}}$

BIAS. A high frequency signal applied to the audio signal at the tape recording head to make the audio signal magnetise the tape over the linear part of head's magnetic characteristic. The bias signal is usually above 40kHz to avoid audible intermodulation distortion. Bias is also a term used to denote the sideways thrust of a pickup arm.

BIAS COMPENSATOR. A device which counteracts the inward bias of a pick-up arm as it tracks the disc. The compensator exerts an outward force on the arm and generally can be adjusted to have a definite relationship to the playing-weight of the pick-up.

BI-RADIAL STYLUS. Also known as elliptical stylus. This is used with lightweight pick-up arms to reduce tracking distortion. The stylus tip has a small radius where it touches the walls of the record grooves as distinct from a conventional stylus which has a hemispherical tip.

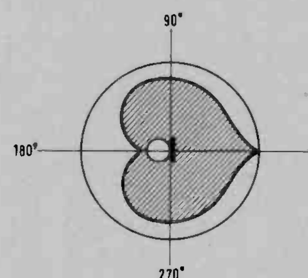
BOTTOMING. A situation in which a stylus reaches the bottom of a record groove because its tip radius is smaller than optimum for the groove. Also the opposite of the pinch effect.

BULK ERASER. An instrument which erases recordings from a whole tape at once while it is still on the spool. It does this by producing an a.c. magnetic field of high intensity.

C

CAPSTAN. The drive spindle in a tape recorder, which in conjunction with the pinch-wheel, pulls the tape across the heads at constant speed.

CARDIOID MICROPHONE. A microphone which has a sensitive response to sounds on one side.



This makes the response very directional. It is called "cardioid" because it has a heart-shaped polar diagram.

CARTRIDGE. The electro-mechanical transducer of a pick-up head that converts stylus vibrations to an electrical signal. It is generally detachable and fits into the head-shell of a pick-up.

CERAMIC. Piezo-electric part of a pick-up, speaker or microphone that acts as a transducer. It has characteristics similar to a crystal transducer but is more robust.

CHANNEL SEPARATION. The degree to which the two signals in a stereo system are electrically isolated. Usually expressed as a ratio in decibels.

CLASS-A. An amplifier where the output transistors or valves are operating permanently on linear portions of their transfer characteristics. Efficiency is low, but a constant current is drawn from the power supply whatever the signal level. Usually recognised by the use of a single transistor or valve driving the loudspeaker.

CLASS-B. An amplifier where two transistors or valves operate on positive and negative half cycles of the signal wave form. Each operates from a low initial current but this rises as the signal level increases. Usually recognised by the use of two transistors or valves operating in anti-phase to drive the loudspeaker.

CLIPPING. Severe distortion caused by overloading the input of an amplifier. A sine wave signal waveform has a flat top and bottom at the peaks when clipping occurs.

COAXIAL CABLE. A screened cable where the inner conductor is surrounded by a concentric outer screen. Commonly known as "co-ax" the cable is carefully manufactured so that it has a constant characteristic r.f. impedance of 70-80Ω. It is used for aerial down-leads and for sending r.f. from one unit to another. Also used to interconnect audio stages or equipment of high impedance to minimise the risk of hum inducement.

COAXIAL PLUG

COLUMN SPEAKER. A loudspeaker cabinet of long "column" shape. Usually the loudspeaker is at one end so that the rear of the drive unit is loaded by a column of air. Often columns are made from drain-pipes. Also the name given to a long speaker cabinet containing several loudspeakers for public address work.

COMPARATOR. Often found in audio showrooms, it is a unit which by switch selection, will connect up a combination of speakers, amplifier, tuner, pick-up, tape player, etc. For comparing different types. Also the name of a circuit which compares two signals and provides a "difference" signal.

COMPATIBILITY. The ability of one unit to be used with another without detrimental effect on the signal through mismatch. A compatible pick-up will play both mono and stereo records.

COMPLIANCE. The ability of a stylus to respond to both horizontal and vertical movement. The degree of compliance is a measure of the capability of the stylus to follow rapid variations in the groove surface.

COMPRESSION. This occurs when the dynamic range is reduced electronically so that quiet sounds are raised and loud sounds lowered. The most common application is an "automatic" recording where it is important that all sounds recorded are made intelligible when played back. Also used where necessary to avoid over recording and distortion, or to lift the signal level clear of background noise or hum.

CONDENSER MICROPHONE. A microphone which contains a metal plate and a thin metal diaphragm set close together. A polarising voltage is applied to the plates. The capacitance of the microphone is thus affected by movement of the diaphragm from air pressure waves.

CONTROL UNIT. A pre-amplifier unit in an audio set-up. Signals from audio sources, i.e. tuner, pick-up microphone, are fed into it. Equalisation (where necessary) is applied, then the signal is fed to the main amplifier. Volume and tone controls are usually incorporated together with any necessary programme selection switch.

COUNTERBALANCE. Counterbalance is a weight, usually adjustable, fitted at the pivot end of a pickup arm. It counters the weight of the pickup head and cartridge unit and allows adjustment of the stylus pressure to the desired value.

CROSSOVER NETWORK. A circuit usually employing capacitors and coils which feeds low notes to a low frequency speaker (woofer) and high notes to a high frequency speaker (tweeter). The crossover frequency is that at which frequency bands divide. Sometimes the audio spectrum is divided into more than two bands to drive more than two speakers.

CROSSTALK. Breakthrough of the signal from one channel to another by conduction or radiation.

CUT-OFF FREQUENCY. The frequency response limitation, either upper or lower end, of a given component or piece of apparatus where the response falls off by 3dB, then is even lower beyond this frequency.

D

DAMPING FACTOR. The ratio of the impedance of a speaker to the amplifier impedance. A high damping factor is desirable to subdue speaker resonances.

DECIBEL. One tenth of a Bel (which see).

DE-EMPHASIS. Reduction of the level of the higher audio frequencies during f.m. reception or tape replay, so that they compensate for the pre-emphasis (which see) applied to the transmission. This restores an overall uniform response, with improved signal-to-noise ratio.

DEMAGNETISER. A device which removes residual magnetism from tape heads. This magnetism, if not removed can introduce noise on recordings and cause high frequency loss.

DEVIATION. In f.m. transmissions and reception deviation is the increase or decrease of signal carrier frequency from the nominal; also applied to drifting. Standard maximum deviation rating is $\pm$75kHz for f.m. radio.

DIN. Stands for Deutsche Industrie Normenausschus. This is an organisation in West Germany (similar to the British Standards Institution) which sets certain industrial standards.

A well-known standard is the DIN 45,500 which applies to domestic hi-fi equipment. Various plugs and sockets are popularly known as "DIN plugs". They have DIN standard geometry and connections.

DIN PLUG

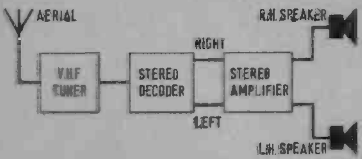
DIPOLE. An aerial generally used for v.h.f. receivers.

DNL. Dynamic noise limiter. A compatible circuit designed by Philips Ltd. primarily for use with tape recorders. It improves the effective signal-to-noise ratio during replay by selective filtering at low signal levels.

DOLBY SYSTEM. A noise reduction system which compresses signals before they are recorded on tape and expands them again on replay. This results in a reduction of background noise and is particularly designed for use with tape recorders.

DRIFT. Variation of r.f. signal carrier frequency above and below the nominal due to unstable reception conditions. It can be alleviated to a great extent by applying automatic frequency control.

DECODER. A circuit built into an f.m. tuner to enable it to translate stereo signal information into two matched audio outputs. Also a



means to extract and process recorded quadraphonic sound information from a complex signal into four matched outputs.

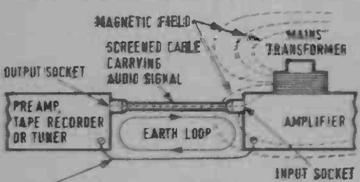
DISTORTION. Unwanted changes in the purity of sound being reproduced or in r.f. signals. In audio it generally implies intermodulation and/or harmonic distortion. These are derived from phase differences and/or amplitude distortion where the amplitude of the output does not bear the same proportion to the input at all frequencies.

DROP-OUT. Sudden decrease in the recorded signal level due to tape imperfections.

DYNAMIC RANGE. The range of signal amplitudes from the loudest to the quietest that can be reproduced effectively by the equipment. The upper limit is set by inherent distortion level, and the lower limit by background noise and/or hum.

E

EARTH LOOP
The wiring of the interconnections between items of audio or radio equipment such that there is more than one return path for the "ground" side of the signal-carrying



EARTH LOOP CAUSED BY THIS EARTH CONNECTION BETWEEN THE TWO CHASSIS AS WELL AS BY THE SCREEN OF THE SIGNAL CABLE.

wiring. This generally results in a loud hum from the speakers.

ELECTROSTATIC. Applied to loudspeakers and microphones (condenser type). An electrostatic force is used to activate the diaphragm. The charged diaphragm is suspended between two perforated plates. As an a.c. signal is applied to the outer plates, the diaphragm vibrates.

EQUALISATION. A pre-arranged circuit that applies correction to a given recording characteristic during replay to result in a uniform frequency response at the output terminals.

ERASE HEAD. A head on a tape recorder which applies a strong high frequency alternating magnetic field to the tape so that earlier recordings may be "erased" as the tape runs past the head.

F

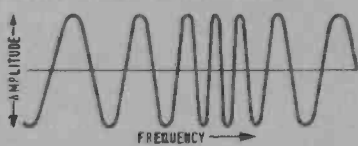
FADING. A drift in the level of received radio signals beyond intelligability. It is often caused by changes in the upper atmosphere. Also applied to deliberate slow reduction of signal level by means of the volume control.

FEEDBACK. A system where part of the output signal from an amplifier is applied to the input. When in antiphase (i.e. negative feedback) this results in reduction of distortion, lowering of the amplifier output impedance, improvement in signal stability.

F.E.T. Field Effect Transistor often used in early stages of an amplifier or tuner to give a high input impedance for minimum loading of the programme source, i.e. aerial or pick-up.

FLUTTER. Rapid variations of pitch or frequency caused by inconsistent speed of a turntable or tape transport mechanism.

F.M. Frequency modulation is a system of transmitting a radio signal where the frequency of the carrier wave is altered by changes in the amplitude of speech or music.



F.M. is applied to v.h.f. sound broadcasting above 87MHz.

FREQUENCY. The number of complete cycles in one second of alternating current, voltage, electromagnetic or sound pressure waves.

FREQUENCY RESPONSE. A graphical characteristic showing relative signal levels at different frequencies with respect to a given reference level. A "flat" frequency response is one that has a uniform level at all frequencies within a given band width.

FRONT END. Refers to the first stage of an amplifier or tuner.

G

GAIN. The increase in the power or voltage level of a signal due to amplification, i.e. the ratio that exists between the output signal level and the input signal level, usually quoted in decibels (which see).

GROOVE. A record "track" which carries the audio signal information in two 45° displacements (stereo). In a long-playing record, groove dimensions could be: width 2·5 mils.; depth 1 mil. and pitch 250-350 groove revolutions per inch.

H

HARMONIC. A harmonic of a fundamental frequency is the frequency of its exact multiple. Thus twice the fundamental frequency is the second harmonic (one octave up) and so on. If the fundamental frequency is 1,000Hz, the second harmonic would be 2kHz, the third 3kHz, and the fourth harmonic 4kHz (two octaves up from the fundamental).

I

IMPEDANCE. Opposition to a.c. current presented by capacitors, inductors and resistors. This effect is measured in ohms and is related to frequency.

INFINITE BAFFLE. A loudspeaker mounting where ideally there is no path of air between the back and front of the speaker diaphragm. An infinite baffle improves the forward radiation of sound at low frequencies and preferably should be a very large plane surface like the wall of a room or a screen of very rigid material (e.g. $\frac{3}{4}$in wood) on which a loudspeaker is mounted. In practice truly infinite baffles are rarely accomplished except in sealed boxes, but these give rise to problems of resonance.

I.P.S. Inches per second. Used for signifying the speed of a tape travelling past the heads of a tape recorder. The most common speeds used in this country are $1\frac{7}{8}$ i.p.s. (4·75cm/s); $3\frac{3}{4}$ i.p.s. (9·5cm/s) and $7\frac{1}{2}$ i.p.s. (19cm/s).

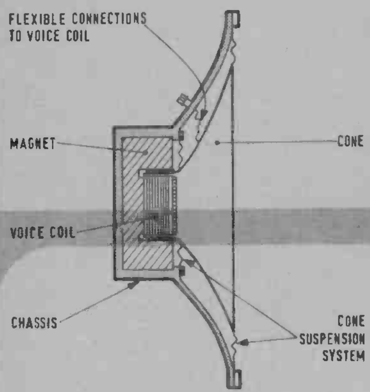
J

JACK. A type of two-or more-ways concentric contact socket for carrying audio signals.

JOHNSON NOISE. A frying or sizzling sound produced by thermal agitation voltages generated in amplifier circuits. It usually occurs in the input circuit (or front end) of an amplifier.

L

LEVEL. The voltage or power of a signal, or the relative voltage or power compared with a reference.
LIMITER. A circuit in an amplifier or tape recorder which reduces volume when over-modulation or distortion is likely to occur.
LINE SOURCE SPEAKERS. A chain of speakers used in public address work that are driven from an amplifier with 100V or 600ohm output line.
LOUDNESS. The intensity of a sound as subjectively judged by the human ear. Loudness levels are measured in "phons" and may differ in effect from one person to another.
LOUDSPEAKERS. A transducer which converts a.c. electrical energy into acoustic energy by movement



of the diaphragm causing air pressure waves.

M

MAGNETIC PICK-UP. A pick-up which employs an electro-magnetic transducer. An armature bears the stylus. The armature is pivoted between the poles of a magnet and stylus movement makes the magnetic field change, inducing a variable voltage in coils wound on the magnet.

The name refers to pick-ups of the moving coil type, moving magnet, moving iron, induced magnet and variable reluctance types.
MATCHING. Equalisation of the input impedance of one unit to the output impedance of another connected to it. Also used to refer to pairs of loudspeakers, microphones or other components which have similar characteristics and which are employed in the two channels of a stereo system.
MICROPHONE. An electro-acoustic transducer which converts sound energy into electrical energy. The method depends on the material used in the microphone.
MIXER. A device which combines two or more separate signals into a common output.
MODULATION. The process whereby an r.f. or other signal is mixed with and caused to vary in accordance with an audio signal. The degree to which a tape or disc recorder is made to record without introducing distortion.
MONITORING. Listening to a signal as it is being recorded so that a check can be made on the quality.
MONOPHONIC. The reproduction of sound through a single channel amplifier.
MUSIQUE CONCRETE. A musical work comprising natural sounds which are recorded, then edited or manipulated and treated so that they do not sound like the original recording, but present an artificial form of musical composition.
MULTIPLEX TRANSMISSION. The transmission of two or more simultaneous signals on a common carrier wave. Used for transmitting stereo broadcasts. A multiplex decoder is needed before these transmissions can be resolved into stereo or other multiple channel audio.

N

NEGATIVE FEEDBACK—See "Feedback".
NOISE. Unwanted sounds of multiple and irregular frequencies and heard as a hiss or click.

O

OFFSET ANGLE. The angle at which the pick-up head is offset from a line through the centre of the arm. Correctly set, it minimises wear on stylus and record groove, and distortion of reproduction by keeping the tracking error down to a minimum.
OMNIDIRECTIONAL. Generally refers to a microphone which has approximately uniform sensitivity in all directions, the polar response being completely spherical.
OVERLOADING. An amplifier or piece of equipment operated beyond its signal-handling capability so as to create a distorted output.
OUTPUT STAGE. A power amplifier's final stage which feeds the audio signal to a oudspeaker or other device.

P

PARALLEL TRACKING. A pick-up cartridge's movement which is exactly parallel to the radius of the record, with the sty us always positioned on that radius for zero lateral tracking error.
PEAK PROGRAMME METER. A meter and associated circuitry which is used for indicating the peak levels of programme volume. Commonly referred to as P.P.M.
PHASE. Phase is the angular relationship in time of an alternating voltage or current with reference to zero voltage (or current) or another comparative waveform. Sound waves are said to be in phase when the voltage of one at any instant is the same polarity and angular displacement as the other and when crossing the zero voltage line in the same direction. "In-phase" sound-waves are identical in frequency and polarity at any instant; out-of-phase, waves may be identical in frequency (but not necessarily) and of opposite polarity at some instant. Anti-phase waves are identical in frequency and exactly opposite in polarity, i.e. 180° out of phase.
PHASING. The arrangement of of loudspeaker or connections in a stereo set-up so that—when an identical signal is fed to the two speakers, the speech coils are so connected that the cones both move in the same direction at the same time.
PHON. A unit of measurement of loudness allowing for the difference in sensitivity of the ear at differing frequencies. The phon is related to the decibel, but is in terms related to one frequency and determined from sound pressure measurements.
PHONO PLUG. A connecting plug often used in audio equipment. It has a centre "live" pin and an outer "earth" shield. Used with


PHONO PLUGS

screened cable for connecting pickups and tuners to an amplifier or control unit.
PICK-UP. The part of a gramophone which extracts recorded information from a disc and

changes it to an electrical signal.

PICKUP ARM. The cantilever support for the pickup head with counterbalance weights, pivots etc. for carrying the cartridge.

PICKUP HEAD. The end of the pickup arm containing the cartridge. It is often removable from the arm and is usually called the "head shell" which carries the actual cartridge.

PIEZO ELECTRIC. An effect whereby a substance generates an electrical current when it is subjected to mechanical stress. This characteristic has been made use of in the design of pickups, microphones and loudspeakers.

PILOT TONE. A 19kHz tone used in stereo broadcasting at the equivalent of 10% f.m. modulation $\pm 7{\cdot}5$kHz. It is transmitted with the sum-and-difference signals to assist in the stereo decoding process in the f.m. receiver.

PINCH EFFECT. The vertical movement of a stylus which takes place during record reproduction when irregularities in groove width occur.

PINCH WHEEL. The rubberised wheel in a tape transport mechanism that holds the tape against the capstan so as to ensure that the tape does not slip.

PITCH. The pitch of a sound is the musical term for sound vibrations. Standard U.S. and European pitch is based on =440Hz. When the pitch is raised one octave, the frequency is twice the original.

PLAYBACK. The reproduction of a tape recording or disc through an amplifier and loudspeaker or phones.

PLAYING WEIGHT. Downward force of a pickup on a record. Sometimes called stylus pressure.

POLAR RESPONSE. Polar diagram or circular graph which shows the sensitivity of an aerial or microphone or the output from loudspeakers in an angular mode through 360°.

POLYESTER BASE. A base material used for magnetic tape on which is coated the magnetically sensitive substance. Widely used for long playing tape, it is less prone to stretching than acetate film.

POWER. The energy dissipated in an electrical or electronic circuit or component that is conducting either a.c. or d.c.

POWER AMPLIFIER. The stage of an amplifier which supplies audio signals to a loudspeaker or phones.

POWER-HANDLING CAPACITY. The maximum power rating of a loudspeaker or other component which determines how much current can be passed safely through without adverse effects.

PRE-AMPLIFIER. An amplifying system for low signal levels. It boosts a low-level signal from a cartridge, for instance, and feeds the signal to a power amplifier. It may contain additional circuitry that affects the frequency response in some way.

PRE-EMPHASIS. The boosting of high frequencies in f.m. broadcasting or recording. Uniform frequency response is restored by "de-emphasis" in the receiver or replay amplifier. The purpose is to reduce the noise level that arises through transmission and tape recording.

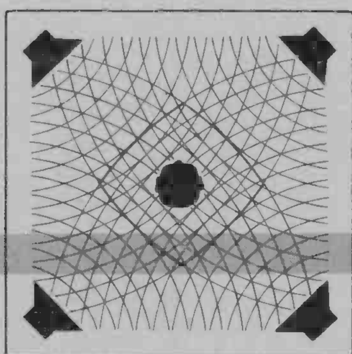
PRESSURE PAD. A felt pad which applies a gentle but firm force to keep a moving tape in good contact with the heads of a tape recorder.

PRESSURE UNIT. A moving-coil speaker drive unit which usually has as its diaphragm a small dome of plastic or metal. It is designed for use in the throat of a horn.

Q

QUADRATURE. Two a.c. signals of equal frequency are said to be in quadrature when they are phase displaced by 90°.

QUADRAPHONY. Four matched discrete audio channels are employed in true quadraphony; four matched microphones are used in the recording process, four-track tape or "quad" records are used for replay through a four-channel amplifier which feeds four loudspeakers.



Various modulation or matrix systems are sometimes used so that four channels can be obtained by using some two-channel (stereo) equipment. The signals are then "decoded" so that four channels of sound can be reproduced through four speakers.

Systems known as "surround sound" are used to produce "synthetic" quadraphonic effects. These units use matrix circuits in conjunction with conventional stereo equipment and records.

QUADRUPLE PLAY. Magnetic recording tape which is thinner than "standard play" tape and consequently enables one to make recordings four times longer than with 'SP' tape.

Q4. The name given to the Practical Wireless quadraphonic decoder to enable quadraphony to be reproduced from stereo or quadraphonic recordings.

R

RADIO FREQUENCY. A term describing incoming radio signals to a receiver or outgoing signals from a radio transmitter. There are no finite limits in the r.f. range but it is usually considered to denote frequency above 150kHz and extending up to the infra-red range.

RAKE. The "rake" angle of a stylus is the angle that the stylus bar makes with a gramophone record when viewed from the side.

RANDOM NOISE. Noise generated in a circuit by random movement of electrons caused by thermal agitation. In tape recording it can be caused by uneven distribution of magnetised particles and is reproduced as a background "hiss".

REAR SUSPENSION. Used in moving-coil loudspeakers, it is a pliable support situated near the apex of the cone, and assists in keeping the coil in a concentric position in the air gap between the magnet poles.

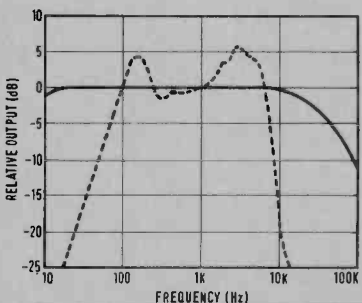
REFLECTOR. An element in a v.h.f. aerial which is situated to the rear of the main dipole. It helps to reflect radio waves on to the dipole. Also the name given to the "dish" often employed to reflect quiet or distant sounds in the open air on to a microphone.

REFLEX CABINET. A type of speaker enclosure fitted with a vent or port through which out-of-phase signals from the rear of the cone are "reflexed" by allowing the enclosed air in the cabinet to be tuned for a coupled resonance effect with the cone of the drive unit. The signals are then brought into phase with the front radiation from the cone of the speaker so as to reduce the "boomy" effect of resonance.

REJECTOR. Filter or part of a circuit which rejects a particular frequency or band of frequencies.

RESONANCE. The nature and dimensions of any object or enclosed volume of air will vibrate at a calculable frequency when disturbed by striking. This frequency is said to be the resonant frequency. When the object is made to vibrate at this frequency by a corresponding sound pressure wave the resonance is enhanced, producing a "boomy" effect, i.e. the volume at that frequency is apparently louder than at any other.

RESPONSE CURVES. Usually measured in decibels, with reference a given level, on a vertical scale, the response curve is a graphical representation of frequency response.



When the response curve of an amplifier, pick-up, microphone, etc. is accurately plotted it represents the relative levels of amplitude at all frequencies within a specified bandwidth.

REVERBERATION. Reflected sound. It is produced by the gradual decay of sounds being reflected from ceilings, walls, floors and furniture.

Reverberation units create an artificial representation of the decay of the sounds electronically.

RIBBON MICROPHONE/SPEAKER. Uses a narrow corrugated aluminium alloy strip suspended in a magnetic field. Sound makes the strip vibrate in a direction perpendicular to the magnetic field, resulting in an a.c. current being induced in a coil.

The natural response of a ribbon unit is bi-directional and a ribbon microphone has certain areas of minimum sensitivity. Only a very small response is produced by quite loud noises from the sides, the polar diagram for this type is known as "figure of eight".

A few ribbon microphones will give cardioid and hypercardioid responses.

RMS VALUE. The "root-mean-square" value of a.c. voltage, current, or power is calculated as 0·707 of peak amplitude at the given frequency. It represents for mathematical purposes an acceptable level by which relationships between these units can be accurately established.

RUMBLE. Low frequency noise produced by the turntable bearings and motor of a record player, and transmitted mechanically by vibrating the pick-up. These vibrations are then detected by the transducer in the cartridge for conversion into an electrical signal.

RUN-IN. The start of a groove at the beginning of a side of a gramophone record which "runs in" to the recorded section.

S

SCRATCH FILTER. A low-pass filter, often an integral part of an amplifier circuit, which attenuates the higher frequency noise derived from disc recordings. The scratch filter is also suitable for the suppression of background noise produced by tape background hiss.

SCREENED LEAD. A cable which has an outer sheath of braiding which provides electrostatic screening of the inner conductor and so makes it ideal for connecting high impedance pick-ups microphones and tuners to the input of an amplifier. Its purpose is to reduce the effects of hum caused by radiation from a.c.-carrying wiring or components.

SELECTIVITY. A tuner's ability to discriminate between a wanted signal and an interfering signal on adjacent frequency settings of the tuning dial.

SENSITIVITY. The ability of any communications equipment, including audio to reproduce very low signals.

SEPARATION. The degree to which right and left stereo signals are isolated in pickup or stereo amplifier.

SHELL. Refers to that part of the pick-up which carries the cartridge. The head shell can often be detached from the pick-up arm.

SIBILANCE. The strong emphasis in pronunciation of the letters "S" and "SH" in speech. It can be exaggerated by microphones having peaks in their high frequency response.

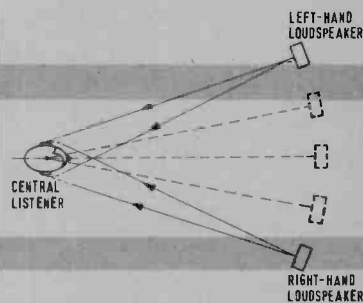
SIDE-THRUST. The tendency of the stylus to "skate" towards the centre of a record causing increased wear on the inner groove wall. With low tracking weight, side thrust can cause the stylus to "jump" the record's groove.

SIGNAL-TO-NOISE RATIO. The difference, measured in decibels, between a specified signal reference level and the level of unwanted noise. The higher the ratio, the better the equipment.

SINE WAVE. A waveform (often viewed on an oscilloscope) of a pure alternating current or voltage. It is drawn on a graph of amplitude versus time or radial degrees and follows the rules of sine and cosine values in relation to angular rotation of an alternator. It can be simulated by means of an electronic oscillator.

SOLID-STATE. A general term that applies to any semiconductor device such as transistors, diodes, an integrated circuit. Can also be used to describe equipment that employs miniaturised modules or building blocks, integrated circuits or micro-circuits.

SOUND STAGE. The area between the two or more loudspeakers of a stereo or quad set-up where subjective sound images or imaginary loudspeakers seem to be, providing a wide area of apparent sound source.



SPEECH COIL. The moving coil in a dynamic loudspeaker. It is suspended in the field of a permanent magnet and is fixed to the speaker diaphragm.

SPLICE. A joint in a length of magnetic tape. For a good strong splice, the two ends of tape should be cut at an angle of 45° so that they butt together in line without any gaps.

SQUARE WAVE. An a.c. periodic waveform in which voltage alternates rapidly from a positive peak value to the negative peak value, and vice versa after a delay.

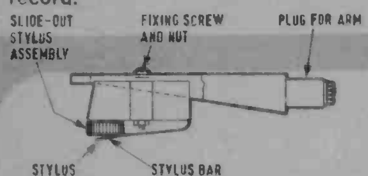
A waveform with these characteristics is ideal for testing audio equipment with an oscilloscope to test for good transient and frequency response. Square waves are also used in switching circuits.

STANDARD PLAY. An arbitrary description given to identify a spool of thick recording tape with a specified playing time according to reel size. For example, a 7in. spool will hold 1,200ft of "standard play" tape a 5in. spool 600ft. The actual playing time is then dependent on tape speed.

STANDING WAVES. The behaviour of air pressure waves in an enclosed room or box, giving rise to resonances which occur. They are created by the effects of multiple sound reflections between opposite walls and cycle at frequencies determined by the distance between them. In effect, the room acts as a resonator.

STEREOPHONY. A two channel recording and reproduction system more popularly referred to as "stereo". At the recording studio separate microphones are used for each recorded channel. The correct reproduction of stereo signals in the home gives to the listener a sense of direction of sound and thus enhances the realism.

STYLUS. A small piece of industrial grade diamond or artificial sapphire, conically-shaped, which tracks the groove in a gramophone record.



STYLUS ARM/BAR. Cantilever which carries the pickup stylus. It is suspended at one end so that it can be allowed to vibrate in a magnetic field or transmit mechanical stresses through a piece of piezo-electric material.

SUPERIMPOSE. To record one or more signals over another without erasure, so that when a tape is played back, all recordings can be heard simultaneously. This is particularly useful if one wishes to have a spoken commentary with a musical background.

SURFACE NOISE. Noise generated by contact of a gramophone stylus with minute particles of dust or other irregularities in a record groove. Can also be caused by excessive wear of a disc or by poor quality coating on recording tape.

T

TANGENT. A straight line that meets a curve or circumference at one point only, such that it is at 90° to the radial line between the centre of the circle and that point. A tangential pick-up arm is one that maintains this condition throughout its tracking across a disc.

TAPE DECK. The mechanical part of a tape recorder. It comprises the complete tape transport system, motors and drive mechanisms. It may also include the heads.

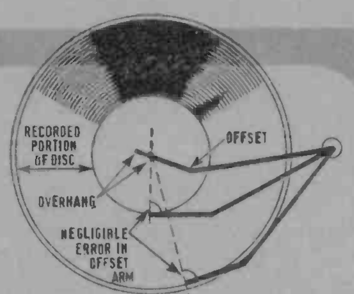
TAPE HEAD. The transducer on a tape recorder past which the tape runs during record or replay. It applies a magnetic field to the tape during the recording process and provides electrical output during replay.

T.P. Triple-play tape. Very thin recording tape of which it is possible to wind 3,600ft. onto a 7in. spool. This would give 180 minutes of playing time at 3$\frac{3}{4}$ i.p.s.

TRACING. The ability of a stylus to follow the variations or modulation pattern of a record groove.

TRACKING. The movement of the record player stylus across a gramophone record.

TRACKING ERROR. The deviation of angle between the stylus bar axis and the radial line between the disc centre and stylus point.



This is a factor applied to pickup arms with offset angle heads.

TRACKING WEIGHT. The downward force of a pick-up stylus which ensures optimum reproduction of recorded groove modulation with minimum wear of groove wall and stylus.

TRANSCRIPTION. Word commonly used to describe high quality pick-up and turntable units. Literally it is a copy or a recording of an audio programme onto tape or disc.

TRANSIENT RESPONSE. The ability of an amplifier or transducer to handle and faithfully reproduce rapid changes in signal amplitude. A very short "rise-time" is a measure of this characteristic.

TREBLE. The high frequency end of the audio spectrum.

TWEETER. A loudspeaker designed specially for reproducing high frequencies. It is used in conjunction with a "woofer" (bass speaker) and a crossover unit for audio reproduction.

V

VARIABLE RELUCTANCE. Principle employed in certain pickups. Deflections of the stylus when playing a record, make an armature vibrate between the poles of an electromagnet. The reluctance is the ratio of magnetic force to magnetic flux in a magnetic field. Variations due to stylus movement create variations in the current through the electromagnet.

VERTICAL TRACKING. Stylus motion path which is near "vertical". Applies to "hill-and-dale" recordings on stereo discs.

V.H.F. Very high frequency radio band. Broadcast v.h.f. Band 2 is the 87 to 108MHz range. Also applies to frequencies above 30MHz for radio or television.

W

WAFER SPEAKER. Thin compact loudspeaker with an "inverted" cone where the magnet is sited forward of the cone.

WATT. Unit of electrical power, often used to signify the signal power output from an amplifier.

WAVEFORM. A graphical representation of the relationship between voltage, current or power against time. It also provides a picture of the behaviour of signals at given frequencies.

WHITE NOISE. The random motion of electrons in a conductor which, when reproduced through a loudspeaker or phones, sounds like noise and covers a wide frequency range. It is used to test loudspeakers and phones for resonance and sensitivity.

WOOFER. A low-frequency or bass loudspeaker for reproducing musical notes in the approximate range of 25-2,500Hz. Employed with a "tweeter" and crossover network to reproduce a range of frequencies for audio reproduction.

WOW. Slow regular variations in the speed of a record turntable or tape transport mechanism. It is heard through a loudspeaker system as a wavering of musical pitch. ■

EXPERIMENTAL WORKSHOP

M. J. HUGHES M.A.

LEARNING BY PRACTICAL PROJECT STEPS

PART 2—THE BISTABLE

WE are going to look at a very fundamental switching circuit this month that is based on the principles we developed in the last part. It is called the *bistable switch*—the reason for this name should become clearer as its story progresses. If you look at the basic circuit in Fig. 9a you will notice a marked similarity to the experiments we did last month; two transistors are cross connected—the base current for each being drawn from the collector circuit of the other. Notice, however, that both base resistors (R2 and R3) are permanently connected in and we are not using switches this time!

Basic assumptions

For those who like to sweat over puzzles try this one before reading on. Assuming that the circuit is completely wired up and power is supplied use your knowledge regarding base current and driving voltages to work out whether Tr1 and Tr2 are conducting or not conducting!

Unless you have made an assumption you should be completely stuck because the system does not seem to make sense. In stages you could have said that when power is not applied both transistors must be non-conducting hence at the instant you apply power both points A and B will be at +9V. This set of circumstances, however, provides base current for the opposite transistor and the effect of this is to make each transistor go into conduction and *both* the respective voltages will fall cutting off the base current; the result of this would be to make both collectors rise back to +9V and we are again at the start point of a vicious circle! To arrive at a sensible result we must make a practical assumption—that there is bound to be a slight difference in the current gains of the two transistors used and the one that has the higher value will go more rapidly into conduction when power is applied. Let us assume Tr1 has a nominally higher current gain than Tr2.

When power is applied Tr1 will draw base current from point B through R3 and the voltage at A will fall rapidly—cutting off the supply of base current to Tr2. The latter therefore will *not* go into conduction and the voltage at B will stay at +9V while that at A will fall to nearly zero. Try this with your experimental circuit making and breaking the power line and you should find that it is always the same transistor that goes into conduction—in your case, of course, it might be Tr2.

Anyway we shall carry on with our assumption that after switch on point A is at zero volts and we have—after all—a stable state. Let's assume

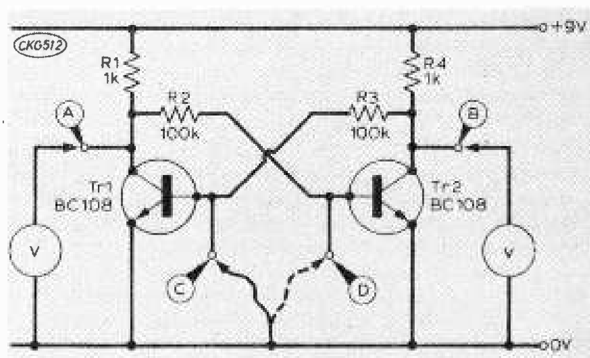


Fig. 9a: A conventional bistable circuit.

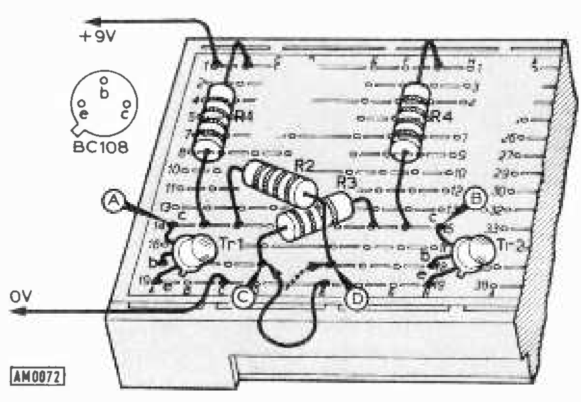


Fig. 9b: T-Dec layout for Fig. 9a.

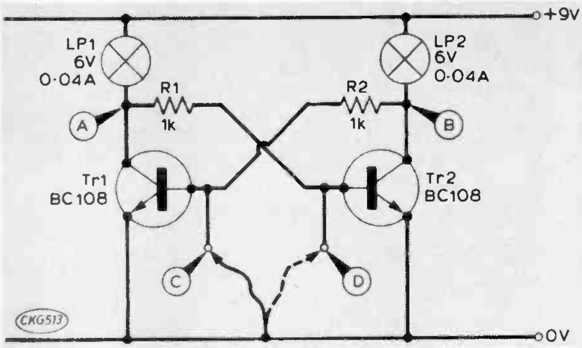


Fig. 10a: A bistable with components modified to drive lamps direct.

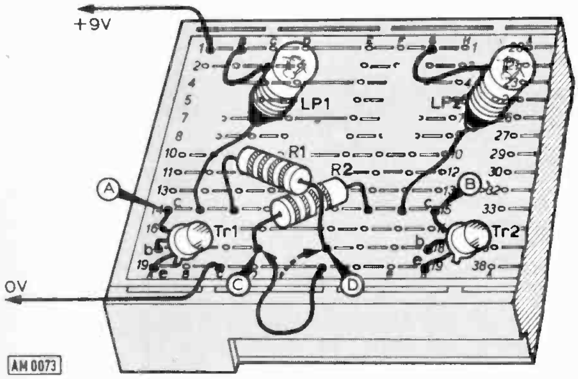


Fig. 10b: T-Dec layout for Fig. 10a.

that we really wanted point B to go to zero volts. For this to happen we must, somehow, make base current flow into Tr2. To do this we must make the voltage at A rise to +9V by momentarily removing Tr1's supply of base current—conveniently done by shorting point C to ground. Do just that and watch the voltage at B as you make the short. Sure enough, it falls to zero while you make the short, but notice that when you have removed the shorting link from C point B stays at zero volts—not only that, but A is now at +9V and the system is again stable. You can make the circuit revert to its original state by momentarily shorting point D to ground. The circuit has two possible stable states (hence its name) and we can make it go into either of them by externally tampering with the base current supplies.

Alternative loads

The rules of current gain apply in this circuit without undue complication and taking into account the normal current limitations of transistors you can use collector loads other than pure resistors. Fig. 10a is an identical circuit in which lamps are used; the cross coupling resistors have to be of lower values to ensure that enough base current flows to control the larger load. Alternatively connect the flying lead to points C and D and you will see that you can make LP1 go on—and stay on—when point D is quickly shorted to ground and similarly with LP2 and point C.

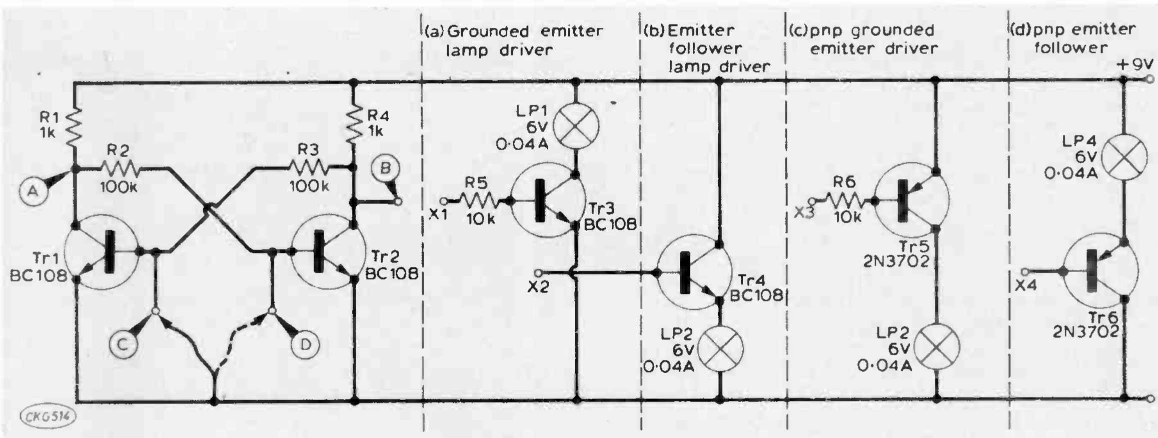


Fig. 11a: Alternative ways of driving low voltage lamps from a bistable. Low voltage relays (requiring less than 100mA) can be substituted for the lamps provided protection diodes are inserted (see part 1, last month).

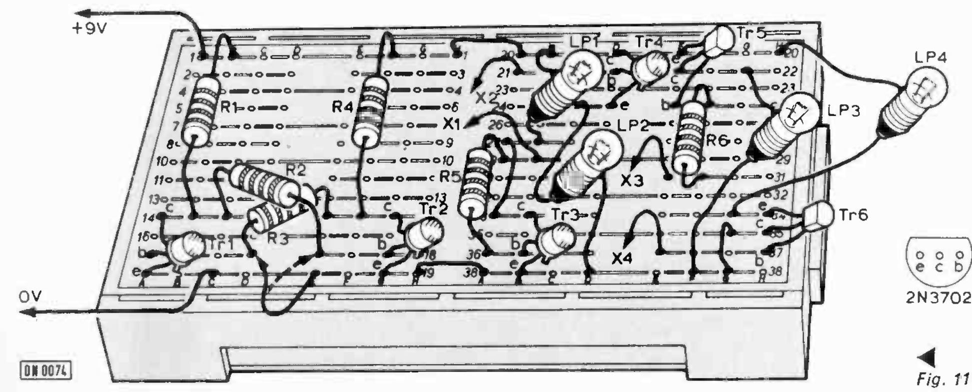


Fig. 11b: T-Dec layout for Fig. 11a.

If you wish to you can use the voltage swings at the collectors of the bistable transistors to drive other circuits. A selection of lamp drivers are shown in Fig. 11a. Any of the single transistor driver stages (with inputs marked X1, 2, 3 and 4) can be connected to either points A or B. (We shall assume they are connected to B.) Take driver (a) which is a simple grounded emitter inverter stage. When point B is +9V Tr3 can draw base current through R5 and the lamp will light. Notice that we have to put a 10kΩ resistor in to prevent the base emitter circuit of Tr3 pulling the voltage at B down to +600mV; if that were to happen the action of the bistable would be interferred with.

Circuit (b) is a simple form of emitter follower and in this case we can do away with the 10kΩ resistor. The reason for this is that when point B goes "high" we immediately pass base current into Tr4 and it starts to conduct, but when this happens the voltage at its emitter rises as current flows through the lamp. The voltage rises to a value 600mV less than the voltage at B; the difference in voltage is due to the standard base emitter forward voltage drop associated with silicon transistors. If, say, point B went to +9V we would end up with approximately 8·4V across the bulb. The only drawback of this circuit—although it does not bother us in this application—is that we will always lose 600mV of driving voltage across the bulb and it will not glow quite so brightly.

In both these two drivers the lamp went on when point B went to +9V. The remaining two drivers use pnp transistors in grounded emitter and emitter follower configurations and because they are sensitive to opposite polarity signals the lamp goes *off* when point B goes high. In circuits it is often useful to make use of opposite polarity transistors to get this type of inversion. It is not very impressive in this application because if we had wanted any inversion we could have used point A as the driving source.

Dividing

An interesting development of the bistable circuit is the *divider* shown in Fig. 12a. The basic circuit of Fig. 9a is still there and you can ignore Tr3 because it is only a lamp driver. We have added a couple of diodes and capacitors and a few more resistors. The object of the circuit is to make Tr1 and Tr2 take up their alternative stable states each time we make a single short circuit path to ground (we shall be shorting point G to ground as a signal).

Let's assume that point A is at +9V (B will be zero and so will C, and D will be at approximately +600mV). The voltage at A effectively reverse biases D1, and D2 is just on the edge of conduction through R6 to point B—which is just slightly more

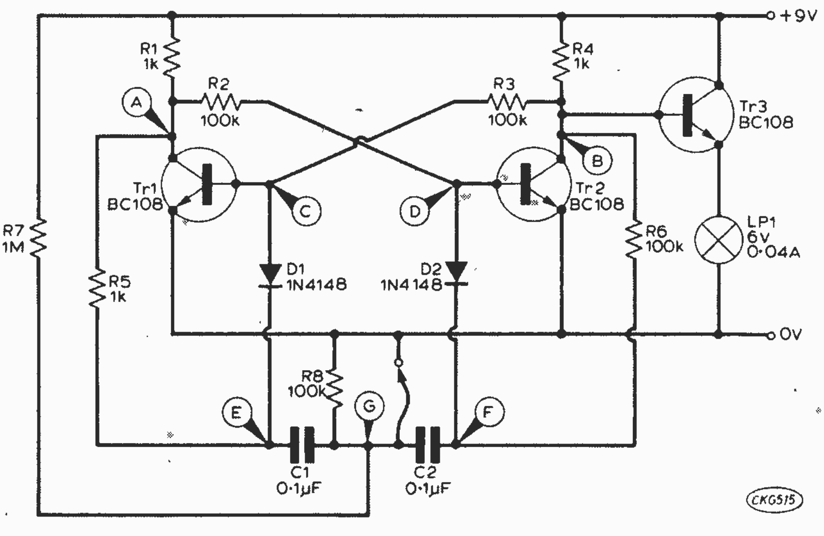


Fig. 12a: A bistable with built in gating so that it switches in alternate directions each time point G is connected to ground. This is sometimes called a divider.

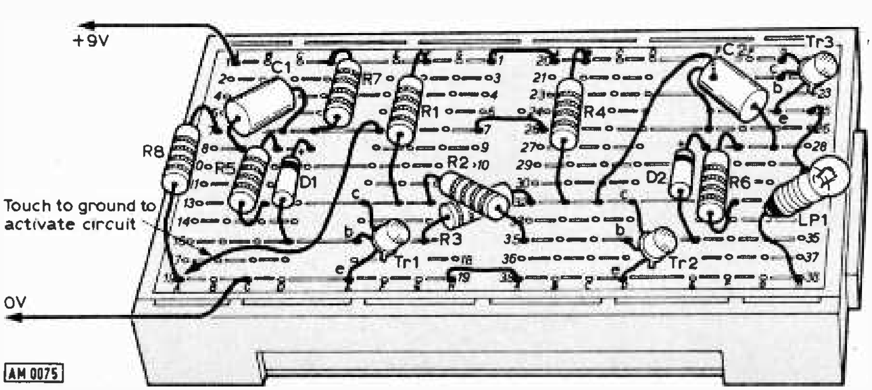


Fig. 12b: T-Dec layout for Fig. 12a.

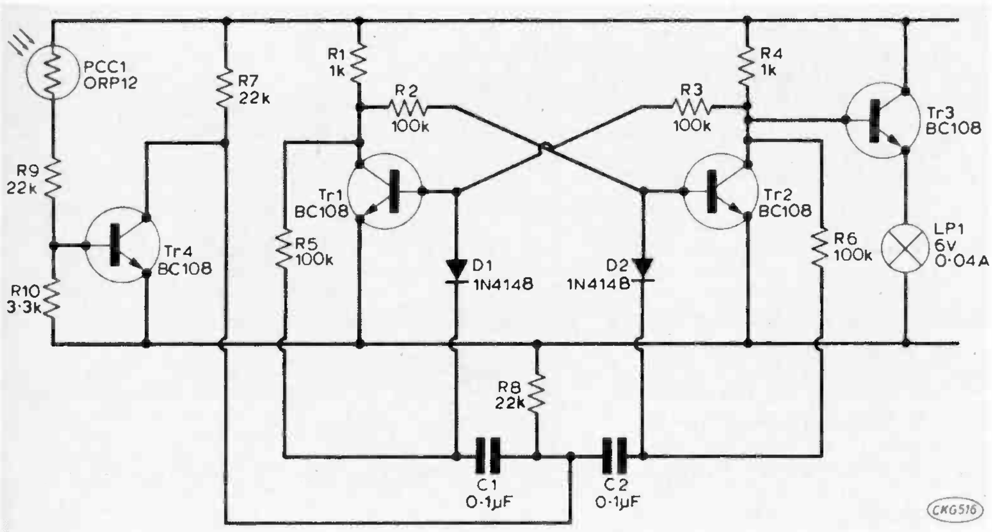


Fig. 13a: With the addition of a few more components, the divider can be made to "toggle" whenever bright light falls on the photo-conductive cell.

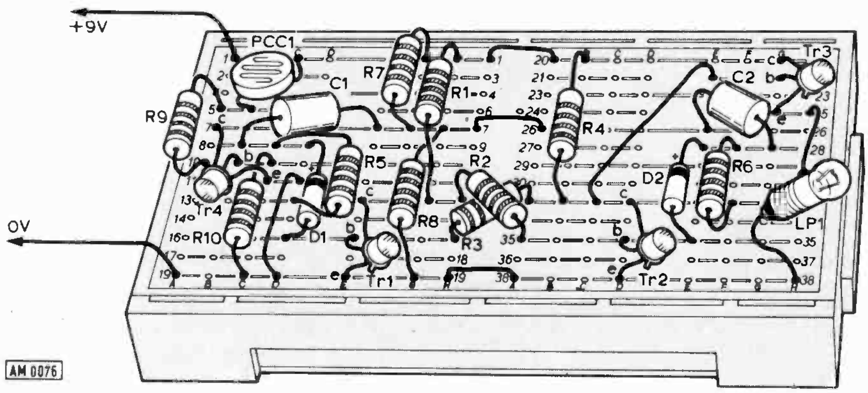


Fig. 13b: T-Dec layout for Fig. 13a

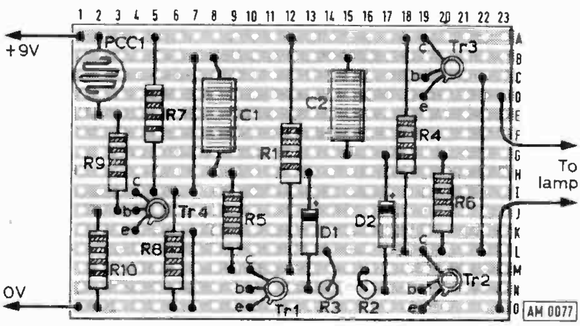


Fig. 13c: Veroboard layout for Fig. 13a.

negative than D. The potential at G (without the shorting link made) will be just under 1V because of the potential divide action of R7 and R8.

By repeated dabbing of the shorting link to ground you can make the lamp go on and off alternatively. There is something that you have to note, however. The circuit is very sensitive and you must make very good clean makes and breaks of the shorting operation; it is very easy to accidently give a double "pulse" when you think you have, in fact, only made one. R7 has deliberately been made a high value to allow time for the voltage at G to recover and this helps to eliminate what appears to be erratic action. Nevertheless the time constant of 1MΩ with the $0{\cdot}1\mu$F capacitors is still quite short so do not be too surprised if sometimes the lamp appears not to respond. What actually happens is that the lamp switches on and back to off so quickly you do not see it happen! Try reducing R7 to 100kΩ and R8 to 10kΩ and you will deliberately aggravate the problem. In a circuit of this nature it is wiser to use some form of non-mechanical switch to do the triggering so that we lose the "bounce' problem.

When you short point G to ground there will be a change in voltage at point E by about 0·8V in a negative direction but because D1 is reverse biased there will be little effect on the base circuit of Tr1. On the other hand the similar drop developed at point F will put D2 into sufficient conduction to momentarily drop the voltage at D and hence remove the base current from Tr2. The voltage at B will rise and bistable action will take place and the voltage at A will fall as the circuit takes up its other stable state. The set of circumstances is now reversed and if the shortening link is removed to allow the two capacitors to regain their original equilibrium the operation can be repeated to make the circuit flip back to its first stable state.

—continued on page 645

EXPERIMENTAL WORKSHOP

—continued from page 644

Fig. 13a shows a very crude electronic form of trigger for the divider. A sudden transition of from near darkness to full room light on PCC1 will make Tr4 go suddenly into conduction and the voltage at the junction of C1 and C2 will fall rapidly to zero—stimulating the divider. Switch off the room light and switch it on again and the circuit reverts. The reason for doing this experiment is to show that it needs two complete operations of switching the room light on and off to make the lamp in the circuit go on and off once. We are effectively dividing the number of operations by a factor of two—the reason why the circuit gets its name. While doing this experiment it is worth noting that slow signals do not have any effect on the divider; slowly covering and uncovering PCC1 will not be an effective trigger—you need the very fast action of switching a light on and off to get reliable results. The reason for this is that C1 and C2 are not able to pass slow waveform signals. You need a wide range of lighting levels to make this circuit switch rapidly but there are a range of switching circuits called 'triggers" which speed up the action of slow stimuli. We shall be looking at this effect next month.

TO BE CONTINUED

Dear Sir, letters

Mum writes in

I am writing as a 'Mum' of one of your enthusiastic readers. Do you by any chance know the ages of some of your younger readers?

My son Edward is 6½ years old and has taken *Practical Wireless* for over a year now. It is used for bedtime stories together with Aesop's Fables (I insist on that!)

Thus one outcome of the enthusiasm of one small boy is that his mother now knows the difference between a diode and a triode, step-up transformers and step-down transformers.

I must confess I find the whole subject of wireless very difficult and show no enthusiasm myself but if you could see a certain little boy's eyes light up when "*P.W.*" as it is affectionately called arrives, it persuades me once more to plough through details of digital multimeters and who is selling what component at the cheaper price!

Through your magazine, Edward bought a pocket multimeter from an advertiser, so we are all having our resistance tested!—**Mrs. Pat Russell** (Herts.).

Darkroom thermometer

Some time ago, you published an article by R. A. Bottomley on the construction of a darkroom thermometer. I have built this unit with great success but I found it was necessary to increase R3 to obtain balance at the mid-point on the scale. I arranged for 24° and 29° by duplicating R3, VR1 and R4. R3 then became 1·5 + 2·2k and 1·5 + 3·3k. A changeover switch completed the revised arrangement, the two temperatures being respectively for developing colour film and colour prints. The meter I used was a Japanese Henelec 0-100uA.—**C. G. Dahl** (Surrey).

The Sinclair Cambridge... no other calculator is so powerful and so compact.

Complete kit-£24·95! (PLUS VAT)

The Cambridge – new from Sinclair
The Cambridge is a new electronic calculator from Sinclair, Europe's largest calculator manufacturer. It offers the power to handle the most complex calculations, in a compact, reliable package. No other calculator can approach the specification below at anything like the price – and by building it yourself you can save a further £5·50!

Truly pocket-sized
With all its calculating capability, the Cambridge still measures just $4\frac{1}{2}$" x 2" x $\frac{11}{16}$". That means you can carry the Cambridge wherever you go without inconvenience – it fits in your pocket with barely a bulge. It runs on ordinary U16-type batteries which give weeks of life before replacement.

Easy to assemble
All parts are supplied – all you need provide is a soldering iron and a pair of cutters. Complete step-by-step instructions are provided, and our service department will back you throughout if you've any queries or problems.

The cost? Just £27·45!
The Sinclair Cambridge kit is supplied to you direct from the manufacturer. Ready assembled, it costs £32·95 – so you're saving £5·50! Of course we'll be happy to supply you with one ready-assembled if you prefer – it's still far and away the best calculator value on the market.

Features of the Sinclair Cambridge

* Uniquely handy package. $4\frac{1}{2}$" x 2" x $\frac{11}{16}$", weight $3\frac{1}{2}$ oz.
* Standard keyboard. All you need for complex calculations.
* Clear-last-entry feature.
* Fully-floating decimal point.
* Algebraic logic.
* Four operators (+, −, x, ÷), with constant on all four.
* Constant acts as last entry in a calculation.
* Constant and algebraic logic combine to act as a limited memory, allowing complex calculations on a calculator costing less than £30.
* Calculates to 8 significant digits, with exponent range from 10^{-20} to 10^{79}.
* Clear, bright 8-digit display.
* Operates for weeks on four U16-type batteries. (MN 2400 recommended.)

GOING QUADRAPHONIC

PW

Q4 PROJECT

PART 2 D. BOLLEN

- QS recordings
- SQ recordings
- Discrete CD-4 recordings
- SURROUND SOUND

It is easy to see how several resistance networks, plus variable separation, could be combined by switching to offer multi-system decoding, but before considering this it would be as well to look first at the circuits of Units A and B.

Unit A circuit

The circuit of unit A is shown in Fig. 12. Tr1 and Tr2 act as unity gain phase splitters, with an input impedance of 47kΩ and an output impedance of about 1kΩ. Mixers Tr3-Tr6 are of the virtual earth type, with an output impedance of 2kΩ, and a gain of two when employed with input resistors of a nominal 100kΩ.

Apart from matrixing, the mixers will accept additional input resistors for mixing in other signals such as reverberation or echo. To keep noise to a minimum, and maintain the correct working point for each transistor, it is advisable to use metal oxide resistors of 5 per cent tolerance or better in the circuit of Fig 12.

Unit B circuit

A constant phase shift of 90° throughout the audio spectrum presents circuit problems. It is arguable how wide the frequency bandwidth needs to be. Some authors maintain that the ear is incapable of detecting phase differences from loudspeakers beyond the limits of 100Hz-8kHz, while decoder manufacturers are currently aiming at a constant phase shift bandwidth of 20Hz-20kHz. Some commercial decoders seem to get by with a bandwidth of 100Hz-10kHz, with a variation of ±10 per cent on 90° so this standard was adopted for the *PW Q4* decoder. The graph of Fig. 11 shows the phase shift characteristic of the unit B circuit.

A 90° phase shifter consists of a phase splitter followed by a network of resistors and capacitors, but a simple splitter of the type used in unit A has insufficient power output to drive such a network effectively, so IC operational amplifiers were employed instead.

In the circuit of unit B, left and right channels are identical and it will suffice to examine the left channel only. IC1 package contains two operational amplifiers of the 741 type, here labelled A and B. The inverting input of amplifier B is connected to the output of amplifier A, which also inverts. Operational amplifier A has a gain of 2·3 and B a unity gain, so the combined outputs of the amplifier pair will be 180° out of phase and 2·3 times the level of the input signal; this gain is just sufficient to offset the gain loss in the following phase shift network.

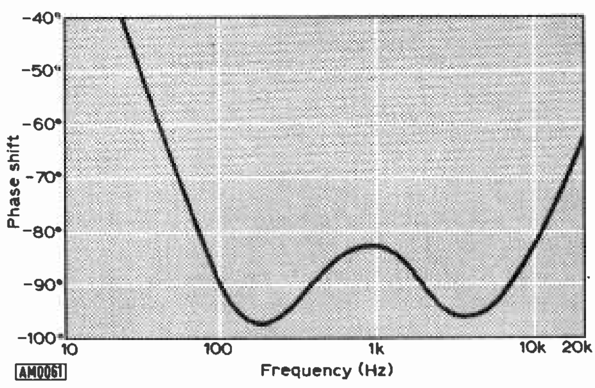


Fig. 11: Phase shift characteristics.

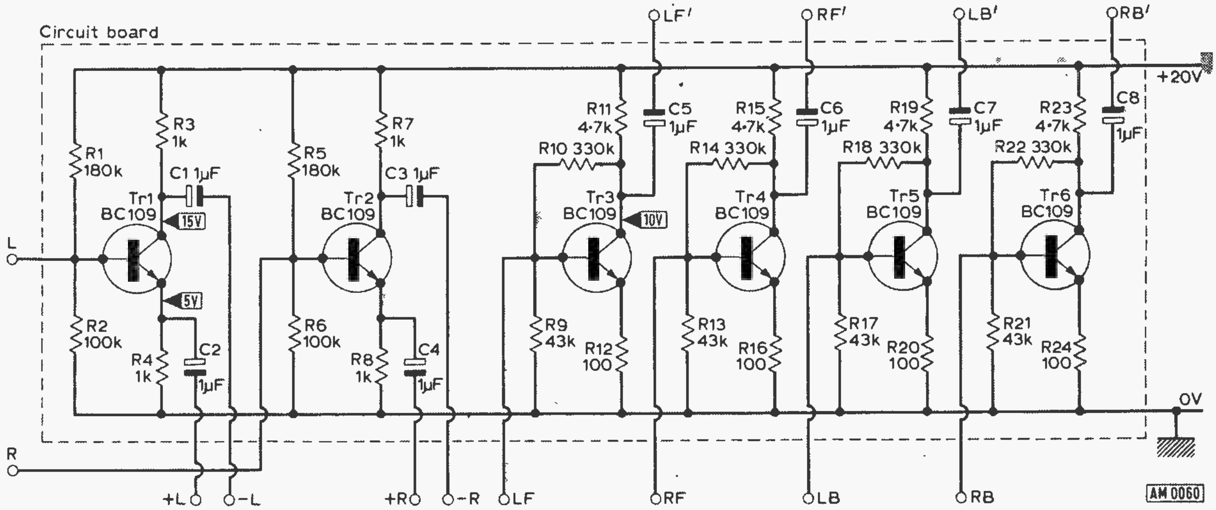


Fig. 12: Circuit of unit A.

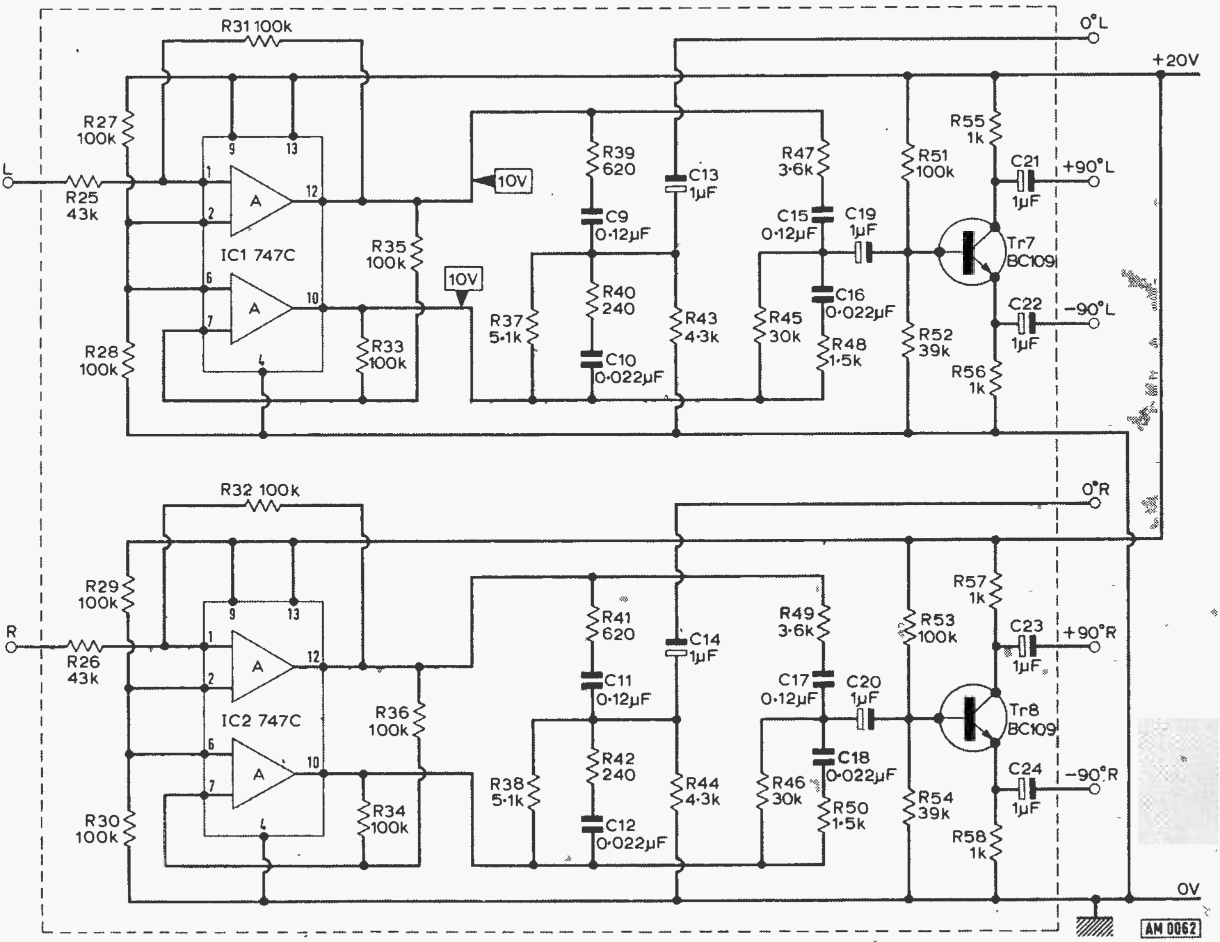


Fig. 13: Circuit of unit B.

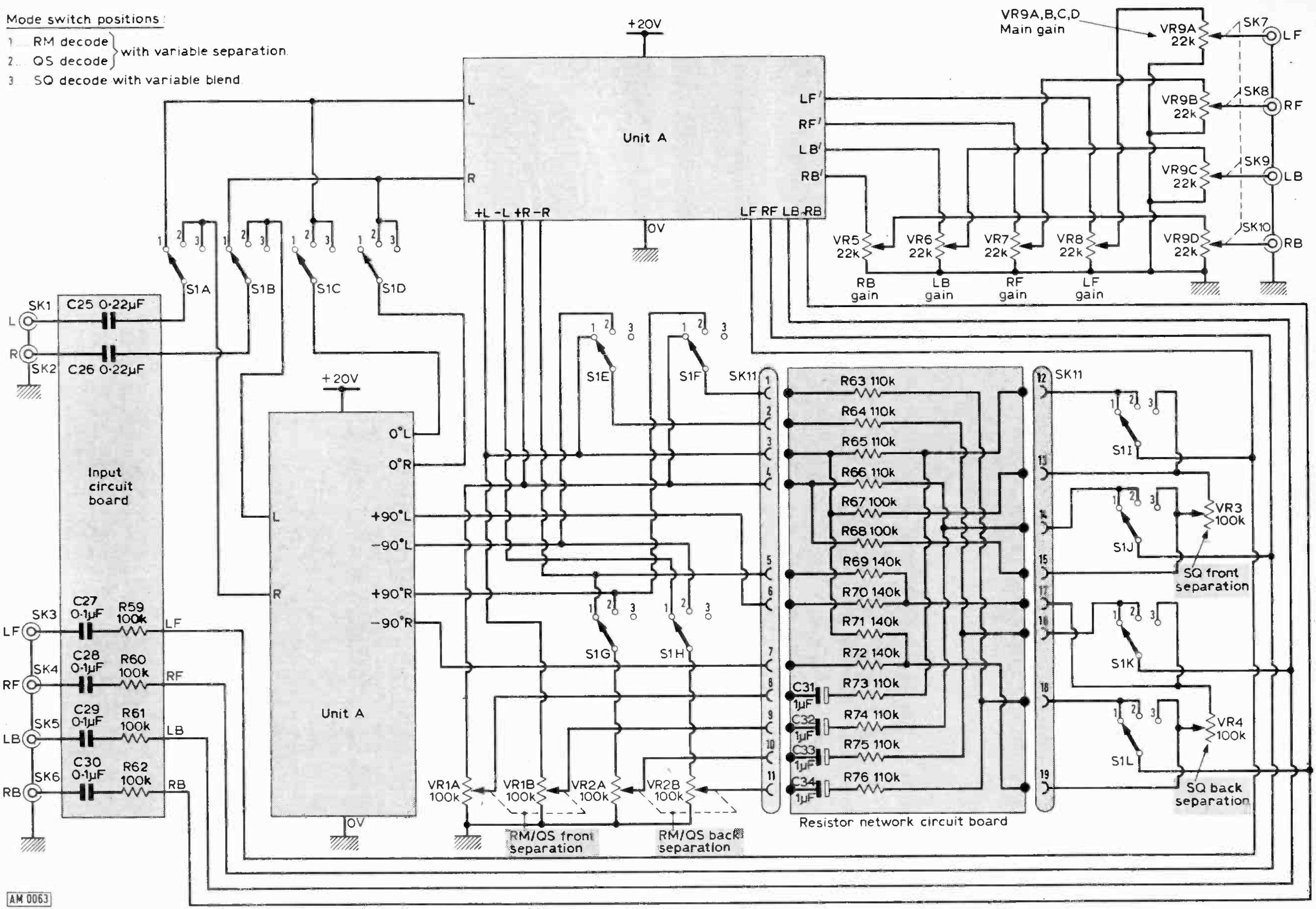


Fig. 14: Circuit diagram of the Q4 multi-system decoder with infinitely variable separation and discrete inputs.

★ Q4 COMPONENTS LIST

UNIT A

Resistors

R1	180kΩ	R13	43kΩ
R2	100kΩ	R14	330kΩ
R3	1kΩ	R15	4·7kΩ
R4	1kΩ	R16	100Ω
R5	180kΩ	R17	43kΩ
R6	100kΩ	R18	330kΩ
R7	1kΩ	R19	4·7kΩ
R8	1kΩ	R20	100Ω
R9	43kΩ	R21	43kΩ
R10	330kΩ	R22	330kΩ
R11	4·7kΩ	R23	4·7kΩ
R12	100Ω	R24	100Ω

All ¼W metal oxide

Capacitors
C1–C8 1μF 25V electrolytic

Transistors
Tr1–Tr6 BC109

Miscellaneous
0·1in pitch Veroboard 0·9in x 4in; terminal pins.

UNIT B

Resistors

R25	43kΩ	R42	240Ω
R26	43kΩ	R43	4·3kΩ
R27	100kΩ	R44	4·3kΩ
R28	100kΩ	R45	30kΩ
R29	100kΩ	R46	30kΩ
R30	100kΩ	R47	3·6kΩ
R31	100kΩ	R48	1·5kΩ
R32	100kΩ	R49	3·6kΩ
R33	100kΩ	R50	1·5kΩ
R34	100kΩ	R51	100kΩ
R35	100kΩ	R52	39kΩ
R36	100kΩ	R53	100kΩ
R37	5·1kΩ	R54	39kΩ
R38	5·1kΩ	R55	1kΩ
R39	620Ω	R56	1kΩ
R40	240Ω	R57	1kΩ
R41	620Ω	R58	1kΩ

All ¼W metal oxide

Capacitors
C9 0·12μF
C10 0·022μF
C11 0·12μF
C12 0·022μF
C13 1μF 25V electrolytic
C14 1μF 25V electrolytic
C15 0·12μF
C16 0·022μF
C17 0·12μF
C18 0·022μF
C19 1μF 25V electrolytic
C20 1μF 25V electrolytic
C21 1μF 25V electrolytic
C22 1μF 25V electrolytic
C23 1μF 25V electrolytic
C24 1μF 25V electrolytic
All capacitors ±5% polycarbonate unless otherwise specified

Transistors
Tr7 BC109 Tr8 BC109

Integrated Circuits
IC1 747C 14 pin DIL
IC2 747C 14 pin DIL

Miscellaneous
0·1in pitch Veroboard 1·8in x 3in; terminal pins

Additional components for multi-system decoder

Resistors

R59	100kΩ	R66	110kΩ
R60	100kΩ	R67	100kΩ
R61	100kΩ	R68	100kΩ
R62	100kΩ	R69	140kΩ
R63	110kΩ	R70	140kΩ
R64	110kΩ	R71	140kΩ
R65	110kΩ	R72	140kΩ

All resistors ¼W metal oxide

Potentiometers
VR1 100kΩ linear dual-gang
VR2 100kΩ linear dual-gang
VR3 100kΩ linear
VR4 100kΩ linear
VR5 22kΩ linear
VR6 22kΩ linear
VR7 22kΩ linear
VR8 22kΩ linear
VR9 22kΩ log (two dual-gang, see text)

Capacitors
C25 0·22μF
C26 0·22μF
C27 0·1μF
C28 0·1μF
C29 0·1μF
C30 0·1μF
C31 1μF 25V electrolytic
C32 1μF 25V electrolytic
C33 1μF 25V electrolytic
C34 1μF 25V electrolytic
All capacitors tubular polyester unless otherwise specified

Switch
S1 12 pole 3 way (RS Components miniature Maka-switch with three 4 pole 3 way wafers)

Sockets
SK1–SK10 phono panel mounting
SK11 0·1in pitch edge connector cut down to 19 way (see text)

Miscellaneous
0·1in pitch Veroboard 1·9in x 3in and 2in x 1·2in; knobs; phono plugs; 18 s.w.g. aluminium sheet 20cm x 29cm and 14·5cm x 35cm.

POWER SUPPLY

Resistors
R77 1kΩ 10% ¼W carbon

Capacitors
C35 1000μF 35V electrolytic
C36 1000μF 25V electrolytic
C37 0·1μF tubular polyester

Transistors
Tr9 BFY52

Diodes
D1 1N4001
D2 1N4001
D3 BZX61 (1·3W zener)

Transformer
T1 0–20V, 0–20V (RS Components Ltd. miniature mains transformer)

Miscellaneous
0·1in pitch Veroboard 1·9in x 2·1in; TO5 heat sink; terminal pins.

The phase splitters in Fig. 13 are Tr7 and Tr8. Phase shift capacitors for the left channel are C9, C10, C15, and C16, and these must have a tolerance of ±5 per cent or better if the performance indicated in Fig. 11 is to be realised. All resistors used in the Unit B circuit should also be 5 per cent or better and preferably of the metal oxide type.

The input impedance of unit B is 43kΩ and the output impedance from the phase splitters approximately 1kΩ. As the 0°L and R outputs are only to be connected to the phase splitters of unit A their impedance may be ignored.

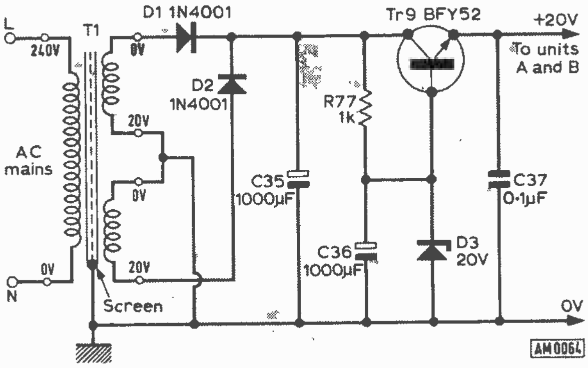


Fig. 15: Power supply circuit.

Multi-system decoder

Fig. 14 shows the circuit of a multi-system decoder based on units A and B. In the RM position of switch S1, with VR1 and VR2 set to mid-track the circuit adheres to the Schieber code with constants of 0·92 and 0·38, giving 3dB separation with a similarly coded recording. When VR1 and VR2 sliders are at the earthed ends of their tracks, left to right separation is virtually infinite. and front to back separation is zero, thus giving centre of the room stereo, and an effect similar to stereophones. At the other extreme, with sliders at the live ends of tracks, left to right separation will be zero and front to back separation is infinite, giving a stereo recording as centre front mono with centre back ambience.

Adjustment of VR1 and VR2 will cover the codes of all early American material, and will also compensate for the widely differing recording techniques used for stereo, to give a well balanced surround-sound result. The resistors associated with the RM decode are R63-R66 and R73-R76.

With S1 switched to QS, the RM resistors are rearranged for Sansui-Pye decode, when VR1 and VR2 are at mid-track. Here, adjustment of VR1 and VR2 can be used to alter the sound stage proportions and to compensate for an oblong speaker array.

In the SQ decode S1 position, resistors R67-R72 are brought into circuit to satisfy the CBS decode constants of 1 and 0 on the front channels, and 0·707 on the back channels, with the required phase shifts in the back channels. At the same time, the controls and resistors associated with RM and QS are rendered inoperative, and VR3 and VR4 are brought in to control SQ front and back separation. With VR3 and VR4 at mid-track, left to right separation will be 10 per cent or 20dB, and this setting will give satisfactory results with SQ recordings where a strong centre front image is not important. The blend values may be varied to compensate for an unusual speaker layout, or to boost a centre front image.

SK3 to SK6 in Fig. 14 are for discrete inputs, and may be used at any setting of S1 when the two-channel inputs to SK1 and SK2 are switched off. Using two and four channel inputs simultaneously would give a mix between the two, so SK3-SK6 can also be employed for mixing in other signals while decoding matrixed material. An output from a reverberation unit could be fed into SK5 and SK6 for increased ambience on certain recordings, or a voice announcement could be mixed into any one of the four channels while music is playing.

Power supply

The supply requirements of units A and B together are 33-40mA at 20V with a low ripple content and a low supply impedance throughout the frequency range. This is provided by the semi-regulated supply circuit of Fig. 15.

C36 and R77 time constant ensures a slow-rise switch on to prevent loudspeaker 'plop' and at the same time keeps impedance down at very low frequencies. C37 offers a low impedance at high frequencies.

The article to follow next month will give constructional details of the multi-system decoder, with notes on testing and setting up.

TUT! TUT!!

P.W. STUDENT OSCILLOSCOPE

On page 340 of the August issue a Veroboard layout was shown. To assist constructors, the co-ordinates of the conductor breaks are listed below:

A43	B1	C4	E15	F24	G15	H5	K66
	B4	C76	E24	F28	G19	H15	
	B27		E36	F33			
	B83						
L54	M57	N34	O39	P24	Q48	R8	S14
L67	M63	N39	O43	P39	Q74	R23	
	M66	N51	O48	P48	Q80		
	M72	N57	O76	P51			
		N63	O80	P76			
		N66		P80			
	T5	U13	V36	W1	W63		X43
	T25	U75	V53	W5	W67		
	T32	U80	V75	W40	W73		
			V80	W50	W80		
				W59	W83		

HOTLINES ON RECENT DEVELOPMENTS

ON AN IMPULSE

WHILE it is always interesting to record the latest developments in electronic components, instruments, etc, it often works out that an application of established principles and equipment is equally fascinating.

One such application is that of amplifying tiny—really tiny—electrical signals or impulses and causing these to control things. Human beings have been doing this since the year one. Signals from the brain control limbs, etc. The twist in this story comes when you take signals generated by the body and couple them to external sources.

A series of experiments has been conducted (another series is in current progress) which shows that well over a dozen different muscle patterns can be produced on cue. The idea is that the subject thinks of raising (say) his right thumb but does not actually move it upwards. Gold electrodes taped to the hands are able to detect these impulse commands.

The experiments to date have involved a subject causing different patterns in an array of lights. Consider the possibilities. You could think that the grass needed cutting—and immediately a radio-controlled E-type lawn mower would belt out of the shed. Obviously there are limits. Imagine being introduced to Raquel Welch, an experience which should produce an impulse or two in most men. Perhaps a built-in manual control could restrict reaction on such occasions to a well willed wink.

PACEMAKERS

Pacemakers, those devices which keep an internal eye on hearts which don't function as reliably as they should, have to be replaced surgically about every two years. Nuclear-powered pacemakers can last ten times as long but can cost five times as much compared to "conventional" ones. They also radiate and are more bulky and heavier than their "conventional" counterparts.

A new pacemaker has arrived. It can be implanted in the patient using only a local anaesthetic. This unit triggers and "fires" only if the heart doesn't beat after a predetermined time. There's more to come too. The unit may be recharged by the patient! The user has a portable recharging unit and a special "vest" which is donned. A special acoustic coupler also enables the wearer to telephone his doctor and transmit heart signs and signals directly for study.

TEMPIS FUGIT

In a previous issue, I wrote of electronic clocks and watches. This seemed to stir a chord in some people and a few even wrote to me. Prices for these items will doubtless come down as production goes up. Not all electronic time pieces cost hundreds of pounds. An electronic stop-watch about to launch itself onto the American market is reckoned to sell there for less than $200. It has a crystal oscillator, LED display and a rechargeable battery. A 28-pin C.M.O.S. chip is employed and the watch measures 0·5in. wide, 1·4in. long and 0·75in. deep. The 24hr readout will happily stay illuminated for about 12 weeks before the battery needs recharging and there is a small button which will switch off the display if it is desired to conserve power.

The electronic watch market in the U.S. alone is estimated at $50 million for this year which might account for all the activity. One manufacturer has recently introduced what is claimed to be the first watch ever which employs field effect liquid crystal displays.

One of the interesting things about the particular display used in these watches is that it is the reverse of the image usually associated with liquid crystal displays. Normally, these adopt a frosted-glass effect for the legends against a mirror background. The field effect LCD's absorb the incident light via polariser filters and the legends (figures, letters, etc) are easily seen as dark outlines against a diffused white background. The lowest price model in this range of wrist watches is around $150. The field effect displays are guaranteed by the manufacturer for 3 years, but it is expressed that they will last for nearer 10 years. Looks as though proud owners will be taking their timepieces to electronic beauty salons every so often for a face change?

One of the most vital parts in the electronic watch, employing a crystal oscillator, is the crystal itself—the electronic heart of the beast. Favourite crystal frequency is 32kHz which is then divided down to supply pulses which in turn feed the displays via display drivers. But there's a snag. Difficulty is being experienced in some areas because the clock/watch maker cannot get enough crystals at 32kHz.

THEY'RE RESISTANT!

One company offers some intriguing resistors which are described as ceramic-insulated and flame-proof. Apparently, these will not burn even if the open flame of a blow-lamp is played on them. Well I'm blowed! Resistance values range from 1Ω to 60kΩ in wattage ratings from 1–10 Watts.

POWER STRUGGLE

Remember the first transistors? Red spot for a.f. with a cut-off around 800kHz. Then White spot transistors which, with luck, managed the 1·8–2MHz Amateur band. They were delicate and couldn't handle too much power. The latest power transistors from one manufacturer are rated to handle 400V at 60A (down to 100V at 200A). A 500V 100A component is in the design stage. Note: these are transistors not thyristors. Perhaps we have a struggle for Power here?

Ginsberg

TAKE 20

DAVID ANDREWS

No. 54
RADIO-GRAM

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

BEFORE you complain that you have been misled by this month's title I had better explain that this device enables you to play records via any type of transistor portable radio without having to make any internal connections to the radio. Thus it is ideal for use with the modern miniature portables that do not have pick-up sockets and thus might save Dad a bit of money when "junior" demands a record player! Apart from the unit to be described you will, of course, need a turntable unit with a CRYSTAL CARTRIDGE pick-up. We stress crystal cartridge not only because it is the cheapest but because the "Radio-Gram" will not work with other types.

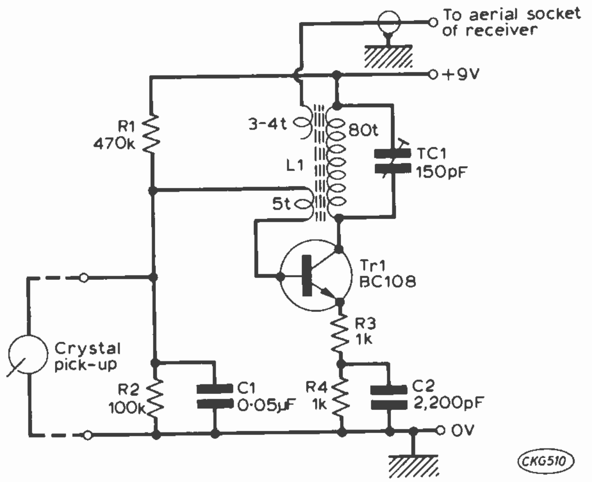
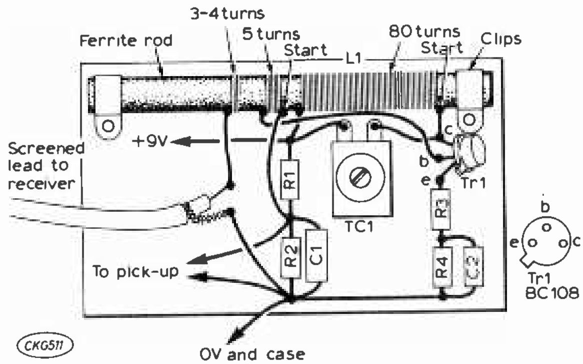


Fig. 1 above, shows the circuit of the Radio Gram. One end of the output coupling coil is left free.
Fig. 2, below, is a suitable layout on veroboard.



Circuit

The circuit shown in Fig. 1 is basically an oscillator that can be tuned with TC1 to operate between about 700kHz and 1·5MHz (i.e. across the range of the medium wave band). The amplitude of oscillation is modulated by direct connection of the pick-up across R2. The modulation process works simply by shifting the bias level of the transistor at audio frequencies and this is remarkably effective. C1 is necessary to help decouple the junction of R1 and R2 to r.f. and it also prevents overmodulation at high frequencies.

Construction and Testing

The coil is wound on a 4 to 6in length of ⅜in diameter ferrite aerial rod, Fig. 2, but when doing this be careful to take note of the sense and start points of the windings; if the connections from the 5 turn feedback coil are reversed the circuit will refuse to operate! The BC108 used should have a gain in the order of 200, which is in the centre of the production spread, but the circuit will operate with devices of widely differing gain.

If, on test, the signal is distorted it is likely that the transistor has too high a gain and the carrier is being clipped. To prevent this increase the value of R3 and reduce R4, keeping the sum of the two about 2kΩ, to introduce a little more negative feedback. Conversely, if the signal strength is weak change the values in the opposite direction. No problem should be encountered here, however, so we have made R3 and R4 fixed values instead of using a more expensive preset.

The unit can be built on veroboard and fitted within a screened metal box. The signal is fed out via a screened lead (very loosely coupled to the ferrite rod as shown) and the centre conductor connected into the aerial socket of the transistor radio. To operate it, select a quiet portion of the medium waveband, put on a record and adjust TC1 until the music is clearly received. First tuning is best carried out on the receiver.

The current drawn by the Radio-Gram is minute, less than 100 microamps, so any small 9V battery will operate it for almost the battery's shelf life.

★ components list

R1	470kΩ	1p
R2	100kΩ	1p
R3	1kΩ	1p
R4	1kΩ	1p
C1	0·05μF	4p
C2	2200pF	4p
TC1	150pF preset	15p
Tr1	BC108	10p
L1	Ferrite rod	25p
		62p

No allowance is made for minimum order costs or for postage and packing and these points should be checked carefully before ordering.

I.F. WOBBULATOR

W.S. POEL G8CYK

THERE can be little doubt that the wobbulator method is by far the best means of setting up an IF strip for optimum bandpass characteristic, combined with optimum sensitivity. There are a number of commercial units made, aimed mainly at the 'trade' and priced accordingly. However, the wobbulator described here costs about £1, whilst providing all the necessary features. An oscilloscope is necessary and preferably one with a simple means of getting at the timebase. (Horizontal X output).

PRINCIPLE OF OPERATION

The wobbulator consists basically of a voltage controlled oscillator whose frequency is being constantly swept across the IF band of the receiver in question. The control is by means of a varicap diode, which can either be one of the purpose-made devices, or more simply, a power rectifier, such as the 1N4001/2/3.

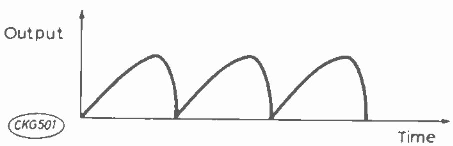


Fig. 1: Typical waveform of a timebase oscillator, used to control the sweep of the wobbulator.

The timebase output on an oscilloscope looks like Fig. 1, which is applied to the diode so that the voltage on the diode is constantly changing in step with the oscilloscope trace. So we have three variables coordinated, namely:—

1. The trace.
2. The voltage on the varicap diode.
3. The varicap capacity and consequently the wobbulator frequency.

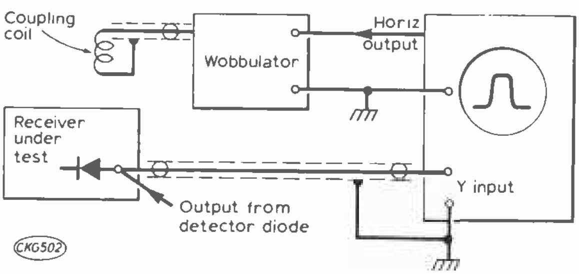


Fig. 2: Interconnections of the scope, wobbulator and IF strip being aligned.

As the frequency sweeps through the IF frequency of the receiver, the IF response curve is displayed on the scope, which is itself monitoring the output from the receiver detector, Fig. 2.

CIRCUIT

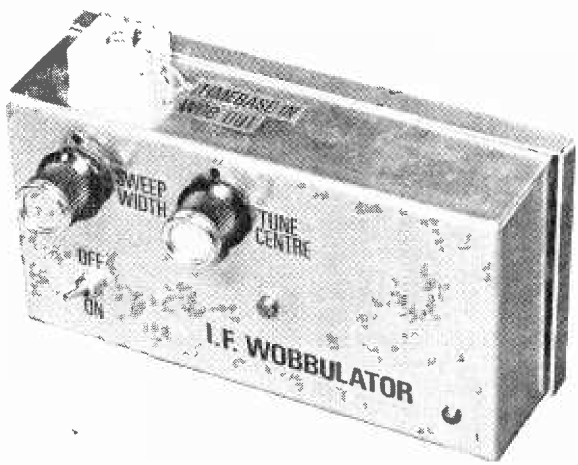
The heart of the device is the single FET Vackar VFO, Fig. 3. The choice of FET is very large, and almost anything in the standard N-channel series will do, e.g. 2N3819, 3823E, TIS88, BFW10. Remember to check the base connections.

The centre frequency is mainly determined by L1, C3 and C5 and VC1. By experimentation with values, it is possible to make the VFO operate past 50MHz, though most sets designed for AM operation use an IF between 455 and 470kHz. An ordinary 455 or 470kHz IFT can be used for L1, the internal capacitor being disconnected.

It is advisable to check the timebase output from the 'scope when choosing the varicap diode, since many scopes have a high voltage at the X output. (The author found out the hard way!) Choose a diode with adequate PIV ratings.

CONSTRUCTION

It will be seen from the diagrams that the layout is quite straightforward. A printed circuit board layout is given, Fig. 4, though at 455kHz there is no objection to Veroboard if that is considered



General view of the prototype wobbulator. Co-axial sockets could be used instead of the terminal block.

Fig. 3: Circuit of the wobbulator. VC1 may be any suitably sized variable of about 200pF.

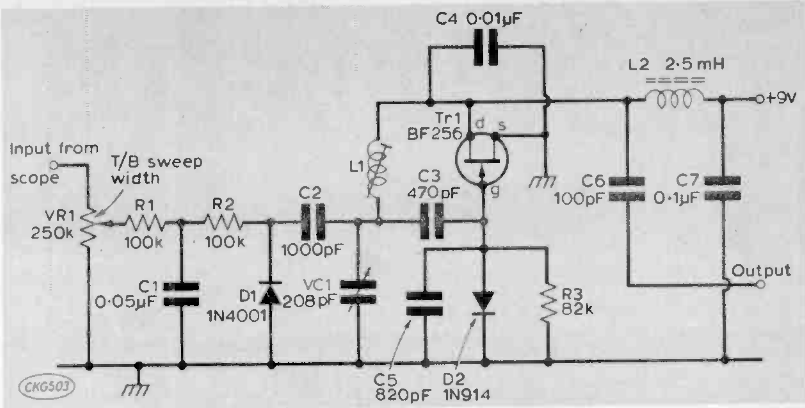
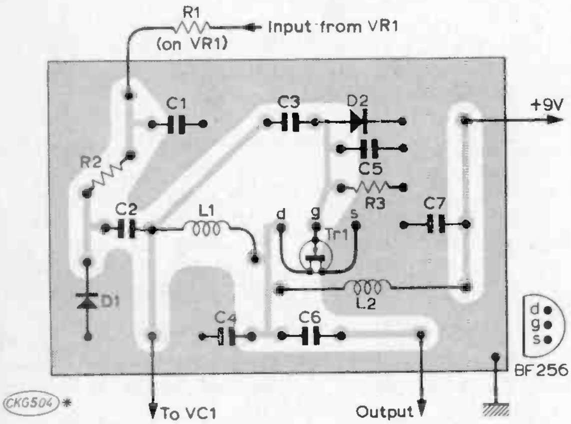


Fig. 4: The printed circuit board, actual size, with component layout.

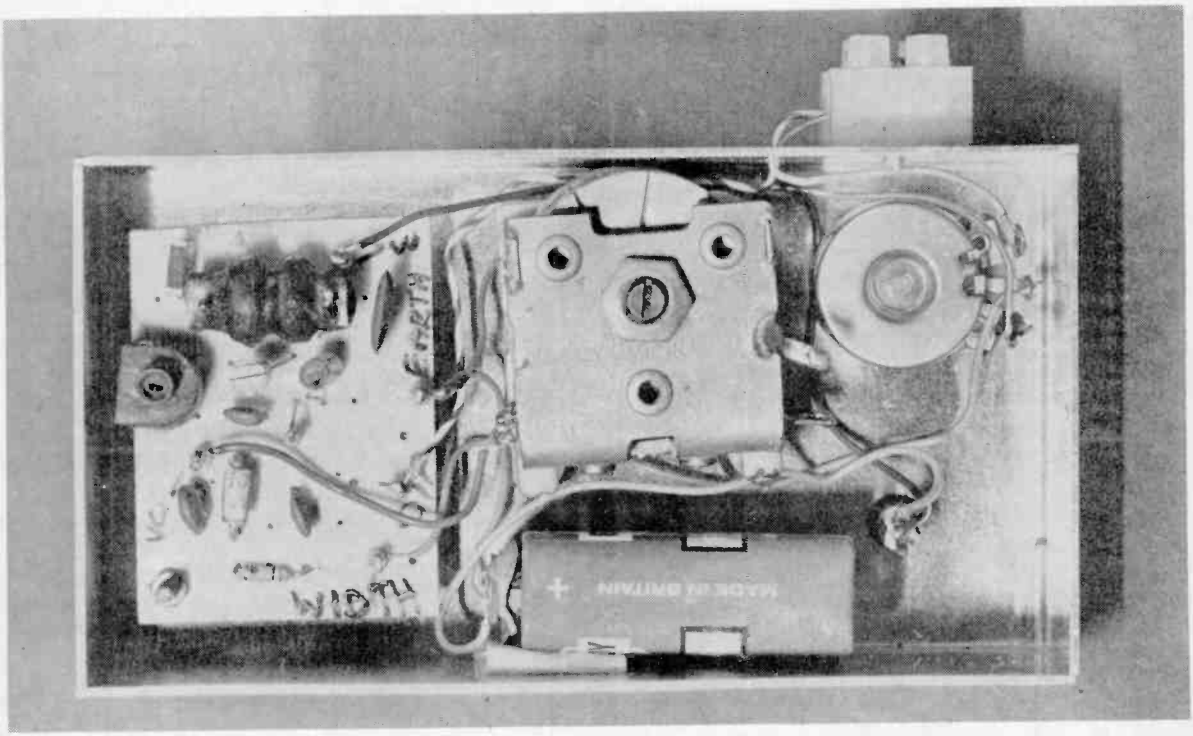


more convenient. Relative positions are not critical, and the wobbulator can very largely be adapted to fit any convenient case.

No particular types of sockets are necessary since most people seem to have adopted their own 'standard,' most probably the standard TV coax system. Remembering the comments on the timebase output it is best to use either a shielded plug or directly soldered connections to avoid shocks when setting up.

OPERATION

The current drawn by the wobbulator is typically 5mA, and any big discrepancy should be investigated before going further. When the system is coupled



The p.c.b. is mounted in the box with bolts and spacing nuts. General layout is not at all critical. An on/off switch could form part of VRI.

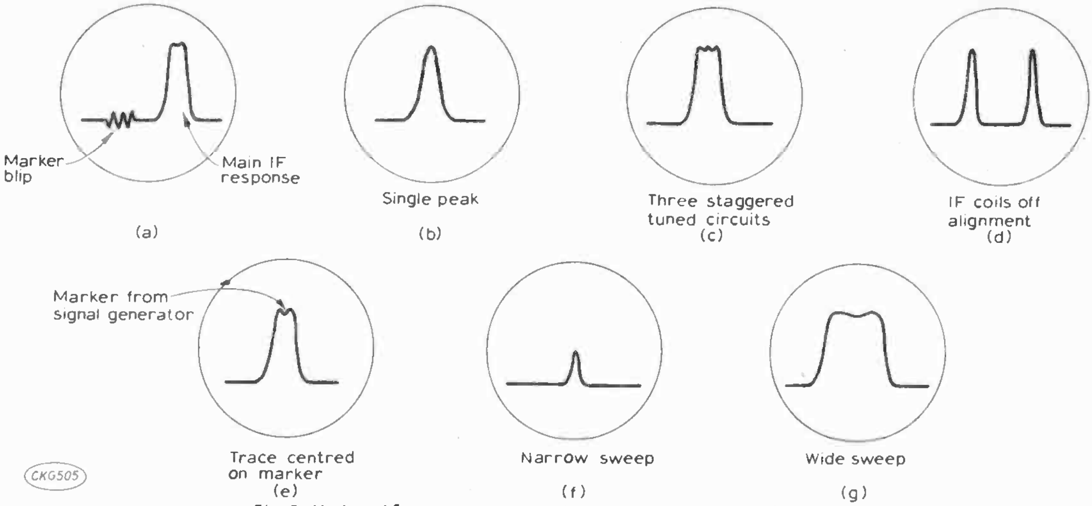


Fig. 5: Various i.f. response curves, obtained with the set-up of Fig. 2.

together as shown in Fig. 2, set the frequency of the wobbulator approximately by the variable capacitor, until a trace of the IF is seen on the scope screen. The sweep frequency should be set at around 50Hz for best results when a 50Hz buzz from the set's loudspeaker will be heard when the wobbulator is correctly aligned. The centre frequency of the IF can then be determined by using an accurately calibrated signal generator, Fig. 5a.

The output from the signal generator is coupled to the IF strip in the same way as the wobbulator, namely a few turns of wire placed near to the mixer input/output. Remember to disable the set's local oscillator before alignment, since this will otherwise lead to spurious traces. A few traces likely to be seen are shown in Fig. 5b-e.

The sweep width potentiometer determines the length of sweep, which may represent from 0 to 20kHz. The narrower the sweep, the more of the IF is displayed on the scope, but it must sweep at least as far as the ends of the IF bandwidth, Figs. 5f-g.

There only remains to align the IF by adjusting the cores in the IFT's to get the desired response. Bandwidth can be determined by using the signal generator to determine the points on the response curve corresponding, say, to 452 and 458kHz (455kHz centre frequency). ■

ON THE AIR

BROADCAST BANDS

MEDIUM WAVE BROADCASTS
by CHARLES MOLLOY

THE International Short Wave Club conducts a poll every three years to determine the most popular short wave stations.

Listeners are asked to participate by sending to the ISWC, 47 Harridge Road, Leigh-on-Sea, Essex SS9 4HE; a list of their five most popular short wave stations in order of merit, together with a short note of *not more than 30 words* why they consider their No. 1 choice to be their most popular station. More than 30 words will automatically disqualify any listener from any award that may be given in connection with the Poll. The final date for voting is December 31st. 1973.

Ex-W.D. Equipment

The short paragraph at the end of the September column announcing that I would be devoting some space to the subject of ex-government Communication receivers has sparked off an even larger than usual postbag. The problem has become so bad that I have had to install a larger letterbox to assist the postman. I would, however, like to remind you all that any letter requiring an answer should be accompanied by a stamped addressed envelope.

I still require information on some of the rarer receivers and if any of you can supply me with this I can assure you that it will be well treated and returned as soon as possible. In particular I would be grateful for any information on the ex-Admiralty B40 receiver.

Readers' Logs

The first log this month comes from **Alan Carpenter** who lives in Aborfield near Reading. Alan's equipment consists of a Heathkit 'Mohican' GC-1U receiver and its 50 inch telescopic aerial. However, a 70 foot long-wire was added to pull in Radio Ceylon.

4915 *Radio Ghana, Accra*, nx. in English at 2245.
6250 *World Music Radio* in English at 0900.
7310 *Radio Vilnius, Lithuania*. English at 2230.
11725 *Radio Ceylon* with Religious programme at 1700.
11725 *R. Free Europe, Lisbon*. Pop music at 2315.
11730 *R. Tashkent, Uzbek* in English at 1400.
15445 *R. Nacional de Brasilia*. English at 2230.

A. W. Guzelian of Coniston in Lancashire has an HRO receiver and a 45 foot long-wire aerial which enabled him to hear:

7105 *R. Nacional de Espana*, in Spanish at 1300.
9555 *R. Baghdad, Iraq* in English at 1940.
11350 *R. Pyongyang, N. Korea*, English at 2100.
11765 *R. Yerevan, Armenia* noted at 2030.
11880 *Voice of Turkey*, in English at 2200.
15115 *R. Tashkent* in English at 1400.
15415 *R. Kuwait* in English at 1730.

Simon Wormleighton and **J. P. Fletcher** of Rendcomb College, Cirencester, Glos. have again sent in a report using the following equipment, Astrad-Altair with 80 foot long-wire; HRO with 8 metre folded dipole; Bush PB63 with 35 foot long-wire. Stations logged included:

6010 *R.T.B., Belgium* in French at 1505.
9022 *Voice of Iran* in English at 2005.
9600 *R. Kuwait*. Nx. in English at 1730.
9670 *Adventist World Radio, Lisbon* at 0935.
11730 *R. Vilnius, Lithuania* in English at 2250.
11850 *R. Norway* in English at 0824.
15325 *R. Canada International* at 1634.

Chris Greenway and **John Greenlees** sent in a combined log from Brandiston in Norfolk. The equipment used being a Lafayette HA600A receiver; Codar PR40 preselector; 100 foot long-wire; 15MHz dipole and homebrew A.T.U. An extract from their log with more than 60 entries is as follows:

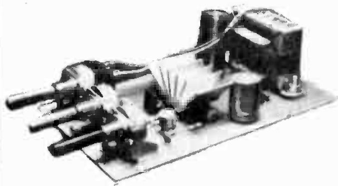
9545 *R. Ghana, Accra* in English at 2135.
9655 *R. Damascus, Syria*, English at 2000.
11650 *R. Bangladesh* with music at 1715.
11710 *R. Kiev, Ukraine* noted at 1945.
11725 *R. Ceylon* in English at 1700.
11935 *R. Pakistan*, news in English at 1725.
15105 *R. Grenada, Windward Islands* at 2120.
15105 *BBC, Ascension Is.* relay noted at 1510.
15185 *R. Nigeria, Lagos*, in English at 0715.
15195 *R. Japan*, news in English at 2215.
15265 *R. Afghanistan* in English at 1800.
15310 *BBC, Tebrau, Malaysia* relay at 1745.

The last log for this month comes from **Christopher Hodgson** of Sunderland who used a Codar Multiband-6 receiver, the PW A.T.U. and a 50 foot long-wire aerial to hear the following stations:

6130 *Radio Norway* at 1800. (Sundays).
9005 *R. Tehran, the Voice of Iran* at 2000.
9840 *Voice of Vietnam, Hanoi* noted at 1815.
15012 *Voice of Vietnam, Hanoi* noted at 1800.
15165 *Radio Denmark* in Danish at 1400
15185 *Radio Finland* at 1810.
15325 *R. Canada International*, s/off at 1313.

RAYMER ELECTRONICS

MICROCHIP SERIES HIGH FIDELITY MODULES

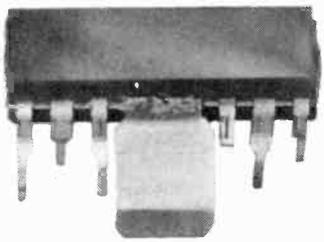


RE 500

Advanced integrated Hi-Fi Amplifier only requires connection to mains speaker and input.
Specifications: load imp 4–16 ohm.
Output: 5 watts.
Frequency response 20Hz to 35kHz ±3dB.
Total distortion less than 1%.
I/P Imp 100k ohm Nom.
£6·30. Post free.
Size: 140 x 80 x 45mm.

MICROCHIP I.C.

5 watts RMS

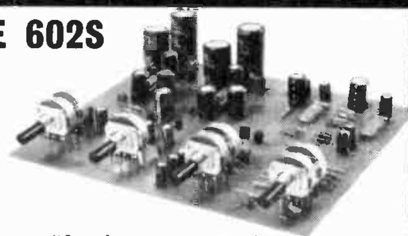


A general purpose Audio i.c. for the constructor capable of 5 watts RMS O/P at less than 1% total distortion, forms an ideal basis for an excellent Hi-Fi system.

Free Data I.C. **£1·50.**

Data, Printed Circuit Board, **75p.** Post paid.

RE 602S



This amplifier forms an ideal basis for the construction of an advanced stereo system at minimum cost with complete ease of assembly. Designed for use with magnetic preamp inputs and main amplifiers on same PCB.
Specifications:
Power O/P 5W RMS per channel (simultaneously).
Total distortion less than 1%.
Active tone controls.
Bass ±10dB, Treble ±12dB @ 100Hz–10kHz.
Freq. response 20Hz to 35kHz ±3dB.
Sensitivity for full O/P 35mV (Ceramic), 3mV (Magnetic).
Input impedance 60K and 200K Ohms.
Load impedance 8–16 ohms.
Operating Voltage 18–28 Volts D.C.
£16·50. Post free.
Power Supply Extra (RE 30 psu)

COMPLETE QUADRAPHONIC AMPLIFIER KIT: RE 4K

A Hi-Fi kit comprising CBS SQ decoder, preamplifier and four channel main amplifier. All modules built and tested.
Specifications:
Similar to the Quadrix system (see below) but with *four* channel main amplifier giving 40 watts total peak power.
This is an opportunity to experience quadraphonic sound at the very minimum of cost.

(Power Amp only shown

£39·00. Post free
Power Supply Extra (RE 35 psu)

POWER SUPPLIES RE 30 PSU
Input 240V AC
O/P 26V DC of 0·6 Amps
£3·60. Post free

RE 35 PSU
Input 240V AC
O/P 26V DC of 1·2 Amps
£4·60. Post free

RE QUADRIX

This is a high quality CBS specification SQ decoder with Hi-Fi stereo amplifier. Designed to allow the conversion of any stereo system to full quadraphonic performance with minimum cost. Extraordinary new presence and reality of sound. More than 20 Watts total peak power.

Specifications:

Decoder
I/P impedance 40K ohms
O/P impedence <300 ohms
Nominal I/P 100mV RMS
Front separation >60dB
Rear separation >20dB

Amplifier
Power O/P 5W RMS per channel (simultaneously)
Distortion at full O/P less than 1%
Sensitivity for full O/P 100mV
Active tone control Bass ±10bB, Treble ±12dB @ 100Hz–10kHz
Load impedance 8–16 ohms

£49·00. Post free

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ON THE AIR

MEDIUM WAVE BROADCASTS
by CHARLES MOLLOY

A. W. GUZELIAN (Coniston, Lake District) has been trying his H.R.O. receiver and 45ft outdoor aerial on the medium waves. His log includes BBC local radio stations at Blackburn on 854kHz; Sheffield 1034kHz; Leeds 1106kHz; Merseyside 1484kHz; Stoke 1502kHz; Nottingham 1520kHz; Teesside 1546kHz; together with programmes in English from the Voice of America (VOA) Munich 173kHz (1734m) on the longwaves at 1600hrs; Milan, Italy on 899kHz at 2300hrs; American Forces Network (AFN) Berlin 935kHz at 2325hrs; Radio Eireann 1250kHz at 1430hrs (low power relay at either Dublin or Cork).

Keith Lavelle (Manchester) has a 10 transistor radio and an outdoor spring-loaded whip antenna. He reports hearing BBC Radio Leeds on 1106kHz; Sheffield 1034kHz; Stoke 1502kHz; Bristol 1546kHz; Manx Radio (Isle of Man) 1594kHz; Trans World Radio, Montecarlo 1466kHz.

J. Hallos (Warrington, Lancs) has built the *Practical Wireless* General Coverage receiver which he is using with a 12ft indoor aerial attached to a 6ft curtain rail. He reports hearing Manx Radio 1594kHz at 0800hrs; Radio Eireann 1250kHz; Radio Leicester 1594kHz at 1400hrs; Bristol 1546kHz; Nottingham 1520kHz; Stoke 1502kHz.

Tim Thorpe (Lowbands, Glos.) has become intrigued with the performance of his Murphy transistor portable after dark. Using its internal aerial he has logged programmes in English from AFN Germany on 872kHz and 1142kHz; Vatican Radio 1529kHz at 2045hrs; TWR Montecarlo 1466kHz at 2100hrs; Radio Berlin International 1511kHz at 2145hrs; Radio Tirana, Albania 1394kHz at 2200hrs; Radio Prague 1286kHz at 2200hrs; Radio Warsaw 1502kHz at 2230hrs; Radio Portugal 755kHz at 2245hrs; Radio Sweden 1178kHz at 2245hrs.

Harold Emblem (Mirfield Yorkshire) has received a verification from the low power Radio Rabat, Morocco 818kHz and he mentions that this station signs off at 0300hrs GMT with "Huna Rabat". This is a good time of year to listen to medium wave stations from North Africa and the Middle East. During the period of Ramadhan, which falls between the 28th September and 27th October this year, many stations are on the air all night and some of them are quite conspicuous after 2300hrs GMT. Listen for Algeria on 533kHz, 548kHz, 890kHz and 980kHz; Tunisia on 629kHz and 962kHz; Libya 1124kHz and 1250kHz; Egypt on 620kHz; Kuwait 1345kHz; Baghdad 760kHz; Beirut 836kHz; Morocco 935kHz; Saudi Arabia 587kHz; Syria 957kHz; Turkey 1061kHz. On the long waves look for Azilal, Morocco on 209kHz (1435m) in Arabic and Tipaza, Algeria 251kHz (1195m) in French.

The BBC transmitter at Moorside Edge on 692kHz (434m) is being increased from 150kW to 300kW to help listeners whose reception is affected by interference from a station in East Germany. The Radio 4 transmitter at Swindon on 692kHz has been changed to 1340kHz (224m) which is marked "Northern Ireland" on many tuning scales.

Charles Molloy

VHF/FM DXING
by SIMON DAVID

FOLLOWING a report a few months ago, **David Gardner** of Dublin has kindly forwarded to me a copy of RTE Guide which covers v.h.f. and television broadcasts from the Republic of Ireland. Radio Na Gaeltachta has only recently opened, broadcasting news, local events and Irish music. Stations have been set up to transmit from Truskmore 91·90MHz, Maghera 97MHz, Mullaghanish 91·30MHz, Kippure 89·10MHz, and Mt. Leinster 90·40MHz all on the v.h.f./f.m. band. Others are on medium wave 240m, 556m, 312m. Irish is spoken throughout while RTE maintains a mainly English speaking service on 89·7MHz, 94·1MHz, 95·3MHz, 94·9MHz respectively.

David says that RTE will verify reception reports, but is still awaiting acknowledgement from R. Na Gael, who have small studios at Casla, Connemara, Co. Galway, Eire. They are a part of RTE, but do not carry commercials. It apparently arose following the setting up of a "pirate" station in the west. This resulted in the "pirate" operator being engaged officially to run R. Na Gael.

Roy Patrick of Derby has taken his v.h.f. receiver on holiday with him on the East Coast (keen DXer!), but unfortunately did not have much DX success. Moving on to Farnborough, Hampshire he picked up Rouen 96·5MHz (loud and clear), Boulogne 99·9MHz (excellent quality) and back in hometown just managed to pick up Boulogne again. Mr. Patrick used a Grundig "Music Boy" receiver.

In some places it is possible for the aerial to pick up not only the direct signal from the transmitter but also signals which have been reflected from tall buildings, hills or other large objects. This is known as multipath interference and it can cause very unpleasant distortion. The directional properties of a carefully-positioned multi-rod aerial can often be exploited to reduce the pick-up of the reflected signals and thus eliminate the interference. If the received signals are too strong this could give rise to 'intermodulation' or interaction between two or more received signals which may result in a 'birdie' background noise on one of the channels—usually Radio 3. Modern receivers are tending to overcome this effect by using special circuitry.

If this form of interference is experienced, it is better to reduce the signal input by using an attenuator in the aerial lead, other than by using a less efficient, and therefore less directional, aerial. Variable attenuators are available and the value to choose is the one which reduces the signal input just sufficiently to remove the 'birdies' without allowing background hiss to be introduced.

If any readers have taken a v.h.f. f.m. receiver on holiday with them, especially when travelling abroad, I shall be pleased to hear from them. We are particularly interested in reception, DX or otherwise, from foreign stations. I would also welcome cassette tape recordings of readers' f.m. reports. Please enclose your full name and address and 4p stamp for the return of your cassette.

ON THE AIR

SHORT WAVES

by DAVID GIBSON, G3JDG

THE summer is now firmly behind us. No more mobile rallies and outings. Which means, I hope, that everyone will have a concentrated onslaught of listening on the Amateur Bands. How about making it a 40 metre autumn/winter? A listen for a minimum of fifteen minutes on 7MHz before you nip off to the more lucrative DX segments of 14 and 21MHz. Spare a thought too for ten metres. Could be interesting bearing in mind that we are only a couple of years away from a sunspot minimum.

One person keeping an r.f. eye on the l.f. end of things is **Stanley Sharred** (Birmingham). He managed to locate a "good" CR100 for the princely sum of £2. He uses it as a back-up to his CR150/2. Using a horizontal Vee antenna (60ft./leg) the following c.w. titbits were logged on topband; GM8MJ, EI9J, LU5HFI, OL1API, PY1RO, ZP9AY, with a couple of GW's and PA0HHV on s.s.b. A sniff around 3·5MHz raised s.s.b. squeaks from; C31DM, FP8DH, KP4AN, PY2FUS, VO1FG, W1FVD, WA3OVC, 3A2EE, 7X2MD. Even the dreaded forty metres was given a "Sharreding" to yield goodies on the c.w. like; CM2BG, CP5GM, K4JO, LU5HFI, WA5WPB, YV3TMD, ZL2MM, ZM2AFH, and s.s.b. from; LU7BDZ, PY7BBX, VK2WC, YV5CYS.

Readers' Logs

Guy Dean (Ringwood) is the proud possessor of a FR50B amateur bands receiver plus a PR30 preselector. Antenna is an inverted Vee trap dipole with the apex at 44ft. Three band log is as follows. Eighty metres; HC1HA, K2LWR, K4CYU, OY5NS, VE1DI, VE1ED, VO1BT, VO1FG, PY1HA, WA2CLQ, W2NR, W3HFV, W5BS. Twenty metres; CE3AEV, CP1WB, CR6RJ, EP2MJ, ET3DS, ET3USA, HC2WF, HC7RD, HP1IW, HR1RSP, HZ1AB, JA4ZA, JY3ZH, JY6GT, JY8LE, KG4CA, KG4FS, KP4DSC, OA4HI, PZ1DR, TF3SV, TI2KF, VE8RC, VE8RCS, VK3BJB, VK3PA, VK5AS, VP3MKE, VU2DK, VU2JM, WA7UKQ, W6KMC, W7IJZ, YV4TY, YV5EED, 5Z4JE, 6Y5GB, 9J2DC, 9X5NA, 9Y4BO. Fifteen metres; A4XFJ, A6XP, CE3ABZ, CE3EGW, CP1FG, CR6AD, CR6AG, CR7OL, EL1G, EL9C, HK3AUE, HK3LT, KP4AOW, KZ5USA, LU1DAB, LU3KAX, OJ0AM, PY2BFJ, TR8AF, VQ9BP, YV3VU, ZD7FT, ZD8AW, ZE1AD, ZE4JW, ZE7JR, ZP5HJ, ZS1FH, ZS4GF, ZS5EL, ZS6QD, 5H3JL, 5T5DY, 5Y4XNH, 5Z4JE, 3D6AU, 9K2JM.

Listening on a CR70A receiver, PR40, a.t.u. and 264ft. end fed, **D. Dance** (Roxburghshire) heard some nice tweets on the h.f. bands. On twenty metres c.w., for example; CN8BO, CR6BX, DU1OR, OA4XK, PY2BOS, PY7VOU, PZ1CP, VP9CB, with s.s.b. from; DU1JMG, EL9C, HV3SJ, VE8RCS, 7X2MD, 9M2LN. Up on fifteen metres c.w.; CN8BO, CR6AL, CR6MX, EA8FE, EA8FS, EL0S/MM (near the Brazilian coast), FG7TG, KZ5EK, LU1HDC, VP9CB, YV3VU, ZC4BI, 9X5NA. Best on ten metres were; ZC4CY, 9H1CH on c.w. with LX1PD, M1C and 9J2DT on s.s.b.

J. Eagland (Brighouse) has a "30ft. long wire aerial, arranged as a spiral in the loft". Dizzy signals arriving from it are fed unmercifully into a CR45 receiver. The log for twenty metres reads; CE3AIU, HC1SS, HK6CPS, LU3FAQ, LX1DAV, PZ6AA, VE2WF, VE7XF, VK2BHR, VK3MO, VR1FL, VP1TB, W9XRP, XE1PO, ZD3D. The same gear on eighty metres managed to locate; CN8HD, CT2AK, OY7JO, OY2X, VE1ZAN, VE3GCS, W2NIN, XE1CV, 4X4KT.

Signals arriving at the ears of **L. Large** (Hassocks) have to walk a 600ft. tightrope. At least that's the length of the antenna which can truthfully be described as a long wire. Apparently it was 1,000ft. long but low-flying motor vehicles proved a hazard. At the end of the line is a 9R59DS receiver and a page in the log marked 14MHz which reads; EI6S, F9JA, GI3GRD, HZ1SH, LX1RR, K6UA, VO5BZ, TF5TP, VE1AM, VE8RCS, YV5AS, 3A2C. On 21MHz the best were CR6QR, and TR8VE.

Loose on 14MHz with an R107, homebrew a.t.u. and 132ft. end fed is **D. Douglas** (Leicester). His best on 14MHz were; CE3AX, CN8BO, CP5CW, CR3WB, CR7EH, EA6BG, EA8CR, EP3SP, ET3RS, ET3USA, HM1AQ, HR1BS, HZ1AB, JW1SO, JY6ZZ, KG6JBE, KP4DDO, KZ5JM, MP4BJP, OX3BH, VE1PV, VO1JR, YN9GL, YV3VU, ZB2BZ, ZE4JG, ZL3UY, ZP5GE, 3V8CA, 4S7BR, 4W1BC, 4X4BA, 4Z4BA, 7X2MD, 9J2DT, 9L1VW, 9Y4PL.

Bernard Hughes (Worcester), JR310 receiver, dipole, bagged these on 14MHz; CR7AG, HR1RSP, HZ1AB, HM1AQ, JX3P, JY6KAM, JA3AJW, KG6JAP, KZ5OH, LG5LG, VQ9MC, VP2VAP, VP2VS, VK2BKG, VK3ALL, WA7PMI, WA7BPS, ZL1JJ, ZD7FT, ZD3D, ZK1DX, 5W1AU, 9V1QO, (9G1HE, 9J2EP. Curses, all Gibbies best gone for a chop—

Events

Contests and events for October include: October 6-7, Oceana contest (phone); 6-7, u.h.f. national field day; 6-7, 432/1296MHz contest; 13-14, Oceana contest (c.w.); 13-14, fifteen/ten metre contest; 20-21, WADM contest (c.w.); 20-21, forty metre contest (c.w.). November 3-4, forty metre contest (phone); 3-4, two metre and 70cms contest.

BROADCAST BANDS

Short Wave Reports by 15th of the month to Malcolm Connah, 59 Windrush, Highworth, Swindon, Wiltshire, SN6 7DT.

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

VHF/FM Reports to Simon David, c/o Practical Wireless, Fleetway House, Farringdon Street, London, EC4A 4AD.

AMATEUR BANDS

Short Wave/VHF

Logs in alphabetical order please by 15th of the month to David Gibson, G3JDG, 12 Cross Way, Harpenden, Hertfordshire.

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● Channel section modules, for building your own mixer. Gain—16 x (24dB). Tone controls—18dB swing. Carr. pd. £3·50 + V.A.T.

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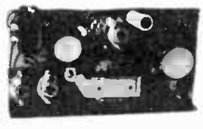

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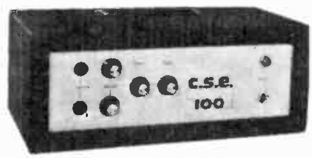
This versatile unit is now available in a black vynide case and so represents even better value than ever delivering speech and music powers of up to 100 watts RMS and continuous signal outputs of 70 watts. Two individually controlled inputs with wide range bass and treble controls.



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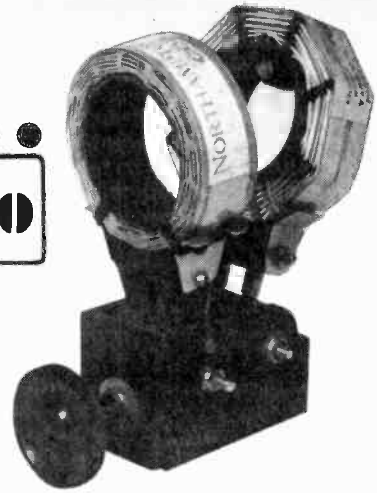


COLIN RICHES
ARTHUR DOW

WE'D like some help and information as soon as possible on early wireless equipment manufactured by "H.P.R. Wireless Ltd." Mr. **R. J. I. Moon**, lately of Guildford, Surrey, has, in the process of moving down to Cornwall, kindly passed on to us some single valve units comprising tuners, detectors and audio stages. These used to be connected together to form a complete receiver and we even have the original heavy copper wires used for that purpose, with end loops perfectly formed.

So far we have not been able to trace the makers in any of our old catalogues but we believe the units are typical of the early 1920's. The units are housed in the inevitable mahogany boxes with black ebonite panels and the equally inevitable brass terminals, each panel being engraved "H.P.R. Wireless Ltd."

Mr. **Ray Williams** of Grantham, Lincs, thinks enough of our humble efforts to have extracted all the Going Back pages from past issues of the magazine and to have bound them together to form a 'useful reference work'. Another reader wonders if we are going to do a reprint of our offerings! Any more letters like that and we shall have enough evidence to demand of the Editor that something be done!

Not quite vintage but of great interest to Ray Williams are two Utility receivers of the last war, both in perfect working order. In view of the vast numbers of these sets that must have been turned out at the time there must still be many thousands out of sight in attics, storerooms, garages etc. So, go to it, Going Back'ers and follow Ray's favourite haunts, 'derelict buildings, under wood piles and in odd corners'. One ancient set was brought round by a neighbour who thought it was a war-time bomb!

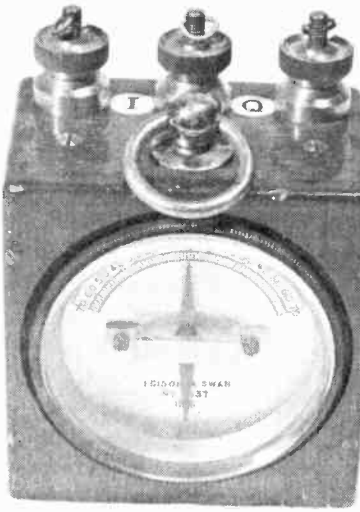
Mr. Williams was also kind enough to send along a photograph, reproduced herewith, of some of his treasures which number twenty eight, so far. He specialises in early crystal sets and has collected some specimens in mint condition. The apple of his eye is an Ediswan crystal set, as new, in its original carton! This was featured on BBC TV in 'Nationwide' in July last year. So . . oh, when you buy that transceiver keep the carton, it could be worth a bomb in fifty years time!

Mr. Ray Williams from Grantham is pictured here with some items from his vintage radio collection.

CQ! CQ! CQ! CQ! CQ!

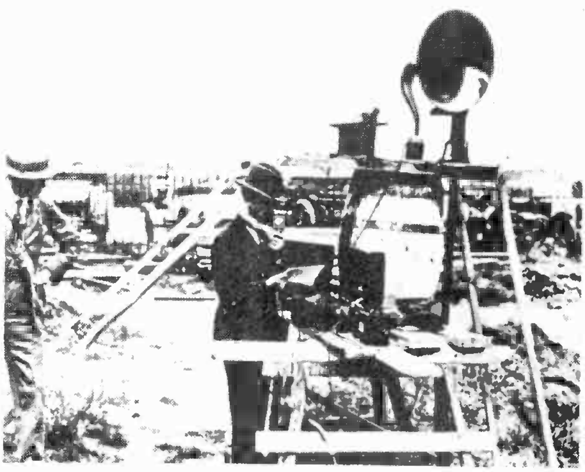
Information Wanted

. . . any information appreciated on this meter. Front dial reads 70-0-70 Edison and Swan No. 11637—1916. Top terminals read I and Q.—**R. J. Goodman,** *26 Killarney Road, Wandsworth, London, SW18 2DX.*



. . . I wish to restore a Gecophone 3-valve a.c. receiver, Frequency is 50/80m and voltage input 200-250V. Number is BC 3130. Inst. No. 7327. I would be glad of any information on this set and a suitable speaker to use with it.—**Maurice Dean,** *29 Lea Road, Dronfield, Sheffield, Yorks.*

. . . information regarding valves in a two-valve Gecophone model BC 3250 (c1926)—**David James,** *12 Circus Street, Greenwich, London, S.E.10.*



This BBC photograph shows an Outside Broadcast commentator at the Brooklands Race Track in 1922.

TRANSMIT/RECEIVE CONTROL BOX

R. H. LONGDON

THIS device is intended to control a transmitter and receiver, but can be used for other purposes, as explained. It gives complete control of suitable home-built equipment, without the need for any relay, or relay supplies.

Fig. 1 is the circuit, based upon the use of a 4-wafer 3-way rotary switch. Switch positions are numbered 1, 2 and 3. The back wafer S1a transfers the circuit from co-axial socket Sk1 to either co-axial socket Sk2 or Sk3. Wafter S1b closes the circuit in position 3. Wafer S1c closes in positions 2 and 3, while the front wafer S1d closes in positions 1 and 2.

METHODS FOR USE

Uses for the control box in an amateur station include the following:

Rx/Tx Control

Plug the aerial or tuner lead into Sk1. Run a co-axial lead from Sk2 to the receiver, and a similar lead from Sk3 to the transmitter. Disconnect the transmitter p.a. h.t. lead from the power pack, and take to A, running a lead from the second terminal A to the power pack. Similarly place B-B in the v.f.o. or v.f.o. h.t. circuit. Disconnect one receiver speaker lead from the speaker and take to C, adding a lead from the speaker to the second terminal C.

Position 1 then provides reception. Position 2 allows the v.f.o. to be tuned to the receiver frequency. Position 3 puts the transmitter on, and receiver off.

Aerial Selection

A dipole may be available for one band, and an end-connected wire for other bands. For such purposes, or a direct comparison of aerials, connect one aerial to Sk2, the other aerial to Sk3, and the receiver to Sk1.

Aerial/dummy load

It is sometimes convenient to run a transmitter output temporarily into a dummy load. For this, connect the Tx to Sk1, the aerial (or tuner) to Sk2, and dummy load to Sk3. For modulation and other tests the dummy load can be a household lamp. Should the dummy load be of known impedance, such as 75 ohms, it can be useful to load the transmitter into this correctly. Then switch to the aerial tuner and adjust the tuner for the same Tx p.a. input reading. A dummy load with r.f. meter is also very useful for obtaining optimum transmitter output.

Receivers

It is sometimes convenient to switch from one receiver to another, for comparison, or because they are most suitable for different purposes (such as general coverage and amateur band only receivers, or h.f. band and l.f. band receivers). This can be done by using Sk2 for one receiver, and Sk3 for the other. Where necessary, the speaker of the receiver not in use can be muted by using terminals A-A, and C-C.

Transmitters

Sometimes a 10W Tx may be used for 160m, and a larger transmitter for other bands. Sk2 can then go to one Tx, Sk3 to the other Tx, and Sk1 to the aerial tuner.

Transmitting Aerials

It is sometimes useful to compare one transmitting aerial with another (e.g., a vertical and long wire) while transmitting. This can be done by taking the Tx to Sk1, and the aerials (with tuners, where required) to Sk2 and Sk3. Other uses will no doubt suggest themselves.

EFFICIENCY

When this method of change-over was first used, there was some doubt about r.f. efficiency, and the possibility of switching high voltages.

R.F. efficiency was compared by feeding r.f. from a Tx to an r.f. wattmeter direct, then through the control box, on 28MHz and lower frequencies. No difference in wattmeter readings could be seen.

R.F. feedthrough from Tx to Rx when transmitting depends on the equipment and layout elsewhere. as well as on stray coupling in the box. It was never large enough to cause trouble. An extra wafer was tried with the control of a large transmitter, to short Sk2 (receiver aerial) to earth, when transmitting. This was not incorporated in the control box as it was felt to be unnecessary.

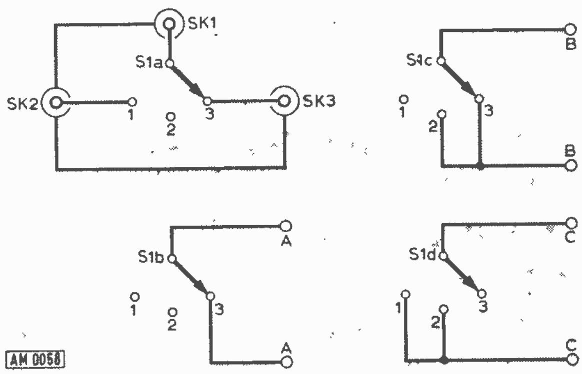


Fig. 1: Circuit of the tx/rx control box

NEW EDU-KIT MAJOR

Completely Solderless Electronic Construction Kit

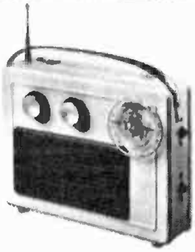
Build these projects without soldering iron or solder

- ★ 4 Transistor Earpiece Radio.
- ★ Signal Tracer.
- ★ Signal Injector.
- ★ Transistor Tester NPN-PNP.
- ★ 4 Transistor Push Pull Amplifier.
- ★ 5 Transistor Push Pull Amplifier.
- ★ 7 Transistor Loudspeaker Radio MW/LW.
- ★ 5 Transistor Short Wave Radio.
- ★ Electronic Metronome.
- ★ Electronic Noise Generator
- ★ Batteryless Crystal Radio.
- ★ One Transistor Radio.
- ★ 2 Transistor Regenerative Radio.
- ★ 3 Transistor Regenerative Radio.
- ★ Audible Continuity Tester.
- ★ Sensitive Pre-Amplifier.
- ★ Parts Price List and Plans 40p (Free with parts).

Total Building Costs £7·23 P P & Ins. 44p (Overseas P & P £1·05)

NEW ROAMER NINE

WITH V.H.F. INCLUDING AIRCRAFT



Nine Transistors, 9 Tuneable wavebands as Roamer Ten Built in ferrite rod aerial for MW/LW. Retractable chrome-plated telescopic aerial for VHF and SW. Push Pull output using 600 mW transistors. 9 Transistors and 3 diodes, tuning condenser with V.H.F. section, separate coil for aircraft, moving coil loudspeaker, volume ON/OFF and wavechange. Attractive all white case with red grille and carrying strap. Size 9¼" × 7" × 2¼" approx. Parts Price List and Plans 30p (Free with parts).

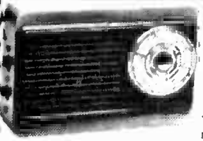
Total Building Costs £6·95 P P & Ins. 44p (Overseas P & P £1·05)

POCKET FIVE

3 Tunable wavebands. M.W. L.W. and Trawler Band, 7 stages, 5 transistors and 2 diodes, supersensitive ferrite rod aerial, moving coil loudspeaker, attractive black and gold case. Size 5½" × 1¼" × 3½" approx. Plans and Parts Price List 15p (Free with parts).

Total Building Costs £2·28 P P & Ins. 24p (Overseas P & P 65p)

TRANSONA FIVE



Wavebands, transistors and speaker as Pocket Five. Larger Case with Red Speaker Grille and Tuning Dial. Plans and Parts Price List 15p (Free with parts).

Total Building Costs £2·50 P P & Ins. 25p (Overseas P & P 65p)

NEW Everyday Series

Build this exciting New series of designs

E.V.5. 5 Transistors and 2 diodes. MW/LW. Powered by 4½ volt Battery. Ferrite rod aerial, tuning condenser, volume control, and loudspeaker. Attractive case with red speaker grille. Size 9" × 5½" × 2¼" approx. Parts Price List and Plans 15p. Free with parts.

Total Building costs £2·73 P P & Ins. 30p (Overseas P & P 70p)

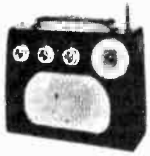
E.V.6. Case and looks as above. 6 Transistors and 3 diodes. Powered by 9 volt battery. Ferrite rod aerial, loudspeaker, etc., MW/LW coverage. Push Pull output. Parts Price List and Plans 15p. Free with parts.

Total Building Costs £3·60 P P & Ins. 30p (Overseas P & P 85p)

E.V.7. Case and looks as above. 7 Transistors and 3 diodes. Six wavebands. MW/LW, Trawler Band, SW1, SW2, SW3, powered by 9 volt battery. Push Pull output. Telescopic aerial for short waves. Parts Price List and Easy Build Plans 20p. Free with parts. Overseas P & P £1·05.

Total Building Costs £4·08 P P & Ins. 31p

ROAMER EIGHT Mk I

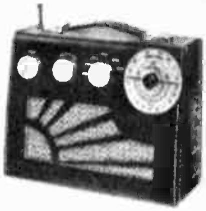


NOW WITH VARIABLE TONE CONTROL

7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Built in Ferrite Rod Aerial for MW and LW. Retractable chrome plated Telescopic aerial for Short Waves. Push pull output using 600mW transistors. Car aerial and Tape record sockets. Selectivity switch. 8 transistors plus 3 diodes. Fine tone moving coil speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning, wave change and tone controls. Attractive case in rich chestnut shade with gold blocking. Size 9 × 7 × 4in. approx. Easy to follow instructions and diagrams. Parts price list and plans 25p (FREE with parts).

Total building costs £6·98 Overseas P & P £1·05) P P & Ins. 47p

ROAMER TEN



WITH VHF INCLUDING AIRCRAFT

10 Transistors. 9 Tunable Wavebands, MW1, MW2, LW, SW1, SW2, SW3, Trawler Band, VHF and Local Station also Aircraft Band

Built in Ferrite Rod Aerial for MW/LW. Retractable, chrome plated 7 section Telescopic Aerial, can be angled and rotated for peak short wave and VHF listening. Push Pull output using 600mW Transistors. Car Aerial and Tape Record Sockets. 10 Transistors plus 3 Diodes. Fine tone moving coil speaker. Ganged Tuning Condenser with VHF section. Separate coil for Aircraft Band. Volume on/off. Wave Change and tone Control. Attractive Case in black with silver blocking. Size 9" × 7" × 4". Easy to follow instructions and diagrams. Parts price list and plans 30p (FREE with parts).

Total building costs £8·50 (Overseas P & P £1·05) P P & Ins. 52p

"EDU-KIT"

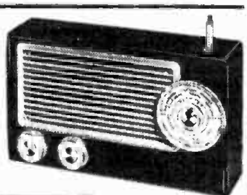
Build Radios, Amplifiers, etc., from easy stage diagrams. Five units including master unit to construct.

Components include: Tuning Condenser: 2 Volume Controls: 2 Slider Switches: Fine Tone Moving Coil Speaker: Terminal Strip: Ferrite Rod Aerial: 2 Plugs and Sockets: Battery Clips: 4 Tag Boards: 10 Transistors: 4 Diodes: Resistors: Capacitors: Three ¼" Knobs. Units once constructed are detachable from Master Unit, enabling them to be stored for future use. Ideal for Schools, Educational Authorities and all those interested in radio construction. Parts price list and plans 25p (FREE with parts).

Total building costs £5·50 P P & Ins. 33p (Overseas P & P £1·05)

TRANS EIGHT

8 TRANSISTORS and 3 DIODES



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

Total building costs £4·48 P P & Ins. 33p (Overseas P & P £1·05)

ROAMER SIX

CASE AND LOOKS AS TRANS-EIGHT

6 Tunable Wavebands: MW, LW, SW1, SW2, SW3, Trawler band plus an extra Medium waveband for easier tuning of Luxembourg, etc. Sensitive ferrite rod aerial and telescopic aerial for Short Waves. 3in. Speaker. 8 stages—6 transistors and 2 diodes. Attractive black case with red grille, dial and black knobs with polished metal inserts. Size 9 × 5½ × 2½in. approx. Plans and parts price list 25p (FREE with parts).

Total building costs £3·98 P P & Ins. 31p (Overseas P & P £1·05)

Please add 10% for VAT INC. P&P

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★ Open 10–1, 2.30–4.30, Mon.–Fri. 9–12 Sat.

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Tel.: 0234 52367. Reg. No. 788372.

I enclose £.................... for ....

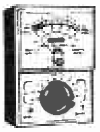
Name ....

Address ....

(Dept. LPW23.)

G.W.SMITH & CO (RADIO) LTD

AUDIOTRONIC MODEL ATM.1



Top value 1000 o.p.v. pocket multimeter. Ranges: 0/10/50/250/1000v. AC and DC DC Current 0-1mA/100mA. Resistance 0/150k ohms. Decibels −10 to +22dB. Size 90 × 60 × 28mm. Complete with test leads. £2·95. Post 15p.

RUSSIAN 22 RANGE MULTIMETER

Model U437 10,000 o.p.v. A first class versatile instrument manufactnred in U.S.S.R. to the highest standards. Ranges: 2·5/10/50/250/500/1000v D.C. 2·5/10/50/250/500/1000v A.C. DC Current 100wA/1/10/100mA/1A. Resistance 300 ohms/3/30/300K/3m Ω. Complete with batteries, test leads, instructions and sturdy steel carrying case. £4·95. P. & P. 25p

MODEL 500

30,000 O.P.V. with overload protection, mirror scale. 0/·5/2·5/10/25/100/250/500/1,000v. D.C. 0/2·5/10/25/100/250/500/1,000V. A.C. 0/50μA/5/50/500mA. 12 amp. D.C. 0/60/K/6 Meg./60 Meg Ω £9·95. Post paid. Leather Case £1·75

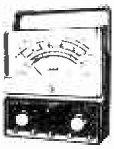
U4312 MULTIMETER

Extremely sturdy instrument for general electrical use. 667 o.p.v. 0/·3/1·5/7·5/30/60/150/300/600/900 VDC and 75mV. 0/·3/1·5/7·5/30/60/150/300 600/900 VAC. 0/300μA/1·5/6/15/60/150 600mA/1·5/6 AMP. D.C. 0/1·5/6/15/60/150/600mA/1·5/6 AMP. AC. 0/200 Ω/3K/30K Ω. Accuracy DC 1%. AC 1·5%. Knife edge pointer, mirror scale. Complete with sturdy metal carrying case, leads and instructions. £9·75. P. & P. 25p.

HIOKI MODEL 700X

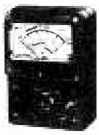
100,000 O.P.V. Overload protection. Mirror scale. ·3/·6/1·2/1·5/3/6/12/30/60/120/300/600/1200V DC 1·5/3/6/12/30/60/150/300/600 1200 V. A.C. 15/30μA/3/6/30/60/150/300mA 6/12 AMP. DC. 2K/200K/2 Meg/20 Meg ohm −20 to +63dB. £14·95. P. & P. 20p

MODEL C-7080 EN



Giant 6" mirror scale. 20,000 o.p.v. 0 / ·25 / 1 / 2·5 / 10 / 50 / 250 / 1000 / 5000V. D.C. 0 / 2·5 / 10 / 50 / 250 / 1000 / 5000V. A.C. 0 / 50μA / 1 / 10 / 100 / 500mA / 10 amp. D.C. 0 / 2K / 200K / 20 meg − 20 to + 50 dB. £13·95. Post 35p.

370 WTR MULTI-METER



Features A.C. current ranges. 20,000 o.p.v. 0/·5/2·5/10/50/250/500 1000 V. D.C. 0/2·5/10/50/250/500/1000V AC 0/50μA/1/10/100mA/1/10 Amp D.C. 0/100mA/1/10 Amp AC 0/5K/50K/500K/5 meg/ 50 meg. −20 +62db. £17·50. P. & P. 25p.

KAMODEN 72.200 MULTITESTER

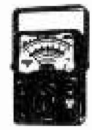
High sensitivity tester. 200,000 o.p.v. Overload protection. Mirror scale. Ranges: 0 / ·06 / ·3 / 3 / 30 / 120 / 600 / 1200V. D.C. 0 / 3 / 12 / 60 / 300 / 11,200V. A.C. 0 / 6μA / 1·2mA / 120mA / 600mA / 12A. D.C. 0 / 12A. A.C. −20 to +63dB. 0 / 2K / 200K / 2 meg / 200 meg ohms. £16·95. Post 30p.

ALL PRICES ARE SUBJECT TO 10% VAT

TMK LAB TESTER.

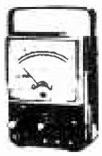
100,000 O.P.V. 6¼in. Scale Buzzer Short Circuit Check. Sensitivity: 100,000 O.P.V. D.C. 5K/Volt A.C. D.C. Volts: ·5, 2·5, 10, 50, 250, 1,000 V. A.C. Volts: 3, 10, 50, 250, 500, 1,000V. D.C. Current: 10, 100μA, 10, 100, 500mA, 2·5, 10 amp. Resistance: 1K, 10K, 100K, 10MEG, 100MEG Ω. Decibels: −10 to +49 db. Plastic Case with Carrying Handle. Size: 7½in. × 6¾in. × 3¼in. £19·95. P. & P. 25p.

Model S-100TR MULTIMETER/ TRANSISTOR TESTER



100,000 o.p.v. mirror scale/ overload protection. 0/·12/·6/3/12/30/120/600 V DC. 0/6/30/120/600. V AC. 0/12/600μA/ 12/300mA/12 AMP DC. 0/10 K/1 MEG/100MEG. −20 to +50db. 0·01–·2 MFD. Transistor tester measures Alpha, beta and Ico. Complete with batteries, instructions and leads. £14·95. P/P 25p.

KAMODEN HM.350 TRANSISTOR TESTER

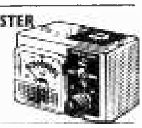


High quality instrument to test Reverse Leak current and DC current. Amplification factor of NPN, PNP, transistors, diodes, SCR's etc. 4" × 4¾" clear scale meter. Operates from internal batteries. Complete with instructions, leads and carrying handle. £12·50. Post 30p.

MODEL 449A IN CIRCUIT TRANSISTOR TESTER

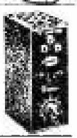
Checks true A.C. beta in / out. Checks Ico. Checks diodes in / out. Checks SCR, etc. Beta HI 10 - 500. LO 2 - 50. Icbo 0–5000μA. 220/240 V A.C. operation £17·50. Post 25p.

LB3 TRANSISTOR TESTER



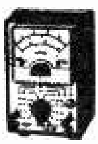
Tests ICO and B. PNP / NPN. Operates from 9v battery. Complete with all instructions, etc. £3·95. P. & P. 20p.

LB4 TRANSISTOR TESTER



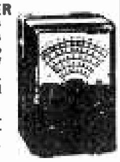
Tests PNP or NPN transistors. Audio indication. Operates on two 1·5v batteries. Complete with all instructions, etc. £4·50. P. & P. 20p.

TE–40 HIGH SENSITIVITY A.C. VOLTMETER



10 meg. input 10 ranges: ·001/·03/·1/·3/1/3/10/30/100/300V. R.M.S. 5cps.-1·2 Mc/s. Decibels −40 to +50dB. Supplied brand new complete with leads and instructions. Operation 230V. A.C. £17·50. Carr. 25p.

TE-65 VALVE VOLTMETER



28 ranges. D.C. volts 1·5–1,500v. A.C. volts 1·5–1,500v. Resistance up to 1,000 megohms. 200/240v. A.C. operation. Complete with probe and instructions. £17·50. P. & P. 30p. Additional probes available: R.F. £2·12; H.V. £2·50.

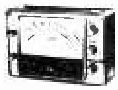
KAMODEN HM. 720B F.E.T. V.O.M.

Input impedance 10 meg ohms. Ranges: 0 / ·25 / 1 / 2·5 / 10 / 50 / 250 / 1000V. D.C. 0 / 2·5 / 10 / 50 / 250 1000V. A.C. 0 / 25μA / 2·5 / 25 / 250 mA D.C. − 20 to + 62dB 0 / 5K / 50K / 500K / 5meg 500meg ohms. £14·95. Post 30p

TMK MODEL 117 F.E.T. ELECTRONIC VOLTMETER

Battery operated, 11 meg input, 26 ranges. Large 4½" mirror scale. Size 5½" × 4½" × 2¼". DC VOLTS 0·3–1200V AC VOLTS 3–300V RMS. 8·0–800V P-P. DC CURRENT ·12–12mA. Resistance up to 2000M ohm. Decibels −20 to + 51dB. Complete with leads/instructions. £17·50. P. & P. 20p.

KAMODEN HMG-500 INSULATION RESISTANCE TESTER



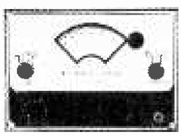
Range 0–1000 Megohms, 500 Volt. Battery operated. Wide range clear meter 4½" × 4". Complete with deluxe carrying case, batteries, instructions. £19·95. Post 30p

MODEL U4311 SUB-STANDARD MULTI-RANGE VOLT AMMETER

Sensitivity 330 ohms/Volt AC and DC. Accuracy 0·5% D.C. 1% AC. Scale length 165mm. 0/300/750μA/ 1·5 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 / 750mA / 1·5 / 3 / 7·5AMP DC 0 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 / 750mA / 1·5 / 3 / 7·5 AMP AC 0 / 75 / 150 / 300 / 750mV / 1·5 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 / 750V DC 0/750mV / 1·5 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 /750V AC. Automatic cut out. Supplied complete with test leads, manual and test certificates. £49·00. Post 50p.

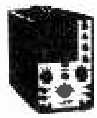
BELCO AF-5A SOLID STATE SINE SQUARE WAVE C.R. OSCILLATOR

Sine 18 × 200,000 Hz; Square 18 × 20,000 Hz



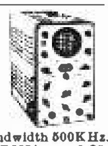
Output max. + 10 dB. (10 K ohms) Operation internal batteries Attractive 2-tone case 7½" × 5" × 2". Price £17·50. Carr. 17p.

TO-3 PORTABLE OSCILLOSCOPE



3in. tube. Y amp. Sensitivity 0·1v p-p/CM. Bandwidth 1·5 cps–1·5 MHz. Input imp. 2 meg Ω 25pF X amp. sensitivity 0·9v. p-p/CM. Bandwidth 1·5cps–800kHz. Input imp. 2 meg Ω 20pF. Time base. 5 ranges 10 cps 300 kHz. Synchronization. Internal/external. Illuminated scale 140 × 215 × 330 mm. Weight 15½lb. 220/240V. A.C. Supplied brand new with handbook. £52·50. Carr. 50p.

CI-5 PULSE OSCILLOSCOPE

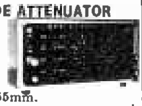


For display of pulsed and periodic waveforms in electronic circuits. VERT. AMP. Bandwidth 10MHz. Sensitivity at 100KHz VRMS/mm. ·1-25; HOR. AMP. Bandwidth 500KHz. Sensitivity at 100KHz, V RMS/mm. ·3-25; Preset triggered sweep 1-3,000μsec.; free running 20-200,000Hz in nine ranges. Calibrator pips. 220 × 360 × 430mm. 115-230V. AC operation. £39·00. Carr. paid.

RUSSIAN CI-16 DOUBLE BEAM OSCILLOSCOPE

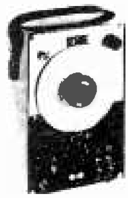
5 Mc/s Pass Band. Separate Y1 and Y2 amplifiers. Rectangular 5in. × 4in. C.R.T. Calibrated triggered sweep from ·2 μ/sec. to 100 milli-sec. per cm. Free running time base 50 c/s-1 mc/s. Built-in time base calibrator and amplitude calibrator. Supplied complete with all accessories and instruction manual £87. Carr. Paid.

MODEL AT201 DECADE ATTENUATOR



Frequency range 0–200KHz. Attenuator 0–111db. 0·1db step. Impedance 600 ohms. Max. input power 30dbm. Size 180 × 90 × 55mm. £12·50. Post 37p.

ARF-300 AF/RF SIGNAL GENERATOR

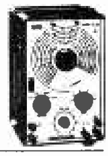


All transistorised, compact, fully portable. AF sine wave 18 Hz to 220 KHz. AF square wave 18 Hz to 100 KHz. Output sine / square 10v. P-P. RF 100 KHz to 200 MHz. Output 1v. maximum. Operation 220/240v. AC. Complete with instructions and leads. £29·95. Post 50p.

MODEL TE.15 GRID DIP METER

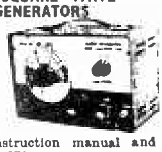
Transistorised. Operates as Grid Dip, Oscillator, Absorption Wave Meter and Oscillating Detector. Frequency range 440Kc/s–280Mc/s in 6 coils. 500μA Meter. 9V battery operation. Size 180 × 80 × 40mm. £15·00. Post 20p.

TE-20D RF SIGNAL GENERATOR



Accurate wide range signal generator covering 120 Kc/s 500 Mc/s on 6 bands. Directly calibrated Variable R.F. attenuator, audio output. Xtal socket for calibration. 220/240V. A.C. Brand new with instructions £17·50. Carr. 37p. Size 140 × 215 × 170 mm.

TE22 SINE SQUARE WAVE AUDIO GENERATORS



Sine: 20cps to 200 kc/s on 4 bands. Square: 20cps to 30 kc/s. Output impedance 5,000 ohms. 200/250V. A.C. operation. Supplied brand new and guaranteed with instruction manual and leads. £17·50. Carr. 37½p.

AUTO TRANSFORMERS

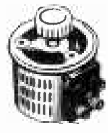
0/115/250V. Step up or step down. Fully shrouded.

80 W	£2·35	P. & P. 18p
150 W	£3·00	P. & P. 18p
300 W	£4·00	P. & P. 23p
500 W	£5·80	P. & P. 33p
1000 W	£8·25	P. & P. 38p
1500 W	£11·25	P. & P. 43p
2250 W	£19·00	P. & P. 50p
5000 W	£40·00	P. & P. £1

"YAMABISHI" VARIABLE VOLTAGE TRANSFORMERS

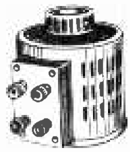
Excellent quality at low cost. All models—Input 230V. 50/60 c/s. Variable output 0–260V.

MODEL S-260 GENERAL PURPOSE BENCH MOUNTING



1 Amp ..	£7·00
2·5 Amp ..	£8·05
5 Amp ..	£11·75
8 Amp ..	£15·90
10 Amp ..	£22·50
12 Amp ..	£23·60
20 Amp ..	£49·00
25 Amp ..	£58·00
40 Amp ..	£82·50

MODEL S-260B

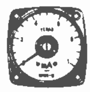


Panel Mounting.

1 Amp ..	£7·00
2·5 Amp ..	£8·05

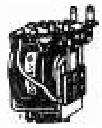
Carriage and Packing Extra

240° Wide Angle ImA Meters



MW 1-6 60mm square £3·97
MW 1-8 80mm square £4·97
P. & P. extra

230 VOLT A.C. 50 CYCLES RELAYS



3 sets of changeover contacts at 5 amp rating, 40p each. P. & P. 10p (100 lots £30. Quantities available.

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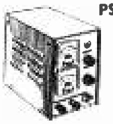
Post and packing 15p per kit

AF20	Mono transistor amplifier	£4 80
AF30	Mono transistor pre-amplifier	£2 61
AF310	Mono amplifier fuse two for stereo	£5 91
AT5	Automatic light control	£2.58
AT30	Photo cell switching unit	£5 70
AT50	400W Triac light dimmer/speed control	£4.80
AT55	1,300W Triac light dimmer/speed control	£5.70
AT56	2,200W Triac light dimmer/speed control	£6 90
AT60	Psychedelic light control, single channel	£7 80
AT65	Psychedelic light control, 3 channel	£14 55
HF61	Medium wave transistor radio	£3 33
HF75	FM transistor receiver	£2 88
HF310	FM tuner unit	£15 81
HF325	De-luxe FM tuner unit	£24 12
HF330	Stereo decoder for HF310/HF325	£9 96
HF395	Aerial amplifier for AM/FM bands I, II, III	£1 77
GP310	Stereo pre-amp for use with 2x AF310	£21 27
GU330	Tremolo unit for guitars etc	£7 50
NT10	Power supply 100 m/a 9V stab 12V unstab	£6 15
NT300	Professional stabilized power supply 2x 30 Volt, 2 2 Amp	£12.51
NT305	Transistor converter 12/15V AC/DC to 6V, 7 5V or 9V DC	£4 50
NT310	Power supply 240V AC to 2x 18V DC at 2 Amps	£4.80
NT315	Power supply 240V AC to 4 5- 15V DC 500 m/a	£9 57

PS.200 REGULATED P.S.U.



Solid state. Variable output 5-20 volt D.C. up to 2 amp. Independent meters to monitor voltage and current. Output 220/240 V. A.C. Size 7¼" × 5¾" × 3¼". £19·95. P. & P. 25p.

PS.1000B REGULATED POWER SUPPLY

Solid state. Output 6, 9 or 12 volt DC up to 3 amps. Meter to monitor current. Input 220/240v AC. Size 4" × 3½" × 6½". £11·97. P. & P. 25p.

MCA. 220 AUTOMATIC VOLTAGE STABILISER

Input 88 125 VAC or 176, 250VAC. Output 120VAC or 240VAC. 200VA rating. £11·97. Carr. 50p.

POWER RHEOSTATS

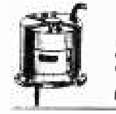
High quality ceramic construction. Windings embedded in vitreous enamel. Heavy duty brush wiper. Continuous rating. Wide range available ex-stock. Single hole fixing. ¼in. dia. shafts. Bulk quantities available.

25 WATT. 10/25/50/100/250/500/1000 ohms. 95p. P. & P. 10p.

50 WATT. 10/25/50/100/250/500/1000/2500 or 5000 ohms. £1·35. P. & P. 10p.

100 WATT. 1/5/10/25/50/100/250/500/1000 or 2500 ohms. £1·95. P. & P. 15p.

230V/240V SMITHS SYNCHRONOUS GEARED MOTORS



Built in gearbox. All brand new and boxed. 30 RPH CW; 2 RPH CW; 20 RPH CW; 2 RPH ACW; 30 RRH CW;

50p each Post 12p.

REFLEX HORN SPEAKER RUH.6

Built in driver unit. Impedance 16 ohm. Power rating 10 watt. Response 380-7000Hz. Approx. size 6" × 6". Weatherproof and shock proof.

OUR PRICE £4·97 P. & P. 30p.

BVD.5 VERNIER TUNING DIAL

Approx. 7-1 ratio planetary drive vernier dials. Log scale 0-180 degrees. Blank scales 1 to 5. Scale width 4¼". Dial size 5" × 3". Overall size 7¼" × 4½" × 1¼" deep including knob and coupling. ¼" dia. shaft.

OUR PRICE £1·62 P. & P. 15p.

SEW CLEAR PLASTIC PANEL METERS

USED EXTENSIVELY BY INDUSTRY, GOVT. DEPTS., EDUCATIONAL AUTHORITIES, ETC.

Over 200 ranges in stock—other ranges to order. Quantity discounts available. Send for fully illustrated brochure.

Type SW.100 100 x 80 mm.

50µA	£4·15	5 amp. D.C.	£3·60
50–0–50µA	£3·95	300V. A.C.	£3·70
100µA	£3·95	VU Meter	£4·30
100–0–100µA	£3·90		
500µA	£3·70		
1mA	£3·60		
20V. D.C.	£3·60		
50V. D.C.	£3·60		
300V. D.C.	£3·60		
1 amp. D.C.	£3·60		

Type SD.830 82.5mm x 110mm Fronts

50µA	£3·40	10mA	£3·10
50–0–50µA	£3·40	50mA	£3·10
100µA	£3·35	100mA	£3·10
100–0–100µA	£3·35	500mA	£3·10
200µA	£3·30	1 amp.	£3·10
500µA	£3·15	5 amp.	£3·10
1mA	£3·10	10 amp.	£3·10
5mA	£3·10	5V. D.C.	£3·10
		10V. D.C.	£3·10
		20V. D.C.	£3·10
		50V. D.C.	£3·10
		300V. D.C.	£3·10
		15V. A.C.	£3·30
		300V. A.C.	£3·30
		VU Meter	£3·50

Type SD.640 63.5mm x 85mm Fronts

50uA	£3·05	500mA	£2·90
50–0–50µA	£3·05	1 amp.	£2·90
100µA	£3·00	5 amp.	£2·90
100–0–100µA	£3·00	10 amp	£2·90
200µA	£3·00	5V. D.C.	£2·90
500µA	£2·95	20V. D.C.	£2·90
1mA	£2·90	50V. D.C.	£2·90
5mA	£2·90	300V. D.C.	£2·90
10mA	£2·90	15V. A.C.	£3·00
50mA	£2·90	300V. A.C.	£3·00
100mA	£2·90	VU Meter	£3·15

Type SD.460 46mm x 59.5mm Fronts

50µA	£2·80	1 amp.	£2·60
50–0–50µA	£2·80	5 amp.	£2·60
100µA	£2·75	10 amp.	£2·60
100–0–100µA	£2·75	5V. D.C.	£2·60
200µA	£2·70	10V. D.C.	£2·60
500µA	£2·55	20V. D.C.	£2·60
1mA	£2·60	50V. D.C.	£2·60
5mA	£2·60	300V. D.C.	£2·60
10mA	£2·60	15V. A.C.	£2·70
50mA	£2·60	300V. A.C.	£2·70
100mA	£2·60	VU Meter	£2·90
500mA	£2·60		

Type MR.85P. 4¼in. x 4¼in. fronts

50µA	£4·40	50mA	£3·90
50–0–50µA	£4·25	100mA	£3·90
100µA	£4·25	500mA	£3·90
100–0–100µA	£4·05	1 amp.	£3·90
200µA	£4·05	5 amp.	£3·90
500µA	£3·90	15 amp.	£3·90
500–0–500µA	£3·90	30 amp	£3.95
1mA	£3·90	20V. D.C.	£3·90
1–0–1mA	£3·90	50V. D.C.	£3·90
5mA	£3·90	150V. D.C.	£3·90
10mA	£3·90	300V. D.C.	£3·90
		15V. A.C.	£3·95
		300V. A.C.	£3·95
		S Meter 1mA	£3·90
		VU Meter	£4·55
		1 amp. A.C.*	£3·90
		5 amp A.C.*	£3·90
		10 amp. A.C.*	£3·90
		20 amp. A.C.*	£3·90
		30 amp. A.C.*	£3·90

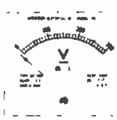
Type MR.52P. 2¼in. square fronts

50µA	£3·50	10V. D.C.	£2·50
50–0–50µA	£3·05	20V. D.C.	£2·50
100µA	£3·00	50V. D.C.	£2·50
100–0–100µA	£2·95	300V. D.C.	£2·50
500µA	£2·65	15V. A.C.	£2·60
1mA	£2·50	300V. A.C.	£2·60
5mA	£2·50	S Meter 1mA	£2·60
10mA	£2·50	VU Meter	£3·60
50mA	£2·50	1 amp. A.C. *	£2·50
100mA	£2·50	5 amp. A.C. *	£2·50
500mA	£2·50	10 amp. A.C. *	£2·50
1 amp	£2·50	20 amp. A.C. *	£2·50
5 amp	£2·50	30 amp. A.C. *	£2·50

Type MR.65P. 3¼in. x 3¼in. fronts

50µA	£3·70	10V. D.C.	£2·60
50–0–50µA	£3·15	20V. D.C.	£2·60
100µA	£3·15	50V. D.C.	£2·60
100–0–100µA	£3·10	150V. D.C.	£2·60
200µA	£3·05	300V. D.C.	£2·60
500µA	£2·75	15V. A.C.	£2·80
500–0–500µA	£2·60	50V. A.C.	£2·80
1mA	£2·60	150V. A.C.	£2·80
5mA	£2·60	300V. A.C.	£2·80
10mA	£2·60	500V. A.C.	£2·80
50mA	£2·60	S Meter 1mA	£2·85
100mA	£2·60	VU Meter	£3·70
500mA	£2·60	50mA A.C. *	£2·60
1 amp.	£2·60	100mA A.C. *	£2·60
5 amp.	£2·60	200mA A.C. *	£2·60
10 amp.	£2·60	500mA A.C. *	£2·60
15 amp.	£2·60	1 amp. A.C. *	£2·60
20 amp.	£2·60	5 amp. A.C. *	£2·60
30 amp.	£2·80	10 amp. A.C. *	£2·60
50 amp.	£2·90	20 amp. A.C. *	£2·60
5V. D.C.	£2·60	30 amp. A.C. *	£2·60

Type MR.38P. 1 21/32in. square fronts



50µA	£2·55	200mA	£2·25
50–0–50µA	£2·50	300mA	£2·25
100µA	£2·45	500mA	£2·25
100–0–100µA	£2·40	750mA	£2·25
200µA	£2·25	1 amp.	£2·25
500µA	£2·25	2 amp.	£2·25
500–0–500µA	£2·25	5 amp.	£2·95
1mA	£2·25	10 amp.	£2·25
1–0–1mA	£2·25	3V. D.C.	£2·25
2mA	£2·25	10V. D.C.	£2·25
5mA	£2·25	15V. D.C.	£2·25
10mA	£2·25	20V. D.C.	£2·25
20mA	£2·25	50V. D.C.	£2·25
50mA	£2·25	100V. D.C.	£2·25
100mA	£2·25	150V. D.C.	£2·25
150mA	£2·25	300V. D.C.	£2·25
		500V. D.C.	£2·25
		750V. D.C.	£2·25
		15V. A.C.	£2·30
		50V. A.C.	£2·30
		150V. A.C.	£2·30
		300V. A.C.	£2·30
		500V. A.C.	£2·30
		S Meter 1mA	£2·30
		VU Meter	£2·65

Type MR.45P. 2in. square fronts

50µA	£2·70	5 amp.	£2·40
50–0–50µA	£2·65	10V. D.C.	£2·40
100µA	£2·60	20V. D.C.	£2·40
100–0–100µA	£2·50	50V. D.C.	£2·40
200µA	£2·50	300V. D.C.	£2·40
500µA	£2·45	15V. A.C.	£2·40
500–0–500µA	£2·40	300V. A.C.	£2·40
1mA	£2·40	S Meter 1mA	£2·50
5mA	£2·40	VU Meter	£2·70
10mA	£2·40	1 amp. A.C. *	£2·40
50mA	£2·40	5 amp. A.C. *	£2·40
100mA	£2·40	10 amp. A.C. *	£2·40
500mA	£2·40	20 amp. A.C. *	£2·40
1 amp.	£2·40	30 amp. A.C. *	£2·40

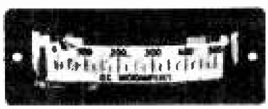
"SEW" BAKELITE PANEL METERS

Type MR.65. 3½in. square fronts

25µA	£4·60	1 amp.	£2·60
50µA	£3·55	5 amp.	£2·60
50–0–50µA	£3·05	15 amp.	£2·60
100µA	£3·00	30 amp.	£2·50
100–0–100µA	£3·00	50 amp.	£2·50
500µA	£2·70	5V. D.C.	£2·50
500–0–500µA	£2·60	10V. D.C.	£2·50
1mA	£2·60	20V. D.C.	£2·50
1–0–1mA	£2·80	50V. D.C.	£2·50
5mA	£2 60	150V. D.C.	£2·50
10mA	£2·60	300V. D.C.	£2·50
50mA	£2·60	50mV. D.C.	£2·90
100mA	£2·60	100mV. D.C.	£2·90
500mA	£2·60	30V. A.C. *	£2·55
		50V. A.C. *	£2·55
		150V. A.C. *	£2·55
		300V. A.C. *	£2·55
		500mA A.C. *	£2·50
		1 amp. A.C. *	£2·50
		5 amp. A.C. *	£2·50
		10 amp. A.C. *	£2·50
		20 amp. A.C. *	£2·50
		30 amp. A.C. *	£2·50
		50 amp. A.C. *	£2·60
		VU Meter	£3·65

Type S-80 80 mm. square fronts

50µA	£3·50	5 amp. D.C.	£3·00
50–0–50µA	£3·40	300V. A.C.	£3·00
100µA	£3·40	VU Meter	£3·70
100–0–100µA	£3·30		
500µA	£3·05		
1mA	£3·00		
20V. D.C.	£3·00		
50V. D.C.	£3·00		
300V. D.C.	£3·00		
1 amp. D.C.	£3·00		



"SEW" EDGWISE METERS

Type PE.70. 3 17/32in. x 1 15/32in. x 2¼in. deep

50µA	£3·75	500µA	£3·20
50–0–50µA	£3·60	1mA	£3·20
100µA	£3·60	300V. A.C.	£3·25
100–0–100µA	£3·50	VU Meter	£3·85
200µA	£3·40		

"SEW" EDUCATIONAL METERS

Type ED.107. Size overall 100mm x 90mm x 108mm

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

50µA	£6·90	20V. d.c.	£5·95
100µA	£6·40	50V. d.c.	£5·95
50–0–50µA	£6·40	300V. d.c.	£5·95
1mA	£5·95	Dual range	
1–0–1mA	£5·95	500mA/5A d.c.	£7·00
1A d.c.	£5·95	5V/50V d.c.	£7·00
5A d.c.	£5·95		
10V d.c.	£5·95		

***MOVING IRON— ALL OTHERS MOVING COIL**

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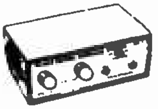
1021 STEREO LISTENING STATION



For balancing and gain selection of loudspeakers with additional facility for stereo headphone switching. 2 gain controls, speaker on-off slide switch, stereo headphone sockets. 6" × 4" × 2½".

Our Price £2·25 P. & P. 15p

AUDIOTRONIC AHA-101 STEREO HEADPHONE AMPLIFIER

All silicon transistor amplifier operates from magnetic, ceramic or tuner inputs with twin stereo headphone outputs and separate volume controls for each channel. Operates from 9v battery.

INPUTS: 5mV/100mV.

OUTPUT: 50mV per channel.

Our Price £7·50 P. & P. 15p

EA.41 REVERBERATION AMPLIFIER

Self contained, transistorised, battery operated. Simply plug in microphone, guitar, etc., and output into your amplifier. Volume control, depth of reverberation control. Beautiful walnut cabinet. 7¼ × 3 × 4½in.

Our Price £7·50 P. & P. 15p

MP7 MIXER PREAMPLIFIER

5 microphone inputs each with individual gain controls enabling complete mixing facilities. Battery operated. 9½" × 5" × 3". Inputs Mics: 3×3mV 50K; 2× 3mV 600 ohm. Phono meg. 4mV 50K. Phono ceramic 100mV 1 meg. Output 250mV 100K.

Our Price £8·97 P. & P. 20p

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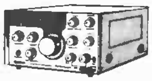
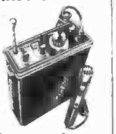
TRIO JR599 RECEIVER



9 wavebands covering 1·8–29·7MHz 144–146MHz and 10·00MHz WWV. SSB, CW, AM and FM. AF output more than 1 watt. S Meter. Squelch control. BFO. Variable RF and AF controls. 4–16 ohm output and phone jack. Power requirements 100/240v. AC. 12–14v. DC.

Our Price £155·00 Carr. Paid

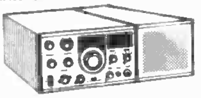
TRIO TR2000 TRANSCEIVER



Fully transistorised portable VHF Transceiver. Will transmit and receive on 6 channels between 144-146MHz. 1 watt transmitter. 12v DC internal or external supply. Built in charger for ni-cad cells. Power/volume switch, squelch control, channel selector, mike socket, earphone/external speaker socket. Complete with microphone, 144·48, 144·72 and 145·32 crystals. Size 134 × 58 × 180mm.

Our Price £79·50 Carr. Paid

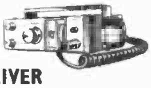
TRIO TS515/PS515 TRANSCEIVER



High quality TS515 SSB/CW amateur band receiver covering 80, 40, 20, 15 and 10 metre bands with PS515 power supply and speaker unit. Transmit/receive frequency 3·5–29·7MHz. Output 1·5 watts. Power requirements 110-120/220-240v. AC.

Our Price £210·00 Carr. Paid

BELTEK W5400 CAR TRANSCEIVER



Solid state mobile transceiver for 12v DC neg. use. Transmits and Receives on any 12 of 28 channels between 144 and 146MHz. Power output 10w and 1w switchable. Internal 3" speaker. Complete with dynamic mike, PTT switch, three sets of crystals for 144·48MHz, 144·60MHz, 145·00MHz, mounting bracket and instructions. Size approx. 150 × 60 × 220mm.

Our Price £75·00 P & P 50p

TRIO JR310 SSB RECEIVER

Covers 3·5 7, 14, 21, 28, 28·5 and 29·1 MHz bands and WWV 15MHz. SSB, AM and CW. AF output more than 1 watt. Crystal controlled BFO for SSB. S meter. ANL etc. AC 110/120–220/240v.

Our Price £75·00 Carr. Paid

GWS

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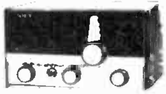
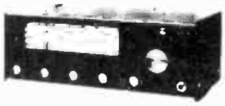
UNR 30 RECEIVER



4 Bands covering 550 Kc/s-30 Mc/s B.F.O. Built-in Speaker 220/240 v. A.C. Brand new with instructions.

Our Price £15·75 Carr. 37p

UR-1A RECEIVER



4 Bands covering 550Kc/s-30 Mc/s. FET, S Meter. Variable BFO for SSB. Built-in Speaker, Bandspread, Sensitivity Control. 220/240 v. A.C. or 12 v. D.C. Brand new with instructions.

Our Price £25·00 Carr. 37p

LAFAYETTE HA-600 RECEIVER

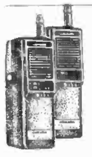
General coverage 150-400 Kc/s. 550 Kc/s-30 Mc/s. FET front end, 2 mech. filters, product detector, variable B.F.O., noise limiter, S Meter Bandspread. RF Gain. 220/240 v. A.C. or 12 v. D.C. Brand new with instructions.

Our Price £50·00 Carr. 50p

TRIO 9R59DS RECEIVER

4 bands covering 550 Kc/s to 30 Mc/s continuous and electrical bandspread on 10, 15, 20, 40 and 80 metres. 8 valve plus 7 diode circuit. 4/8 ohm output and phone jack. SSB-CW, ANL, Variable BFO. S meter. Sep. bandspread dial. IF frequency 455 kc/s, audio output 1·5w. Variable RF and AF gain controls 115/250 v. A.C. with instruction manual.

Our Price £49·50 Carr. Paid



HAND-HELD 2-WAY WALKIE-TALKIES

P. & P. 50p.

SKYFON—100MW. £24·95 pair, P302—2 CHANNEL 300MW. £52·50 pair. P1003—3 CHANNEL 1 Watt £71·25 pair. LICENSE REQUIRED FOR OPERATION IN U.K.

3-STATION INTERCOM KE.630

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

Our Price £5·25 P & P 50p

AUDIOTRONIC RANGE OF HIGH QUALITY EQUIPMENT

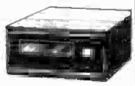
Audiotronic Products are manufactured exclusively for the Audiotronic Group of Companies and as a member of the group we are pleased to offer you this fabulous range of high quality equipment. Made to our own specifications each item provides outstanding performance and reliability at a value for money price!

ACD.660 Stereo Cassette Deck

A beautifully styled 4 track stereo deck with an outstanding specification offered at a remarkably low price. Incorporates a host of features including switchable noise filter normal/chrome tape selector, twin VU meter, slider record/playback level controls, front panel headphone socket, recording indicator lamp, phono/Din line input sockets, 3.5mm mike input sockets etc. etc. Frequency response 100–8KHz (100–12KHz Cr02) S/N–45dB. Crosstalk 45dB. Separation–35dB. Noise limiter–6dB at 10KHz. Complete with phono connecting leads.

OUR PRICE £39·50 Carr. & Ins.50p

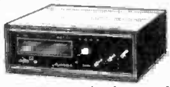
AHP-8D 8 Track Stereo Tape Deck



Can be used with most hi fi amplifiers. Push button track selector and illuminated track indicators. Attractive cabinet with black and silver trim. Output level 750mV. AC 220/240v.

OUR PRICE £11·95 P. & P. 50p.

AHP-8A 8 Track Stereo Tape Player



Incorporates built in amplifiers giving 2½ + 2½ watts rms output. Push button track selector, illuminated track indicators, slider controls for volume, balance and tone. Attractive cabinet with black and silver trim. Output impedance 8 ohms. AC 220/240v.

OUR PRICE £17·25 P. & P. 50p.

Stereo Headphones

LSH.20 Individual volume controls Stereo mono switch. 8 ohms. 40–19,000 Hz. £3·50 P & P 30p

LSH.30 Open back type. Individual tone and volume controls. 8 ohms. 30–20,000 Hz. £5·50 P & P 30p

LSH.40 Two way speaker system. Individual volume controls. 8 ohms. 20–20,000 Hz. £6·95 P & P 30p

LSH.60 3" speaker units. 8 ohms. 20–20,000 Hz. Complete with zipped carrying case. £8·50 P. & P. 30p

LQH.400 4-channel dynamic headphones. Each earpiece has 4 drive units. 4-32 ohms. 20-20,000 Hz. £9·95 P. & P. 30p

LSH.50 Electrostatic with self powered energiser and control unit with headphone/speaker selector. 4-32 ohms. 20-24 000 Hz. £15·95 P. & P. 30p

AUDIOTRONIC DOLBY 'B' NOISE REDUCTION UNITS

Reduce tape hiss by 3dB at 600Hz, 6dB at 1200Hz and 10dB for all frequencies above 3000Hz. Size 16½" × 8" × 3¼". AC 200/250v

PROCESS FOUR

For use with semi-professional tape recorders. Freq. res. 30Hz–20KHz ± 2dB. S/N better than 70dB. Full source tape monitoring. Record/Replay metering. Switchable multiplex filter. Supplied with test tape.

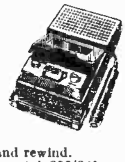
Our Price £50·00 P & P 50p

PROCESS TWO

For use with cassette and tape recorders. Freq. res. 30Hz–20KHz ± 2dB. Off tape monitoring. Switchable multiplex filter. Two Dolby calibration meters. S/N better than 70dB. Supplied with test cassette or tape as required.

Our Price £34·50 P & P 50p

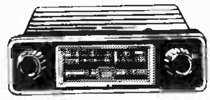
ACR.14 Battery Mains Cassette Recorder



Portable twin track mono recorder with automatic recording level control. Built in speaker. Earpiece socket. Input for radio or record player. Fast forward and rewind. Output 500mW. AC 220/240v or 6v DC operation. Complete with remote control microphone, mains lead, earpiece and batteries.

OUR PRICE £10·50 P. & P. 50p.

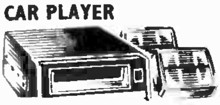
ACR 3500 CAR RADIO



Manual tuning of Medium and Long waves. 12v pos. or neg. earth. Complete with speaker, mounting brackets and instructions.

Our Price £6·50 P & P 50p

ACP.8 8 TRACK CAR PLAYER



12v neg. earth. Slider controls for Volume, Tone and Balance. Channel selector button with red pilot lamp, with speakers, mounting brackets and instructions.

Our Price £12·50 P & P 40p

LOW NOISE CASSETTES

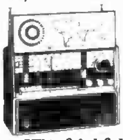
Top Hi-Fi quality in library cases

TYPE	5	10	25
C60	£1·29	£2·53	£5·99
C90	£1·85	£3·62	£8·59
C120	£2·29	£4·48	£10·68

P. & P. 15p.

Cassette Tape Head Cleaner 30p

AMR-900 GLOBAL AM/FM PORTABLE RADIO



10 wavebands covering AM: 535–1605 kHz, LW: 150–380 kHz, MB 1·6–4·00 MHz, SW1: 4·0–8 MHz, SW2: 8·0–1·6 MHz, SW3: 16–24 MHz, PSB1: 30–50 MHz, PSB2: 148–174 MHz, FM 88–108 MHz, AIR: 108–136 MHz. Features time zone map and timing dial. Large clear scale. Telescopic aerial and built in aerial. AFC or FM. 6" × 4" speaker and personal earpiece. Battery/mains operation. Size: 345 × 133 × 305mm.

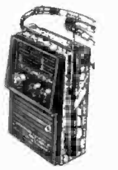
OUR PRICE £36·00 P. & P. 50p.

AR.1000 SPORTSMAN AM/FM PORTABLE RADIO

5 wavebands covering AM 535 1605KHz. FM 88–108MHz. AIR 108–135MHz. PB 147–174MHz. WB 162. 5MHz. Large horizontal slide dial with logging scale. Slider volume and squelch controls. 7 section telescopic aerial for FM and built in ferrite bar for AM. AFC. 3in. speaker. Earpiece socket. Size 152 × 79 × 219mm. Battery/mains operation.

OUR PRICE £11·50 P. & .P 35p.

AUDIOTRONIC AMB.500 MULTIBAND RADIO



5 wavebands covering MW 535–1605KHz and FM 88–175MHz. All transistor. Battery or mains operation. Built in aerial and 8 section telescopic aerial. Complete with batteries, shoulder strap and earpiece.

OUR PRICE £6·95 P & P 35p

AM/FM Portable Radio AR3000

4 wavebands covering FM 87 - 108 MHz, MW510 - 1605 KHz, - LW 145 - 285 KHz, SW 5·8 - 12·5 MHz. Push button wave change plus AFC and on/off. Thumbwheel tuning. Slider volume and tone controls. Earphone socket. Built in and telescopic aerials. Car aerial socket. Battery/Mains operation.

OUR PRICE £14·95 P. & P. 50p

DIGITAL CLOCK RADIO ADC.1

Covers AM 540 - 1600 KHz. FM 88 - 108 MHz with AFC Illuminated dial. 24 hour alarm setting. Wake up to the sound of music or loud buzzer. Sleep switch will automatically turn off radio etc. Internal speaker plus socket for earpiece or pillow speaker. AC 240v. Size 254 × 92 × 178mm. Complete with earpiece, FM aerial and operating instructions.

OUR PRICE £12·50 P. & P. 50p.

SAVE UP TO 33⅓% OR MORE! GWS

SH628 STEREO HEADPHONES

Outstanding value. Soft ear-pads, adjustable headband. 8-16 ohms. 20-20,000 Hz. Complete with lead and stereo plug.

Our Price £1·87 P. & P. 30p

LHO2S STEREO HEADPHONES

Lightweight headphones with padded earpieces. 4-16 ohms. 20-20,000 Hz. Complete with 6 ft. cord and plug.

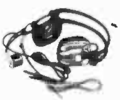
Our Price £1·97 P. & P. 30p

TE1018 DE-LUXE MONO HIGH IMPEDANCE HEADSET

Sensitive magnetic headset with soft earpads. Impedance 2,600 ohms (d.c. 600 ohms). Frequency response 200–4,000 Hz.

Our Price £2·25 P. & P 30p

BH.001 HEAD SET AND BOOM MICROPHONE



Moving Coil. Ideal for language teaching, communications. Headphone imp. 16 ohms. Microphone imp. 200 ohms.

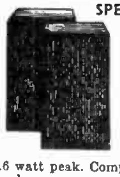
Our Price £4·95 P. & P. 30p

DH02S STEREO HEADPHONES

Wonderful value and excellent performance combined. Adjustable headband. 8 ohm impedance. 20-12,000 cps. Complete with lead and plug.

Our Price £2·25 P & P 30p

SPECIAL OFFER ! STEREO SPEAKERS

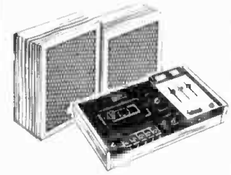


Matched pair of stereo bookshelf speakers. Deluxe teak veneered finish. Size 14½″ × 9″ × 7½″. 8 ohms. 8 watt RMS. 16 watt peak. Complete with DIN lead.

Our Price £12·95 Carr. 50p

SUPER AKAI HIFI BARGAINS

CS35 Stereo Cassette Recorder



For conventional or Chromium Dioxide tape. 4 track record/playback. Volume and tone controls. Frequency response 40 - 16kHz (using CrO2 tape), distortion better than 2%, wow and flutter better than 0·2% RMS. Complete with pair of matching Akai CSS8 speakers.

Rec. Price £96·10 **OUR PRICE £56·50** P.&P. 50p

CS35D STEREO DECK

4 track record/playback deck. Accepts chrome/regular tape cassettes.

Rec. Price £68·30 **GWS PRICE £44·45** P.&P. 50p

MICROPHONES (P. & P. 50p)

ADM Dynamic (pair) £7·50

FERGUSON EXPORT MODELS

FERGUSON 3408 STEREO TUNER AMPLIFIER

Covers FM 88-108 MHz. Five push button tuning scales. 8+8 watts rms. Inputs for stereo ceramic cartridge and tape etc. Separate bass treble, balance and volume controls.

Our Price £31·50 P. & P. 50p

3416 STEREO TAPE DECK

4 track. 7½, 3¾, 1⅞ i.p.s. Stereo/mono record/play. 7″ reels. Inputs for dynamic mikes, radio, gram. Complete with cover.

Our Price £41·95 P. & P. 75p

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Model 350. 13″ × 8″ with single tweeter/crossover. 20–20,000 Hz. 15 watt RMS. Available 8 or 15 ohms. £7·25 each. P. & P. 37p.

Model 450. 13″ × 8″ with twin tweeter/crossover. 55–13,000 Hz. 8 watt RMS. Available 8 or 15 ohms. £3·62 each. P. & P. 25p.

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AP76/M44–7	£27·20
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AP76 Module M75–6	£29·10
86SB Module/M75-68M	£32·30
AP96 Module M75–6	£38·20
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210/SC7M	£7·40
MP60/G800	£15·00
MP60/TPD1/G800	£15·80
MP60/M44–7	£16·60
HT70/TPD1/G800	£19·20
GOLDRING	
GL72/G800	£34·20
GL75/G800	£39·10
GL75/G800E	£41·55

RECORD DECKS

Carriage and Packing 50p

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610/TPD1	£15·45
710	£21·15
810	£26·30
MP60	£8·25
MP60/G800	£10·90
MP60/TPD1	£13·20
MP60/TPD2	£11·25
HT70	£11·60
HT70/G800	£14·25
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GL72/P	£33·75
GL75	£32·20
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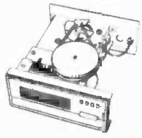
GL78/G800E	£44·95
GL85P/C	£72·00

BSR 8 TRACK PLAYER CHASSIS



Famous BSR 8 track chassis as used in Model TD8S complete with silver and black excutcheon ready to fit into cabinet. Output 125mV. AC 240v. Overall size approx. 185 × 215 × 80mm.

OUR PRICE £8·95 P. & P. 50p.

PORTABLE CASSETTE RECORDER CT5050

Instant recording and playing. Piano key controls. Automatic level control. Built in speaker. Complete with remote control microphone, carrying case and shoulder strap.

OUR PRICE £8·50 P. & P. 50p.

NEW! SINCLAIR CAMBRIDGE CALCULATOR

To build yourself. Complete kit of parts with step by step instructions to build a full specification pocket sized calculator.

OUR PRICE £24·95 P. & P. 50p.

(Also available ready built (Rec. Price £29·95)

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MINUTEMAN MM3 POCKET CALCULATOR

Size only 4⅛″ × 3″ × 1″. 8 digit display with overflow and error indicators. Floating decimal. Adds, subtracts, multiplies and divides. Chain and mixed calculations. Constant factor for series multiplication or division. Complete with batteries, instructions and case.

OUR PRICE £23·95 P. & P. 25p

MINUTEMAN MM3M

as above with addition of memory key, per cent key and a fixed or floating decimal. Complete with rechargeable batteries, AC adaptor, instructions and case.

OUR PRICE £38·50 P. & P. 25p

BINATONE DS100 DIGITAL CLOCK

240v. mains operation. Ivory case with large clear numbers for hours, minutes and seconds. Approx. size 6½″ × 3″ × 3½″.

OUR PRICE £4·50 P. & P. 30p.

SINCLAIR PROJECT 60 PACKAGE DEALS

2 × Z30 Stereo 60/P/Z5 £15·55. P. & P. 37p.

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Transformer for PZ8 £3·65.

Active Filter Unit £4·45.

Pair of Q16 Speakers £10·70

Sinclair Project 605 £20·97. P. & P. 37p.

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2000 Amplifier £22·95

3000 Amplifier £28·95

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QS30 Speakers £29·98 pair

P. & P. 50p each of above items

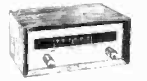
FM TUNER CHASSIS

6 TRANSISTOR HIGH QUALITY TUNER. SIZE ONLY 6 × 4 × 2½in. 3 I.F. stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9V battery. Coverage 88–108Mc/s. Ready built ready for use. Fantastic value for money.

Our Price £5·95 P. & P. 20p

Stereo multiplex adaptors £4·97.

A1018 FM TUNER

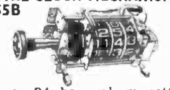


Specification as above chassis but complete in cabinet with on/off switch. Size 7½″ × 3¾″ × 5″.

Our Price £9·65 P & P 30p

Stereo multiplex adaptor £4·97.

DIGITAL CLOCK MECHANISM DT.55B



Features 24 hour alarm setting with built-in buzzer. On/off and auto alarm 'sleep' switch. Illuminated rotary dial with hours, minutes and seconds. Automatically turns off TV, radio, light, etc. and with autosetting will switch on again when required. AC 240v. operation. Switch rating 250v. 3A.

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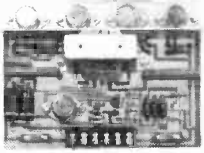
TUAC

NEW TUAC POWER MODULES. Now in their second successful year offering more power and quality than ever before.



TP100
Illustrated
£15·25

★ 125 Watts RMS continuous sine wave output
★ 4 RCA 150 Watt 15 Amp output transistors
★ Special layer wound driver transformer
★ Short, open, and thermal overload protection
★ Compact size: 7 x 6½ x 3 in.

TL100
Illustrated
£11·50

★100 Watts RMS sine wave
★2 RCA 15 Amp output transistors
★Rugged transformer driver
★Full thermal overload protection
★Compact size: 5 x 5 x 3 in.

TL60
£9·75

★ 60 Watts RMS sine wave
★RCA 115 Watt output transistors
★Only six connections to make
★Same size as TL100

Specification on all three power modules :
All output power ratings ±1dB. Output impedance 8–15 Ohms. THD at full power 1% typically 0·5%.
Input sensitivity 60mV into 10kΩ. Frequency response 10Hz–25kHz ±2dB. Hum and noise better than −75dB.

Power supplies vacuum impregnated Transformers with supply board incorporating stabilised pre-amp supply :

PS 125	±50 volts for one TP100	£8·75
PS 100	±45 volts for one TL100	£8·00
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PSU 2	For supplying Disco Mixer	£3·50

PRE AMPLIFIERS

All Tuac audio modules are constructed on glass fibre P.C. board, are ready assembled and fully tested. Low noise silicon and FET transistors together with H.S. carbon film resistors are used throughout. Extensive research has gone into the various wide range tone control circuits, producing superb sound quality from any signal. Previous range still available. 40V d.c.; 60mV o/p.

VA08 Vol, Treb, Mid and Bass Controls. HI IMP. FET I/P. Suitable Mic, Guitar, Radio, Crystal/Ceramic P.U. Sensitivity 4mV. Treb +35dB at 16kHz, Mid +20–15dB at 1kHz, Bass +20–10bB at 40Hz. **£4·22**

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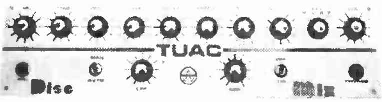

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Controls: Mic Vol, Tone, Over-ride depth, Auto Manual Sw. Tape Vol, L & R Deck Faders, Deck Volume. Treb. & Bass. H. Phon Vol, Selector. Master Vol, on/off sw. Max. output 1V RMS. Specification as VA06. **PANEL SIZE 18" x 4½" DEPTH 3"**

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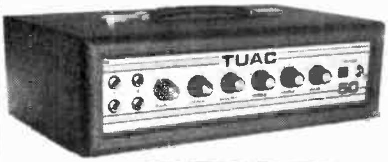

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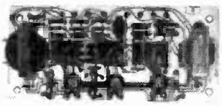

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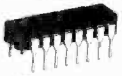

	1	25		1	25		1	25		1	25
SN7400	0·17	0·16	SN7426	0·50	0·46	SN7454	0·17	0·16	SN7494	0·85	0·82
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SN7406	0·39	0·34	SN7437	0·71	0·68	SN7475	0·50	0·48	SN74107	0·44	0·42
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* Devices may be mixed to qualify for price breaks.

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301A	8 Pin DIL	0·66	709C	TO99	0·34	741C	TO99	0·38			
307	DIL	0·69	710C	DIL	0·44	747C	DIL	0·80			

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4 VOLT

47μF	6½p
100μF	6½p
220μF	6½p
330μF	6½p
1000μF	13p
4700μF	29p

6·3 VOLT

33μF	6½p
68μF	6½p
150μF	6½p
470μF	11p
680μF	13p
1500μF	18p
2200μF	18p
3300μF	26p
6800μF	40p

10 VOLT

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

16 VOLT

15μF	6½p
33μF	6½p
68μF	6½p
150μF	8p
220μF	9p
680μF	17p

16 VOLT

1000μF	17p
1500μF	25p
2000μF	43p
3300μF	38p
6800μF	65p

25 VOLT

10μF	6½p
22μF	6½p
47μF	6½p
100μF	8p
150μF	8p
220μF	10p
470μF	13p
680μF	20p
1000μF	22p

25 VOLT

2200μF	39p
5000μF	68p

40 VOLT

6·8μF	6½p
15μF	6½p
33μF	6½p
47μF	6½p
100μF	9p
150μF	10p
220μF	11p
470μF	19p
680μF	25p
1000μF	25p
2200μF	44p
3300μF	65p

63 VOLT

1μF	6½p
2·2μF	6½p
4·7μF	6½p
6·8μF	6½p
10μF	6½p
22μF	6½p
68μF	10p
100μF	11p
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470μF	26p
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AC142K	25p	AF115	15p	BC169	11p	OC28	40p	2N3703	11p	1N4148	5p	OA91	8p
AC141K	26p	AF116	15p	BC182	12p	OC35	40p	2N3704	11p	1N4001	4½p	OA95	8p
AC176	15p	AF117	15p	BC183	12p	OC36	45p	2N3705	11p	1N4002	4½p		
AC187	14p	BC107	9p	BC184	12p	OC44	14p	2N3706	11p	1N4003	5½p		
AC188	14p	BC108	9p	BC212	12p	OC45	14p	2N3707	11p	1N4004	6½p		
AC187K	25p	BC109	10p	BC213	12p	OC71	14p	2N3708	11p	1N4005	8p		
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1 watt 10% carbon .. range 10 ohms to 4·7 megohms.	2½p	2p
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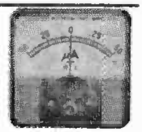

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50 volt
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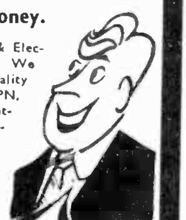

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Also 7BP7. All unused as new. Price £1·55 post paid.

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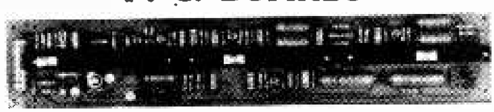

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Completely replaces the conventional cone speaker Super-thin construction permits new installation ideas.

Power capability: 40 watts peak. **Frequency range:** 40 Hz–20 KHz **Sensitivity:** 85 dB/M for 1 watt electrical input. **Input impedance:** 8 ohms. **Operating temperature range:** –20°F to +175°F. **Size (WxDxL):** 1-7/16" x 11-3/4" x 14-11/16". **Weight:** 19 ounces.

£7·50 each Stereo pair £14·50
post free

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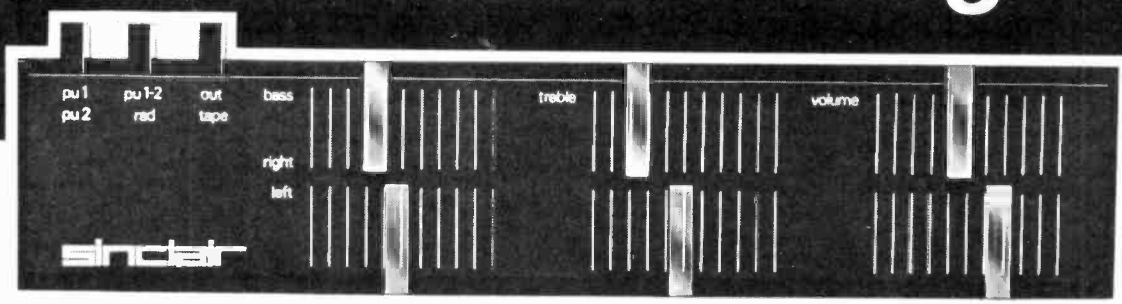
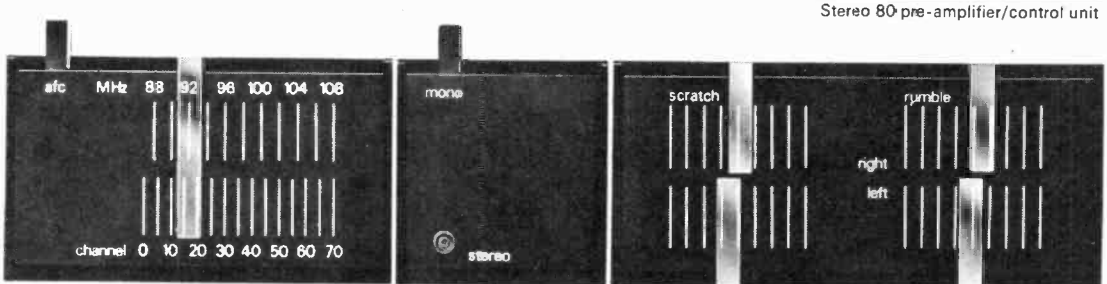
now...

Project 80

...exciting new thinking in modular hi-fi design

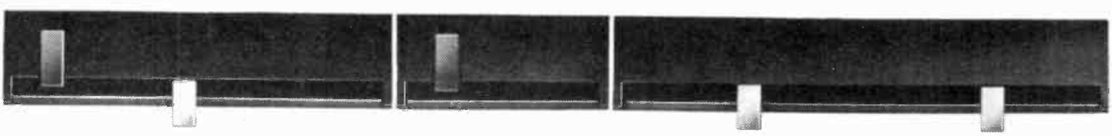


Stereo 80 pre-amplifier/control unit



Project 80 tuner — Stereo decoder — Project 80 Active Filter Unit (AFU)

the slimmest, most elegant hi-fi modules ever made



Living with hi-fi takes on new meaning now that Project 80 is here. These amazing new modules mark a brilliant technical advance all round; their size and presentation bring exciting new opportunities to install systems in ways hitherto only dreamed about but never before made practical. You can build a Project 80 system virtually anywhere and it is unbelievably simple to install and connect up. Everything that could possibly be wanted in a top quality do-it-yourself domestic hi-fi system will be found in Project 80 – compactness, elegantly ultra-modern styling, ease of fixing and operation, new control methods, and above all superb performance. New as well as popular established ideas on installation are featured on page four of this announcement to provide just a few examples of the system's fantastic versatility.

sinclair

INTERNATIONAL AUDIO FAIR STAND C. 8

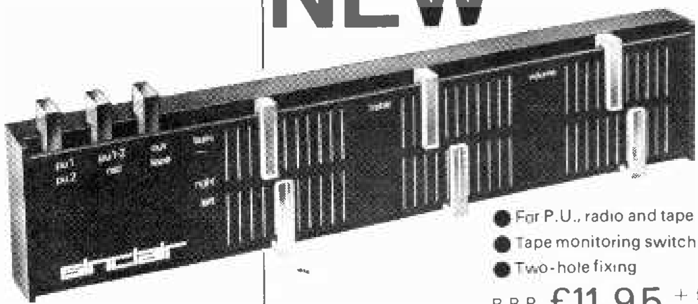
Project 80 new modules

Stereo 80 pre-amplifier and control unit

As with other Project 80 units, the Stereo 80 is mounted by means of two bolts fixed at the rear which pass through holes drilled in the wood or plastic on which modules are to be mounted. *All the electronics are contained within the ¾" deep front panel!* Connecting leads are taken away similarly out of sight. Each channel in the Stereo 80 has its own independent tone and volume controls operated by sliders. This enables exceptionally good environmental matching to be obtained. Provision is made for magnetic and ceramic pick-ups, radio and tape in and out. A virtual earth input stage forms part of the up-dated circuitry of the Stereo 80 to ensure the finest possible quality from all signal sources. Generous overload margins are allowed on all inputs. Clear instructions with template are supplied.

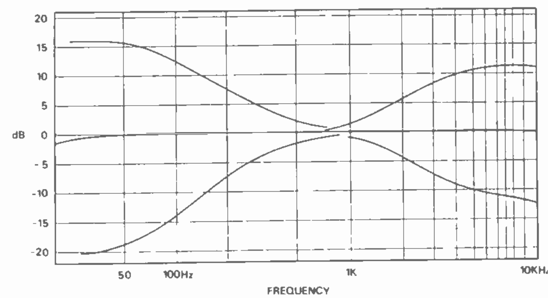
TECHNICAL SPECIFICATIONS
Size – 260 × 50 × 20mm (10¼ × 2 × ¾ins)
Finish – Black, with white markings
Inputs – Mag. P.U. 3mV RIAA corrected; Ceramic P.U. 300 mV
Radio 300 mV; Tape 30 mV
S/N ratio – 60db
Frequency range – 20Hz to 15KHz ± 1dB; 10Hz to 25KHz ± 3dB
Power requirements – 20 to 35 volts
Outputs – 100mV + AB monitoring for tape
Controls – Press button for tape, radio and P.U. selection Volume.
Bass + 12dB to – 14dB at 100Hz; Treble + 11dB to – 12dB at 10KHz

NEW



- For P.U., radio and tape
- Tape monitoring switch
- Two-hole fixing

R.R.P. £11.95 + £1.19 V.A.T.

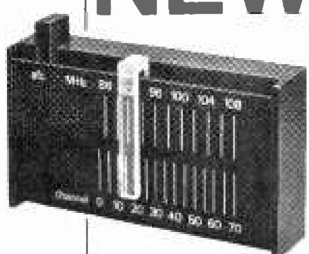


Project 80 FM tuner smaller, more efficient

A truly remarkable tuner in every way – its unbelievably compact size – its original circuitry – its dependable performance – all this in a boldly designed modern case measuring 85 × 50 × 20mm (3½ × 2 × ¾ins). Greater adaptability (and possibly financial convenience) results from the tuner and stereo decoder section being made available separately.

TECHNICAL SPECIFICATIONS
Size – 85 × 50 × 20mm (approx. 3½ × 2 × ¾ins)
Tuning range – 87 to 108 MHz
Detector – I.C. balanced coincidence, for good A.M. rejection
AFC – Switchable, with thermistor control to prevent from drift
One 26 transistor I.C.
Twin dual varicap tuning
Distortion – 0·3% at 1KHz for 75KHz deviation
Ceramic filter in I.F. section
Aerial impedance – 75 Ω or 240-300 Ω
Sensitivity – 4 microvolts for 30dB quieting
Power requirements – 12 to 45 volts

NEW



- AFC switch
- Twin dual varicap tuning
- 4-hole ceramic filter
- Slider tuning

R.R.P. £11.95 + £1.19 V.A.T.

Project 80 stereo decoder

Making the Project 80 decoder separate from the F.M. tuner gives the constructor a wider choice of systems as well as saving money in cases where stereo reception may not be required. This unit gives a 40dB channel separation with an output of 150mV per channel. The gallium arsenide light emitting beacon automatically lights up to show when a stereo transmission is tuned in. Designed essentially as an integral part of Project 80 systems, this multiplex stereo demodulator may be used in many cases with existing single channel frequency modulated tuners to provide stereo reception.
Size – 47 × 50 × 20mm (1⅞ × 2 × ¾ins)
One 19 transistor I.C.

NEW

- Solid-state stereo indicating beacon
- Readily adaptable for use with other tuners

R.R.P. £7.45 + 0.74p V.A.T.

new constructional techniques

. . .and again Sinclair leads the world

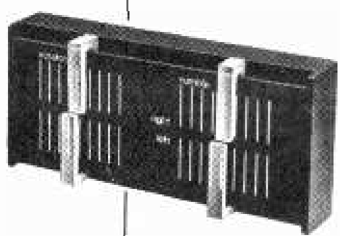
1962 Micro-miniature power amp small enough to stand on a 10p. piece. Slimline pocket receiver smaller than a 20 cigarette pack
1963 Micro-6 receiver, smaller than a matchbox
1964 Pocket F.M. receiver; PWM amp.
1965 Z.12 power amplifier module. PZ.3 power supply
1966 Stereo 25 pre-amp/control unit
1967 Micromatic Q.14 loudspeaker; the first Neoteric
1968 IC.10, the first ever integrated circuit for constructors use
1969 Q.16 – improved version of Q.14 Systems 2000 and 3000: Project 60 launched
1970 IC.12 Project 605
1971 Project 60 stereo FM tuner. Z.50 PZ 8
1972 Improvements to Project 60 with Z.50 MK.2 and PZ.8 Mk.3 The Executive Calculator: Digital multi-meter Q.30 speaker
1973 Cambridge Calculator
PROJECT 80 LAUNCHED

. . . and next ?

Project 80 active filter unit

This efficiently designed unit makes a highly desirable part of any worthwhile system where inputs may be from record, radio or tape. As with Stereo 80, separate controls are applied to each channel thereby making it easier to obtain ideal stereo balance in any kind of indoor environment

TECHNICAL SPECIFICATIONS
Size – 108 × 50 × 20mm (4¼ × 2 × ¾ins)
Voltage gain – minus 0 2dB
Frequency response – 36Hz to 22KHz, controls minimum
Distortion – at 1KHz – 0·03% using 30V supply
HF cut off (scratch) – 22KHz to 5·5KHz. 12dB/oct slope
L.F. cut off (rumble) – 28dB at 20Hz. 9dB/oct. slope



NEW

- For scratch and rumble control
- Transistorised active circuitry

R.R.P. £6.95 + 0·69p V.A.T

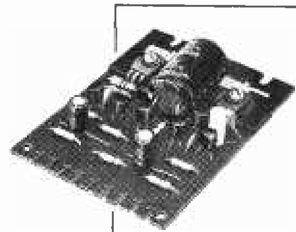
Z.40 & Z.60 power amplifiers
totally short-circuit proof

Either of these entirely new power amplifiers is intended for use in Project 80 installations although, of course, they are readily adaptable to an even wider range of applications. Both Z.40 and Z.60 incorporate built-in protection against shortcircuiting and risk of damage arising from mis-use is greatly reduced. Comprehensive instructions are supplied with each of the modules.

Z.40 Technical Specifications
Size – 55 × 80 × 20mm (2⅛ × 3⅛ × ¾ins) 9 transistors
Input sensitivity – 100mV
Output – 15 watts RMS continuous into 8 Ω (35V). 30 watts music power into 4 Ω (30V)
Frequency response – 10Hz–100KHz ± 1dB
Signal to noise ratio – 64dB
Distortion – at 10 watts into 8 Ω less than 0 1%
Power requirements – 12-35 volts

Z 60 Technical Specifications
Size – 55 × 98 × 20mm (2⅛ × 3⅞ × ¾ins) 12 transistors
Input sensitivity – 100-250mV
Output – 25 watts RMS into 8 Ω (45V). 50 watts music power into 4 Ω (50V)
Distortion – typically 0 03%
Frequency response – 10Hz to more than 200KHz ± 1dB
Signal to noise ratio – better than 70dB
Built-in protection against transient overload and short circuit
Load impedance – 4Ω min; max. safe on open circuit

NEW



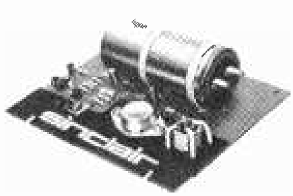
Z.40
R.R.P. £5.45 + 0·54p V.A.T.

Z.60
R.R.P. £6.95 + 0·69p V.A.T.

Sinclair power supply units PZ.8

the worlds most advanced unit in its class

Stabilised power supply unit Re-entrant current limiting makes damage from overload or even direct shorting impossible, a principle never before inorporated in a commercially available constructor module. Normal working voltage (adjustable) 45V.
R.R.P. £7.98 + 0.79p V.A.T.
Without mains transformer
PZ.5 30V unstabilised
R.R.P. £4.98 + 0.49p V.A.T.
PZ.6 35V. stabilised
R.R.P. £7.98 + 0.79p V.A.T.



Recommended Project 80 applications

System	The Units to use	Units cost
Simple battery record player	Z.40	£5.45 +54p V A T
Mains powered record player	Z.40, PZ.5	£10.43 +£1.04 V.A.T.
30W. RMS continuous sine wave stereo amp	2× Z.40s, Stereo 80; PZ.6	£30.83 +£3 08 V A.T
50W (8 Ω) RMS continuous sine wave de luxe stereo amplifier	2× Z.60s, Stereo 80; PZ.8	£33.83 +£3 38 V A.T
Indoor P.A	Z.60, PZ.8	£14.93 +£1.49 V.A.T.
Car Radio	F.M. tuner, Z.40	£16.40 +£1.64 V.A.T

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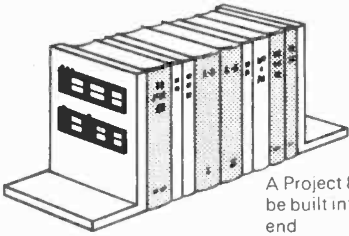
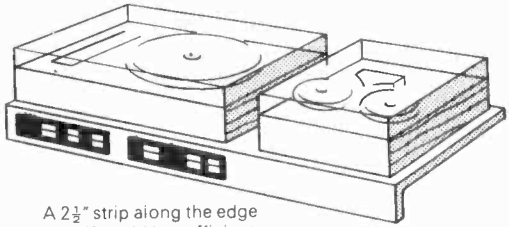
From Sinclair the worlds most advanced hi-fi modules

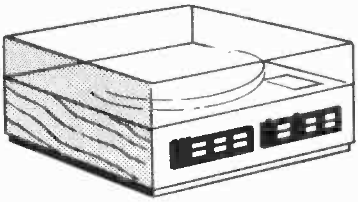
Sinclair Project 80 the ultra-modern non-obtrusive hi-fi



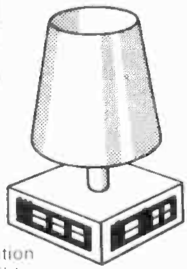
A Project 80 system could be built into a book-shelf end



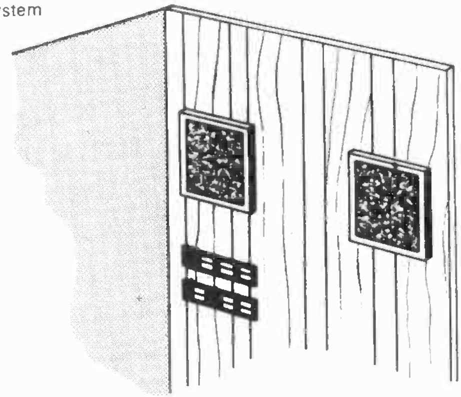
A 2½" strip along the edge a shelf could be sufficient to contain a complete system



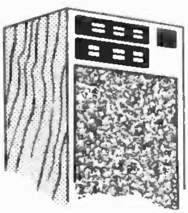
The modules mount very easily onto a playing plinth



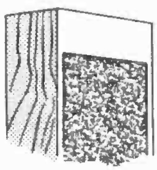
A novel application would be to build around the base of a lampshade



Two Sinclair Q.16 loudspeakers suitably positioned together with Project 80 could be mounted on to a false wall.



Project 80 could be easily mounted onto a loudspeaker cabinet



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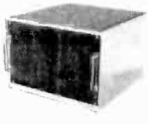

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Model 120 all aluminium two part construction. Top and sides, blue hammer finish, front, rear and base: white. Others: mild steel three part construction.
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120	8	2½	6	£1·85
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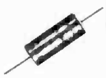
Sub-miniature
Axial lead electrolytic



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

Tantalum Bead

Mfd	V	Price	Mfd	V	Price
0·1	35	12p	10	16	14p
0·22	35	12p	10	25	16p
0·47	35	12p	15	16	16p
1·0	35	12p	22	16	16p
2·2	35	12p	47	6·3	16p
4·7	35	14p	100	3	16p

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3 to 40pF	13p	20 to 250pF	18p
30 to 140pF	13p	100 to 500pF	21p

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Vert or Horiz
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All ¼" shaft. Grub screw fixing

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K30/1 (13mm) 24p
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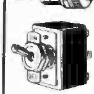

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Miscellaneous

MAINS MOTOR

Precision made—as used in record decks and tape recorders—ideal also for extractor fan, blower, heaters, etc. New and perfect. Snip at 78p. Postage 20p for first one then 10p for each one ordered.

MUSIC ON TAPE

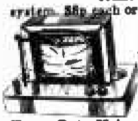
A further buy enables us to offer these at an even lower price—namely 65p each or 5 for £2·50. Send for list of titles. We can't repeat when sold out.

BALANCED ARMATURE UNIT

500 ohm, operates as speaker or microphone, so useful in intercom or similar circuits, 37p each, 10 for £3·76.

CAR ELECTRIC PLUG

Fits in place of cigarette lighter. Useful method for making a quick connection into the car electrical system. 38p each or 10 for £3·48.



12 VOLT 1½ AMP. POWER PACK

This comprises double-wound 230/240V mains transformer with full wave rectifier and 2000 mF smoothing. Price £2·20 plus 20p post & packing.

Heavy Duty Mains Power Pack. Output voltage adjustable from 15-40V in steps — maximum load 250W—that is from 6 amp at 40V to 15amp at 15V. This really is a high power heavy duty unit with dozens of workshop uses. Output voltage adjustment is very quick—simply interchange push on leads. Silicon rectifiers and smoothing by 3,000mF. Price £6·38 plus 65p post.

BAKELITE INSTRUMENT CASE

Size approx. 6½" × 3½" × 2" deep with brass inserts in four corners and bakelite panel. This is a very strong case suitable to house instruments and special rigs, etc. Price 40p each. Pixolin lid 11p extra.

MINIATURE WAFER SWITCHES

2 pole, 2 way—4 pole, 2 way—3 pole, 3 way—4 pole, 3 way—2 pole, 4 way—3 pole, 4 way—2 pole 6 way—1 pole, 12 way. All at 25p each.

CONNECTING WIRE

7·0076 Copper conductors. 500 metre drums available in the following colours:—Red/Brown – Yellow – Green/Grey – Blue/Green – Red/Orange – Green/White – Grey/White – Blue/Orange – Brown/Red – Brown/White – Red/Grey – Blue/Grey – Blue/Brown. Price £2·20 per drum plus 10p post. State alternative colours.

Screened Cable 70076 core suitable for pick up or mike lead or for inter-connecting amplifiers. 10 metres. 33p.

DOOR SWITCH

As fitted to refrigerators, etc. Switches off as door closes. White 17p each. Black 15p each.

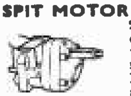
U.V. LIGHTING

Useful for flaw detection in metals and for looking for water marks, etc., also for fitting over tropical fish tanks. African violets and other indoor plants which must have U.V. for healthy growth. The outfit comprises of a 12" U.V. tube—choke—starter holder and tube ends. Price £2·20 plus 20p post.

80 WATT TUBULAR ELEMENTS

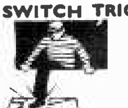
Brass encased with beaded flex ends. Standard replacements in most absorbtion refrigerators but also has dozens of other uses. 83p each

SPIT MOTOR



200–250V Induction Motor, driving a Carter gear box with 1½" of output drive shaft running at 5 revs per minute. Intended for roasting chickens also suitable for driving models—windmills, coloured disc lighting effect, etc., etc. £2·04 plus 20p post and insurance.

SWITCH TRIGGER MATS



So thin is undetectable under carpet but will switch on with slightest pressure. For burglar alarms, shop doors, etc.

24" × 18" £1·69
13" × 10" £1·21

ROCKER SWITCH

13 amp self-fixing into an oblong hole. Size approximately 1" × ⅝" 9p each. 10 for 81p.

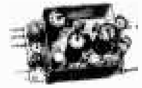
KETTLE ELEMENTS

Made by the famous A.E.I. Co. Complete with washers and combined fixing ring and plug shroud. Normal 2 round pin and flat pin earth connection and overload reset push button. 2 Models—1⅞" (approx.) suitable for Swan and other similar models—1½" (approx.) suitable for G.E.C., Hotpoint, etc. All quick boil 2½Kw elements at 240v. Price £1·38 each.

WINDSCREEN WIPER CONTROL

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

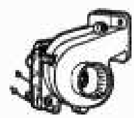
MULLARD AUDIO AMPLIFIERS



All in module form, each ready built complete with heat sinks and connection tags, data supplied.
Model 1153 500mW power output 79p.
Model 1172 750mW power output 94p.
Model EP9000 4 watt power output £1·60.

Unilex DIY STEREO. Complete £11·30.

CENTRIFUGAL BLOWER



Miniature mains driven blower centrifugal type blower unit by Woods. Powerful but specially built for quiet running—driven by cushioned induction motor with specially built low noise bearings. Overall size 4½" × 4½" × 4". When mounted by flange, air is blown into the equipment but to suck air out, mount it from centre using clamp. Ideal for cooling electrical equipment or fitting into a cooker hood, film drying cabinet or for removing flux smoke when soldering etc., etc. A real bargain at £2·05.

MIGHTY MIDGET

Probably the tiniest possible radio, as described in Practical Wireless, January 73.' All electronic parts £2·20 post paid.

TAPE PLAYBACK UNITS

Mains operated. Made by Reditune the famous "music in background people". These are complete units for playing tape at standard speed (3¾"). These have a superior motor driven fly wheel to control the tape through the capstan and also an even equally useful valve amplifier with EL84 output. In a steel case with carrying handle. Tested and good working order £6·50, or some in need of repair but complete £3·50, cassettes of tape pre-recorded £1·10 (please state type of music required.) 75p carriage up to 200 miles then 50p per 100 miles extra.

6 MAINS TRANSFORMERS

Our Ref: **MTM1** 27 volt at 8 amp. Upright mounting fully shrouded—flying leads—fully tapped primary. Price £3·30.

Our Ref: **MTM2** 12v at 1 amp. Upright mounting with fixing lugs, tag connection. 240v primary—12v 1 amp secondary. Price 88p.

Our Ref: **MTM3** 6·3v 2 amp upright mounting with fixing lugs, tag connections, 240v primary 6·3v 2 amp secondary. Price 77p.

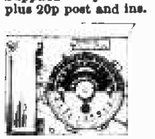
Our Ref: **MTM4** 18v ½ amp with thermal cut-out, upright mounting with fixing lugs—tag connections. Primary 240v, secondary 18v at ½ amp. Price 88p.

MAINS ISOLATION 350 watts earth shielded—flex leads—upright mounting lugs for fixing terminals for output. Price £6·50 each.

MAINS TRANSFORMER BARGAIN. Standard mains 240v input. Secondary 2·4v 9 amp intermittent. 5 amp continuous. Price 55p.

DISTRIBUTION PANELS

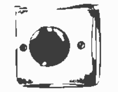
Just what you need for work bench or lab. 4 × 13 amp. sockets in metal box to take standard 13 amp. fused plugs and on/off switch with neon warning light. Supplied complete with 7 feet of heavy cable. Wired up ready to work, £2·50 plus 20p post and ins.



24-HOUR TIME SWITCH

Made by Smiths, these are AC mains operated, NOT CLOCKWORK. Ideal for mounting on rack or shelf or can be built into box with 13A socket. Two completely adjustable time periods per 24 hours, 5A changeover contacts will switch circuit on or off during these periods. £2·75 post and ins. 25p. Additional time contacts 55p pair.

THYRISTOR LIGHT DIMMER

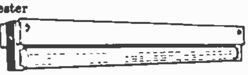


For any lamp up to 1kw. Mounted on switch plate to fit in place of standard switch. Virtually no radio interference. Price £2·95 plus 20p post and insurance. Industrial model 5A £3·30. (Not on plate).

THIS MONTH'S SNIP

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

TWENTYLITE

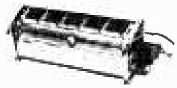


Fluorescent lighting units with polyester choke and finished white enamel. 40ins. model. Ideal kitchen, bedroom, hallway, porch, lift, etc., with tube. Assembled ready to install. Price £2·20 + 40p p. & p.

10 AMP DIMMER/CONTROLLER

For the control of lighting of stage or studio or portable equipment in workshops etc. This has socket outlets each controlled by 5 AMP Solid State regulator. Also fitted with master switch fuse and neon indicator and terminating with 6 feet of flex. Overall length 17in. 3½in. x 1½in. deep. £7·50, plus 25p P. & P.

TANGENTIAL HEATER UNIT



This heater unit is the very latest type, most efficient, and quiet running. Is as fitted in Hoover and blower heaters costing £15 and more. We have a few only. Comprises motor, impeller, 2kW, element and 1kW. element allowing switching 1, 2 and 3kW, and with thermal safety cut-out. Can be fitted into any metal line case or cabinet. Only needs control switch. £3·85. 2kW. Model as above except 2kW. £2·75. Don't miss this. Control Switch 44p, P. & P. 40p.

NEW ITEMS THIS MONTH

VOLTAGE CHANGING TRANSFORMERS made by Parmeko. Upright mounting, fully shrouded and with terminal blocks for input and output. For changing mains voltage, ideal for working low voltage equipment from 230/240 mains and for increasing voltage due to losses in long leads. Voltage up or down between 190–250v. 250 watts. Price £1·65 plus 30p post, etc.

DOOR OPENING OR PLATFORM ROTATING MOTORS. Very powerful motors estimated rating at ¼ H.P. Reversible with gearbox and "V" belt drive wheel of 7" diameter. Price of motor which weighs approx. 15lbs. is £10. *Note:* These are ex-equipment but guaranteed for six months.

Gas and Smoke detector/Sensor—ref GD1—recently referred to as the electronic nose—£2 each; circuit of smoke detector alarm included. Constructional details appeared in September's Practical Wireless, so we can supply the SL 03D at £1·75, the ZN414 at £1·35 also most other items, send for PW 10 radio parts list.

SPRING RETURN WAFER SWITCH. As used in intercom and other similar equipment a two wafer 6 pole 3 way switch, spring return from centre position when turned clockwise and permanent off or on when turned anti-clockwise. Price 55p each.

A.C. BUZZERS. 12v. Fix these into a box which will resinate and they will give a loud piercing note. Suitable for alarms or signal. 33p each.

PUSH ON TAG CONNECTORS. These are being increasingly used on cars and domestic appliances. 2 sizes prevail, the most popular being for ¼" tag. We offer these at attractive prices. 10 for 10p. 50 for 40p. 100 for 70p and 1,000 for £5.

4 MINUTE TIMED ON SWITCH by Smiths. Our ref. TS AU1. This is for processing photographic plates, etc. Has a scale graduated 0-4 min. Turn the pointer knob, and set it at the desired time—switch will stay closed until pointer knob returns to Zero. Clockwork motor, so can be independent of mains if desired, but the switch itself is double pole, rated 250v. 15 amps Price £1·65p.

ONE HOUR TIMED ON SWITCH by Smiths. Our ref. TS AU2. As TS AU1 except that the complete rotation of the pointer knob lasts for one hour. Price £1·10p each.

COUNTER, 3 DIGIT. Belt, rubber band or friction drive, as fitted to Tape Recorders and similar. Counts or takes away up to 999. Resettable from any count by processing knob. 55p each.

DRILL CONTROLLER

NEW IKW MODEL

Electronically changes speed from approximately 10 revs. to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. £1·95. Made up model also available. £2·95.

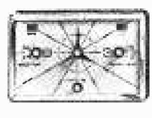
MAINS TRANSISTOR P. P.

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

STEREO PRE-AMP MODULE

Mullard ref LP 7182/2—transistors and all ancillary components mounted on PC board £1·32 with connection dig.

15A ELECTRICAL PROGRAMMER



Learn in your sleep: Have radio playing and kettle boiling as you awake — switch on lights to ward off intruders — have a warm house to come home to. All these and many other things you can do if you invest in an electrical programmer. Clock by famous maker with 15 amp. on/off switch. Switch-on time can be set anywhere to stay on up to 6 hours. Independent 60 minute memory jogger. A beautiful unit. Price £2·15 + 20p p. & p. or with glass front, chrome bezel, 83p extra.

THERMAL CUTOUT

A miniature device ⅜" dia. on one screw fixing mount—can be used for motor overload protection—fire alarm—soldering iron—switch off, etc., etc. 15 amp contacts open with flame—radiant or conducted heat. 11p each or 10 for 99p.

HONEYWELL PUSH BUTTON MICRO SWITCHES

As used in some vending machines, etc. Each switch is a change-over type rated at 15 amps 250v A.C. Intended for panel mounting with fixing nuts and single black push knob. Single change-over switch 28p. Double switch 42p. Triple switch 61p.

MACLAREN THERMOSTAT

Make and break 20 amp A.C. with the sensor probe coupled by 2 feet capillary covering range of 10—100°C—complete with large engraved control knob. Price 83p.

TERMS: 10% discount if ten of an item ordered, send postage where quoted—other items, post free if order for these items is £6·00 otherwise add 20p.

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EF22 .63

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GZ32 .39
GZ33 .70
GZ34 .57

GZ37 .67
HABC80 .44
HL23DD .40
HL41DD .98
HL42DD .50
HN309 1.40
HVR2 .58
HVR2A .53
KT2 .25
KT41 .98
KT44 1.00
KT66 .80
KT81 2.00
KTW61 .63
KTW62 .63
KTW63 .50
MHLD6 .75
P61 .40
PABC80 .32
PC86 .44
PC88 .44
PC95 .58
PC97 .36
PC900 .29
PCC84 .29
PCC85 .24
PCC88 .39
PCC89 .42
PCC189 .46
PCF80 .26
PCF82 .30
PCF84 .40
PCF86 .44
PCF200 .67
PCF801 .40
PCF802 .37
PCF806 .55
PCH200 .62
PCL82 .29
PCL83 .54
PCL84 .32
PCL805/85 .55
PCL86 .36
PD500 1.44
PEN4DD 1.38
PEN45 .80
PEN45DD .80
PEN46 .20

PEN453DD .98
PENDD-4020 .88
PFL200 .50
PL33 .38
PL36 .46
PL81 .43
PL81A .48
PL82 .31
PL83 .30
PL84 .28
PL504/500 .60
PL508 .90
PL509 1.00
PL802 .85
PY33/2 .50
PY81 .25
PY82 .25
PY83 .26
PY88 .31
PY500 .80
PY500A .80
PY800 .31
PY801 .31
PZ30 .48
QQV03/10 1.20
Q875/20 .63
Q895/10 .49
QV04/7 .63
R19 .28
TH233 .98
TP2620 .98
UABC80 .30
UAF42 .49
UBC41 .45
UBC81 .40
UBF80 .33
UBF89 .33
UBL21 .55
UC92 .35
UCC84 .33
UCC85 .33
UCF80 .31
UCH21 .60
UCH42 .57
UCH81 .29
UCL82 .30
UCL83 .54

UF41 .50
UF42 .60
UF80 .35
UF85 .34
UF86 .63
UF89 .27
UL41 .54
UL84 .28
UM80 .33
UY41 .38
UY85 .23
U10 .45
U12/14 .38
U19 1.73
U25 .65
U26 .60
U191 65
U251 .62
U301 .40
U403 .33
U404 .38
U801 .76
U4020 .55
VP23 .40
VP41 .38
VT61A .35
VU111 .44
VU120 .60
VU120A .60
VU133 .35
W107 .50
W729 .60
X65 .50
X66 .50

Transistors & Diodes

2N404 .20
2N966 .58
2N1756 .55
2N2147 .94
2N2297 .25
2N2369 .24
2N2613 .43
2N3053 .36
2N3121 2.75
2N3703 .21
2N3709 .22
2N3988 .55
2S323 .55
AA119 .17
AA120 .17

AA129 .17
AAZ13 .20
AC107 .17
AC113 .28
AC126 .14
AC127 .19
AC128 .22
AC132 .23
AC154 .28
AC156 .22
AC157 .28
AC165 .28
AC166 .28
AC168 .42
AC176 .61
AC177 .31
ACY17 .28
ACY18 .22
ACY19 .21
ACY20 .20
ACY21 .21
ACY22 .17
ACY28 .20
AD140 .40
AD149 .55
AD161 .50
AD162 .50
ADT140 .69
AF106 .55
AF114 .28
AF115 .17
AF117 .21
AF121 .33
AF124 .28
AF125 .19
AF126 .20
AF139 .72
AF178 .75
AF180 .53
AF186 .61
BA115 .15
BA116 .28
BA129 .14
BA130 .11
BA153 .17
BC107 .14

BC108 .14
BC113 .28
BC115 .17
BC116 .28
BC118 .35
BCY10 .50
BCY12 .55
BCY33 .22
BCY34 .25
BCY38 .25
BCY39 .28
BCZ11 .42
BF158 .32
BF159 .28
BF163 .22
BF173 .42
BF180 .33
BF181 .44
BF185 .44
BF194 .17
BFY50 .25
BFY51 .21
BFY52 .22
BY100 .20
BY105 .20
BY114 .20
BY126 .17
BY127 .20
BYZ10 .28
BYZ11 .28
BYZ12 .28
BYZ13 .28
CG12E .22
FSY11A .25
FSY41A .25
GD9 .22
GET113 .22
GET118 .22
GET119 .27
GET587 .47
GET873 .17
GET887 .25
GET897 .25
GET898 .25
M1 .17
OA5 .31

OA9 .14
OA10 .47
OA47 .11
OA70 .17
OA73 .17
OA79 .10
OA81 .10
OA85 .09
OA90 .14
OA91 .10
OA95 .10
OA200 .10
OA202 .11
OC22 .42
OC23 .42
OC24 .42
OC25 .42
OC35 .35
OC36 .47
OC44 .11
OC45 .12
OC46 .17
OC70 .14
OC71 .12
OC72 .12
OC74 .25
OC75 .12
OC76 .17
OC77 .30
OC78 .17
OC78D .17
OC81 .12
OC81D .12
OC82 .12
OC82D .12
OC83 .22
OC84 .26
OC123 .25
OC139 .25
OC169 .25
OC172 .39
OC200 .24
OC201 .42
OC203 .33
OC204 .33
OC205 .47

MATCHED TRANSISTOR SETS:—
LP15 (AC113. AC154. AC157. AA120) ·58p per pack. 1—OC81D & 2—OC81. 47p. 1—OC44 & 2—OC45, ·47p. 1—OC82D. & 2—OC82 ·58p. Set of 3—OC83 ·72p.

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1B3GT	0.48
1L4	0.28
1R4	0.50
1R5	0.45
1S4	0.30
1S5	0.30
1T4	0.30
1U4	0.60
1U5	0.75
1V2	0.60
1X2B	0.60
2D21	0.45
3A4	0.50
3S4	0.40
3V4	0.70
5R4GY	0.80
5U4G	0.40
5V4G	0.50
5Y3GT	0.45
5Z3	0.75
5Z4G	0.45
6/30L2	0.90
6AB4	0.45
6AB5	1.00
6AF4A	0.65
6AG5	0.25
6AG7	0.45
6AH6	0.60
6AJ8	0.30
6AK5	0.40
6AK6	0.60
6AL3	0.43
6AL5	0.25
6AM6	0.37
6AQ5	0.45
6AQ6	0.70
6AR5	0.60
6AR6	0.68
6AS5	0.55

6AS7G	0.85
6AT6	0.45
6AU6	0.30
6AV6	0.45
6AW8A	0.65
6BA6	0.28
6BE6	0.35
6BF6	0.65
6BH6	0.75
6BJ6	0.55
6BK7A	0.75
6BN5	0.48
6BN6	0.60
6BQ5	0.28
6BR7	1.00
6BR8	0.80
6BS7	1.35
6BW6	0.90
6BW7	0.90
6BX6	0.25
6BZ6	0.45
6BZ7	0.70
6C4	0.35
6C5GT	0.55
6CB6	0.40
6CD6GA	1.40
6CG7	0.65
6CL6	0.65
6CU6	0·80
6CW4	1.00
6CY5	0.50
6CY7	0.75
6D3	0.55
6DC6	0.65
6DK6	0.60
6DQ6B	0.80
6DS4	1.35
6EA8	0.70
6EH7	0.30
6EJ7	0.35
6EW6	0.70
6F1	0.75
6F5	0.75
6F6G	0.50

6F11	0.50
6F13	0.50
6F14	0.70
6F15	0.65
6F18	0.50
6F23	0.90
6F24	0.80
6F25	1.00
6F26	0.35
6F28	0.70
6GK6	0.60
6J4	0.60
6J5GT	0.45
6J6	0.30
6J7	0.45
6K4/7	0.60
6K6GT	0.75
6K7	0.45
6K8G	0.45
6K25	0.75
6L6GT	0.55
6L7	0.45
6L18	0.50
6LD20	0.50
6N7GT	0.55
6Q7	0.50
6SA7	0.45
6SG7	0.45
6SK7	0.50
6SL7GT	0.48
6SN7GT	0.48
6SQ7	0.50
6SR7	0.50
6T8	0.38
6U4GT	0.75
6U8A	0.48
6V6GT	0.50
6X4	0.40
6X5GT	0.45
6X8	0.70
6Y6G	0.80
7Y4	0.75
9BW6	0.75
10C2	0.60

10D1	0.65
10D2	0.55
10F1	0.75
10F9	0.65
10F18	0.60
10L1	0.60
10LD11	0.70
10P13	0.75
12AB5	0.70
12AC6	0.70
12AE6	0.65
12AL5	0.55
12AQ5	0.50
12AT6	0.40
12AT7	0.40
12AU6	0.45
12AU7	0.33
12AV6	0.50
12AV7	0.70
12AX7	0.33
12AY7	0.75
12B4A	0.70
12BA6	0.45
12BE6	0.50
12BH7	0.50
12BY7	0.65
12E1	3.00
12K5	1·00
12K7GT	0.50
12Q7GT	0.45
12SR7	0.50
20D1	0.60
20L1	1.10
20P1	0.50
20P4	1.10
20P5	1.20
25C5	0.70
25L6GT	0.60
25Z4G	0.40
25Z6GT	0.75
30A5	0.60
30AE3	0.40
30C1	0.30
30C15	1.00

30C17	1.00
30C18	0.90
30F5	1.00
30FL1	0.80
30FL12	1.10
30FL14	0.90
30L1	0.40
30L15	0.95
30L17	0.95
30P12	1.00
30P19	0.95
30PL1	0.95
30PL13	1.10
30PL14	1.10
35A3	0.65
35A5	0.75
35B5	0.65
35C5	0.60
35D5	0.75
35L6GT	0.75
35W4	0.50
35Z3	0.75
35Z4G	0.40
50A5	1.00
50B5	0.85
50C5	0.60
50CD6G	1.20
50L6GT	0.60
85A2	0.60

90AG	2.40
90AV	3.00
90C1	0.75
90CV	2.40
807	0.50
811A	1.60
813	4.50
866A	1.00
5642	0.80
6080	2.25
6146	2.00
6146B	3.00
6360	1.25
6939	3.00
7199	1.00
7586	2.50
7895	1.50
A2293	2.50
AZ1	0.60
AZ31	0.55
CBL1	0.99
CBL31	1.20
CY1	0.50
CY31	0.50
DAF96	0.50
DF96	0.50
DK92	0.70
DK96	0.60
DL96	0.55
DM70	0.60

DM160	0.70
DY51	0.55
DY86	0.35
DY87	0.36
DY802	0.37
E80F	1.40
E88CC	0.75
E180F	1.00
E810F	2·90
EABC80	0.38
EAF42	0.60
EBC33	0.60
EBC41	0.65
EBC81	0.33
EBF80	0.40
EBF83	0.40
EBF89	0.32
EBL31	1·50
EC53	0.50
EC80	2.65
EC86	0.60
EC88	0.60
EC90	0.35
EC92	0.45
EC93	0.65
ECC40	0.70
ECC81	0.40
ECC82	0.33
ECC83	0.33
ECC84	0.30

ECC88	0.40
ECC89	0.50
ECC91	0.30
ECC189	0.65
ECC807	1.00
ECF80	0.35
ECF82	0.35
ECF804	1.65
ECH42	0.75
ECH81	0.30
ECH83	0.45
ECH84	0.45
ECL80	0.55
ECL81	0.55
ECL82	0.35
ECL83	0.70
ECL84	0.55
ECL85	0.55
ECL86	0.40
ECLL800	3·20
EF37A	1.00
EF40	0.55
EF41	0.65
EF42	0.70
EF80	0.25
EF85	0.35
EF86	0.30
EF89	0.28
EF91	0.37

EF92	0.50
EF95	0.40
EF97	0.65
EF98	0.75
EF183	0.30
EF184	0.35
EF804	1.25
EK90	0.35
EL34	0.50
EL36	0.50
EL41	0.75
EL81	0.55
EL83	0.50
EL84	0.28
EL85	0.43
EL86	0.40
EL90	0.45
EL360	1.25
EL822	1.60
ELL80	0.85
EM71	0.80
EM83	0.50
EM84	0.35
EM85	1.00
EM87	0.70
EN91	0.40
EY51	0.45
EY81	0.40
EY83	0.55
EY86	0.40
EY87	0.43
EY88	0.43
EZ40	0.50
EZ41	0.75
EZ80	0.28
EZ81	0.29
GT1C	4.00
GY501	0.70
GZ30	0.45
GZ31	0.40
GZ32	0.50
GZ34	0.65
HABC80	0.60

HK90	0.50
KT66	2.50
KT77	1·00
KT88	2·90
N78	1·80
PABC80	0.40
PC86	0.60
PC88	0.60
PC97	0.50
PC900	0.48
PCC84	0.40
PCC85	0.40
PCC88	0.55
PCC89	0.50
PCC189	0.60
PCC805	0.95
PCC806	0.95
PCF80	0.30
PCF82	0.35
PCF84	0.60
PCF86	0.60
PCF87	1.00
PCF801	0.50
PCF802	0.50
PCF805	0.90
PCF806	0.75
PCF808	0.90
PCH200	0.70
PCL81	0.50
PCL82	0.35
PCL83	0.65
PCL84	0.45
PCL86	0.45
PCL88	1.10
PCL200	0.75
PCL800	1.10
PCL801	0.95
PCL805	0.50
PD500	1.30
PF86	0.70
PF818	1.00

PL33	0.40
PL36	0.55
PL81	0.50
PL82	0.45
PL83	0.45
PL84	0.40
PL302	0.95
PL504	0.75
PL508	0.90
PL509	1.10
PL801	1.00
PL802	0·95
PM84	0.65
PY31	0.40
PY33	0.63
PY80	0.40
PY81	0.30
PY82	0.35
PY83	0.38
PY88	0.40
PY500	1.00
PY800	0.47
PY801	0.50
PZ30	0.38
QQVO2-6	3.00
QQVO3-10	1.25
TT21	4.20
TT22	4.40
U18/20	0.75
U25	0.85
U26	0.85
U31	0.70
U52	0.40
U76	0.40
U78	0.40
U191	0.75
U201	0.50
U281	0.55
U282	0.55
U301	0.55
U403	0.70

U404	0.70
U801	0.80
UABC80	0.40
UAF41	0.70
UAF42	0.60
UB41	0.75
UBC41	0.55
UBC81	0.45
UBF80	0.40
UBF89	0.40
UBL1	0.70
UBL21	0.70
UC92	0.45
UCC85	0.45
UCF80	0.70
UCH21	0.60
UCH42	0.75
UCH81	0.40
UCL81	0.60
UCL82	0.35
UCL83	0.66
UF9	0.65
UF11	0.60
UF41	0.65
UF42	0.65
UF43	0.65
UF80	0.35
UF85	0.40
UF89	0.40
UL41	0.65
UL84	0.43
UM84	0.30
UY1N	0.50
UY41	0.48
UY82	0.50
UY85	0.40
W729	0.75
XC12	0.60
Z759	4.00
Z5048	4.50
Z5058	6.00
Z803U	1.35

TRANSISTORS

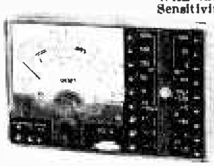
2N696	0.15
2N697	0.15
2N698	0.30
2N705	0.70
2N706	0.10
2N708	0.15
2N753	0.25
2N929	0.20
2N930	0.20
2N987	0.45
2N1131	0.25
2N1132	0.25
2N1164	1.25
2N1302	0.17
2N1303	0.15
2N1304	0.20
2N1305	0.20
2N1306	0.27
2N1307	0.25
2N1308	0.25
2N1309	0.30
2N1613	0.17
2N1711	0.20
2N1756	0.75
2N2147	0.75
2N2160	1.00
2N2217	0.25
2N2218	0.20
2N2369A	0.15
2N2477	0.65
2N2646	0.40
2N2905	0.22
2N2923	0.12
2N2924	0.13
2N2926	0.10
2N3053	0.20
2N3054	0.50
2N3055	0.60
2N3133	0.25
2N3134	0.25
2N3391	0.17
2N3392	0.17
2N3393	0.15
2N3394	0.15
2N3395	0.20
2N3402	0.15
2N3403	0.15
2N3404	0.22
2N3414	0.20
2N3415	0.15
2N3417	0.25
2N3646	0.30
2N3702	0.10
2N3703	0.10
2N3704	0.12
2N3705	0.10
2N3706	0.10
2N3707	0.12
2N3709	0.10
2N3710	0.10
2N3711	0.10
2N3819	0.25
2N3906	0.25

2S746	0.25
AC113	0.15
AC125	0.30
AC126	0.20
AC127	0.17
AC128	0.15
AC132	0.25
AC153	0.30
AC154	0.15
AC157	0.17
AC176	0.25
AC187	0.20
AC188	0.20
ACY17	0.35
ACY18	0.20
ACY19	0.25
ACY20	0.20
ACY21	0.20
ACY22	0.14
AD139	0.40
AD149	0.40
AD161	0.35
AD162	0.35
ADZ11	1.25
ADZ12	1.25
AF114	0.17
AF115	0.17
AF116	0.17
AF117	0.17
AF118	0.25
AF180	0.50
AF181	0.50
AF186	0.40
AFZ12	1.00
ASY26	0.25
ASY27	0.30
ASY28	0.25
ASY29	0.30
ASY54	0.25
ASZ15	0.80
ASZ16	0.80
ASZ17	0.80
ASZ18	0.80
BC107	0.10
BC108	0.10
BC109	0.10
BC113	0.15
BC118	0.20
BC134	0.20
BC147	0.10
BC149	0.11
BC152	0.19
BC158	0.11
BC175	0.20
BC186	0.25
BCY30	0.35
BCY31	0.45
BCY33	0.35
BCY34	0.35
BCY72	0.15

BD121	0.65
BD123	0.80
BD124	0.60
BD131	0.40
BD132	0.50
BF115	0.20
BF167	0.25
BF173	0.28
BF179	0.30
BF180	0.35
BF181	0.35
BF185	0.20
BF194	0.10
BF195	0.10
BF196	0.11
BF197	0.12
BF200	0.32
BFW87	0.25
BFW88	0.20
BFW89	0.20
BFW91	0.20
BFX88	0.20
BFY17	0.40
BFY19	0.25
BFY50	0.20
BFY51	0.20
BFY52	0.20
BSY26	0.17
BSY27	0.20
BSY28	0.17
BSY65	0.20
BSY95A	0.12
BU105	1.60
OC16	1.00
OC22	0.50
OC23	0.60
OC24	0.60
OC25	0.35
OC26	0.25
OC29	0.60
OC35	0.50
OC36	0.65
OC42	0.30
OC44	0.15
OC45	0.12
OC70	0.10
OC71	0.12
OC72	0.12
OC73	0.30
OC75	0.15
OC76	0.15
OC78	0.25
OC78D	0.20
OC81	0.20
OC81D	0.20
OC83	0.20
OC139	0.30
OC141	0.60
OC170	0.25
OC171	0.30
OC200	0.30
OC201	0.60
OC202	0.65
OC203	0.40
OC204	0.40

NEW MULTIMETER from U.S.S.R. TYPE U4323

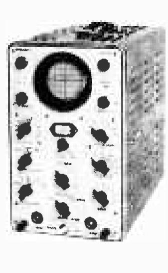
With taut suspension movement
Sensitivity: 20.000 Ω/V.



7 D.C. Voltage ranges 0·5–1000V
6 A.C. Voltage ranges 2·5–1000V
5 D.C. Current ranges 0·05–500mA
4 Resistance ranges 1k Ω–1M Ω
Built-in oscillator providing AF output of 1kHz and I.F. output of 465kHz with an amplitude of 1 volt minimum.
Dimensions: 140 × 87 × 40 mm. Weight 0·5kg.
PRICE complete with leads and plastic storage case £7·00.

SYNCHROSCOPE TYPE C1-5

Made in USSR



3-in tube fitted with telescopic viewing hood, giving bright display in full daylight. Sensitivity 10mV/mm (narrow band) to 30mV/mm (wide band).
Bandwidth 10 c/s—10 mc/s. Triggered sweep pre-set at 1-2-5-10-30-100-300-1000-3000 μsec per stroke.
Free-running time base 20 c/s to 200kc/s with built-in crystal calibrator providing timing marks at ·05-·2-1·5-20-100 μ sec.
Amplitude calibrator directly calibrated in volts.
Input attenuator 1-10-100.
Power supplies 127/230v AC.
PRICE £39·00. Packing and carriage £1·50.

11·5 AMP THYRISTORS BTX47-1200R

Max. average forward current 11·5A
Max. r.m.s. forward current 25A
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Continuous reverse voltage 800V
PRICE: £2·50.

Series BZX61 1-watt ZENER Diodes

Available in: 7·5-8·2-11-15-16-24-27-30-33-36-62-68 volts. £0·20 each.

DIODES

OA5	0·25	OA81	0·07
OA6	0·12	OA85	0·07
OA7	0·15	OA86	0·15
OA10	0·20	OA90	0·07
OA47	0·08	OA91	0·07
OA70	0·07	OA95	0·07
OA79	0·07	OA200	0·07

MINIATURE HALF WAVE SILICON RECTIFIERS

IA8029 (Avalanche)	1000 P.I.V.	1·5A	0·30
IN540	400 P.I.V.	750mA	0·30
IN645	225 P.I.V.	400mA	0·16
IN649	600 P.I.V.	400mA	0·35
IN3193	200 P.I.V.	750mA	0·15
IN3194	400 P.I.V.	750mA	0·17
IN4001	50 P.I.V.	1A	0·06
IN4002	100 P.I.V.	1A	0·07
IN4003	200 P.I.V.	1A	0·075
IN4004	400 P.I.V.	1A	0·08
IN4005	600 P.I.V.	1A	0·10
IN4006	800 P.I.V.	1A	0·12
IN4007	1000 P.I.V.	1A	0·14
IN5399	1000 P.I.V.	1·5A	0·25
IN5408	1000 P.I.V.	3A	0·50
BY100	700 P.I.V.	450mA	0·15
BY101	450 P.I.V.	1·1A	0·15
BY105	800 P.I.V.	1·1A	0·15
BY125	200 P.I.V.	425mA	0·10
BY126	650 P.I.V.	1A	0·10
BY127	1250 P.I.V.	1A	0·12
DD000	50 P.I.V.	500mA	0·15
DD006	400 P.I.V.	500mA	0·25
DD058	800 P.I.V.	500mA	0·35

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Practical Wireless Beginner's SHORT

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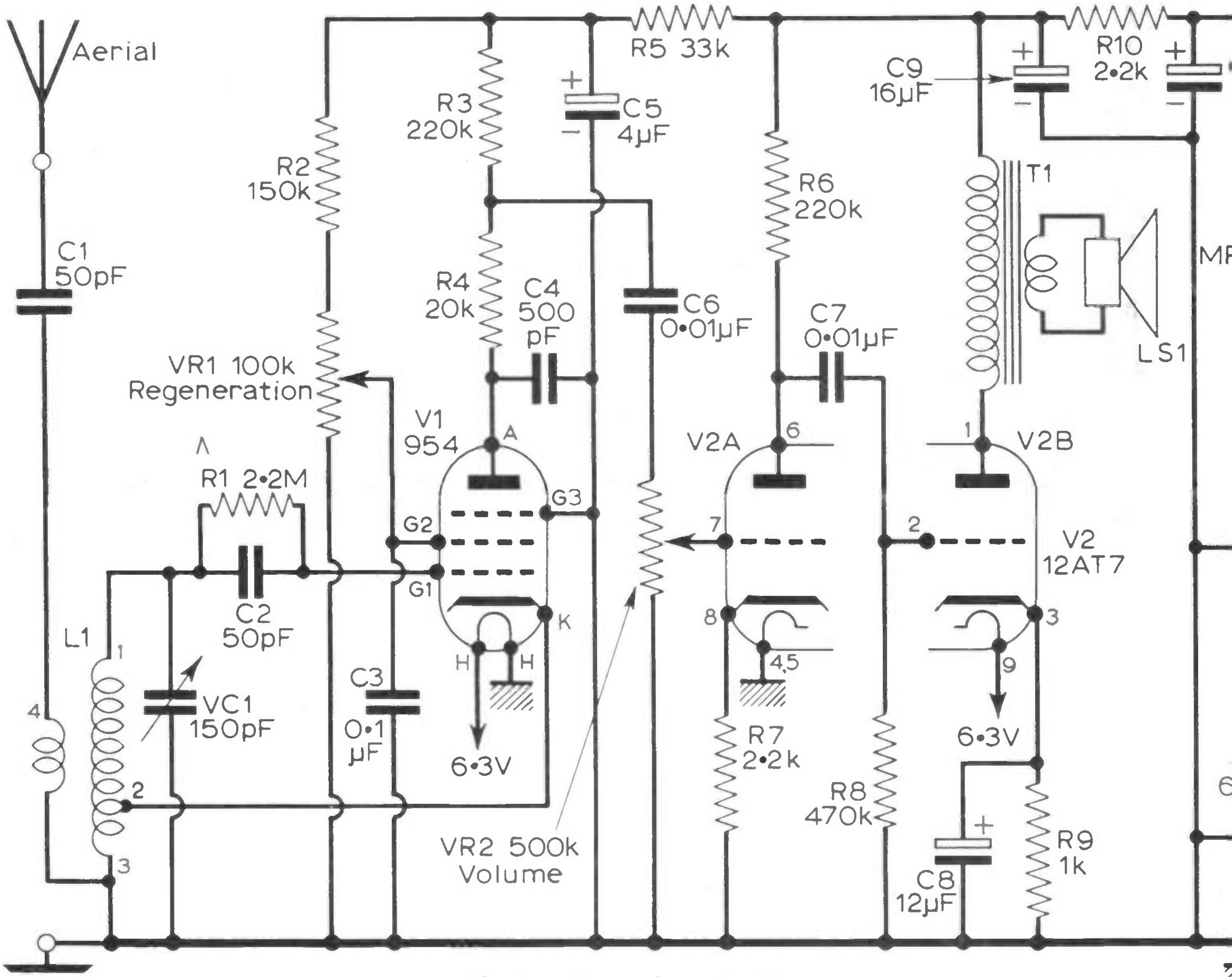
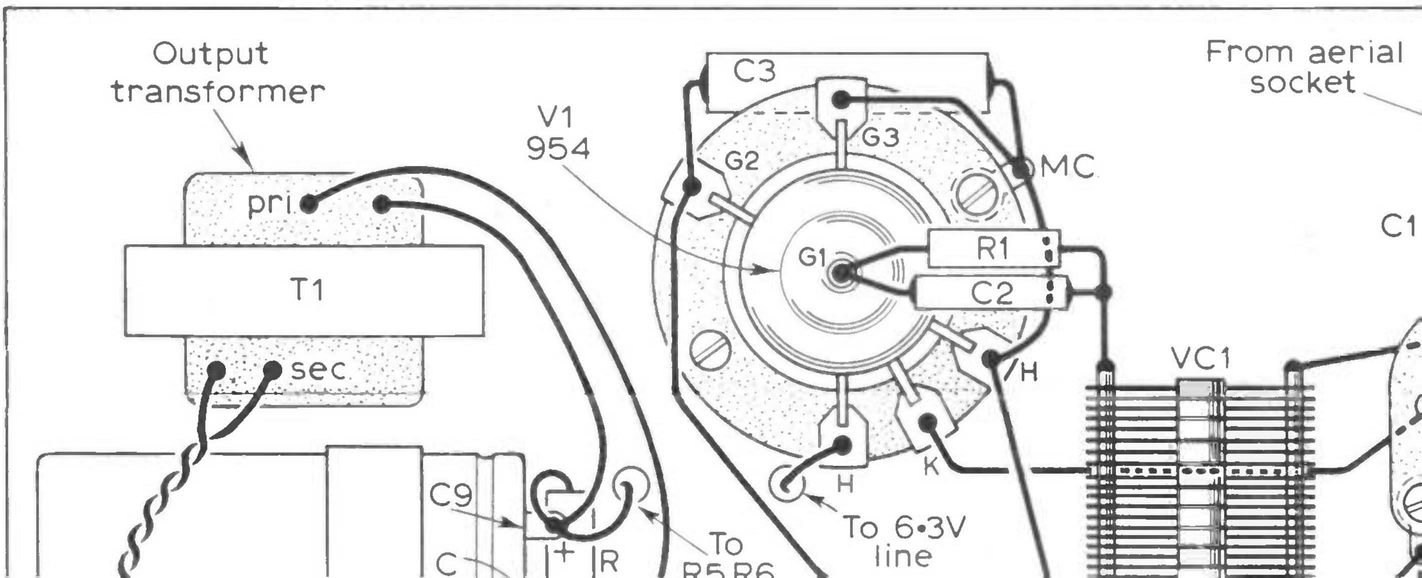


Fig.1 – The circuit diagram.



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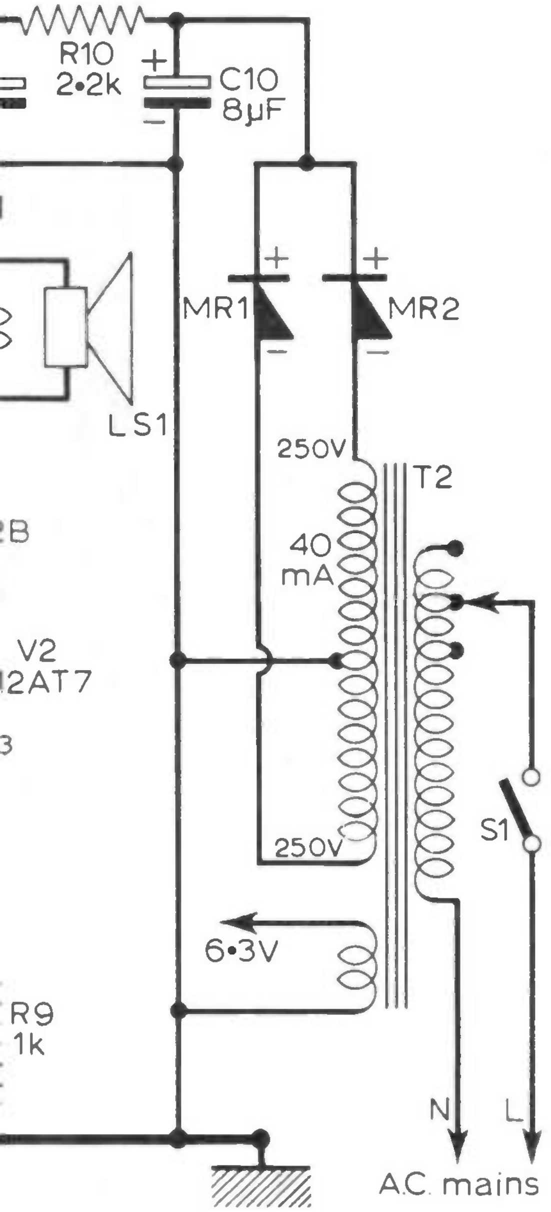

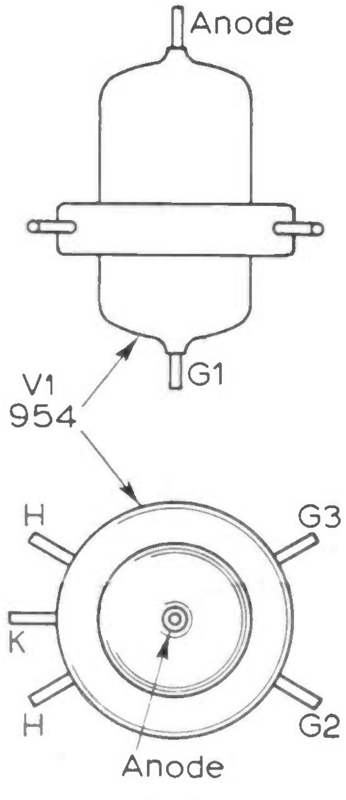

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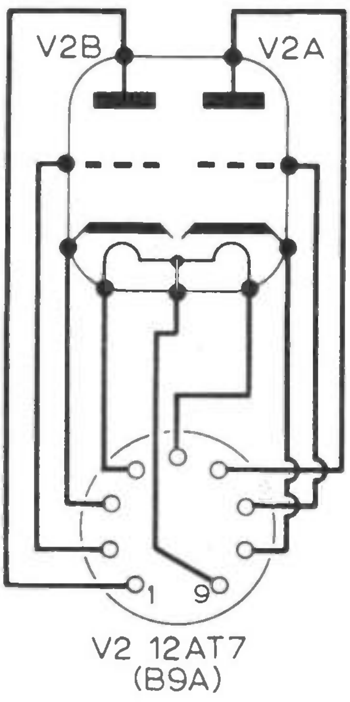
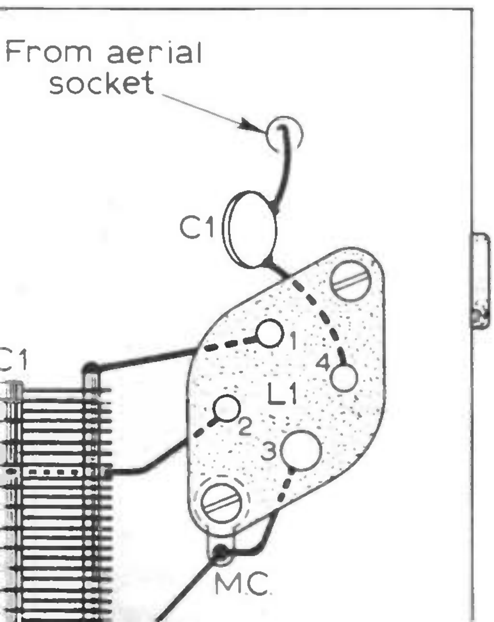
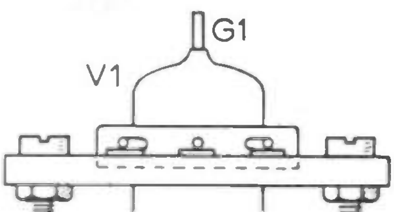
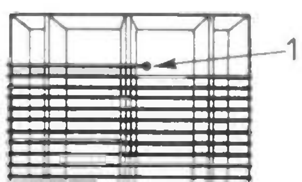


(b)







COMPONENTS LIST

Resistors:

R1	2·2MΩ	R6	220kΩ
R2	150kΩ	R7	2·2kΩ
R3	220kΩ	R8	470kΩ
R4	20kΩ	R9	1kΩ
R5	33kΩ	R10	2·2kΩ 3W w.w.

All 10%, ½W carbon, except where otherwise indicated

VR1 100kΩ wire-wound potentiometer
VR2 500kΩ carbon potentiometer

Capacitors:

C1 50pF mica or ceramic
C2 50pF mica or ceramic
C3 0·1µF paper
C4 500pF mica or ceramic
C5 4µF electrolytic 350V
C6 0·01µF paper
C7 0·01µF paper
C8 12µF electrolytic 25V
C9 16µF } dual electrolytic 350V
C10 8µF }
VC1 150pF air dielectric variable

Transformers:

T1 Output transformer 60 : 1
T2 Small mains transformer. Tapped primary. Secondaries: 250-0-250V 40mA; 6·3V 1A

Valves:

V1 954 V2 12AT7

Other Circuit Components:

LS1 2½in. diameter loudspeaker 2–3Ω
S1 Toggle switch s.p.s.t.
MR1, 2 Contact cooled rectifier 250V 40mA

Miscellaneous:

Ball drive 6 : 1 ratio. Knobs: one 2in. diameter, two 1in. diameter. One B9A valveholder. Ribbed 4-pin plug-in coil formers (Eddystone). Coil holder (Eddystone). Aerial-earth socket strip. Tag strip (2 insulated). Chassis 7in. x 4in. x 2½in. approx. Panel 6in. x 7½in.

COIL WINDING DATA

1·2–4Mc/s (250–75 metres)
100 turns 34s.w.g., tap at 2 turns. Aerial coupling, 20 turns.

2·5–7·5Mc/s (120–40 metres)
50 turns 32s.w.g., tap at 1½ turns. Aerial coupling, 15 turns.

6·75–22Mc/s (44–13·6 metres)
16 turns 30s.w.g., tap at ¾ turn. Aerial coupling, five turns.

14·5–50Mc/s (20·6–6 metres)
5½ turns 30s.w.g., tap ⅓ to ½ turn. Aerial coupling, two turns.

40–100Mc/s (7·5–3 metres)
2¼ turns 20s.w.g., double spaced, tap at ½ turn. Aerial coupling, one turn.

The two larger coils are close wound. The other coils are on threaded formers, and spaced 21 turns per inch. Aerial windings are near the tuned winding as indicated in Fig. 4(d).

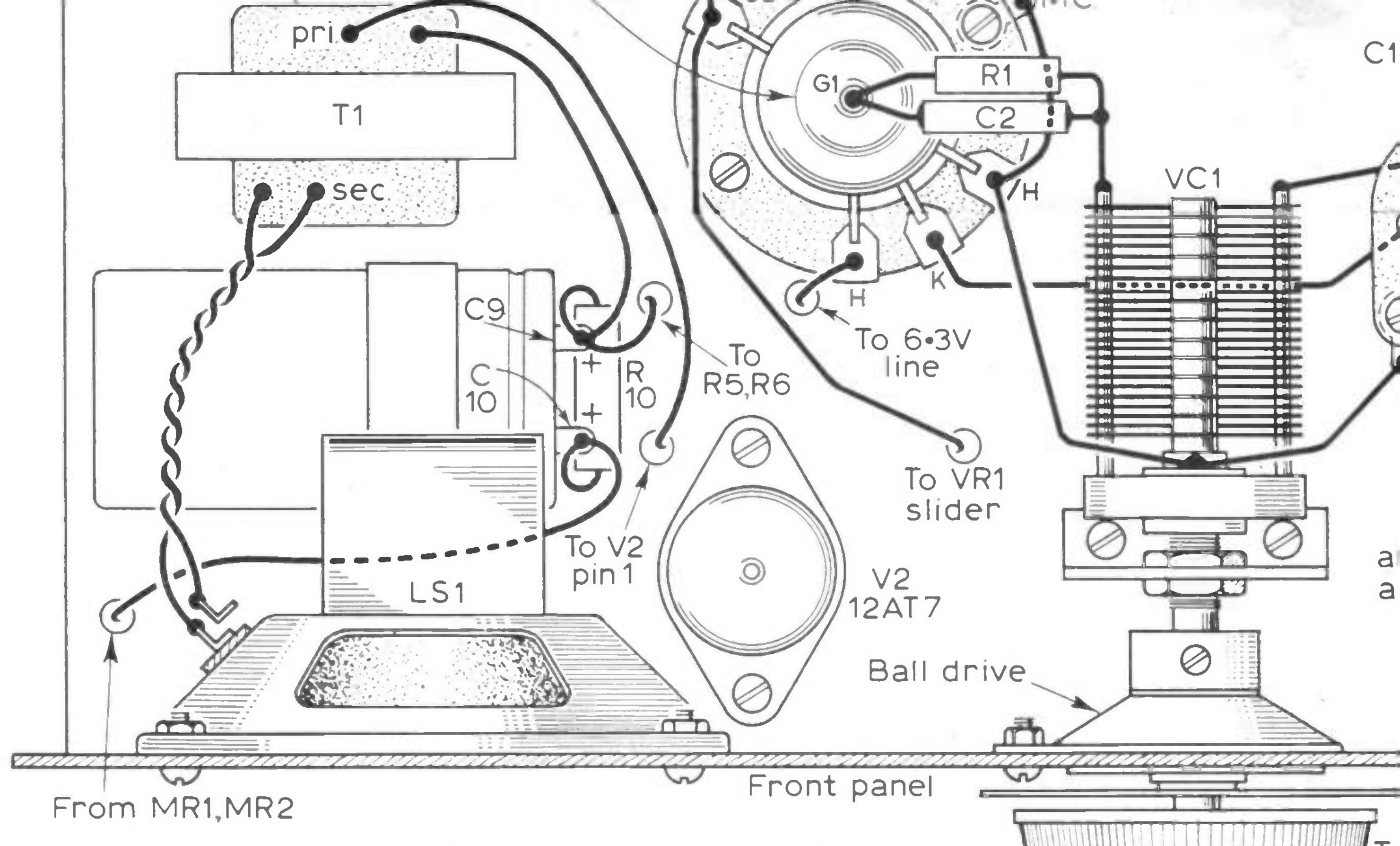


Fig. 2 – Above – chassis wiring.

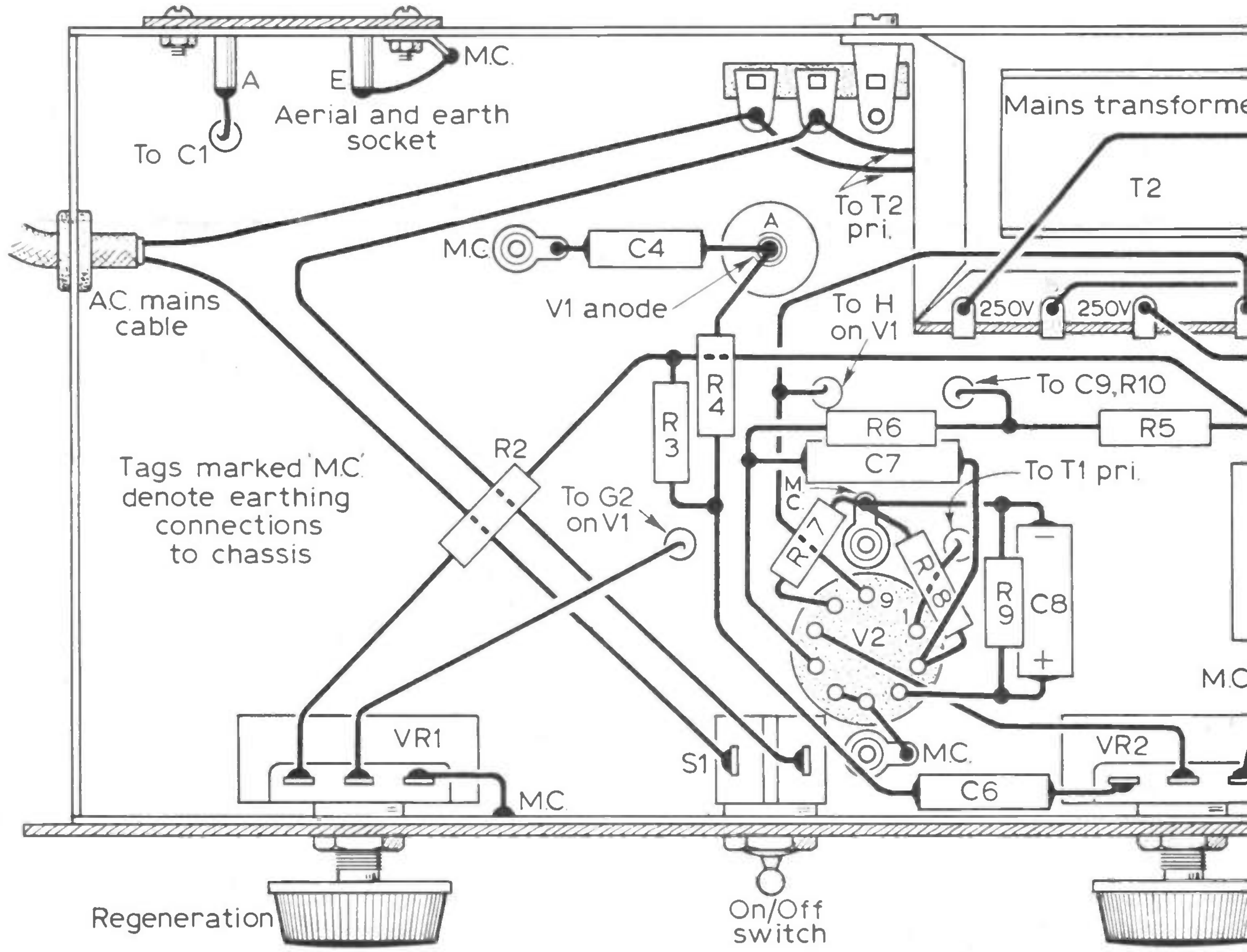
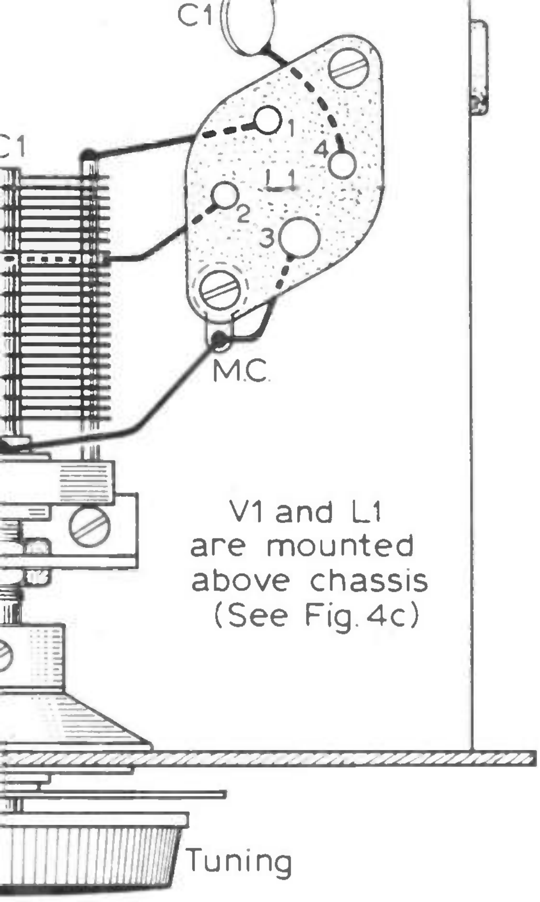
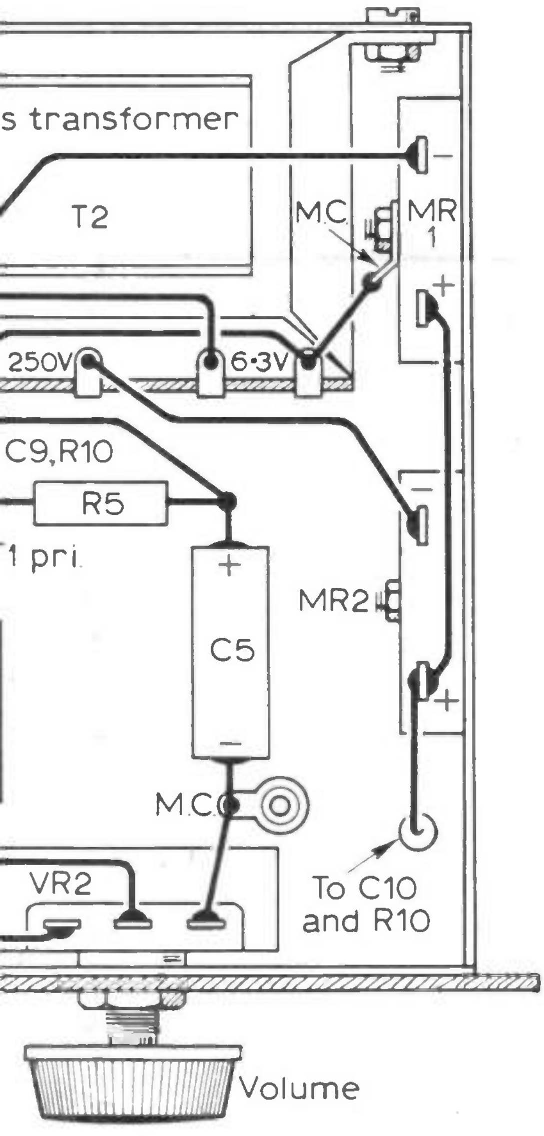


Fig. 3 – Below-chassis wiring.



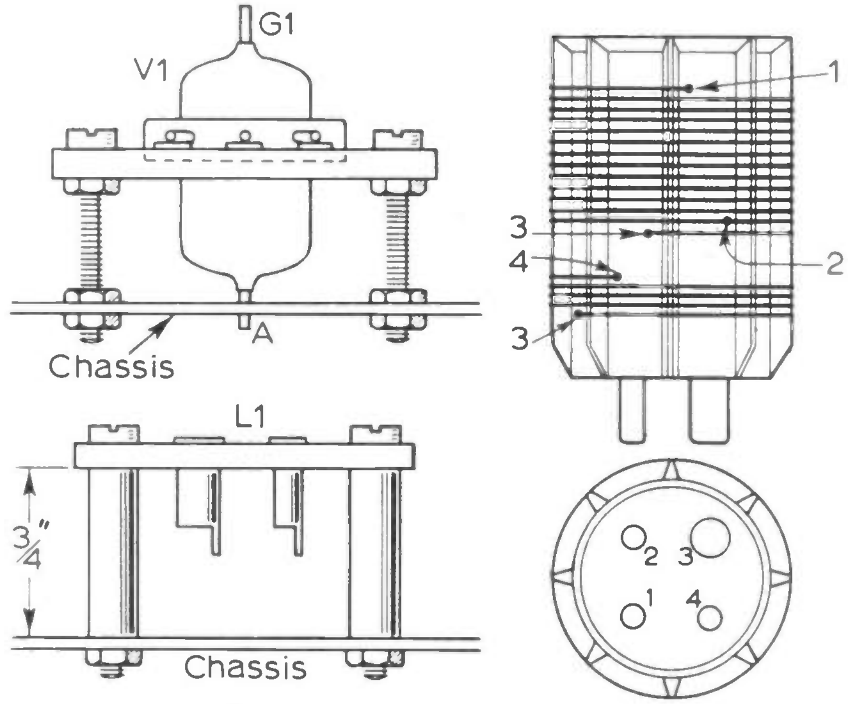


V2 12AT7 (B9A)

(b)

Aerial coupling, one turn.

The two larger coils are close wound. The other coils are on threaded formers, and spaced 21 turns per inch. Aerial windings are near the tuned winding as indicated in Fig. 4(d).



(c) (d)

Fig. 4 – Coil and valve details.

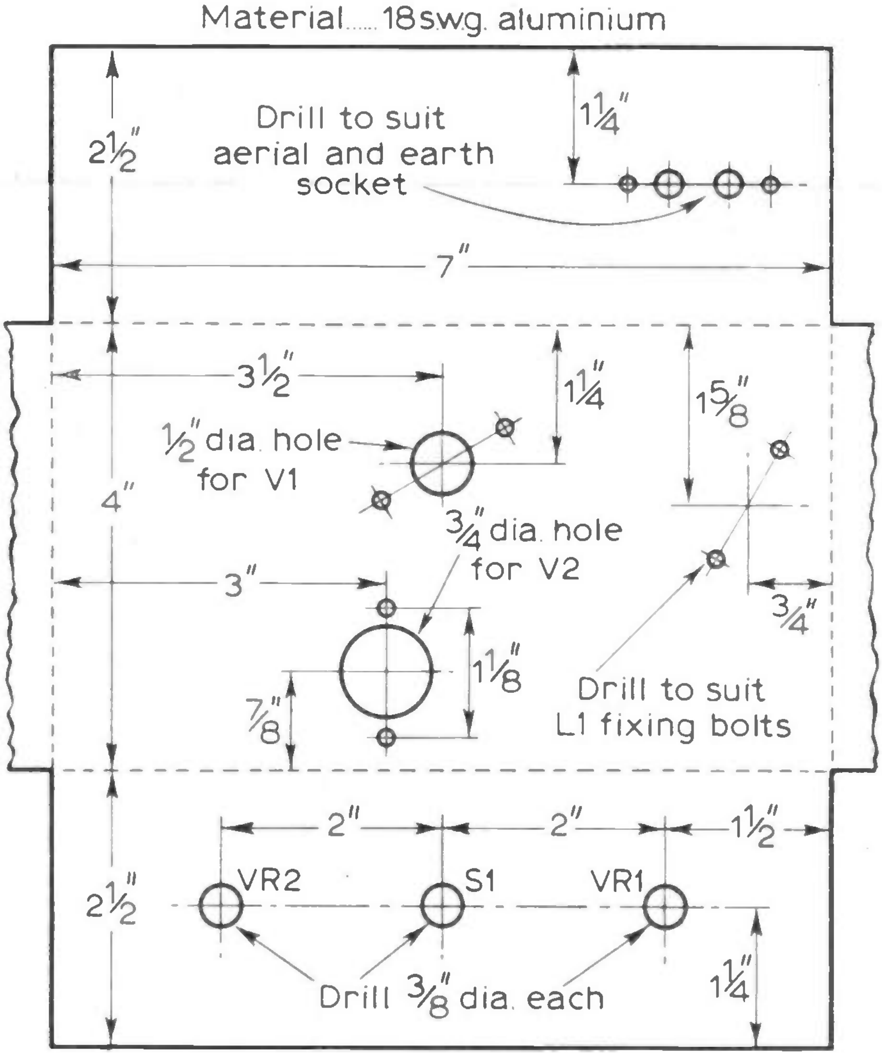


Fig 5 – Chassis drilling details.

SHORT WAVE
BROADCASTING STATIONS

THIS list is not intended to be a complete guide to the many hundreds of short wave broadcasting stations in operation, but it does indicate the stations which, in normal conditions, are most easily heard.

Frequency (kc s)	Wavelength (metres)	Station
5930	50·57	Prague, Czechoslovakia
5960	50·34	Rome, Italy
5990	50·08	Bucharest, Roumania
6005	49·96	R.I.A.S., Berlin, Germany
6010	49·92	Rome, Italy
6025	49·79	Radio Nederland, Holland
6025	49·79	Lisbon, Portugal
6030	49·75	Muhlacker, W. Germany
6035	49·71	Monte Carlo, Monaco
6055	49·55	Schwarzenburg, Switzerland
6065	49·46	Horby, Sweden
6070	49·42	Sofia, Bulgaria
6075	49·38	Osterloog, W. Germany
6090	49·26	Radio Luxembourg
6100	49·18	Belgrade, Yugoslavia
6140	48·86	Voice of America, Tangier
6145	48·82	Allouis, France
6160	48·70	Voice of America, Munich, W. Germany
6165	48·66	Schwarzenburg, Switzerland
6175	48·58	Allouis, France
6190	48·47	Bremen, W. Germany
6190	48·47	Vatican City
7050	42·55	Cairo, Egypt
7105	42·22	Madrid, Spain
7125	42·11	Warsaw, Poland
7135	42·05	Monte Carlo, Monaco
7180	41·78	Baghdad, Iraq
7195	41·70	Bucharest, Roumania
7200	41·67	Belgrade, Yugoslavia
7220	41·55	Budapest, Hungary
7255	41·35	Sofia, Bulgaria
7275	41·24	Rome, Italy
7280	41·21	Allouis, France
7285	41·18	Ankara, Turkey
9009	33·03	Tel Aviv, Israel
9410	31·88	B.B.C. Overseas Service
9475	31·66	Cairo, Egypt
9505	31·56	Prague, Czechoslovakia
9510	31·55	B.B.C Overseas Service
9515	31·53	Rome, Italy
9520	31·51	Voice of America, Tangier
9535	31·46	Schwarzenburg, Switzerland
9540	31·45	Warsaw, Poland
9570	31·35	Shepparton, Australia
9575	31·33	Rome, Italy
9585	31·30	Allouis, France
9620	31·19	Horby, Sweden
9630	31·15	Sackville, Radio Canada
9645	31·10	Vatican City
9665	31·04	Schwarzenburg, Switzerland
9675	31·01	Warsaw, Poland
9700	30·93	Sofia, Bulgaria
9715	30·88	Radio Nederland, Holland
9720	30·86	Radio Nacional, Rio de Janeiro, Brazil
9735	30·82	Deutsche Welle, W. Germany
9745	30·78	Ankara, Turkey
9770	30·71	Vienna, Austria
9780	30·67	Cairo, Egypt
9865	30·40	Djakarta, Indonesia
11705	25·63	Horby, Sweden
11715	25·61	Schwarzenburg, Switzerland
11720	25·60	Sackville, Radio Canada
11755	25·52	Leopoldville, Congo
11800	25·42	Accra, Ghana
11810	25·40	Rome, Italy
11820	25·38	B.B.C. Overseas Service
11830	25·36	Voice of America, Munich, W. Germany and Tangier
11835	25·35	Algiers, Algeria
11865	25·28	Schwarzenburg, Switzerland
11865	25·28	Havana, Cuba
11900	25·21	Paradys, South Africa
11910	25·19	Armed Forces Radio Service, Greenville, U.S.A.
11915	25·18	Voice of the Andes, Quito, Ecuador
11920	25·17	Allouis, France
11925	25·16	Radio Bandeirantes, Sao Paulo, Brazil
11965	25·06	Conakry, Guinea
11990	25·02	Prague, Czechoslovakia
12095	24·80	B.B.C. Overseas Service
15070	19·91	B.B.C. Overseas Service
15080	19·89	Paradys, South Africa
15115	19·85	Voice of the Andes, Quito, Ecuador
15125	19·83	Lisbon, Portugal
15155	19·80	ELWA, Monrovia, Liberia
15165	19·78	Damascus, Syria
15190	19·75	Brazzaville, Congo
15205	19·73	Voice of America, Greenville, U.S.A.

When and Where T

THIS is a far from easy task on which to give specific information. Forecasting propagation on short waves is, in some ways, as difficult as forecasting the weather. There are certain overall patterns but there are very many variable factors which can affect conditions at any one time. The main changes to be borne in mind are the seasonal ones, the difference between daytime and night-time conditions and, above all, the 11-year sunspot cycle.

From now until around 1966 conditions will not change greatly in their main features as we are in a period of low sunspot numbers, and the information given below is meant to apply to this period. Once sunspot numbers begin to increase, the pattern of band usage will change in many ways.

One useful pointer to remember is that broadcasting stations will beam their transmissions to Britain at the time and on the frequencies giving the best chance of good reception. Thus, if Radio Australia broadcasts to us around 07.00 G.M.T. on the 31 and 25 metre bands, that is when expert opinion expects best conditions for the path, although reception from Australia may be possible at other times.

All times quoted below are in G.M.T., using the 24-hour clock system. Let us consider various areas of the world and suggest the best times and frequencies for receiving stations in those areas.

1 **North America and Caribbean area** The best time for this area is between 15.00 and 23.00 during the whole year; in winter the peak is around 18.00 but in summer it is around 20.00/21.00. Western North America is harder to hear, and usually best around 15.00 to 18.00. For broadcast stations, the best bands in winter are 19 metres in the afternoon, then 25 metres after dark In the summer period, 19 metres is usually best. For the amateur bands, 20 metres is the most reliable all the year, during the winter 40 metres and 80 metres can provide North American stations between 23.00 and 05.00.

2. **Central America** This can be an awkward area to hear and the best times are similar to those for North America. For the broadcast bands, as there are not many stations in this area which use the higher frequencies, the best band tends to be 49 metres around 04.00 to 06.00. On the amateur bands, 20 metres is again the most useful, but this area can come through on 15 metres at times when no North Americans can be heard.

3. **South America** The best times are around 09.00 to 11.00 and from 17.00 to 01.00. The Pacific coast tends to be best around 07.00 to 10.00 and later around 20.00 to 02.00. On the broadcast bands, during spring, winter and autumn, 19 metres is best for the morning period, with 25 and 31 metres best for the evening and night. In summer, the early period is not usually feasible, and 19 metres is best for the evening, but this area is not usually heard too well during the summer. On the amateur bands, 20 metres is usually best, with 40 metres possible later at night, and 15 metres is also a good possibility for the early evening.

4. **North A**
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Signal Reporting Systems

IT has become the usual practice to use some type of code for giving signal reports. The most usual system in use on the amateur bands is a Readability/Signal Strength code, using a scale from 1 to 5 for readability and from 1 to 9 for signal strength. These are not always used correctly and often when incorrectly adjusted "signal strength meters" are used, reports such as "S9 plus 40 dB" are heard. As will be seen below, S9 means "extremely strong" which can hardly be improved on! Following are the scales for readability and signal strength:

Readability:

R1 Unreadable
R2 Only just readable, and only occasional words heard
R3 Readable, but with considerable difficulty
R4 Readable with almost no difficulty
R5 Perfectly readable

Signal Strength:

S1 Signals only just perceptible
S2 Very weak signals
S3 Weak signals
S4 Fair signals
S5 Fairly good signals
S6 Good signals
S7 Moderately strong signals
S8 Strong signals
S9 Extremely strong signals

For reporting on telegraphy (CW) signals, an additional scale for "tone" is used to indicate the quality of the note. This is also a 1 to 9 scale, as follows:

Tone:

T1 Extremely rough note
T6 Modulated note, slight

THE "Q

THE "Q" C
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its full form.
two letters)
"*what is your*
location is . .
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usual ones wi

QRA Full ad
QRH Your f
QRK Signal
price
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QRL Busy
QRM Man-m
QRN Atmos
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QRO High p
QRP Low p
QRT Closed
QRU Nothin
QRV Ready

STANDAR

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standards an
stations are

here To Listen

4. **North Africa and Near East** This area is best around 12.00 to 23.00, although it is possible to hear it almost round the clock. On the broadcast bands, 16, 19 and 25 metres are usually good in daylight, with 31 and 41 metres being better after dark. On the amateur bands, 15 and 20 metres are usually best, on 15 metres 08.00 to 11.00 is often a good time.

5. **Central and South Africa** The best times for this area are between 13.00 and 22.00. On the broadcast bands, during daylight 19 metres is best, but after dark 25 and 31 metres are better, especially in the winter half. On the amateur bands 15 metres is likely to be useful, with 20 metres best around 17.00 to 20.00. This area is possibly one of the few which will be heard during any openings on 10 metres.

6. **North Asia** The best times are around 06.00 to 09.00 and around 20.00, this is not an easy area to hear, especially Japan. On the broadcast bands, 19 and 25 metres are the best. On the amateur bands, 20 metres is probably the only worthwhile recommendation.

7. **South and South-East Asia** This is usually best around 11.00 to 17.00. The best broadcast bands are 16 and 19 metres for the earlier part, with 25 metres being most useful later towards the end of the best period. On the amateur bands 20 metres must again be the best suggestion, with just a chance that 15 metres might occasionally open in that direction. During the winter half it is likely that the best period may extend on to around 21.00 with the 31 and 41 metre broadcasting bands being best for this.

8. **Australasia** The best times for this area are 06.00 to 10.00 and, in winter, around 14.00 to 17.00 and around 22.00. New Zealand is not too easy to hear, and is usually better around 09.00 to 11.00. Reception is much better in the spring, winter and autumn than in the summer. In the better seasons, the best broadcast bands are 25 and 31 metres for the morning, 31 and 41 metres in the afternoon and 19 metres for the night opening which is less reliable. On the amateur bands, 20 metres is the favourite with 40 metres useful in winter in the mornings.

9. **Pacific** This is a difficult area usually, and is best around 06.00 to 11.00. There are few high power broadcasting stations in the area, and 19 and 25 metres are the most likely bands. Of the amateur bands, 20 metres is best.

10. **Europe** Obviously, this area can be heard 24 hours a day. On the broadcast bands, 25 and 31 metres are best for Southern Europe with 41 and 49 metres best for Northern Europe, 19 metres can provide European reception during the day. On the amateur bands 20 metres during the day, and 40 and 80 metres after dark are best, but in summer short skip occurs on 15 and 10 metres at times.

THE "Q" CODE

THE "Q" Code is used by aeronautical and maritime services and other commercial services and is very comprehensive in its full form. In its correct use, each group (made up of Q and two letters) can stand either for a question (e.g. QTH? means "*what is your location?*"), or the answer (e.g. QTH means "*my location is* . . ."). Amateurs have adopted certain of the code groups to their own use and the following list shows the more usual ones with their meanings.

QRA	Full address	QRX	Wait
QRH	Your frequency varies	QSA	Readability of signal
QRK	Signal strength (also price or value, humorously)	QSB	Fading
		QSL	Acknowledgement of receipt; confirmation of contact
QRL	Busy		
QRM	Man-made interference	QSO	Contact
QRN	Atmospheric interference; static	QSP	Pass on a message
		QSY	Change frequency
QRO	High power	QTC	Telegram, message
QRP	Low power	QTH	Location
QRT	Closed down	QTR	Time check
QRU	Nothing further to say		
QRV	Ready to operate		

STANDARD FREQUENCY STATIONS

THE frequencies 2500, 5000, 10000, 15000, 20000 and 25000 kc/s are set aside for station transmitting accurate frequency standards and also time signals in many cases. Some of these stations are:

ATA, New Delhi, India, operating on 10000 kc/s.

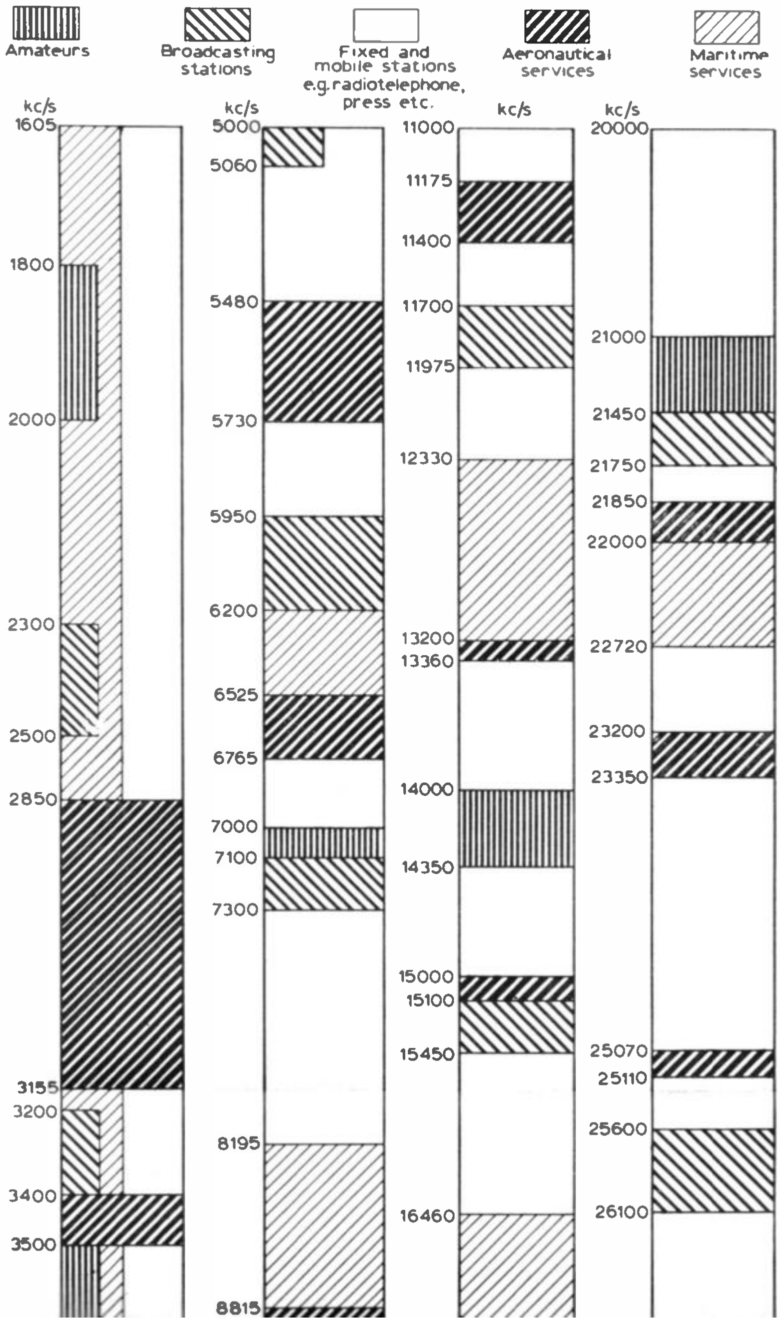
THE SHORT WAVE SPECTRUM

THE International Telecommunications Union is the controlling body over the whole of the radio frequency spectrum and allocations have been made from 10 kc/s to 40 kc/s. The accompanying chart shows the allocations between 1605 kc/s and 30000 kc/s, which is the range generally known as the "short waves". The I.T.U. divides the world into three regions for frequency allocation purposes; Region I comprises Europe, Africa, the Near East and the whole of the U.S.S.R.; Region 2 is made up of North America, Central America, South America and Greenland; and Region 3 contains Asia (except the U.S.S.R.) Australasia and the Pacific.

In the main, the allocations in the s.w. range are fairly uniform over all three Regions, but there are a few differences which should be noted.

1. The amateur band 1800 to 2000 kc/s is only available in a limited number of countries.
2. The broadcasting bands 2300 to 2500 kc/s, 3200 to 3400 kc/s and 4750 to 5060 kc/s are classed as "tropical" and are limited to countries in these regions.
3. In Region 2 the amateur band beginning at 3500 kc/s extends through to 4000 kc/s.
4. In Region 2 the amateur band beginning at 7000 kc/s extends through to 7300 kc/s and the allocation 7100 to 7300 kc/s is not available for broadcasting.

The chart obviously has to leave out several minor points of difference, but these are mainly confined to the lower frequencies. The main classes of service are indicated as follows:



11865	25·28	Schwarzenburg, Switzerland
11865	25·28	Havana, Cuba
11900	25·21	Paradys, South Africa
11910	25·19	Armed Forces Radio Service, Greenville, U.S.A.
11915	25·18	Voice of the Andes, Quito, Ecuador
11920	25·17	Allouis, France
11925	25·16	Radio Bandeirantes, Sao Paulo, Brazil
11965	25·06	Conakry, Guinea
11990	25·02	Prague, Czechoslovakia
12095	24·80	B.B.C. Overseas Service
15070	19·91	B.B.C. Overseas Service
15080	19·89	Paradys, South Africa
15115	19·85	Voice of the Andes, Quito, Ecuador
15125	19·83	Lisbon, Portugal
15155	19·80	ELWA, Monrovia, Liberia
15165	19·78	Damascus, Syria
15190	19·75	Brazzaville, Congo
15205	19·73	Voice of America, Greenville, U.S.A.
15220	19·71	Shepparton, Radio Australia
15250	19·67	Voice of America, Bethany, U.S.A.
15260	19·66	B.B.C. Far Eastern Station, Malaya
15280	19·63	Armed Forces Radio Service, Greenville, U.S.A.
15290	19·62	Voice of America, Tangier
15305	19·60	Voice of America, Greenville, U.S.A.
15320	19·58	Sackville, Radio Canada
15330	19·57	Voice of America, Greenville, U.S.A.
15370	19·52	Radio Tupi, Rio de Janeiro, Brazil
15385	19·50	WRUL, Boston, U.S.A.
15400	19·48	Rome, Italy
15445	19·43	Brazzaville, Congo
15475	19·38	Cairo, Egypt
17695	16·95	B.B.C. Overseas Service
17780	16·87	Voice of America, Bound Brook, U.S.A.
17795	16·86	Schwarzenburg, Switzerland
17820	16·84	Sackville, Radio Canada
17895	16·76	Lisbon, Portugal
17920	16·74	Cairo, Egypt
21470	13·97	B.B.C. Overseas Service
21495	13·96	Lisbon, Portugal
21560	13·91	Rome, Italy

N.B.—No frequencies are given for *Radio Moscow* or *Radio Free Europe* as the schedules of these stations vary more often than others, but they will usually be heard on several frequencies in each band.

Readability:
R1 Unreadable
R2 Only just readable, and only occasional words heard
R3 Readable, but with considerable difficulty
R4 Readable with almost no difficulty
R5 Perfectly readable

Signal Strength:
S1 Signals only just perceptible
S2 Very weak signals
S3 Weak signals
S4 Fair signals
S5 Fairly good signals
S6 Good signals
S7 Moderately strong signals
S8 Strong signals
S9 Extremely strong signals

For reporting on telegraphy (CW) signals, an additional scale for "tone" is used to indicate the quality of the note. This is also a 1 to 9 scale, as follows:

Tone:
T1 Extremely rough note
T2 Very rough note
T3 Rough, low pitched note
T4 Rather rough note
T5 Musically modulated note
T6 Modulated note, slight whistle
T7 Fairly good note, smooth ripple
T8 Good note, slight ripple
T9 Pure DC note

(If the note seems to be crystal controlled, an "x" is added, if the note is chirpy, a "c" is added.)

The readability/strength code can be used for reporting to broadcasting stations, but a better system for this purpose is the **SINPO** code. This has five scales, each of 1 to 5, as indicated by the letters S (Signal Strength), I (Interference), N (Noise, i.e. static), P (Propagation Disturbance, i.e. fading) and O (Overall quality of reception).

The scale for signal strength is: 1—barely audible; 2—poor; 3—fair; 4—good; 5—excellent. The scales for Interference, Noise and Propagation Disturbance are: 1—extreme; 2—severe; 3—moderate; 4—slight; 5—nil. The scale for Overall quality is: 1—unusable; 2—poor; 3—fair; 4—good; 5—excellent. Thus, in the SINPO code, a perfectly received signal would be given 55555.

QRK Signal price o ously)
QRL Busy
QRM Man-m
QRN Atmos ence; s
QRO High p
QRP Low po
QRT Closed
QRU Nothin
QRV Ready

STANDAR

THE freque kc/s are se standards and stations are:

ATA, New
BPV, Pekin
FFH, Paris,
HBN, Neuc
IAM, Rome
IBF, Turin,
JJY, Tokyo 15000 kc/
LOL, Bueno 15000 kc/
MSF, Rugby
OMA, Prag
RWM, Mos 15000 kc/
WWV, Wa 15000, 20
WWVH, H
ZUO, Joha 10000 kc/

In addition, and 14670 kc/

Most of th intervals, and time checks a

AMATEUR CALLSIGN PREFIXES

AMATEUR radio stations, in common with all other communications stations, have to identify themselves by callsigns. Each station has an individual officially allocated callsign which follows a standard pattern, being made up of a prefix, a numeral, and a suffix. The prefix may be one letter, two letters or a numeral and letter, but it is derived from the international list of callsign allocations. The numeral may have some geographical significance, but this is not always so. The suffix may be one, two or three letters; in the bigger countries they are issued in alphabetical order, but in smaller countries they are often issued haphazardly, a popular idea being to allow the operator to use his initials as his call.

To take an example of a callsign—G3AKA. The G is the prefix allocated to England, the figure 3 has no special meaning and the AKA is the suffix. In another case—say W7XYZ. Here the W is the U.S.A. prefix, but in this case the figure 7 indicates that the station is located in a particular area of the U.S.A., and the XYZ is the suffix. One final example—say 5N2ABC. In this case 5N is the prefix for Nigeria, the figure 2 has no significance, and the ABC is the suffix.

The following is an up-to-date list of prefixes, the numeral is only given here where it is necessary to distinguish between countries, for instance VQ is the general prefix for Commonwealth countries in East Africa, but VQ1 is Zanzibar and VQ2 is Northern Rhodesia, so the numeral is virtually part of the prefix in these cases. This list is not intended to be an "official" list of countries, the various clubs and societies each issue their own lists of this kind, which only differ where some of the more out of the way places are concerned.

Occasionally, stations can be heard with additional letters, such as /P or /M after the callsign. Examples of these and their meanings are: /A indicates the station is being operated from another address than that given in the licence. /P means the station is being operated "portable", i.e. not from a mains electricity supply; this letter is usually heard when Field Day contests are being held. /M means that the station is "mobile", i.e. in a car or other vehicle. /MM means "maritime mobile", on board a ship. /AM is "aeronautical mobile", on an aircraft In the U.S.A., however, /P and /A are not used; instead, the call area in which the station is temporarily operating is added, for instance W2ZZZ operating portable in the W2 area would sign W2ZZZ/2, if he went over to California he would sign W2ZZZ/6. If he crossed into Canada, he might sign W2ZZZ/VE3 and so on.

CALL AREAS

As mentioned above, in certain countries, there is a subdivision into call areas, indicated by the figure in the callsign. Most of the South American countries use this system, and it also applies in Australia, Canada, New Zealand and the U.S.A. Details for these latter four countries are:

Australia VK1—Canberra; VK2—New South Wales; VK3—Victoria; VK4—Queensland; VK5—South Australia; VK6—Western Australia; VK7—Tasmania; VK8—Northern Territory.

Canada VE1—Nova Scotia, New Brunswick and Prince Edward Island; VE2—Province of Quebec; VE3—Ontario; VE4—Manitoba; VE5—Saskatchewan, VE6—Alberta; VE7—British Columbia; VE8—Yukon and North West Territories; VO1—Newfoundland; VO2—Labrador.

New Zealand ZL1—Auckland; ZL2—Wellington; ZL3—Canterbury; ZL4—Otago.

United States of America K/KN/W/WA/WB/WN/WV prefixes: 1—Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont. 2—New Jersey and New York. 3—Delaware, Maryland, Pennsylvania and District of Columbia. 4—Alabama, Florida, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia. 5—Arkansas, Louisiana, Mississippi, New Mexico, Oklahoma and Texas. 6—California. 7—Arizona, Idaho, Montana, Nevada, Oregon, Utah, Washington and Wyoming. 8—Michigan, Ohio and West Virginia. 9—Illinois, Indiana and Wisconsin. Ø—Colorado, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota.

AC3 Sikkim
AC4 Tibet
AC5 Bhutan
AP Pakistan
BY China
BV Taiwan
CE Chile
CE9 Chilean Antarctic
CEØ Easter Island
CM Cuba
CN Morocco
CO Cuba
CP Bolivia
CR4 Cape Verde Islands
CR5 Portuguese Guinea, Principe Is., and Sao Thome
CR6 Angola
CR7 Mozambique
CR8 Portuguese Timor
CR9 Macao
CT1 Portugal
CT2 Azores Islands
CT3 Madeira Islands
CX Uruguay
DJ Germany (West)
DL Germany (West)
DM Germany (East)
DU Philippine Islands
EA Spain
EA6 Balearic Islands
EA8 Canary Islands
EA9 Ceuta, Melilla and Ifni
EAØ Spanish Guinea and Fernando Poo
EI Eire
EL Liberia
EP Iran
EQ Iran
ET Ethiopia
F France
FB Amsterdam and St. Paul Is., Crozet and Kerguelen Is.
FC Corsica
FG Guadeloupe
FH Comoro Island
FK New Caledonia
FL French Somalil
FM Martinique
FO Marquesas Is., Is., Tuamoto, T Clipperton Is.
FP St. Pierre and Is.
FR Reunion Islands
FS St. Martin Islan
FU New Hebrides
FW Wallis and Fo
FY French Guiana
G England
GB United Kingdo (special station
GC Channel Islands
GD Isle of Man
GI Northern Irela
GM Scotland
GW Wales
HA Hungary
HB Switzerland
HBØ Liechtenstein
HC Ecuador
HC8 Galapagos Islan
HH Haiti
HI Dominican Rep
HK Colombia
HL Korea
HM Korea
HP Panama
HR Honduras
HS Thailand
HV Vatican
HZ Saudi Arabia
I Italy
IL Pelagian Islands
IP Pantellaria Islan
IS Sardinia
IT Sicily
JA Japan
JT Mongolia
JY Jordan
JZØ Netherlands N Guinea
K United States o America
KA Japan (U.S. For
KB Baker, Howland American Phoe
KC4 U.S. Antarctic a Navassa Island

	ously)		receipt; confirmation of contact
QRL	Busy	QSO	Contact
QRM	Man-made interference	QSP	Pass on a message
QRN	Atmospheric interference; static	QSY	Change frequency
QRO	High power	QTC	Telegram, message
QRP	Low power	QTH	Location
QRT	Closed down	QTR	Time check
QRU	Nothing further to say		
QRV	Ready to operate		

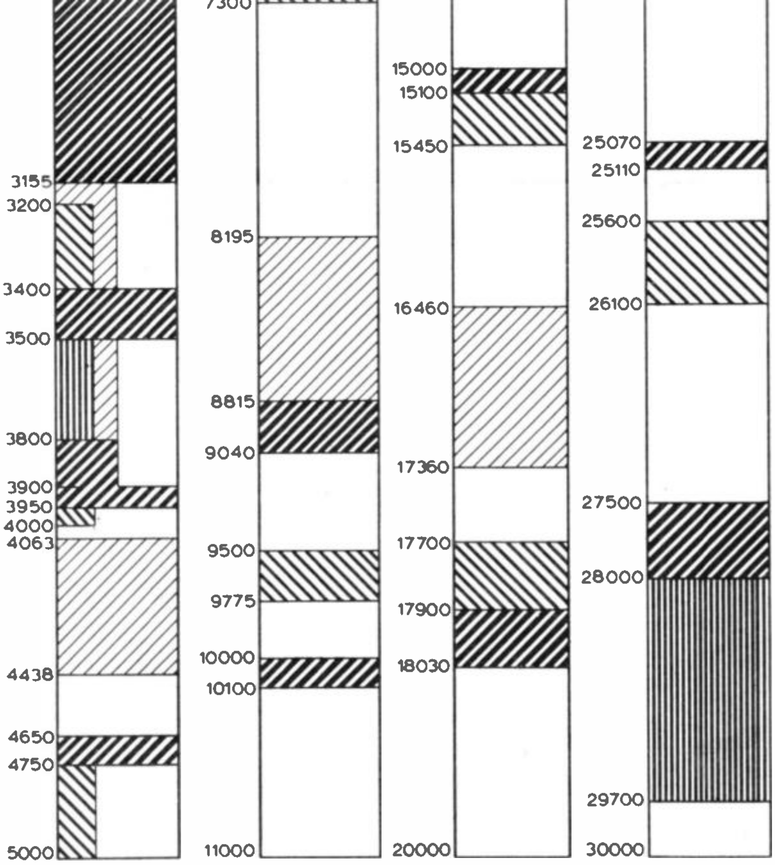
STANDARD FREQUENCY STATIONS

THE frequencies 2500, 5000, 10000, 15000, 20000 and 25000 kc/s are set aside for station transmitting accurate frequency standards and also time signals in many cases. Some of these stations are:

ATA, New Delhi, India, operating on 10000 kc/s.
BPV, Peking, China, operating on 5000, 10000 and 15000 kc/s.
FFH, Paris, France, operating on 2500 kc/s.
HBN, Neuchatel, Switzerland, operating on 5000 kc/s.
IAM, Rome, Italy, operating on 5000 kc/s.
IBF, Turin, Italy, operating on 5000 kc/s.
JJY, Tokyo, Japan, operating on 2500, 5000, 10000 and 15000 kc/s.
LOL, Buenos Aires, Argentina, operating on 5000, 10000 and 15000 kc/s.
MSF, Rugby, England, operating on 2500, 5000 and 10000 kc/s.
OMA, Prague, Czechoslovakia, operating on 2500 kc/s.
RWM, Moscow, U.S.S.R., operating on 5000, 10000 and 15000 kc/s.
WWV, Washington, U.S.A., operating on 2500, 5000, 10000, 15000, 20000 and 25000 kc/s.
WWVH, Hawaii, operating on 5000, 10000 and 15000 kc/s.
ZUO, Johannesburg, South Africa, operating on 5000 and 10000 kc/s.

In addition, CHU, Ottawa, Canada, transmits on 3330, 7335 and 14670 kc/s.

Most of these stations make speech announcements at intervals, and give their callsigns in morse code. WWV gives time checks and also propagation forecasts.



FC	Corsica
FG	Guadeloupe
FH	Comoro Islands
FK	New Caledonia
FL	French Somaliland
FM	Martinique
FO	Marquesas Is., Society Is., Tuamoto, Tubuai Is., Clipperton Is.
FP	St. Pierre and Miquelon Is.
FR	Reunion Islands
FS	St. Martin Island
FU	New Hebrides
FW	Wallis and Fortuna Is.
FY	French Guiana and Inini
G	England
GB	United Kingdom (special stations)
GC	Channel Islands
GD	Isle of Man
GI	Northern Ireland
GM	Scotland
GW	Wales
HA	Hungary
HB	Switzerland
HBØ	Liechtenstein
HC	Ecuador
HC8	Galapagos Islands
HH	Haiti
HI	Dominican Republic
HK	Colombia
HL	Korea
HM	Korea
HP	Panama
HR	Honduras
HS	Thailand
HV	Vatican
HZ	Saudi Arabia
I	Italy
IL	Pelagian Islands
IP	Pantellaria Island
IS	Sardinia
IT	Sicily
JA	Japan
JT	Mongolia
JY	Jordan
JZØ	Netherlands New Guinea
K	United States of America
KA	Japan (U.S. Forces)
KB	Baker, Howland and American Phoenix Is.
KC4	U.S. Antarctic and Navassa Island
KC4	Caroline Islands
KG1	Greenland (U.S. Forces)
KG4	Guantanamo Bay
KG6	Guam, Mariana Islands and Marcus Islands
KH	Hawaiian Islands
KJ	Johnston Island
KL	Alaska
KM	Midway Islands
KN	United States of America (novice stations)
KP4	Puerto Rico
KP6	Palmyra and Jarvis Is.
KR	Ryukyu Islands
KS4	Swan Island
KS6	American Samoa
KV	American Virgin Islands
KW	Wake Island
KX	Marshall Islands
KZ	Panama Canal Zone
LA	Norway
LU	Argentina
LX	Luxembourg
LZ	Bulgaria
MP4	Bahrain, Muscat and Oman, Qatar & Trucial Oman
OA	Peru
OD	Lebanon
OE	Austria
OH	Finland
OK	Czechoslovakia
ON	Belgium
OX	Greenland
OY	Faroe Islands
OZ	Denmark
PA	Netherlands
PI	Netherlands
PJ	Netherlands Antilles
PK	Indonesia
PX	Andorra
PY	Brazil
PZ	Surinam
SL	Sweden (Forces)
SM	Sweden
SP	Poland
SU	Egypt
SV	Greece
TA	Turkey
TF	Iceland
TG	Guatemala
TI	Costa Rica
TJ	Cameroon
TL	Central African Republic
TN	Republic of Congo
TR	Gabon
TT	Tchad
TU	Ivory Coast
TY	Dahomey
TZ	Mali
UA	U.S.S.R.
UB	Ukraine
UC	White Russia
UD	Azerbaijan
UF	Georgia
UG	Armenia
UH	Turkoman
UI	Uzbek
UJ	Tadzhik
UL	Kazakh
UM	Kirghiz
UO	Moldavia
UP	Lithuania
UQ	Latvia
UR	Estonia
UT	Ukraine
UV	U.S.S.R.
UW	U.S.S.R.
VE	Canada
VK	Australia
VK9	New Guinea, Papua, Norfolk Island, Nauru, Cocos Is., Lord Howe Islands
VKØ	Australian Antarctica, Heard Island and Macquarie Islands
VO	Canada (Newfoundland and Labrador)
VP1	British Honduras
VP2	Anguilla, Antigua, Barbuda, Brit. Virgin Is., Dominica, Grenada, Montserrat, St. Kitts, Nevis, St. Lucia, St. Vincent
VP3	British Guiana
VP4	Trinidad and Tobago
VP5	Cayman & Turks & Caicos Islands
VP6	Barbados
VP7	Bahama Islands
VP8	Falkland Islands and Dependencies, Grahamland, South Georgia
VP9	Bermuda
VQ1	Zanzibar
VQ2	Northern Rhodesia
VQ4	Kenya
VQ7	Aldabra Islands
VQ8	Mauritius
VQ9	Seychelles
VR1	Gilbert & Ellice Islands, Ocean Islands, British Phoenix Islands
VR2	Fiji Islands
VR3	Line Islands
VR4	Solomon Islands
VR5	Tonga
VR6	Pitcairn Island
VS1	Singapore
VS4	Sarawak
VS5	Brunei
VS6	Hong Kong
VS9	Aden, Socotra, Maldive Islands, Kamaran Islands
VU	India
W	United States of America
WA	United States of America
WB	United States of America
WG	Mariana Is. (novice stations)
WL	Alaska (novice stations)
WN	United States of America (novice stations)
WP4	Puerto Rico (novice stations)
WS6	American Samoa (novice stations)
WV	United States of America (novice stations)
XE	Mexico
XT	Upper Volta
XU	Cambodia
XV	Vietnam
XW	Laos
XZ	Burma
YA	Afghanistan
YI	Iraq
YJ	New Hebrides
YK	Syria
YN	Nicaragua
YO	Roumania
YS	El Salvador
YU	Yugoslavia
YV	Venezuela
ZA	Albania
ZB1	Malta
ZB2	Gibraltar
ZC5	North Borneo
ZD3	Gambia
ZD6	Nyasaland
ZD7	St. Helena
ZD8	Ascension Island
ZD9	Tristan da Cunha and Gough Islands
ZE	Southern Rhodesia
ZK1	Cook Islands
ZK2	Niue
ZL	New Zealand
ZLØ	New Zealand Antarctica
ZM6	Western Samoa
ZM7	Tokelau Islands
ZP	Paraguay
ZS	South Africa
ZS3	South West Africa
ZS7	Swaziland
ZS8	Basutoland
ZS9	Bechuanaland Protectorate
3A	Monaco
3V	Tunisia
3W	Vietnam
3X	Guinea
4S	Ceylon
4U	United Nations
4W	Yemen
4X	Israel
5A	Libya
5B4	Cyprus
5H3	Tanganyika
5N2	Nigeria
5R	Malagasy Republic
5T	Mauretania
5U	Niger
5V	Togolese Republic
5W	Western Samoa
5X5	Uganda
6O	Somali Republic
6T	Sudan
6W	Senegal
6Y	Jamaica
7X	Algeria
9A	San Marino
9G	Ghana
9K	Kuwait
9L	Sierra Leone
9M	Federation of Malaya
9N	Nepal
9Q	Congo Republic
9U	Burundi
9X	Ruanda

EVERY PACKET CARRIES A GOVERNMENT HEALTH WARNING